STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

At a session of the Public Service Commission held in the City of Albany on June 20, 2024

COMMISSIONERS PRESENT:

Rory M. Christian, Chair
James S. Alesi
David J. Valesky
John B. Maggiore
Uchenna S. Bright
Denise M. Sheehan

CASE 22-M-0645 - Proceeding on Motion of the Commission Concerning Central Hudson Gas & Electric Corporation's Development and Deployment of Modifications to its Customer Information and Billing System and Resulting Impacts on Billing Accuracy, Timeliness, and Errors.

ORDER ADOPTING TERMS OF SETTLEMENT AGREEMENT

(Issued and Effective June 20, 2024)

BY THE COMMISSION:

This Order adopts the terms and conditions of a Settlement Agreement (Agreement) executed by Central Hudson Gas & Electric Corporation (Central Hudson or the Company), and the Department of Public Service (Department or DPS) Office of General Counsel (OGC), attached hereto as Appendix 1, that fully resolves all claims asserted in the Order to Show Cause issued by the Commission on December 15, 2022, in this combined prudence and enforcement proceeding. As discussed in more detail below, the Agreement is valued at over $62 million and requires the Company to both (1) promptly transition to an actual meter read program and (2) address certain foundational strategic issues identified by an independent third-party

monitor (Independent Monitor) previously authorized by the Commission to examine the Company's actions related to deploying a new Customer Information and Billing System (or SAP System).

FACTUAL AND PROCEDURAL BACKGROUND

On September 1, 2021, Central Hudson deployed a new Customer Information and Billing System. In the months following implementation, Central Hudson customers filed numerous complaints with local officials and the Department about excessive, delayed, and revised bills and a lack of customer support by the Company. These customer complaints increased during the late fall and winter of 2021-2022.

To address the complaints, the DPS Office of Investigations and Enforcement (OIE) commenced an investigation on April 5, 2022, into the cause of the complaints and complications related to the upgrade to Central Hudson's Customer Information and Billing System. The investigation resulted in OIE issuing a report (OIE Report) on December 15, 2022, finding, among other things, that Central Hudson's Customer Information and Billing System contained defects at launch (or "go-live") that resulted in overcharges and delayed bills for thousands of customers. The OIE Report identified and documented apparent missteps by the Company, including the failure to adequately test the system, properly resource the

project, and properly train staff on using the system. The OIE Report also recommended that the Commission require the Company to both conduct actual reads of customer meters each month and discontinue alternate month meter reading estimates.[1]

In conjunction with the issuance of the OIE Report, the Commission issued an Order to Show Cause (OTSC), directing Central Hudson to respond to the allegations contained in the Report and show cause why a penalty and/or prudence proceeding should not be commenced. The OTSC directed Central Hudson to submit to Department Staff: (1) a plan to adjust its billing practices to conduct actual meter reads each month for its electric and gas service customers and to discontinue its practice of alternate month billing estimates for its customer accounts; and (2) a study evaluating if monthly meter reading and an end to alternate monthly bill estimates would be in the interests of the Company's customers.[2]

On January 17, 2023, Central Hudson responded to the Order to Show Cause. While the Company contested some of the

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[1] Case 22-M-0645, DPS Office of Investigations & Enforcement, Investigation Report (December 2022) (Item No. 1).

[2] Case 22-M-0645, Proceeding on Motion of the Commission Concerning Central Hudson Gas & Electric Corporation's Development and Deployment of Modifications to its Customer Information and Billing System and Resulting Impacts on Billing Accuracy, Timeliness, and Errors, Order to Commence Proceeding and Show Cause (issued and effective December 15, 2022) (Item No. 3).

findings and allegations contained within the OIE Report, the Company acknowledged that deployment of the new billing system had adversely impacted some of its customers:

> Central Hudson recognizes that immediately after launching its new SAP-based Customer Information System ("CIS") on September 1, 2021, there were issues with its new SAP CIS ("SAP System"). These issues resulted in impacts to a portion of Central Hudson's customers, including delayed and inaccurate invoices, confusion, and anxiety. Central Hudson has been humbled by the identification of these issues and the resulting impact on customer satisfaction.[3]

On January 17, 2023, Central Hudson filed a proposed Plan to Implement Monthly Meter Reading. In its proposal, the Company stated that, "[s]ince the inception of monthly billing in July 2016, Central Hudson customers have consistently expressed dissatisfaction with bi-monthly meter reading estimates, as the estimates are a source of frustration and confusion. The Company believes converting to actual monthly meter reads is a valuable step in reducing customer discontent."[4] Central Hudson called for a phased rollout of its proposed monthly meter plan that was set to begin on or about August 1,

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[3] Case 22-M-0645, Central Hudson Response to Order to Commence Proceeding and Show Cause, p. 1 (dated Jan. 17, 2023) (Item No. 4).

