Market Improvement Fund 2021-R1-008
Project AMIDST
Transferring smart AMI meter readings directly into CMOS

Final Report November 2023

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This document has been produced by Anglian Water Services Ltd and MOSL. Any enquiries relating to this report should be referred to the authors

1 Executive Summary

Project AMIDST is a Market Improvement Fund (ref: 2021-R1-008) collaboration project between Anglian Water and MOSL to investigate the feasibility of Wholesalers providing a monthly meter reading directly into CMOS where a Smart AMI meter is installed.

As smart metering becomes increasingly widespread, the opportunity to provide reads directly to CMOS will ensure the benefits are maximised and it will help to future proof the market.

The provision of accurate and timely meter reads would benefit the Wholesaler and Retailer settlement processes and in turn, NHH (Non-Household) customer invoicing.

The two areas of focus within the project were:

Technical – Establish a direct API connection from Wholesalers to CMOS using a standardised data format (system to system transfer) with retailer approval, in line with current market code.

Market Code – Investigate the potential code changes and associated risks and benefits to allow the reads to be submitted that are settlement affecting, without Retailer approval.

Additionally, stakeholder feedback was sought from two Wholesalers and three Retailers, one of which was also able to give insight into the impact of AMI smart meter reads into the energy market.

As a result of this project a successful system-to-system AMI smart meter read data transfer has been developed using an MVI API solution, initially including a step for Retailer validation of meter readings as an interim solution to stay in line with the current market code.

This has been successfully tested based on a sample of 1,000 smart meters in the AWS region and gives the potential for all Wholesalers who implement a smart metering programme to provide monthly AMI meter reads into CMOS.

Stakeholder engagement revealed that Retailers extract/submit meter reads into CMOS differently. Some enter the reads direct into CMOS, and subsequently into their billing system, others enter reads through the billing system into CMOS. In order to achieve the maximum benefits of the interim solution we have created two solutions to minimise the impact to Retailers.

The preferred option to achieve the system-to-system transfer is for Retailers to use the MVI to submit and approve the monthly reads into CMOS

The additional option will allow Retailers to download the monthly meter reads to load into their billing system and then transfer into CMOS.

Following the successful testing with two Retailers (Everflow and Wave) Anglian are using the solution in the live environment, and are planning a rollout to the remaining Retailers.The project recommends an enduring (longer term) solution which is the submission of AMI Smart reads to CMOS without Retailer approval. The impact of this on Market Codes has been identified with proposed recommendations.

Following the Roles and Responsibilities review led by the Metering Committee it has been recommended to take a code change forward (now implemented as CPW142) to allow Wholesalers to take responsibility to submit Smart AMI reads into CMOS. Throughout the code change process this recommendations report can be used to assist in the code review and any decision making.

2 Introduction and Objectives of Project AMIDST

The opportunity to provide reads directly to CMOS as smart metering becomes increasingly widespread will ensure the benefits of this are maximised and help the market to be future proofed. This will necessitate simple and easy provision of AMI meter reads into the CMOS (Central Market Operating System) in a standardised format. Accurate and timely meter reads are used to the benefit of Wholesaler and Retailer settlement processes and in turn the NHH (Non-Household) Customer invoicing.

The objectives of the project were to investigate, evaluate and develop a pathfinder solution for the most effective system, to enable the central market to access monthly AMI reads direct from the Wholesaler. It was essential the impacts of any proposed solution were evaluated across the market, and consideration has been given to the following:

- Ease of development
- Cost
- Benefits realisation for end user customer and the market
- Impact on market codes
- Standardised format of data and transfer process

3 Project Approach

Project AMIDST (AMI Data Strategic Transfer), is a Market Improvement Fund pathfinder project to investigate the feasibility and benefits of submitting a monthly meter reading from wholesaler smart AMI meters direct to CMOS**.**

The key purpose of the project is to contribute to future proofing the Market, by investigating standardisation in the way AMI meter read data is provided to the Central Market, using a technology platform that is easy to access and easy to use.

This is a collaboration project between Anglian Water and MOSL, exploring technical options to transfer the data, as well as identifying areas of the market code that would require review and potential change.

This report will be submitted to the Metering Committee for consideration of next steps. Our recommended roadmap is contained in Section 11.

Any system developed needs to be an easy-to-use interface, that is capable of automatically transferring a monthly AMI meter reading from the host's (Wholesaler's) AMI meter data management system directly into CMOS. As new smart meters are installed, these need to be able to be readily included in the system.

At present, Market Code is limited to only allow Wholesalers to provide a 'W' Read (wholesaler read) which is held in a staging table for Retailers to access and then approve into CMOS. The scope of this project is to establish direct connection, removing the need for Retailer approval, and thereby making full use of the AMI Smart Meter functionality.

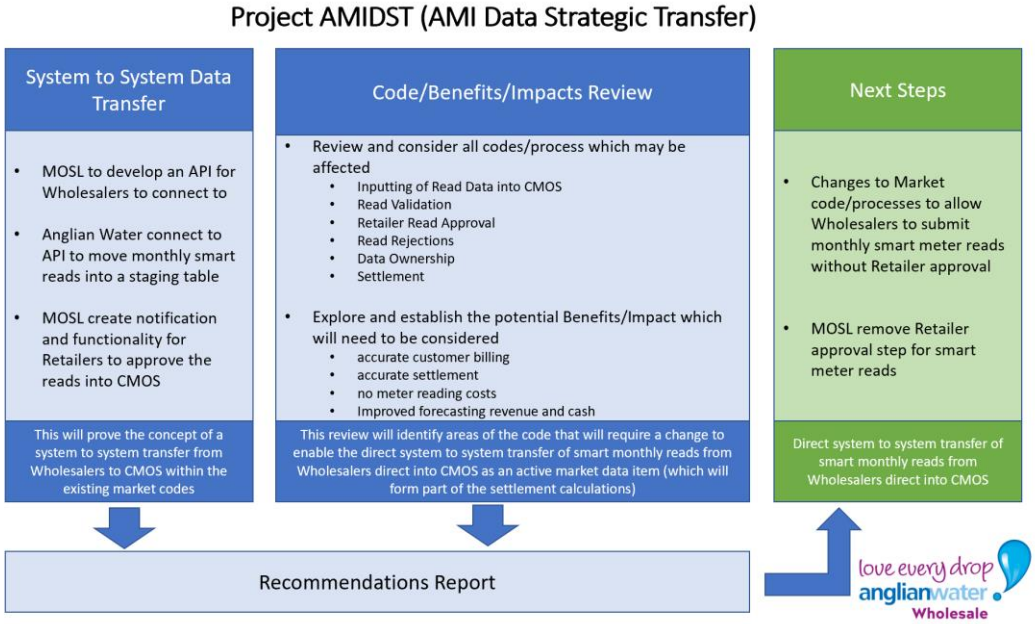
Therefore, this project has been split into the 3 phases.

Phase 1: Technical – Establish a direct API connection from Wholesalers into CMOS, to submit AMI monthly reads into the staging table for Retailers to approve (in line with the current Market Code)

Phase 2: Market Code – Investigate the potential code changes and associated risks and benefits to allow the reads to be submitted without Retailer approval. In addition, identify further technical development required to remove the approval step outlined in Phase 1.

Phase 3: Report – Document phase 1 and 2 outcomes (the technical API solution and results of the investigation to the potential Market Code changes). The report shall be presented to the MOSL Metering Committee and subsequently to the Strategic Panel as required.

The diagram below details the project approach and phasing.



For clarity, the technical development phase of this project (Phase 1) has developed an interim solution which enables the provision of AMI reads into CMOS from the Wholesaler, via the Retailer, and with retailer approval. This is to comply with the existing market codes.

Phase 2 and Phase 3 have explored the recommended enduring solution. That is, providing AMI reads direct into CMOS from the Wholesaler, to be automatically applied to the settlement process and without the Retailer approval stage. It has considered what further technical development is needed, as well as what Code changes are necessary in order for the enduring solution to be implemented.

The project measures of success were as follows:

- Successful API connection to import Smart AMI Meter Data from Anglian Water directly into CMOS via a medium volume interface (MVI), or a high-volume interface (HVI).
- Positive results which showed that this solution would provide overall benefit to the market.

This report evaluates the achievement of these measures and will be presented to the MOSL Metering Committee for consideration and review.

3.1 Scope

We have looked specifically at the provision of AMI meter read data to CMOS direct from wholesalers and how this data provision may potentially impact settlement. We have not considered the potential for using more granular AMI data (e.g. hourly reads) centrally for water efficiency, leakage or benchmarking purposes.

4 Background

4.1 Anglian Water smart metering programme

In 2020 Anglian Water started their programme to upgrade 1.1 million meters (domestic and non-household customers) over the next 10 years, replacing the current visual read meters with AMI smart meters that automatically supply meter readings.

Anglian Water is one of the first Wholesalers to commence a significant NHH smart metering rollout programme, but many others are considering this for the future.

Anglian Water are currently providing smart AMI data direct to retailers through two routes as part of their RDE (Retailer Data Exchange) These routes are outlined below.

Option 1: API

- Each retailer is provided with a URL along with a unique 'Authorisation key' to facilitate connectivity to AW systems, thereby allowing data to be 'called' for a specific SPID, meter and date range.
- The request is validated automatically to ensure the retailer is requesting their customer data. A check is also done to provide hourly or daily data to meet GDPR requirements.
- The data is held up to the previous 45 days. It is up to retailers to request and store the data as they require.

Option 2: Secure File Transfer Protocol (SFTP)

- Each Retailer receives a weekly data file for each of their customers with an AMI Smart meter installed. The file contains daily or hourly data as appropriate, (to meet with GDPR requirements) for the previous 7-day period.
- Data is held for a rolling 30 days.
- It is the retailers' responsibility to retrieve the data file from the SFTP and carry out consumption checks and other analytics.

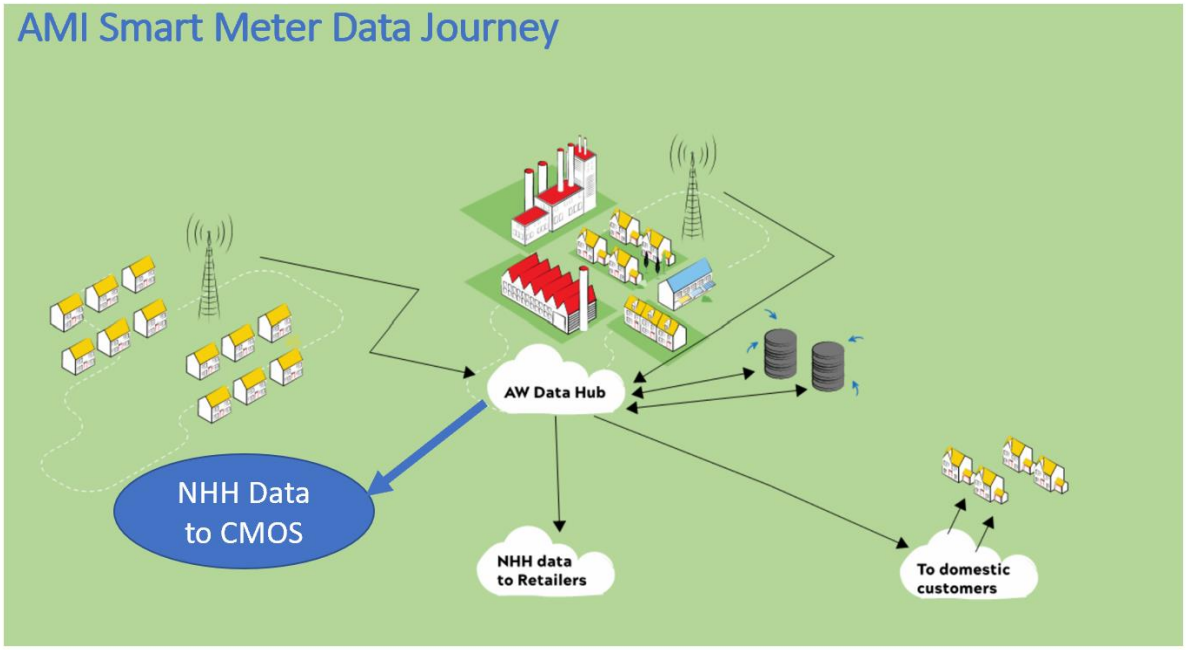
Within the non-household market, this means Anglian Water are already supplying granular read data (hourly or daily) for business customers in areas where smart meters have been installed.

