

ROOT CAUSE ANALYSIS REPORT

Subject of this Report	Root cause analysis of an error discovered in the Flow Weighted Average Calorific Value – Phase 2 Service Improvements as part of the November 2024 UK Major Release
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For the Recipients	Impacted Parties: Shippers, DNOs (Cadent only), National Gas Transmission, Ofgem
Date of the RCA Report	23/01/2025

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1. Purpose

1.1 This document has been prepared for the Recipients (as shown above) to provide:

- (a) an understanding of how and when the Issue arose.
- (b) assurances that the Issue has been fixed; and
- (c) assurances that the Issue in the system will not reoccur

1.2 References in this document to “the Issue” means the error detected in the FWACV2 process, and the impact caused on the service to its dependent stakeholders.

2. Executive Summary

2.1. This Root Cause Analysis (RCA) examines an error in the Flow Weighted Average Calorific Value (FWACV2) process, introduced as part of the November 2024 UK Link Major Release.

2.2. The issue arose during the implementation of the FWACV2 service enhancements as part of the November 2024 UK Link Major Release on 12th November. A missing section of system code led to incorrect calorific value (CV) capping for the West Midlands LDZ, resulting in understatements to gas measurements, energy allocations, charging and errors in industry reporting. These customer impacts will be highlighted later in this report.

2.3. The issue was identified on 26th November 2024 during a meeting with National Gas. A query was raised into the capping of the West Midlands LDZ from the 14th November 2024.

2.4. Investigations revealed that a section of system code was omitted from the technical specification, preventing recalculations necessary for accurate capping. Additionally, test assumptions failed to identify the gap and automated monitoring did not flag the issue due to reliance on email trigger alerts, consequently email alerts were not issued to Cadent.

2.5. Immediate corrective actions included a workaround to prevent further errors, manual corrections to recent data, and communication with stakeholders. Additionally, Cadent were notified of this issue on the 27th November 2024 and a workaround fix was implemented.

2.6. Shippers and Distribution Networks (DN's) were notified of this issue on the 4th December 2024.

2.7. An enduring code fix was deployed on 7th December 2024, and subsequent monitoring confirmed resolution. Energy adjustments and financial corrections to address the impact of the error will be described later in this report.

2.8. Key lessons include improving alignment between functional and technical specifications, ensuring test fully captures known real-world scenarios, strengthening first usage monitoring and incident management processes. Recommendations for future improvements are outlined in Section 7.

3. Issue Description and Customer Impacts

A missing section of system code led to incorrect calorific value (CV) capping for the West Midlands LDZ, the implemented system code to process the monitoring point CVs, failed to ensure the greatest CV was included in the recalculation of the lowest CV for the LDZ. The recalculation failure led to the incorrect capping of the West Midlands LDZ as it incorrectly applied the lowest CV; additionally, the email which would normally be triggered to alert the relevant DN of an LDZ being capped was not issued due to the missing system code.

Impacts to customers included:

Quantified Impacts

- The issue has caused an underestimate of the daily LDZ input energy amounts - the total energy input underestimated amount is 39,164,598 kWh, equating to approx. 2.9% of the total energy input amounts applicable across 14/11/24 – 21/11/24, equating to approximately £1.7m under recording of energy charges.
- Total Daily Metered (DM) energy allocations in WM LDZ for 14/11/24 – 21/11/24 were too low by 3,058,295 kWh due to the incorrect CV, impacting 110 DM sites and approximately £120k unreconciled DM energy charges.

Unquantified Impacts

- Incorrect WM CV reporting within the November edition of the Ofgem Audit Report.

- MIPI (National Gas's Market Information Provision Initiative operational data system) was updated with incorrect CV data.
- Incorrect CV data issued via SC9 files.
- Shippers having to adjust consumer billing within their billing cycles.

Other Impacts

- Potential price differential for Shippers who traded gas on the impacted days ie price paid for the gas ahead of the Day vs System Average Price attributed to the adjustments.
- Profiles that were used for the NDM reconciliation and calorific values that will continue to be used for reconciliation going forward.

4. Root Cause

The root cause of the FWACV2 issue was that logic required to support the introduction of Remote Monitoring Point (RMP) comingled sites (to support biomethane blending) into the CV capping process, whilst the requirements were correctly included within the functional specification, a key element of the CV recalculation logic had been omitted from the technical specification. As a result, the system code that was built and deployed was also missing these recalculation steps.

As this activity occurs after the reassessment of the of the RMP CV data (which is the scenario encountered) should not have resulted in the LDZ CV being capped, the details of the RMP site were correctly removed from the email notification table and therefore the email notification to Cadent of the capping site details was not triggered.

Additionally, the test cases that were developed to assure the new functionality focused on more complex RMP data set up scenarios and therefore the data conditions omitted to cover the known data configuration of a single RMP site within an LDZ.