[4] Id., Plan to Implement Monthly Meter Reading (dated Jan. 17, 2023), p. 3.

2025.[5]

Of note, the Department subjected Central Hudson to a separate Comprehensive Management and Operations Audit, completed in February 2023, that also examined the Company's lack of monthly meter reading.[6] Among other things, the audit report (Audit Report) recommended that the Company, "[b]egin reading meters on a monthly basis to better align billed consumption with fluctuating energy supply prices and reduce the issues created in SAP by pairing monthly bills with bi-monthly reads."[7]

On July 27, 2023, DPS and Central Hudson entered into an Interim Agreement, adopted by the Commission on August 18, 2023, requiring the Company to continue to (1) investigate all complaints of billing errors, (2) promptly refund overpayments

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[5] Id., p. 5.

[6] Case 21-M-0541, Proceeding on Motion of the Commission to Conduct a Comprehensive Management and Operations Audit of Central Hudson Gas & Electric Corporation, Comprehensive Management and Operations Audit of Central Hudson Gas & Electric Corporation (Item 13) (prepared by Overland Consulting) (dated February 2023).

[7] Id., pp. 1-15. The Audit Report reported a 54% deployment rate for automated meter read meters as of mid-2022. Id., at 8-5. At its March 2024 session, the Commission approved – with modifications – Central Hudson's revised implementation plan in response to the Audit Report. Case 21-M-0541, supra, Order Approving Implementation Plan with Modification (issued and effective March 15, 2024).

to all overcharged customers, and (3) subject itself to targeted testing and verification of the SAP System by an independent third-party monitor (Independent Monitor).[8] In conjunction with entering into the Interim Agreement, Central Hudson filed a Revised Monthly Meter Reading Plan (Revised Monthly Meter Reading Plan).

On July 31, 2023, in a separate proceeding, Central Hudson filed tariff leaves and testimony seeking to increase its electric and gas delivery revenues starting July 1, 2024 (Rate Case).[9] The filing commenced a fully litigated rate case proceeding wherein Central Hudson identified incremental annual costs of $4.4 million associated with its Revised Monthly Meter Reading Plan.[10] On May 1, 2024, the Administrative Law Judges assigned to the Rate Case issued a Recommended Decision that, among other things, recommended the Commission approve the costs related to the Revised Monthly Meter Reading Plan to be

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[8] Case 22-M-0645, Order Adopting Terms of Interim Agreement with appendix and attachments (issued and effective August 18, 2023) (Item Nos. 12, 13).

[9] Case 23-E-0418 et al., Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation, Central Hudson 2023 Rate Case Filing (dated July 31, 2024).

[10] Id., Recommended Decision, p. 380 (issued May 1, 2024). In a subsequent review by DPS OAAF Staff, this number was revised to $4.1 million.

collected through an applicable rate adjustment clause mechanism (e.g., surcharge).[11]

On March 1, 2024, the Independent Monitor submitted a final report (Monitor Report) to DPS Staff in this proceeding. The Independent Monitor found that Central Hudson had resolved critical billing issues and reached a stable current state. The Independent Monitor also identified foundational strategic issues that pose a significant risk to Central Hudson's ability to sustain a stable state in the event that it initiates new transformational projects or faces future unforeseen challenges. To address this finding, the Independent Monitor recommended several strategic changes and personnel enhancements designed to address the risks identified (Foundational Strategic Recommendations). The Independent Monitor also noted that SAP is designed to operate with actual monthly meter reads and that the root cause of estimation-related variances in customer bills was Central Hudson's novel use of SAP with bi-monthly estimates.[12] The Independent Monitor Report is attached to the Settlement Agreement.

On June 11, 2024, Central Hudson proposed a second revision to its Monthly Meter Read Plan (Updated Revised Monthly Meter Reading Plan), which outlined progress regarding

[11] Id., p. 51.
[12] PA Consulting, Central Hudson Independent Monitor Analysis Report, pp. 89-90 (submitted March 1, 2024).

implementation of monthly meter reading to date, as well as a new timeline for completion of its meter read plan.[13] On the same date, following several months of discussions, the parties entered into the Agreement, attached hereto as Appendix 1.