This smart metering programme is part of our plan to tackle future water shortages by helping our customers use less water and drive down leakage across the network. In addition, by sharing timely accurate data it supports more accurate bills for end-user customers.

Recognising the value collaboration plays in addressing the challenges of future water resources and the need to work together with a wide variety of stakeholders, the provision of reliable, easy to access consumption data is key to help unlock additional value for Business Customers.

Project AMIDST is the next natural development towards this goal.

The figure below shows a schematic of Anglian Water's current data journey, with the addition of the potential data transfer to provide Monthly Reads direct to CMOS:



4.2 About AMI Meters - Validation

It is recognised that transfer of AMI smart meter reads direct to CMOS requires a high level of confidence that the meter reads are accurate and reliable.

The accuracy of data from AMI meters is made up of two elements:

1. The accuracy of the meter to record the water consumption passing through it (turning water flow into a meter reading)
2. The accuracy of the electronic pick-up that captures the consumption recorded by the meter (turning the meter reading into an electronic reading)

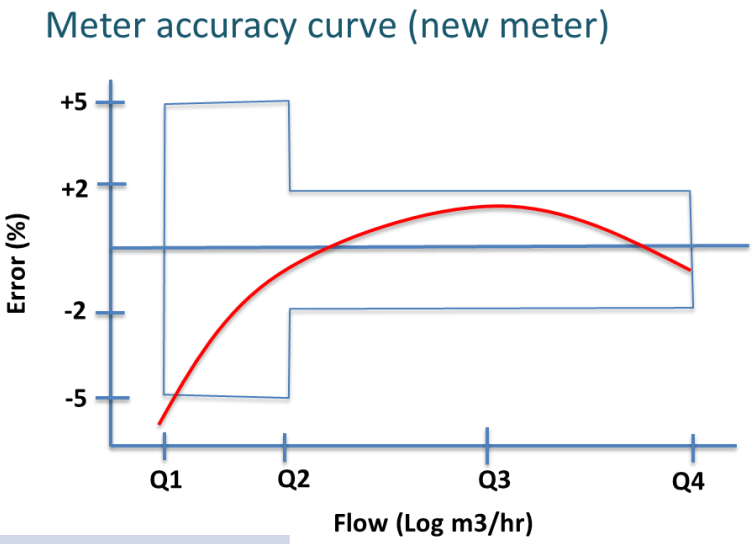
4.2.1 Meter accuracy

Meters used in the UK are required to be compliant with the international standard ISO 4064-1:2014 'Water meters for cold potable water and hot water — Part 1: Metrological and technical requirements'. This sets out a standard accuracy requirement for meters.

A typical meter accuracy flow curve is shown below. The diagram shows that over the majority of the flow range the meter is within +/-2% accuracy, and at very low flowrates within +/-5% accuracy. Meters are sized by their Q3 (permanent flowrate) and their overall accuracy range by the R ratio.

Meters in the market are generally considered to be accurate, however it is expected that a wholesaler would have:

- a programme to test in-service accuracy of meters and address any cohorts of meters showing deteriorating accuracy
- a process to identify and replace broken meters



In-service accuracy limits are: +/-2.5 and +/-6 %

Q1 = minimum flowrate at +/- 5%
Q2 = minimum flowrate at +/- 2%
Q3 = permanent flowrate
Q4 = maximum flowrate

R = Q3/Q1
Q2/Q1 = 1.6
Q4/Q3 = 1.26

Meter physical size is internal pipe diameter in millimetres **(DN)**

Example **DN15 Q2.5 R400**
15 mm meter
Q1 = 0.00621 m3/hr
Q2 = 0.01 m3/hr
Q3 = 2.5 m3/hr
Q4 = 3.125 m3/hr

4.2.2 Electronic 'pick-up' accuracy

There are two main types of electronic pick-up.

1. Meter with an integrated electronic digital register	2. Meter with a mechanical register and a pulse pick-up to a secondary electronic register
	

1. **Electronic digital register** - The meter readings taken from this type of smart AMI system are considered to be fully reliable. Where the meter has a digital register the AMI reading is identical to the reading the customer would see if they tried to take a visual meter reading. Therefore, it could be assumed that for validation purposes the readings are accurate. The only role of validation in this situation would be to identify large changes in consumption which could be indicative of issues such as leakage, seasonality, or the customer vacating the property. Therefore, meter reading validation would be focused on identifying those customers where some form of additional investigation was required. This should provide a significant benefit to retailers.

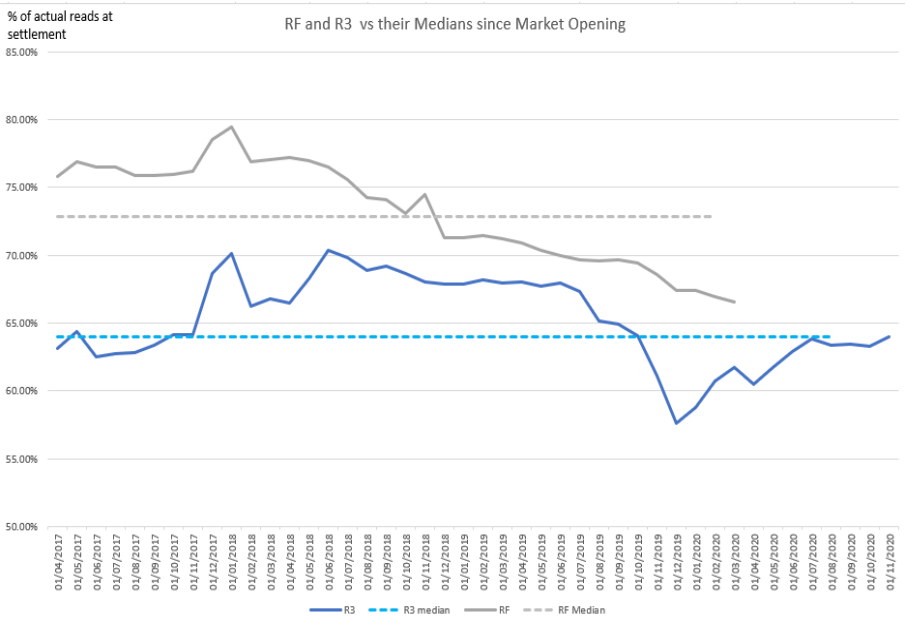
2. **Mechanical register with pulse pick-up secondary electronic register** – These devices can either be a remote secondary electric register with a wired connection to a pulse pick-up unit attached to the meters or a complete clip-on unit as shown in the picture above. For these types of meters, a programme of verification reads will likely be required. In very broad terms, a degree of desktop verification following installation to confirm that the correct pulsing factors have been put into the PRF (to check that consumption is broadly in line with previous billing and use) will be required. Pulse unit reliability is much improved, however an active verification read sample programme will be required to determine the frequency required for check reads.

4.3 Current Market Code

The timing and frequency of meter reads added into CMOS are key factors that determine bill accuracy, as well as enabling enhanced analysis of water consumption and targeted water efficiency intervention. Given the multiple sources of non-standardised meter read data that retailers receive and the use of estimated consumption, there is a market requirement to improve in this area.

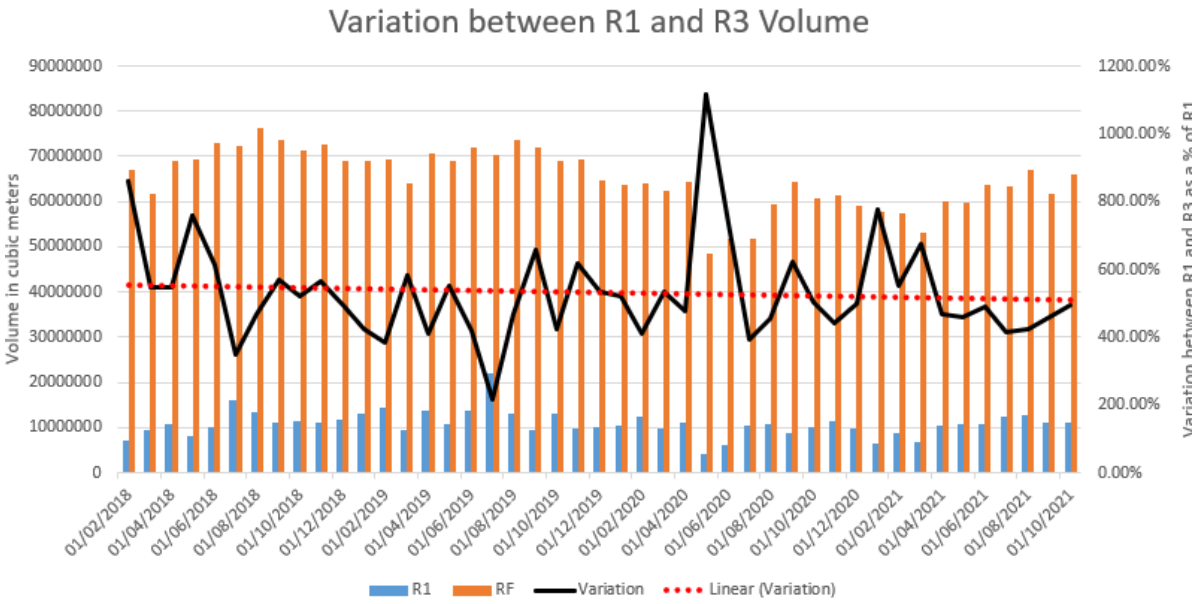
To illustrate the current reliance on estimates at the point of settlement, the following graph shows the retailers with more than 5000 customers whose meters make up most of the market share (i.e., 1.275m out of the 1.292m meters in the market). Reliance on estimated reads at R3 and especially RF has been increasing since market opening (i.e., the % of actual reads has been dropping). Actual reads at R3 are on the rise now, although they are still arguably below an acceptable level.

The following helps to illustrate where consumption is underestimated, and presumably the retailer underpays at R1.



The blue stack is the volume at R1, the orange stack is the volume at RF, and the black line represents the difference between R1 and RF represented as a percentage of R1.

The trend line suggests that all retailers underestimate the R1 volume by around 531%[a] across the reporting period (from the start of 2018 to the most recent RF view which is Oct 2021).



The market is currently restricted and only allows Retailers to submit meter reads for settlement purposes. However, with the evolution of Smart Meters and the availability of smart reads within the Wholesaler platform, there is an opportunity to improve meter read data quality and address some of the issues with estimation.