5. Charging Impact & Corrective Actions

5.1 The impact of the issue meant that whilst the volume of gas going into the LDZ was measured correctly, the CV applied was too low, because it was incorrectly capped at too low a value. This meant that the amount of gas recorded as entering the LDZ in KWh was understated. Each LDZ is balanced separately each day and Unidentified Gas (UIG) is the balancing figure. The input measurement error meant that UIG was too low.

5.2 Due to the CV being too low, Shippers were not assigned enough gas and for the National Transmission System (NTS) too little gas was recorded as leaving the NTS i.e. appeared to have 'lost' some gas on those days.

5.3 The incorrect CV values flowed into Gemini and MIPI (Market Information Provision Initiative). This National Gas Data Portal system is owned and used by National Gas to share data (including CV data) across the industry. Industry parties may use information from this system within their own systems/process when calculating energy.

5.4 CDSP Business Experts assessed the energy impacts and understood the corrective actions to be taken and agreed these with Cadent and National Gas. The energy adjustments will correct energy

positions, the adjustments will be completed as per the timeline below. The non-daily metered position will continue to utilise the CV that has closed out data as they cannot be adjusted.

5.5 To correct the energy charging and data positions corrective actions needed to be performed. A number of the corrective actions were put in place and completed immediately. Others need a longer period due to Energy and UIG adjustments needing to be performed.

- **Corrective action 1** On 27th November 2024. CV values for the 22nd – 26th November 2024 were corrected to reflect the correct CV value. These were loaded into the Gemini system within close out (Gas Flow Day – GFD+5). The values for the 14th – 21st November 2024 could not be corrected as they had reached close out (Gas Flow Day + 5). Energy amendments are being undertaken to correct these positions.

- **Corrective action 2** On 27th November 2024 National Gas updated their National Gas Data Portal MIPI (“Market Information Provision Initiative) with the amended CV data to reflect the correct uncapped CV’s for the days affected by the issue, the 14th – 21st November for the West Midlands LDZ.

- **Corrective action 3** The corrective adjustments that have been applied to Gemini (corrective action 1) were reflected on the Energy Balancing Invoices (EBI) invoices for the billing period of November 2024. These invoices were issued to Shippers on the 6th January 2025, the adjustment values were communicated to Shippers on 19th December 2024. Please note that these dates can be found on the billing calendar which is published on Xoserve.com. For the Non-daily Metered (NDM) sites within the West Midlands LDZ, NDM reconciliations covering the 14th – 21st November 2024 will continue to use the closed-out CV.

- **Corrective action 4** CDSP is working on the corrections to the UIG position, and these will be issued as part of the Unidentified Gas Reconciliation (UGR) charge on the December Amendment Invoice. The existing LDZ measurement error process will be used to correct the Total LDZ inputs and this will appear on the Invoice as a UGR charge. This invoice will be issued on the 27th January 2025. Please note these dates can be found on the billing calendar that is published on Xoserve.com.

5.6 A webinar took place on 19th December 2024 to support Shippers to understand the impacts and provide them an opportunity to ask any questions they may have. The focus of the webinar was to describe the issue, confirmation of actions taken to date and a walkthrough of the remaining actions, specifically the adjustment timeline and associated information. A follow up webinar also took place on 22nd January 2025.

6. Detail of Identified Root Cause

6.1 There were three main reasons underpinning the Root Cause.

1. **Functional Rules** Whilst rules were correctly recorded and customer, business and technical requirements were correctly captured in the functional specification, the code details within the technical specification missed the step for recalculating the lowest LDZ CV. As a result of the misalignment between the functional and technical specification the required code was not built and deployed. Both the functional and technical specification documents were reviewed, and it was discovered that there was a misalignment. The technical specification was incomplete because it had

logic missing from it relating to the CV recalculation, while the traceability undertaken was not sufficiently granular to identify this.

2. Code testing prior to implementation Across the testing phases for the FWACV2, 106 test cases were completed. The test phase was made up of functional unit testing, system testing, regression testing and user acceptance testing. A test case was created for the new scenario and the data conditions created to cater for this step. An incorrect assumption was made that 1: many test case would prove all conditions including the known scenario of 1:1. This was an incorrect assumption and had this scenario been tested, the test would have failed, and the missing code would have been identified. This 1:1 scenario was a new introduction, not previously existing within UKLink. The current configuration of regression testing, which contains previous scenarios rather than brand new ones, meant the 1:1 scenario was not included in the suite of tests.

3. Monitoring Process monitoring was being conducted following the implementation of the new release. However, this relied on the email trigger alert. This trigger alert had been successfully used as the monitoring tool since the implementation of FWACV1 and has been automated as part of this change. The post Go Live monitoring checks should have manually checked for the email trigger alongside the system checks. This did not happen due to a full reliance on the email trigger alert.