SUMMARY OF THE PROPOSED SETTLEMENT AGREEMENT

The Agreement would resolve all claims asserted in the Order to Show Cause, including alleged violations of the Public Service Law, Commission regulations and orders, and other claims related to an overall lack of prudence with respect to Central Hudson's implementation of its SAP System. The Agreement requires Central Hudson to undertake the following key actions:

(1) forego cost recovery of monies spent by the Company between September 1, 2021 (go-live) through June 30, 2024 in order to remediate Customer Information and Billing System issues (approximately $35.3 million);

(2) pay incremental costs already incurred and projected to be incurred to deploy its Updated Revised Monthly Meter Reading Plan through June 30, 2025 at the expense of Company shareholders (estimated cost of $6.3 million);

(3) commit $4.0 million from Central Hudson shareholders to a Customer Benefit Fund to be applied at the discretion of the Commission;

[13] Central Hudson's June 11, 2024 Updated Revised Monthly Meter Reading Plan is attached to the Settlement Agreement as Exhibit 2.

(4) forego any challenge to the negative revenue adjustments (NRAs) associated with the Company's failure to meet certain service quality metrics between September 1, 2021 and December 31, 2023 (approximately $8.75 million);

(5) forego any challenge to the over $8 million in costs incurred by shareholders associated with back-billing credits to customers that were related to the billing system problems; and

(6) implement the Foundational Strategic Recommendations identified by the Independent Monitor in its March 1, 2024 Monitor Report at the expense of Company shareholders (costs of implementation to date are included in category (1)).

We now turn to review in more detail these specific categories of the Settlement Agreement.

(1) Incremental Costs to Remediate SAP System Flaws

The Agreement (¶ 1) makes clear that Central Hudson agrees to waive its right to seek recovery of the approximately $35.3 million incurred between September 1, 2021, through June 30, 2024, related to Customer Information and Billing System issues. Absent such an agreement, the Company would have the right to petition the Commission for recovery of all expenses associated with system changes and costs associated with those changes, and the Department would have the right to seek to deny recovery of those expenses through the mechanism of

a prudence review. This category of shareholder responsibility concerns prudence-related claims in the OTSC. Here, the Agreement precludes Central Hudson from seeking recovery and avoids the need to litigate the prudence of those expenditures.

(2) Monthly Meter Reading

The Agreement (¶¶ 4a & 5) requires Central Hudson to implement the Updated Revised Monthly Meter Reading Plan for monthly meter reading with an expected completion date of October 31, 2024. Although Central Hudson originally sought recovery of costs associated with implementing the monthly meter program from ratepayers in its recent rate filings, the Agreement would require the Company's shareholders to cover past and future costs related to its implementation through June 2025.[14] The Agreement specifies that all costs associated with monthly meter reading implementation incurred by the Company up until and including June 30, 2024 (estimated at approximately $2.2 million) would be borne by Company's shareholders. The Agreement also requires Central Hudson through its shareholders

[14] Indeed, the Recommended Decision issued in those cases called for the costs to be collected from ratepayers through an applicable rate adjustment mechanism such as a surcharge. See Cases 23-E-0418 et al., Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service, Recommended Decision (issued May 1, 2024), p. 51.

to pay the incremental costs associated with monthly meter reading from July 1, 2024, through June 30, 2025, estimated to be $4.1 million. The Agreement provides that Central Hudson waives its right to seek recovery of those expenditures from ratepayers.

In the event Central Hudson fails to reach the monthly meter read goals set forth in the Updated Revised Monthly Meter Reading Plan, the Agreement (¶ 5) calls for Central Hudson through its shareholders to deposit $500,000 in the Customer Benefit Fund described below for each month the Company fails to meet the October 31, 2024 deadline described in the Updated Revised Monthly Meter Reading Plan, up to a maximum of $2.0 million.

(3) Customer Benefit Fund

The Agreement (¶ 4b) requires Central Hudson to commit $4.0 million of shareholder money to a Customer Benefit Fund. The fund is to be used at the discretion of the Commission for the sole benefit of Central Hudson's customers, including as a rate moderator in Central Hudson's pending rate case.