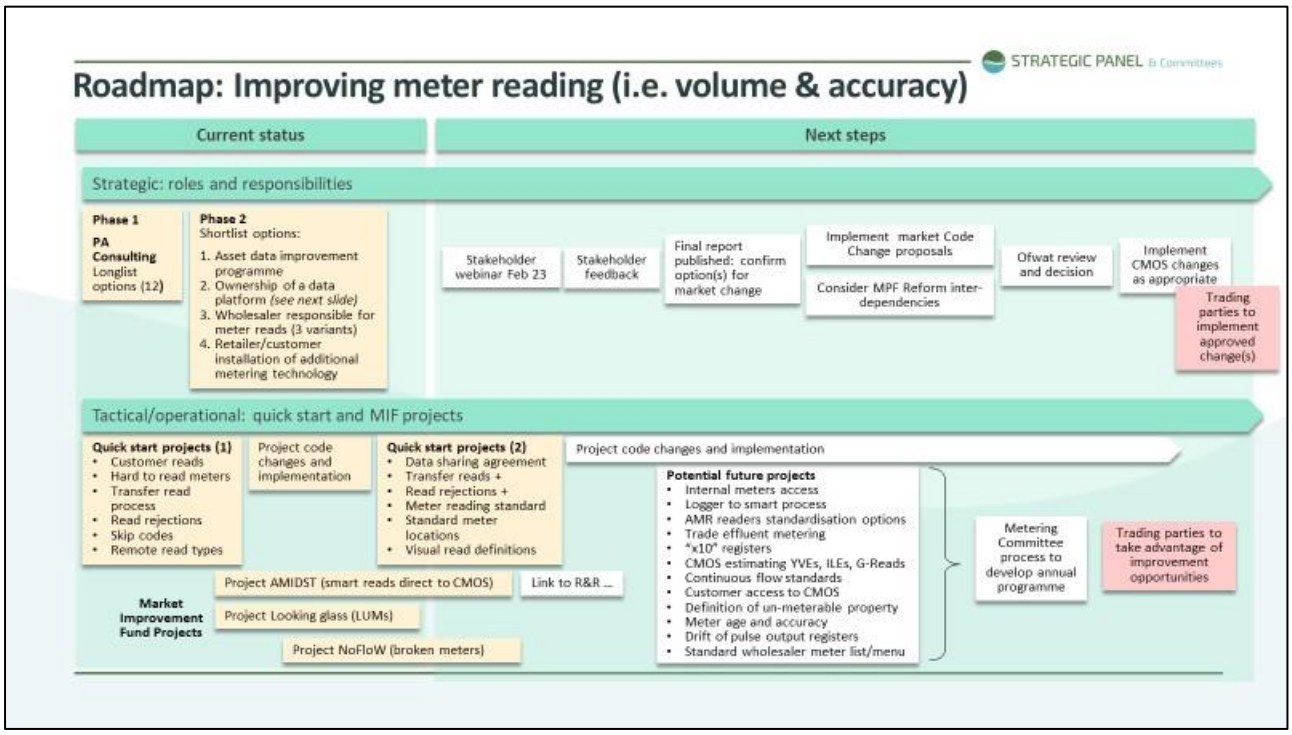
With timely data being available in the Market this provides opportunities for the data to be used to enable accurate invoicing to the NHH customers, removing estimation and providing an overall better service.

a Source: MOSL

4.4 Metering Committee Activities

There are several strategic themes that the Metering Committee are leading on, which has dependencies for Project AMIDST. A metering roadmap has been prepared with three key workstreams, the relevant one for Project AMIDST being 'Improving the meter reading process'.

The following roadmap shows the programme of development for metering issues and improvements. There are clear interdependencies and interrelated issues with Project AMIDST relating to the effective introduction of smart metering.



From the roadmap there are several key dependencies in the metering work programme that could influence the implementation of the outputs from Project AMIDST, these include:

- The project on Roles and Responsibilities. Phase 2 of the work has recommended that a Code Change be implemented to transfer the responsibility for meter reading back to the wholesaler (referred to as Option 3) where meters that are enhanced to smart AMI
- Wholesaler metering programmes in PR24 and the extent to which smart metering will be increased in the next AMP period.

4.4.1 Strategic Metering Review

In April 2022 MOSL published the findings of a commissioned research project undertaken by Artesia Consulting[1] . The key report findings centred on the benefits of rolling out Smart Metering technology (both AMR and AMI meters) across both the domestic and non-household markets, stating that this would be one of the key ways in which water companies plan to meet the increasing demand for water.

The report goes on to highlight that, hand in hand with the smart metering technology investment, is the need for water companies to be able to provide “timely, accurate and granular data from meters" to ensure customers’ bills are based on actual consumption as opposed to estimations, and that data is available to support reduction in leakage and improve water efficiency.

[1] Artesia Consulting: A Strategy for Enhancing Metering Technology, March 2022 and available on the MOSL website here

Artesia's research clarifies that there are several equally valid approaches to achieving enhanced metering technology for the non-household market and highlights instead the importance of adopting common data standards across the market.

4.4.2 Roles and Responsibilities Review

In June 2022 and March 2023 MOSL published the findings of a commissioned research project undertaken by PA Consulting[2][3]. These reports consider the options and merits of potential changes to the current roles and responsibilities relating to NHH meters, from responsibility for reading meters to meter ownership.

Although wholesalers 'own' the meter, they do so as 'stewards' for customers and retailers, who are directly affected by decisions about the meter (e.g., technology) and rules relating to it (e.g., responsibilities for reading meters, how and when data is made available, etc).

The project aims were to revisit the current roles and responsibilities to:

1. Consider whether they are still appropriate and optimal
2. Address any unintended consequences from decisions made prior to market opening (e.g., transferring responsibility for reading meters from wholesalers to retailers)
3. Explore potential opportunities for changes to the current status quo, particularly those that could benefit customers.

There are a number of potential options that have been identified which have been developed through extensive engagement with NHH market experts through the Metering Committee, one of which (Option 3) is to change the responsibility for meter reading to the wholesaler where a wholesaler smart meter is installed.

Once the automatic transfer of meter reading to CMOS is in place (as described by Project AMIDST) there is a good case for changing the responsibility for meter reading from the retailer to wholesaler when smart meters are installed by the wholesaler. Since the data will be captured by the wholesaler and can be effectively transferred to the retailer there will be virtually no need for the retailer to read a meter. Based on the recommendation of the Phase 2 report MOSL, at the request of the Metering Committee has started the process to implement a code change to change the responsibility for meter reading where a smart meter is installed and operational to the wholesaler and that the meter reading should be entered directly to CMOS.

[2] PA Consulting: Roles and responsibilities for metering in the NHH market phase 1 report, May 2022 and available on the MOSL website here

[3] PA Consulting: Roles and responsibilities phase 2 – Proposed options to progress to Market Code Change Process, March 2023 and available on the MOSL website

4.4.3 Smart Meter Installation Plans

The table below shows the predicted Smart meter installation by other Wholesalers. Therefore, this work is fully applicable to all wholesalers and will set a standard for other to take advantage of.

The water industry is generally moving towards smart metering, primarily for household customers. Driven largely by regulatory incentives to improve customer service, manage leakage and demand (water efficiency), programmes of smart metering are either being proposed or delivered by each water company. The result is a broad increase in smart metering at different rates in different geographical areas and using different technology. Most smart metering programmes are also including NHH meters although in some cases they lag behind the household installations.

For the market this means that smart metering will not be a structured or managed implementation process but a gradual increase in numbers. Estimates from CMOS suggest that 6% of market meters are now smart as at 29 November 2023. It is expected these numbers will increase as a result of the current smart metering programmes and is likely to increase in AMP8 (2025-30) if water companies propose significantly more smart metering in their Water Resource Management Plans and PR24 regulatory business plans (see summary table below prepared by the metering committee)

Wholesaler	End of AMP8 (2030)	End of AMP9 (2035)	End AMP10 (2040)	Notes
Anglian	All NHH meters converted to smartAMI			WRMP clearly defines a programme for NHHs
Northumbrian	All NHH meters converted to smartAMI			WRMP clearly defines a programme for NHHs
Severn Trent	All NHH meters converted to smartAMI			Programme is implied from HH
South West	All NHH meters converted to smartAMI			WRMP clearly defines a programme for NHHs
Southern	All NHH meters converted to smartAMI			Programme is implied from HH
Thames	All NHH meters converted to smartAMI			rdWRMP sets out alternative AMP8 plan
United Utilities	All NHH meters converted to smartAMI			90% of NHH meters smartAMI by 2030
Wessex	All NHH meters converted to smartAMI			WRMP clearly defines a programme for NHHs
Yorkshire	Not available			SoR suggests 85% of NHH meters to be Smart AMI in AMP8
Affinity	All larger NHH meters converted to Smart AMI			Strategy tbd for small consumption meters
Bristol	Details on smart metering to be completed in final plan			Meter programmes in final WRMP will be Smart
Portsmouth	All NHH meters converted to smartAMI			To be confirmed when Appendix 8 published
South East	All NHH meters converted to smartAMI			WRMP clearly defines a programme for NHHs
South Staffordshire	All NHH meters converted to smart AMI			WRMP clearly defines a programme for NHHs
Sutton and E Surrey	All NHH meters converted to smart AMI			7-year programme from 2025

A fully developed Project AMIDST could then be implemented as each NHH meter becomes 'smart'. It means there will be a gradual transfer from retailer led infrequent meter reading to meters being automatically read and data provided on a monthly basis to CMOS. This change will need to be managed by retailers to capture meter readings for billing, to manage their meter reading providers appropriately, and to work with customers as they move towards bills based regularly on actual readings.

5 Anticipated Benefits

There is a strong benefit case for rolling out enhanced metering technology to NHH customers, as highlighted by the Artesia report described in section 4.4.1. However, as companies plan to upgrade or roll out smart meters it requires large-scale investment, which could see a roll out period that could stretch up to 15 – 20 years. Given the longevity of the programmes, the anticipated benefits across the market will be cumulative and it may be some time before they are all realised, however, Project AMIDST will help set the standard for providing smart reads, in readiness for the increase in smart data.

The below table gives a summary of the potential benefits of providing reads direct into CMOS.

Category	Benefit	Description
NHH Customer Invoicing and Service	Timely bills based on true read, fewer estimates	Providing monthly Smart AMI reads will enable bills to be raised on actual true reads
	Fewer customer queries/ complaints	As bills are based on true actual reads the reduces the potential for errors
	Better ability to understand consumption	With a history of monthly actual reads, it will provide better intelligence to understand consumption.
	Better transfer read estimates	With a history of monthly actual reads, the data will be more accurate to calculate an estimate when required.
	Support for better customer transfer journey	With a history of monthly actual reads, the data will be more accurate to calculate an estimate when required.
Settlement	Accurate timely reads, less estimates	Providing monthly Smarts AMI read will enable settlement to be calculated on actual true reads
	Forecasting revenue and cash	Having actual true reads improves the quality of data in the market enabling for accurate forecasting of revenue and cash
	Potential to reduce the 18 month billing cycle	Providing monthly Smart AMI reads will give settlement on a month by month basis which could remove the need for an extended billing cycle.
Market Obligations	No longer required to send Smart Reads into the Market	As Smart AMI reads would be sent from the Wholesaler the requirement for Retailer to send a read will no longer be necessary
	Potentially reduced risk of being penalised on the MPF	As Smart AMI reads would be send monthly the risk for the Retailer of being penalised is removed
	Reduce the visual read programme (Reduction in cost to serve)	As Smart AMI reads would be sent from the Wholesaler, Retailers no longer require a visual read programme (Meter Reading Contract)
Performance & Reporting	More accurate data for reporting market performance	Having actual true reads improves the quality of data in the market enabling for accurate market performance reporting
	Market operates more effectively	A system to system transfer of actual reads provide regular accurate data for billing, settlement and reporting

The benefits identified can provide benefit across more than one stakeholder in the market, as detailed in the following matrix.

Category	Benefit	NHH Customer	Retailer	Wholesaler	MOSL
NHH Customer Invoicing and Service	Timely bills based on true read, fewer estimates				
	Fewer customer queries/ complaints				
	Better ability to understand consumption				
	Better transfer read estimates				
	Support for better customer transfer journey				
Settlement	Accurate timely reads, fewer estimates				
	Forecasting revenue and cash				
	Potential to reduce the 18 month billing cycle				
Market Obligations	No longer required to send Smart Reads into the Market				
	Potentially reduced risk of being penalised on the MPF				
	Reduce the visual read programme (Reduction in cost to serve)				
	Less costs of meter reading				
Performance & Reporting	More accurate data for reporting market performance				
	Market operates more effectively				

6 Findings of Phase 1: Technical - System to System Data Transfer

"**Phase 1: Technical** – Establish a direct API connection from Wholesalers into the market to submit the AMI monthly reads into the staging table for Retailers to approve. (In line with the current Market Code)"

6.1 Technical Solution Options

Several potential options were considered for the submission of smart meter readings into CMOS. The main options are outlined below.