7. Lessons Learned and Recommendations

7.1 Lessons Learned and Recommendations:

The following lessons and recommendations have been captured as a result of this issue occurring and the investigation that followed:

Lesson	Recommendation	Timescales
<p>Technical Specifications Logic had been missed from the technical specification which led to code not being built and implemented.</p>	<ul style="list-style-type: none"> • Extra review, with support from Solution Consultants, and approval step to be introduced to ensure alignment of technical specification to design and functional specifications – this will be documented as a governance step. 	<ul style="list-style-type: none"> • Immediately
<p>Code Testing Prior to Implementation Testing was conducted against the new rules, but an incorrect assumption led to the known site set up not being tested</p>	<ul style="list-style-type: none"> • Specific ‘real life’ test scenarios should be captured and tested to ensure coverage especially where new rules/site set up and functionality are concerned. • Specific data conditions should be agreed and traced back to all test scenarios. • Automated regression testing to continue to be enhanced for BPCs/process experts to apply knowledge to the new rules/functionality/scenarios. 	<ul style="list-style-type: none"> • Immediately with Customers as appropriate. • Immediately where a specific data condition has been captured

<p>Monitoring First usage monitoring</p>	<ul style="list-style-type: none"> • First usage monitoring should always monitor system activity alongside new functionality/alerting mechanisms. • First usage will be monitored daily across all aspects for monitoring assurance and track during PIS lifespan 	<ul style="list-style-type: none"> • Immediately • Immediately
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8. Appendices

Change Background

To support the delivery of the initial Provision of a Flow Weighted Average Calorific Value Service (XRN5231) a number of DN requirements and process improvement opportunities that were identified during the delivery phase were agreed to be deferred until a later date. These requirements and process improvements were captured in a second change – FWACV2 (XRN5585) and facilitate the operation of the service in a more efficient and effective manner, and fall into the following areas:

- Automation of manual processes.
- Reduce the frequency and volume of email notifications that are provided to DNs as part of the FWACV process.
- Make interactions more effective by amalgamating datasets where possible – eg combined loss of record notifications.
- Ensure information is provided to the relevant Distribution Network operational contacts.
- Assess any additional opportunities to improve the efficiency and effectiveness of the FWACV Calculation process.

More detail relating to these changes can be found here:

XRN5231 - [XRN 5231 | Xoserve](#)

XRN5585 - [XRN 5585 | Xoserve](#)

Event Timeline

The following list shows the timeline of events following the deployment of the November 2024 UK Link release:

- Tuesday 12th November 2024 – FWACV2 was implemented as per the November 24 Project Implementation Plan with a weekday Go Live date being the preferred date to allow for Process Experts from Organisations to be present and working.
- Thursday 14th November 2024– The incorrect capping at the West Midlands LDZ occurred in relation to the site-specific set up of a RMP status within the West Midlands LDZ. This occurred due to a bio-methane site in the West Midlands LDZ being updated to include the site within the LDZ capping calculation process. This error went unnoticed and was not picked up as part of the post implementation support monitoring.

- Tuesday 26th November 2024 – During a meeting between National Gas and the CDSP, National Gas raised a query in relation to capping of the West Midlands LDZ. Following this meeting the CDSP commenced an immediate investigation.
- Wednesday 27th November 2024 – the CDSP’s investigation concluded and established the cause of the Issue. As a result, a workaround was identified which would stop the sites in question capping on future days. Cadent were contacted and informed of the capping issue and the workaround discussed and agreed. The workaround was to update remote measurable points to remove them from the capping process. This was implemented by the CDSP with Cadent’s approval who updated the capping flag manually to a ‘N’ which immediately removed the sites from future capping calculations and the capping process.
- The incorrect CVs in the Gemini system were replaced with the correct values for the West Midlands LDZ for the period 22nd to 26th November.
- Thursday 28th November 2024 – Daily calls commenced with Cadent to communicate the impacts, steps to rectify and for any questions to be raised. These calls reduced to three times per week from the 6th December 2024 and to once per week from the 13th December 2024.
- Wednesday 4th December 2024 – An incident communication was issued to Shippers and Distribution Networks via the CDSP Issue Management Process.
- Friday 6th December 2024 – testing completed, test assurance commenced; This involved checking of evidence against the expected outcomes of the test case.
- Saturday 7th December 2024 code deployed into production.
- Thursday 12th December 2024 – An updated communication was issued to Shippers and DNs. It built upon the initial messaging, providing more information on the underestimation values and the energy adjustments that were going to be undertaken. It also explained when those adjustments would be received and provided assurance that Shippers would individually receive financial information early in January 2025 confirming the energy value for sites impacted within their portfolio.
- Friday 13th December 2024 – Day+5 monitoring for the enduring solution was completed - no issues were observed. The monitoring included manually checking for capping of the West Midlands LDZ and checking the email trigger notification report.