6.1.1 Non-transactional updates

A low-cost application programming interface (API) interface could be developed to submit meter readings directly into the CMOS database, bypassing the CMOS application. This would however remove any audit and non-repudiation capability provided by CMOS and would require significant redrafting of the market code. Additionally, retailers would not receive any notifications and no validation would take place.

The risks of new data quality issues would be high. If for example a meter reading could be submitted for a meter that hasn't yet been registered in CMOS then the reading could become stranded in the database or potentially crash the application or affect settlement calculations.

Whilst offering a low-cost approach, the loss of control, audit, and potential security concerns rule this out as a viable solution. It would also require changes to the CMOS architecture and additional CGI (MOSL partner) development. This would need to be scheduled for a future release, which would likely be 12 months or more away, not meeting the timescales for this project.

6.1.2 Changes to T105.W (Wholesaler Meter Readings) to include cyclic meter reads

Making a change to the T105.W transaction to enable wholesalers to submit cyclic meter readings is at face value relatively simple. The business logic is already in place to validate other wholesaler readings like final (F) reads, including supply point ownership and meter association with the supply point.

If the wholesaler is taking responsibility for all cyclic reads, then the solution would be low cost, although it would need to go through the CMOS release lifecycle, which could take 12 months and assumes that all wholesalers take responsibility for cyclic readings at the same time.

If wholesalers take responsibility for cyclic smart reads only then there would need to be a formal definition of what constitutes a smart meter in CMOS terms. Given existing data quality issues, wholesalers would need to ensure that CMOS accurately reflects the types of meters installed. CMOS would then be able to validate whether the meter qualifies for a smart read and accept or reject the read as appropriate.

If retailers retain ownership and responsibility for all cyclic meter readings, then it is likely that a capability to opt in/out would be required within CMOS. This would probably take the form of an agreement management solution within CMOS that would enable CMOS Contract Managers to define wholesaler/retailer relationships. CMOS would then govern the submission of wholesaler meter readings in accordance with the agreements. The development of a solution to manage and police agreements would require both front-end and back-end development, with costs rising steeply depending upon the level of flexibility required.

Consideration would also need to be given as to whether wholesalers and retailers could submit cyclic meter readings for the same meter. Many retailers use Common Off the Shelf (COTS) billing systems to submit meter readings. Typically, these systems do not provide the ability to selectively decide which meter readings to send and changes could be expensive and prohibitive, particularly for smaller retailers.

Retailers will also be impacted in terms of their business processes and their systems. Currently the majority of retailers load meter readings into their billing systems and then send them to CMOS, either through the Low Volume Interface (LVI), the High Volume Interface (HVI) or the MOSL Medium Volume Interface (MVI). With wholesaler readings, the direction would be reversed. Readings would be submitted to CMOS, which would then need to be reflected into the retailer billing system to ensure that the customer is accurately billed. This may have a significant impact upon some retailers who will need to find effective and efficient ways to update their systems.

Changes to the T105.W will generate T105.M cyclic read notifications for the HVI retailers that their billing systems are not expecting. Changes to their systems will be required and this would need to be coordinated at a market level or alternatively retailers could proceed at their own pace if opt in/out agreements are in place.

The use of the T105.W should ultimately provide a good solution for wholesaler submission of smart meter readings, however this is not a short-term solution. It will take considerable effort to get consensus across the market, and the CMOS development could be considerable depending upon the final solution.

Given the development effort that could be involved, it may be more appropriate to roll this activity into the CMOS modernisation programme to avoid nugatory effort and given the timescales of the AMIDST project this has been excluded.

6.1.3 Extension to the Medium Volume Interface

The MVI is a service that is developed and supported by MOSL, which enables batches of transactions to be uploaded and submitted to CMOS using the trading party's HVI channel. Developed initially to support smaller retailers, the MVI has been used by most wholesalers and retailers to submit bulk updates.

The MVI service enables trading parties to upload batches of transactions to the Market Operator (MO) Portal using an Excel spreadsheet template. Each transaction is validated to ensure that the data is formatted appropriately and then stored within the MVI database.

When the user submits the batch, each transaction is converted into an XML document in accordance with CSD0301 and submitted to CMOS using the trading party's HVI channel. CMOS responses either go directly to the trading party's systems or back to the MVI where they can be processed.

MOSL is aware that there is at least one wholesaler/retailer combination that is using this mechanism to submit wholesaler readings into CMOS on a monthly basis as regular cyclic reads. Reads are exported from the wholesaler's system into the Excel template and sent to the retailer. The retailer then uploads the spreadsheet to the MVI, which in turn submits the transactions to CMOS. Whilst this is more efficient than other existing options, there is still significant friction in the process.

To eliminate the friction from this proven process, MOSL would adapt the MVI to remove the need to exchange spreadsheets between parties. By developing a new API for the MVI, the wholesaler will be able to directly load the transaction data into the MVI, where it will be validated and stored in the MVI database. The retailer will then login to the MVI, where they can see any wholesaler uploaded batches that they can then approve for submission. Whilst the additional step of retailer approval is not required from a technical perspective, the current market codes dictate that the retailer is responsible for the submission of cyclic reads and therefore this additional step ensures that the solution remains compliant and doesn't require code change and approval before implementation. In the future there could be an agreement between the wholesaler and relevant retailer to auto upload into CMOS for settlement purposes (subject to detailed review).

6.2 Selected Approach

On the basis that the other options require code change and CMOS development, the only viable technical solution that could be developed within the cost envelope and the timescales for AMIDST was to create a new MVI API.

6.2.1 High level Architecture

The MVI is a modular application that is hosted in Microsoft Azure and uses Kubernetes containers to provide both high availability and scalability. The high-level architecture for the MVI solution is shown in the diagram below. To ensure there are no capacity limitations on the number of reads that can be accepted, consideration of future capacity planning for CMOS and other systems such as Market Performance Framework will be required.

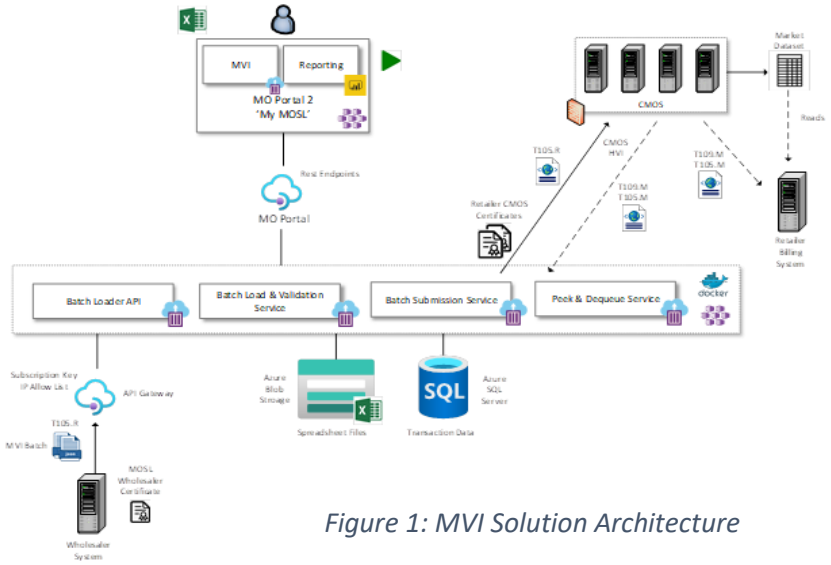


Figure 1: MVI Solution Architecture

6.2.2 Batch Load and Validation Service

The batch load and validation service is the service that processes and validates transactions submitted using an Excel spreadsheet. The service processes files that have been uploaded to Azure storage via the MVI Portal. For each transaction in the spreadsheet, the service extracts the metadata, validates that it is structurally correct and stores it in the MVI database so that it can be reviewed by the user and subsequently submitted to CMOS.

6.2.3 Batch Loader API

The Batch Loader API is a new service that is based upon the Batch Load and Validation Service. Rather than processing transactions from a file, it processes transactions received from a new API. Transaction data is validated for structural integrity and stored in the MVI database.

6.2.3.1 Messaging protocol

CMOS uses extensible Markup Language (XML) to support transactional messaging for the HVI. Whilst this was a messaging standard of choice in 2015, newer lightweight protocols have been developed with XML now being deprecated by many providers. MOSL offered both XML and JavaScript Object Notation (JSON) interfaces as part of the Bilateral Hub programme to deliver an HVI capability. On the basis that

there have been no XML implementations, there is little appetite for XML in the market, and therefore JSON was selected for the MVI API messaging.

6.2.3.2 Message structure

MOSL developed a simple message format that is comprised of a header and a payload, which is similar to the composition of CMOS messages. The header provides the details of the batch and includes:

- The CMOS retailer identifier
- The CMOS wholesaler identifier
- A description of the batch so that the retailer can distinguish the batch from other batches
- The person responsible for the submission of batch within the wholesaler
- The number of transactions within the batch

The message payload is formed from an array of up to 5000-meter readings. Since the payload needs to be converted and submitted as T105.R transactions, the format of the payload array mirrors the T105.R structure as defined in CSD0301 as shown in the following image.

Transaction Number	T105.W, T105.R	
Transaction Name	Submit Meter Read	
From	Wholesaler, Retailer	
To	Market Operator	
Data Item Number	**Name**	**Notes**
D2001	SPID	Required unless meter is a Non-Market Meter
D3013	Meter Manufacturer	Required
D3014	Manufacturer Meter Serial Number	Required
D3008	Meter Read	Required
	Meter Read Date	Required
D3010	Meter Read Type	See Additional Notes below
D3044	Meter Read Method	See Additional Notes below
D3028	Estimated Read Reason Code	Required only if D3044 is ESTIMATED
D3029	Estimated Read Remedial Work Indicator	Required only if D3044 is ESTIMATED
D3012	Re-Read	Required
D3020	Rollover Indicator	Optional
D3046	Meter Removal Reason	Required only if D3010 is “F”. Not valid otherwise.
D4003	Text Comment Field	Optional
Description	A Meter Read submission from the Wholesaler or Retailer	

Messages that do not comply with the structure will be rejected by the API.

6.2.3.3 Interface Security

In line with the requirements defined in CSD 0400 Common Technical Specification, MOSL has implemented a defence in depth security approach for the API. This includes IP whitelisting, digital certificates and a wholesaler specific security token. This is provided by the Azure API Management service. The API Management service will ensure that the interface is secure and meets the code mandated requirements for non-repudiation.

6.2.4 Batch Submission Service

The Batch Submission Service is responsible for submitting batches that have been authorised by a user for submission to CMOS. Transactions are submitted at a rate of approximately one per second and are taken evenly from across any running batches.

The service takes transactions from the MVI database in sequence and converts them to CMOS XML transactions in accordance with CSD 0301. The service then attaches a trading party specific digital certificate and submits the transaction to CMOS.

With the transaction data being persisted to the MVI database, the service is able to recover from CMOS outages and therefore trading parties are not constrained by the availability to upload batches.

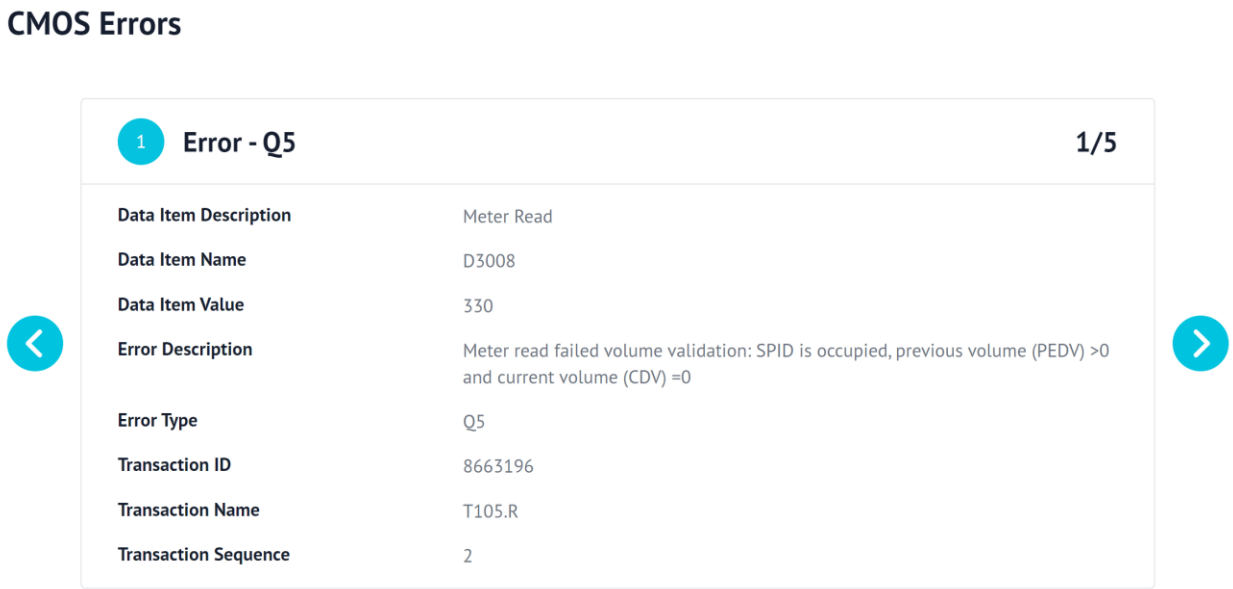
6.2.5 Peek and Dequeue

The peek and dequeue service is designed to retrieve notifications from CMOS, where the trading party does not have an HVI interface. On a scheduled basis, the peek and dequeue service polls each trading party's queue in CMOS using the trading party's digital certificate.

Where there are responses available the service stores the response in the MVI database where the trading party can subsequently review the outcome of submitted transactions. CMOS will take up to 5 minutes to generate a notification and therefore the end-to-end process of submitting a batch to retrieving all of the responses may be as long as 15 minutes depending upon the batch size.

For large batches of 5000 transactions submitted by the Batch Load and Validation service, this can take a few hours.

The MVI additionally retrieves the outcome of all submitted transactions. Previously if an organisation used the HVI then the notifications were returned to a trading party's system, making it difficult to determine whether a transaction was successful. Now error messages can be viewed within the MVI Portal. An example is shown below.



6.2.6 Retailer Interface

The retailer process is triggered by the MVI sending an email to the retailer when a new batch of meter readings is received from the wholesaler. The email notification will contain information relating to the batch and a link to the MVI Portal.

Retailers will access the MVI service through the MVI Portal, which is accessed from the MOSL website through 'My MOSL'. 'My MOSL' provides a consistent common "front door" for all MOSL services and includes single sign-on.On opening the MVI service, the user is presented with a landing page that contains all batches for their organisation with the newest batches first. To submit a batch, the user will simply click the green 'play' button as shown in Figure 2 below. Assuming that there are no other batches running for the trading party, the batch submission service will start to send transactions to CMOS. For a large batch, this may take several minutes as the submission of transactions is throttled to protect CMOS performance for other trading parties.

Whilst the submission may take several minutes, there is no requirement for the user to wait for the batch to complete before logging out of the MVI

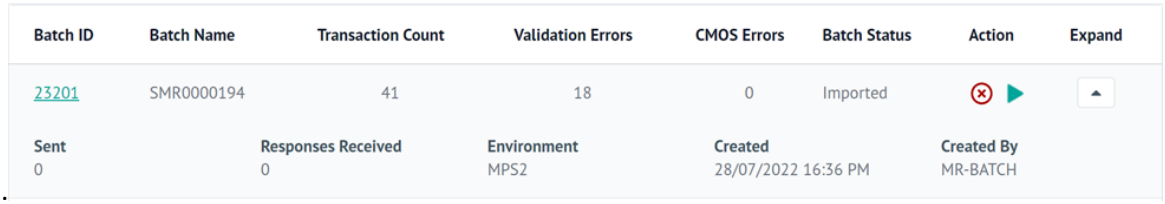


Figure 2: MVI Batch Submission

Functionality has been developed to allow Retailers to download each batch as a file to provide visibility. This file can be used for any validation/billing systems for those Retailers who add meter reads into their billing system, then subsequently into CMOS.

6.3 Cost

The MVI solution makes considerable reuse of existing code. The 'Batch Loader API' service makes extensive use of the 'Batch Load and Validation Service', whilst the 'Batch Submission Service' and 'Peek and Dequeue' services remain largely unaltered. This solution will cost around £25,000 to £30,000 (MOSL estimate) and will have little if any impact upon ongoing service delivery costs in MOSL.

The cost of the other options will depend largely upon the level of complexity and flexibility required within a target solution, with potential changes to settlement being arguably the biggest individual cost. Indicatively, a simple solution that was mandated across the market would cost in the region of £100,000 rising to £750,000 or more for settlement changes and a more flexible solution that would support a staggered retailer adoption.

There are a number of dependencies that will need to be investigated and agreed within the market before defining which of the above options would be appropriate along with the associated timescales.

6.4 Testing Approach

Since the API is an extension of the MVI, MOSL has used and adapted the MVI regression tests to undertake both functional and non-functional testing of the interface. This excludes penetration testing which will be incorporated into the next test cycle.

End-to-end testing has been undertaken using both small and large batches against the CMOS test environment MPS2. This includes positive and negative test cases to ensure that the solution does not have any detrimental impact upon CMOS or other trading parties.

6.5 Potential Future Enhancements

6.5.1 Agreements

Validation of the agreement between the wholesaler and retailer is currently hard coded into the API. Whilst this is viable at small scale, it will not scale well and does not enable MOSL IT Operations to manage and deliver the process. The development of a database driven agreement validation service would simplify the process and provide greater flexibility.

6.5.2 Automated Submission

Currently a user must physically login to approve a batch for submission, which adds friction to the process. A 'pre-approval' process would enable retailers to automatically submit batches upon their receipt through the API reducing the friction and ensuring the timely submission of meter readings.

6.5.3 Detailed Transaction Data Reports

Although AMIDST is predicated on the direct submission of meter readings into CMOS, it is likely that retailers will require visibility of what will or has been submitted, if only to update their billing systems to ensure that customers are billed on actual reads and not estimates.

Further work with retailer groups will be needed to determine the precise requirements for enhanced reporting over and above what is delivered in the MVI and CMOS today.

6.6 Wholesaler solution

A batch program has been created and scheduled in SAP to run every month end which triggers the extract of smart meter reads for NHH customers from Anglian Water's OT platform.

Once the data is extracted from the OT platform, it will create the JSON data in the specified format.

When the job is executed, if the Meter read details are not available for the SPID in the AWS OT platform, the most recent data that is available will be sent, providing the read is within the last 4 weeks (28 days). This is to avoid re-sending data that was sent in the prior month.

CPI sends the meter details along with the other required fields to MOSL through external API interface as a JSON message.

The JSON message should have a header which includes the Retailer ID in order to separate the reads by retailer.

Each API call is limited to a maximum number of reads that is 500 reads per API call to comply with MOSLs restrictions

In case of a meter exchange, reads for the latest meter needs to be considered.

In case of Success/failure, Wholesaler distribution group and/or nominated individuals will be notified.

The total cost to deliver this API connections was approximately £30,000, however, as we (Anglian) had already developed the API for our Retailer Data Exchange Solution we were able to build on what was previously developed. End to end development was approximately 12 weeks including testing.

6.7 Performance of the API trial solution

During testing an automated schedule was set up to send daily readings for 100 smart meters from Anglian Water Wholesale to CMOS over a period of at least 7 days. These successfully reached MOSL and initiated the current CMOS validation rules.

Some were rejected due to incorrect asset data, number of meter dials v number of digits on the meter read. This is understood to be due to the asset data being set up incorrectly in the test environment which created the rejection.

Some were rejected due to the volume validation. Within the testing environment there was a lack of historical meter reads available to validate against. This was as expected based on the experience during testing at market opening.

The rejected reads due to volume validation were submitted again using the re-read flag, which resulted in all being accepted. To fulfill the end to end testing a further set of meter reads were submitted for the same meters and these passed volume validation rules.

This may be a consideration when we go live, as the first batch of reads may require resubmission with a re-read flag to align the data.

In conclusion the API system-to-system AMI smart meter read data transfer testing has been successful and is fit for purpose for further widespread pilots on the assumption that the points above are considered

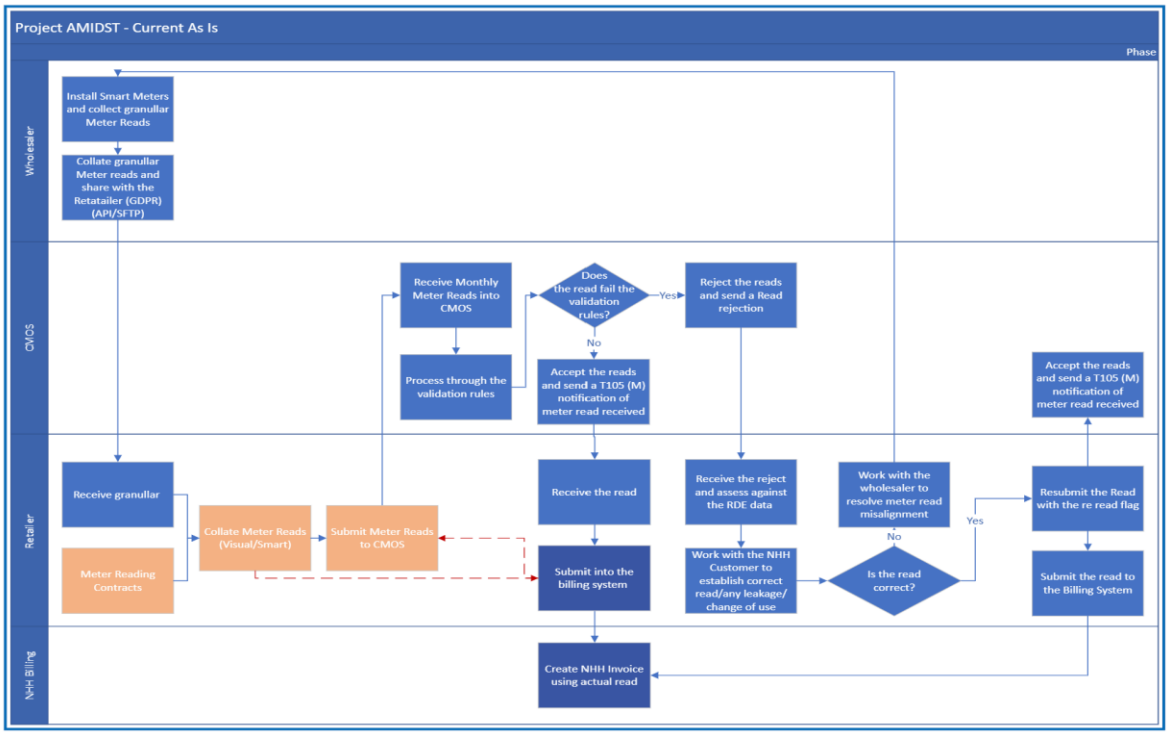
7 Process maps for different stages of the development

It is understood that there is not a consistent approach in the Retailer processes to submit the Read to CMOS. It varies between

- Reads being submitted to CMOS; the CMOS read is then used within the billing system
- Reads being submitted into the retailer billing system, then shared into CMOS

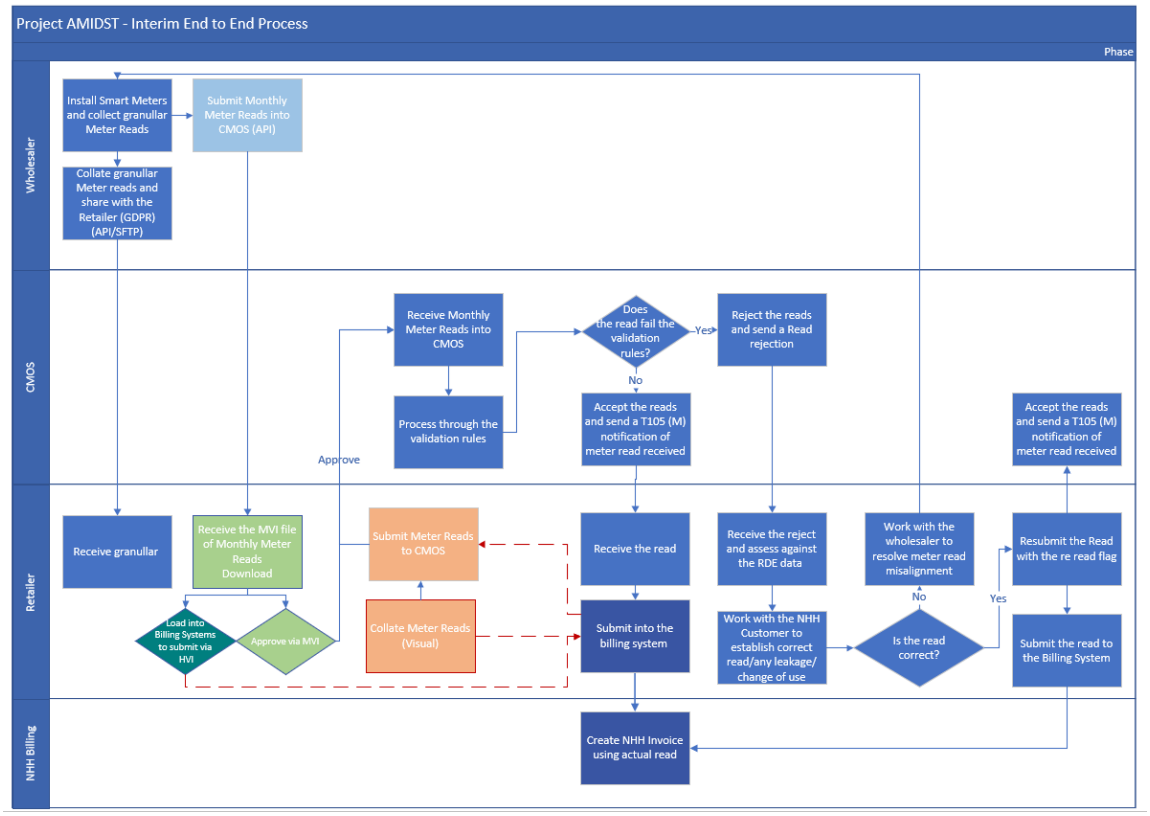
Project AMIDST is not proposing that this would change, and the solution would still offer the flexibility to use the Smart Monthly Reads submitted to CMOS or the Granular Smart Meter Reads provided via the RDE (Retailer Data Exchange)

The following diagram shows the current as is process, detailing both the above options (the red dotted line reflecting the reads being submitted into the retailer's billing system then shared into CMOS):



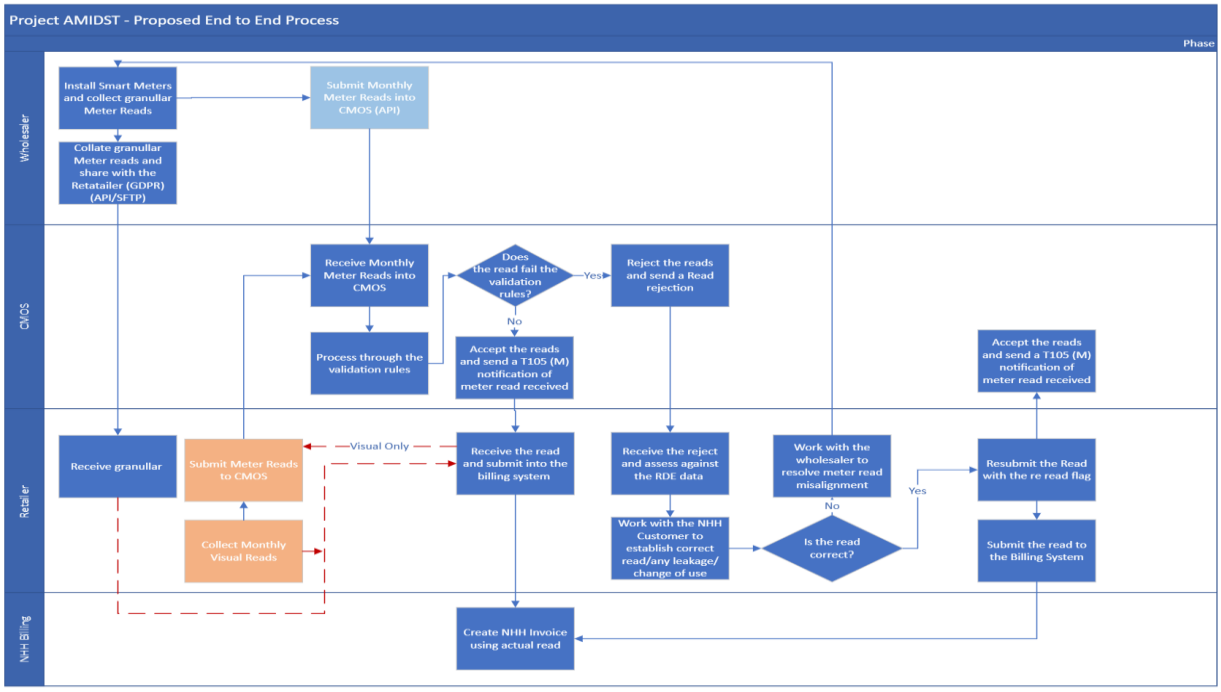
As Project AMIDST will initially deliver a proof of concept to allow system to system transfer of Monthly Meter Reads, currently the code requires Retailer intervention to process the Meter Reads.

The following diagram shows the proposed interim process, detailing both of the above options (the red dotted line reflecting the Reads being submitted into the Retailer billing system then shared into CMOS). It also details the additional steps required by the Retailer to approve the MVI file that is created by the wholesaler to submit the Monthly Reads to CMOS.



If the recommended enduring solution were to be progressed and required code changes were implemented, then the additional approval step required by the Retailer would not be required.

The following diagram shows the proposed final/ enduring process, detailing both above options (the red dotted line reflecting the reads being submitted into their billing system then shared into CMOS). However, the additional steps required by the Retailer to approve the MVI file that is created by the Wholesaler to submit the Monthly Reads to CMOS have now been removed.



8 Findings of Phase 2: Market Code - Code, Benefits and Impacts Review

Phase 2: Market Code – investigate the potential code changes and benefits to allow the reads to be submitted without Retailer approval. In addition, identify the further technical development required to remove the approval step outlined in Phase 1.

8.1 Overview

This section describes the market codes considerations and solutions as required by the recommendations of Project AMIDST. It sets out the main areas of consideration that would need investigating to develop a change to the market codes.

8.2 Areas of Consideration

In order to meet the objectives of Phase 1, Technical solution – system to system data transfer, the MVI API was developed. This approach allowed the proof of concept to be tested whilst working within the current market code (Retailer approval step retained) and timescale for Project AMIDST.

This section is based on the enduring solution and all parties having access to and using the High-Volume Interface (HVI). This is because any code changes to allow wholesalers to submit cyclical smart meter reads would impact on the HVI interface and Settlement. However, it is understood that some retailers will require to use the MVI and this would need further consideration to allow those parties unable to use the HVI (this is excluded from this section).

CPW087 – 'Ability for Wholesalers to add meter reads' delivered an option to the codes that allows Wholesaler reads to be added to CMOS. However, this is a very manual process as it requires the

Retailer to manually add the Wholesaler reads to CMOS, and therefore would not be a suitable enduring solution. It is also worth noting that the W read process is currently being reviewed by the Metering Committee under a quick start project (QSP14).

8.3 Inputting of Read Data into CMOS

As stated above this solution is based on use of the HVI, further consideration would be required for a MVI solution.

When submitting the monthly reads to CMOS[4], then either a new transaction type will need to be created or the current T105.W amended. Adapting the current T105.W may be the least complex and therefore better value option.

If the T105.W is adapted, then the following changes would be required:

- D3010 'Meter Read Type'- New value required.
  - Wholesaler AMI SMR (Smart Meter Read)
- D3044 'Meter Read Method' – New values required[5].
  - Smart – Read obtained from a meter with an integrated electronic register
  - Pulse – Read obtained from a secondary electronic register connected to a pulse device attached to the meter

Only one new value could be used for the D3044, 'Smart', but given the potential for drift on a pulse from the meter it may be worth differentiating between the two.

If a later read has already been accepted should the Wholesaler still be able to insert the wholesaler meter read (WSMR) via the TCORR172.W? Once the WSMR are being entered monthly there shouldn't be the need for inserting reads as the WSMR being inserted should be the latest read. The value of inserting a historic read would need to be measured against any additional complexity (and cost) this may bring to the solution.

Given Smart meter reads can provide daily readings (and some more frequent than that), should there be the ability to submit more frequent reads to CMOS? A maximum of two smart meter read per month is probably sufficient. This would allow for a monthly read to be submitted for reconciliation and an additional read that has been used for customer billing (customer billing cycles do not always align with reconciliation). If there was the desire for more reads (e.g., daily/weekly) to be loaded, then CGI would need to undertake analysis to understand the capacity of CMOS to manage reads.

[4] The above would not prevent a Retailer from submitting a SMR themselves via a T105.R.
[5] The new values are suggestions only and would need to be considered as part of the development of a change to ensure they are accurate and do not cause confusion

8.4 Read Validation

Given the reads will be obtained directly from the meter or a pulse output, then consideration could be given to relaxing the read validation. However, given there is a potential widening of the tolerances if CPW128 'Updating Volume Validations Tolerance' is approved, and the system hasn't managed monthly smart meter reads it is recommended that initially there is no amendment to the tolerances. It may be viewed that the current validation should work in the favour of these meters, because there will be more reads to use to check the candidate daily volume (CDV) or volume between meter reads on a daily basis and previous estimated daily volume (PEDV) calculations. This means the meter's consumption profile will be 'more filled in'. A recommendation could be made to review the tolerances following one year of smart meter reads being entered into CMOS.

If regular and accurate reads have not been entered into CMOS historically, there is the potential for an initial batch of read rejections when the first smart read is entered. However, once accurate AMI monthly reads are entered into CMOS this will improve. Going forward any read rejections will reflect site behaviour and consumption and therefore be an indicator to the Retailer that the site potentially needs investigating.

There should be no amendments to the Nominal Maximum Design Volume (maximum volume based on meter size) and the Rollover Detection Algorithm as these will both be required whether the readings are from a smart or visual read meter.

8.5 Retailer Read Approval

The current rules on Wholesaler reads, that were developed as part of CPW087 'Ability for Wholesalers to add meter reads', require that the Retailer approves the read, by submitting the same read with the same read date, before it is used for settlement. Given the readings are directly from the meter, there should be no issues with accuracy (such as misreading which can occur with a visual read). There is a chance of an erroneous reading due to a meter fault however this is low, and the read could be replaced or withdrawn. Therefore, it is recommended that any reads that have a 'Meter Read Type' of 'Wholesaler SMR' would not require Retailer approval and would automatically be used for settlement.

Given the Retailer would be settled on these reads there would need to be a method for them to Remove and/or replace them from settlement if they felt the read was inaccurate or there was a fault on the meter or pulse drift. There are potentially two methods for this:

- A Wholesaler SMR (WSMR) read could be flagged by the Retailer as not to be used for settlement, though there is currently no flag for this in CMOS.
- A TCORR171.R (Remove Meter Read) and TCORR172.R (Insert Meter Read) could be used by the Retailer to replace the WSMR which would involve an update to the CMOS logic
- If a Wholesaler SMR read is being replaced should a reason code be provided? If so, a new field would need to be added and a list of potential reasons created. Alternatively, the 'Text Comments Field' could be utilised with a standard set of options. The latter would be a simpler solution.

- If a Wholesaler SMR read is being removed should a reason code be provided? If so the TCORR171.R would need to be updated. As with the read replacement, a new field would need to be added and a list of potential reasons created. Alternatively, the 'Text Comments Field' could be utilised with a standard set of options.

- Should the Wholesaler be notified when the read is replaced? If so, then the TCORR171.M would need to be sent to both the Retailer and Wholesaler.

- Should the Wholesaler be able to replace a WSMR? If they are, would the replacement read be used for settlement? Given the Wholesaler is likely to only have access to the smart meter read then they will probably not have access to read to replace the WSMR.

8.6 Read Rejections

If a read is rejected by CMOS, then traditionally the party submitting the read would be notified of the rejection. However, if the read is rejected as it has failed a tolerance test then the Retailer should be advised as they should be better placed to advise if the read is correct and are able to contact the customer. There are two possible ways to notify the Retailer:

1. The Wholesaler engages directly with the Retailer to confirm whether the reading is valid
2. A T109M is sent to both the Wholesaler and Retailer to advise of the read rejection. So that the Retailer is aware that the read rejected is a WSMR the T109M could be updated to include data items, D3008 'Meter Read', D3009 'Meter Read Date', D3010 'Meter Read Type' and D3044 'Meter Read Method'

If a rejected read is deemed to be valid and a re-read is required who would be the party to submit it? If the first option is chosen above, then it must be the Wholesaler. If option two is chosen, then the T105.R would need to allow a Retailer to submit a WSMR where it is a re-read.

For simplicity, and because the more reads there are the better volume validation works, option one may be the most suitable though it is more manual. Changing the T109 could have a substantial market impact, since it's used to confirm acceptance or rejection of basically all transactions.

8.7 Read Approval

If the read passes CMOS validation, then it would need to be sent to the Retailer so they are aware that the read could be used for settlement and the Retailer is able to bill the customer using that read. Potential solutions to advise the Retailer are:

1. The T109.M could be sent to both the Wholesaler and Retailer to advise the read has been accepted. A T105.M is automatically generated with a T109.M which would include the read details.
2. When a WSMR is accepted then a T105.M could be triggered to the Retailer. The T105 already contains the D3010 and D3044 so no data items would need to be added.

If the Wholesaler can replace the WMSR then, one of the above solutions would need to be adapted to advise the Retailer that the WSMR has been replaced.

One area to be addressed is, if there are separate Water and Sewage Retailers, then would the Sewage Retailer need to be notified of WSMR reads and could they remove and replace reads?

8.8 Data Ownership

This solution will bring into question the concept of data ownership. Are WSMR owned by the Wholesaler, Retailer, or both? Given the reads would impact on a Retailer's settlement, then they would probably be considered an owner. However, in the market this is a shared data ownership. This is an area that would require input from the MOSL legal team as part of any future Change Proposal.

8.9 Minimum Visual Read Frequencies

Given a monthly reading will be submitted into CMOS directly from the meter there should be a review of any requirements to obtain a visual a read from the meter where a Smart meter is present. Where a smart meter is present, and monthly reads being submitted and accepted in CMOS, then the currently minimum frequency could be increased. This could be potentially every two years for Twice-yearly Read Meters and annually for Monthly Read Meters, though this is an area that would need consideration as part of development of the change. Visual inspections of the meter should still be required to ensure there are no signs of damage to the meter or tampering etc. Where there is a pulse head attached to the meter then the requirements for visual reads could still be extended though given the potential for drift between the physical meter and the pulse output this should not be extended as much as for smart meters. This could be potentially annually for Twice-yearly (biannual) Read Meters and six monthly for Monthly Read Meters

8.10 Next Steps as they relate to Market Codes

There are several areas of consideration for the solution and more will most likely arise as the above is considered. In turn there would be other areas that would need considering when developing the solution as part of any change proposal:

- Areas of Codes affected
- Areas of MOSL needed to deliver the project
- Interactions with the current Market Performance Framework (MPF) and in turn the MPF Reform
- Consideration of impacts on other processes in the market, e.g., MPS Charges, Transfers/Switching
- Potential areas of complexity, e.g., multiple Retailers, Interim Supply Arrangements (ISA)
- Potential risks associated with options outlined
- Rationale for solution over potential alternatives
- Grading of options
- Data ownership

9 Interim Conclusion - April 2023

The system-to-system AMI smart meter read data transfer was successful using the MVI API and has satisfied the proof of concept.

In terms of the enduring solution, impacted areas of the market codes have been identified with proposed recommendations. These can be used throughout the change process recommended through the Roles and Responsibilities review to allow Wholesalers to submit Smart AMI reads direct into CMOS

As part of the project, we have a better understanding of potential risks and these are summarised in the following table:

Risk	Description	NHH Customer	Retailer	Wholesaler	MOSL
Changes to processes	Potential changes to existing processes to send, receive and process the data				
Changes to systems	Potential cost to system changes to enable to send, receive and process the data				
Hybrid Settlement processes	With the potential reduction of settlement timetable (18mth) will create a hybrid of visual and AMI settlement runs which could increase the overall complexity				
Volume of Meter Reads accepted in CMOS	CMOS functionality will only accept 1 meter read per second. It is expected that there will be approximatly 151k by 2030 (Anglian, Thames, Yorkshire). Therefore could take upto 48 hours to load these reads.				
Code changes are not approved	If the identified code changes are not approved the interim solution would stay in place				
Wholesalers not distributing reads evenly	CMOS has been designed to support a meter reading profile that is largely flat across the month. If wholesalers submit bulk readings at the end of the month, then this would create performance issues				
Wholesalers and retailers submitting reads for the same meters	If wholesalers and retailers submit readings for the same meters, then it is likely that some will be some conflicts that will cause readings to be rejected				
Changes to retailer systems and processes result in a delayed rollout	It is likely that retailers will need changes to their systems and processes to support wholesaler readings. Where retailers are not in control of the product development lifecycle, there may be implementation delays				
Incorrect meter readings leading to Unplanned settlement runs	Whilst smart meter readings are generally much more accurate than visual readings, there are still scenarios where readings are incorrect or data quality in CMOS is poor. This would lead to Unplanned Settlement Runs for which it is unclear who would be responsible for the costs incurred				
Customers don't get billed accurately	Some retailers may struggle to automate the changes to their processes and customers may not necessarily benefit from AMI readings				
CGI resource availability	Changes to CMOS to support smart meter readings and a reduction in the settlement window will require a significant level of skilled and knowledgeable resource within the CMOS development and testing team that may not be available.				
Knock on impacts to other Market Operator services not being clearly understood	Other services delivered by MOSL will need to change to support wholesaler readings including Market Performance, where changes would be required to the calculation engines to ensure retailers are not incorrectly charged				
Resource availability within MOSL	Resources within MOSL are not available to make changes to ancillary systems like MPS leading to delays in the rollout of smart meter readings across the market				

9.1 Stakeholder engagement

To complement our understanding of the challenges of implementing the Project AMIDST recommendations, engagement has taken place with three Retailers and two Wholesalers, face to face, (using Teams) and then with follow up survey. The details of which are provided in Appendix A.

Overall, the feedback was that the approach is a positive step forward, however, could potentially have an impact on how Retailers process the data within their own systems. In particular, their system development and validation process needs further evaluation.

10 Learning from Electricity Market Smart Metering

Elexon (Market Operator for the Energy market) shared that one of the benefits of Smart metering is an improvement in Suppliers' ability to obtain actual meter readings as these will be taken remotely without the need for meter readers to access the property. In addition, Smart meters will store data on a HH (Half Hourly) basis, potentially giving Suppliers access to more detailed data. There is therefore an expectation that Suppliers will obtain meter readings on at least a monthly basis (if not once a day) to allow them to issue accurate monthly invoices to customers. Therefore, it should also be possible for actual data relating to Smart meters to be entered into Settlement at an earlier date.

The percentage of actual data entering Settlements for both Visual and Smart Meters is monitored under the BSC as part of the Performance Assurance Framework. 3.2 Currently the following percentages of meters are settled on actual data at each Settlement Run.

Run Type	% of NHH meters settled on actuals	% of HH meters settled on actuals
SF	8.5	99.24
R1	29	99.53
R2	69	99.65
R3	90	99.64
RF	97	99.50[2]

This shows that the data may have the ability to reduce the number of settlement runs, and/or reduce the overall Settlement timescales. Elexon has put a paper together to highlight the expected benefits and potential issues of such a reduction. PSRG_09_01_Reducing_Settlement_timescales.pdf (elexon.co.uk)

Currently in the Water Industry the % of meters settled on actuals shows a similar trend for actual reads in the energy market. Therefore, with Smart AMI reads being submitted into the market monthly the % settled on actual should come much sooner in the settlement run therefore providing opportunity to reduce the settlement period from 18 months.

11 Interim Recommendations and next steps - April 2023

To realise the next steps for this project the following recommendations are proposed. Please note these are based on our current understanding of meter read ownership and CMOS functionality and does not consider potential future changes to CMOS modernisation.

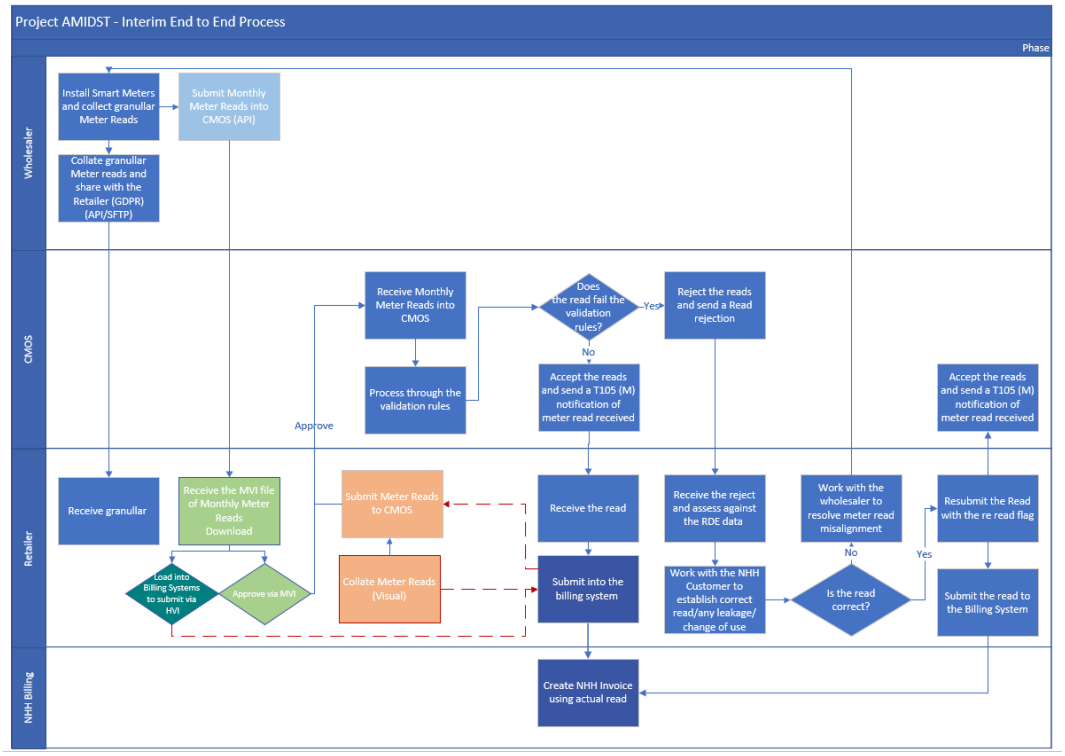
Communication

1. AWS to present the findings of this work to the Metering Committee and Strategic Panel and confirm the recommendations below. (Presented to the Technical Advisory Group 01 June 2023 and the Code Change Committee September 2023)
2. Present the findings to all Market stakeholders in the form of a webinar potentially in Summer 2023. (Roles and Responsibilities Webinar 01 February 2023)
3. Promote the interim solution of (Market Focus September 2023)
    a. Retailers to use the MVI to submit and approve the monthly reads into CMOS, or
    b. Retailers to download the monthly meter reads to load into their billing system and then transfer into CMOS.

Before implementing this:

a. MOSL should review and resolve any issues that this would create, such as capacity limits. (Rolled over to CPW142 Change Process)
b. Pilot with several Retailers in the live environment to provide confidence in the API solution and allow them to understand how to integrate it within their systems and processes. (Anglian are Live with 2 Retailers)

The below diagram shows the proposed interim process, detailing the steps required by the Retailer to approve the MVI or download file that is created by the Wholesaler to submit the Monthly Reads into CMOS/billing system.



Enduring Solution

4. MOSL and AWS to monitor the accuracy of settlement from monthly AMI meter reads versus historical, for sample set of AMI meters.
5. MOSL on behalf of the Metering Committee to implement a Code Change Proposal to amend the responsibilities for the submission of smart meter readings by the wholesaler for settlement purposes.
   This would additionally include:
   - develop a detailed business case for the enduring solution, detailed plan (including timeline and costs), risk assessment, CMOS options and requirements and impact on stakeholders (Change process)
   - Consultation with trading parties on opportunities and impacts
   - Ensure there is a costed proposal developed for the meter reading transfer process and system in CMOS for all interface types (HVI, LVI, MVI)
   - Develop a cost benefit case for each option interface option above.

12 Final Conclusion - November 2023

The AMIDST project created an interim solution to allow Wholesalers to provide reads through the API-MVI and satisfied the proof of concept to provide learning into CPW142 formal code change. While this is being progressed through the code change process the interim solution is available for all Wholesalers with a Smart Metering programme to utilise.

Anglian are using this with the two retailers who were key stakeholders to this project and the below is their feedback.

Retailer	Feedback
Everflow went live in August 2023 using the full interim solution, submitting reads direct into CMOS using the MVI They said:	"As a national retailer, we spend approximately 600 hours a year checking and converting the meter read data from different meter read service providers. Removing a large percentage of this means we could drive more contact around water efficiency and leak checks. "Using the AMIDST process, 97% of the reads went in perfectly. The other three per cent went through a quality check, with most passing as a re-read. We expect the first-time success rate to increase, further reducing the time spent quality checking. "Accurate smart meter reads coming into the market once a month means we can support our customers with accurate bills and less contact, allowing them to get on with running their businesses."
Wave went live in September 2023 using the interim MVI solution to download and submit reads into their billing system to validate and send to CMOS. They said:	their billing system to validate and send to CMOS. They said: "The project team have listened, responded, and applied changes based on retailer feedback throughout this project, providing Wave with an interim solution that works well with our internal processes. Wave have utilised Anglian Smart read data since August 2022 and have seen the benefit to billing accuracy and settlement accuracy, the AMIDST read files have complemented this process. Project AMIDST as a proof-of-concept piece has proven successful in my eyes and should encourage other wholesalers to focus on Smart/AMI rollout plans and to share Smart/AMI read data via the Market each month; to benefit the settlement process between wholesalers and retailers as well as the end customer. The benefits of Smart metering and shared data are far reaching from timely leakage identification to settlement accuracy. If all wholesalers were to follow this path it could even lead to a shortening or removal of settlement stages between P1 and RF, as accurate data would be available from the initial P1 settlement stage."

Anglian will continue using the solution and are currently having discussions with the remaining retailers to onboard them.

13 Final Recommendations November 2023

The interim API/MVI solution created through project AMIDST is available to all Wholesalers with a Smart Metering Programme. This has been shared through:

- Technical Advisory Group (June 2023)
- Code Change Committee (September 2023)
- Roles and Responsibilities Webinar (February 2023)
- Market Focus (September 2023)

The recommendation is that other Wholesalers should be encouraged to use the solution in preparation for their smart metering programmes.

The project also recommends an enduring (longer term) solution which is the submission of AMI Smart reads to CMOS without Retailer approval. The impact of this on Market Codes has been identified with proposed recommendations.

Following the Roles and Responsibilities review led by the Metering Committee, it has been recommended to take a code change forward giving Wholesalers responsibility for submitting Smart AMI reads into CMOS. This code change is now underway as "CPW142 Wholesaler Smart Meter Reads"

Throughout the code change process this recommendations report can be used to assist in the code review and any decision making.

14 Glossary

AMI	
AMIDST	AMI Data Strategic Transfer
AMR	
API	Application Programming Interface
AW	Anglian Water
CDV	Candidate Daily Volume
CGI	
CMOS	Central Market Operating Systems
GDPR	General Data Protection Regulations
HVI	High Volume Interface
ISA	Interim Supply Arrangements
LVI	Low Volume Interface
MPF	Market Performance Framework
MPS	Market Performance Standards
MVI	Medium Volume Interface
NHH	Non Household
PEDV	previous estimated daily volume
RDE	Retailer Data Exchange
SFTP	Secure File Transfer Protocol
SPID	Supply Point ID
URL	
W Reads	Wholesaler Reads
WSMR	Wholesaler Smart Meter Read

15 Appendix A – Stakeholder Engagement tables

The full details of the Retailer results have been summarised in the below table.

Question	Waterscan	Everflow
Would you welcome the interim solution of Wholesalers providing Monthly Smart Meter Reads to CMOS with a step for Retailers to approve?	Yes	Yes
Comments	Providing that this solution does not require more steps than the current wholesaler read process in CMOS.	These currently go in as W reads and we will convert to C reads once checked
Do you anticipate an impact to your processes and systems if this solution were to be implemented?	Yes	Yes
If yes, please expand…	The smart meter reads will need to be incorporated into our internal meter read system and potentially need to be manually validated before we add them. Providing the data is accurate it will also reduce the number of visual reads we arrange with 3rd party contractors and Anglian to provide.	I would like to see flags and alerts set up for this most of the reads may go in fine. It could be an exception queue where the higher than normal reads go into for retailers to approve. Need to look at a bulk method to or an export from MOSL which we can pull and compare and then an approval all button
Do you foresee cost impact you would have to implement this solution?	Yes	Yes
Comments	It would be a beneficial cost impact, reducing the number of visual reads sent to contractors. We would need to change some internal processes but the cost for this would be minimal.	If it's a manual check one by one we would need to look at resource. For example we get 1500 reads from Thames AMI, currently we do a comparison against previous read/adc and then convert these in bulk to C reads.
Would you welcome the ultimate solution of Wholesalers providing Monthly Smart Meter Reads to CMOS as an active market data item?	Yes	Yes
Comments	As long as the reads are validated and a solution can be found for when a read fails the CMOS validation and we can take action in time to prevent a missed monthly meter read from a failed validation.	
Do you anticipate an impact to your processes and systems if this solution were to be implemented?	Yes	Yes
If yes, please expand…	Similar impact is the interim processes, just with a slight change to account for the different read types on CMOS	As per question 2

Question	Waterscan as at June 2022	Everflow as at July 2022
Comments	Positive cost change due to a reduction in meter reading requests, however slight cost associated with developing a new process to implement this solution.	
There will need to be a review of the codes and processes that will potentially need to change to support the ultimate solution. Are there any specific areas which concern you that you would like to highlight for us to factor into the review?	Yes	Yes
Comments	Will the retailer be able to remove smart reads which appear to be false (comparing against a visual read). What will the impact be on MPS given that these transactions will be carried out by the wholesaler?	The current process of W reads entering to the market and its upto retailers to convert to C reads is reliable. The above would override this process and would speed up the process for all parties if all was done in bulk methods. Both ends of the process really need to be fit for purpose and scalable as it might be a quick and easy data drop into CMOS for wholesalers but could become very long winded for retailers if we have to check these one by one with no means of bulk approval or exporting data.

The full details of the Wholesaler results have been summarised in the below table.

Question	Thames Water as at June 2022	Yorkshire Water as at June 2022
Would you welcome the interim solution of Wholesalers providing Monthly Smart Meter Reads to CMOS with a step for Retailers to approve?	Yes	Yes
Comments	Since the start of the Covid-19 pandemic Thames Water have already been sharing monthly reads with retailers from our circa 30,000 NHH smart meters. Following Code changes / changes made to CMOS we then transitioned to uploading these into CMOS as W reads. We support an interim solution that reduces the administrative burden from uploading these reads as long as this is not outweighed by any system development costs at our end, or additional validation requirements of meter data.	From a settlement point of view, the more actual, accurate/up-to-date reads in CMOS, the better (provided that there is a robust validation process). This makes settlement much more accurate. Having said that, what implications will this have for meter reading contracts?
Do you anticipate an impact to your processes and systems if this solution were to be implemented?	Possibly	Yes
If yes, please expand…	Possibly, depending on the format or process implemented, but we would hope it would only be minor changes to the existing process, and improvements by simple automation rather than additional manual processes or IT changes. The current process involves: • native query that is run monthly from the MDMS database, which pulls the last read for NHH meters. • This is then uploaded into an Azure Data Lake which triggers an automatic process to generate W read transactions. • These are then released by our DBO team into CMOS over a 2/3 day period.	Impact would be more accurate settlement (with the above caveat about validation). Who would manage the reads going into CMOS from Yorkshire Water – presume data team? If settlement team was to be involved, this would need a process created & resource agreed
Do you foresee cost impact you would have to implement this solution?		Yes

Question	Thames Water	Yorkshire Water
Comments	Hopefully not, as we are already doing this activity. We would need to ensure the solution didn't require significant IT or system changes, as these can be very slow and costly to implement. It would need to be a simple solution that fit with current data and system's capability, and didn't add a need for additional team resource. From our experience we have had a small increase in the number of Retailer querying reads, and as the number of NHH smart meters increase and the number of monthly smart reads provided to the market increases, this could add extra cost/resource, but current levels are manageable.	Impact would be more accurate settlement (with the above caveat about validation). Who would manage the reads going into CMOS from Yorkshire Water – presume data team? If settlement team was to be involved, this would need a process created & resource agreed
Would you welcome the ultimate solution of Wholesalers providing Monthly Smart Meter Reads to CMOS as an active market data item?	Yes	Yes
Comments	We support this solution as it aligns and builds on what we are already doing and could bring automation and further process improvements and benefits to Retailers and NHH customers.	Yes – see point 1. What I would question is, how realistic is this from a YW perspective? How many NHH smart meters do we have & what is our rollout plan & turnover? There are also other questions, such as what threshold (%) of smart meters in the YW NHH portfolio would need to be smart for this to have an impact
Do you anticipate an impact to your processes and systems if this solution were to be implemented?		Yes
If yes, please expand…		See point 2
Do you foresee any cost impact you would have to implement this solution?		Yes
Comments		See point 3
There will need to be a review of the codes and processes that will potentially need to change to support the ultimate solution. Are there any specific areas which concern you that you would like to highlight for us to factor into the review?		Yes
Comments		Does the settlement cycle change, as earlier settlement runs become more and more accurate? What threshold of Wholesaler smart meters v traditional or "dumb" meters need to be met for the code change to occur? What happens in the interim – do smart meters have a different settlement cycle to traditional meters?