(4) Negative Revenue Adjustments (or NRAs)

The Agreement (¶ 1) specifies that Central Hudson had incurred approximately $8.75 million dollars in NRAs as a result of missed customer service metrics between September 1, 2021,

and December 31, 2023. To the extent that there has been disagreement between the Company and Staff concerning the appropriate assessment of NRAs between SAP System go-live and December 31, 2023, the Agreement explicitly precludes Central Hudson from challenging Staff's assessment of the NRAs.

(5) Backbilling

As provided in a whereas clause (page 2), Central Hudson's shareholders incurred over $8 million in expenses in providing backbilling credits to customers. These backbill credits represent money lost by Company shareholders as a result of failing to provide an accurate, timely bill to customers as otherwise required under the Public Service Law and associated Commission regulations.

(6) Independent Monitor Recommendations and Other Enhancements

Finally, the Agreement (¶ 3) requires Central Hudson to implement the Foundational Strategic Recommendations identified by the Independent Monitor in its March 1, 2024 Monitor Report, at the expense of the Company's shareholders. In its final report, the Independent Monitor identified foundational recommendations related to software development, billing metrics, and technical operations. The Company has incurred $1.1 million to date, which funds are included within the expenses noted in category (1) above. Central Hudson has

agreed to implement the recommendations and to waive any right to seek recovery from ratepayers of expenses related to the changes, including to any expenses incurred during the next rate year.

DISCUSSION AND CONCLUSION

In reviewing the Agreement, the Commission looks to ensure that its terms are in the public interest. An appropriate compromise should be consistent with the environmental, social, safety, consumer, economic, and legal policies of the Commission and the State. Also, it should produce results that are within the range of reasonable results that would have likely arisen from a Commission decision in a litigated proceeding. An agreement likewise should endeavor to balance interests of ratepayers, shareholders, and public safety consistent with the applicable legal framework.[15]

Here, the Commission finds that approval of the Agreement is in the public interest. The Company, the Independent Monitor, and DPS Staff have all identified a lack of regular monthly meter reading as a root cause for many of the customer service and billing issues that arose in late 2021 and

[15] These public interest inquiries are consistent with the considerations noted in, for example, Cases 90-M-0255, et al., Procedures for Settlements and Stipulation Agreements, Opinion 92-2 (issued March 24, 1992).

continued into 2023. The actions taken by DPS and the Commission to date have set Central Hudson on a course of reading meters every month. This Agreement requires Central Hudson to accomplish regular monthly meter reading across the Company's entire service territory by October 31, 2024 and, as added insurance and incentivization, for the Company's shareholders to deposit an additional $500,000 in the Customer Benefit Fund for each month the Company fails to meet the October 31, 2024 deadline, with a total potential additional deposit of $2.0 million.

The Agreement also requires Company shareholders to pay all additional expenses the Company has incurred to date for the transition to monthly meter reading and requires Company shareholders to pay the estimated $4.1 million in incremental costs associated with monthly meter reading through June 30, 2025. For these reasons, the Commission finds that the move to regular monthly meter reading will significantly reduce billing estimates, which have been a source of great frustration for many of Central Hudson's customers.

The Commission finds it particularly appropriate for Central Hudson shareholders to pay for the $35.3 million incurred between September 1, 2021, through June 20, 2024, related to the SAP System issues, and the Company to forgo any attempt to recover these costs from ratepayers. While the Company would not necessarily be entitled to recovery, absent an

agreement, it would have the right to attempt to seek recovery of much of the costs and to force the Department to litigate the prudence of each dollar spent. From our perspective, by the terms of this Agreement, it is as if the parties fully litigated and resolved the prudence matter and the Department prevailed in all respects.

Above and beyond Central Hudson's agreement to absorb costs incurred to remediate the SAP System, the Company has also agreed to deposit $4.0 million in a Customer Benefit Fund. The source of the money will be Company shareholders, and the funds threin will be used at the discretion of the Commission for the sole benefit of ratepayers. The Commission determines that the Company's establishment of this fund is an appropriate enforcement-related remedy developed for this case and comports with the public interest. At a future date, we will consider how to appropriately use these funds consistent with the public interest.

The Commission also finds that the Agreement appropriately requires Central Hudson to take affirmative steps to ensure that potential billing system flaws are prevented in the future. The filings in this proceeding, including the OTSC and the OIE Report, raised concerns with respect to the initial development and implementation of the SAP System. The Independent Monitor found that Central Hudson has resolved critical billing issues and that the Company's billing system

and practices had reached a stable current state. Based on the Independent Monitor's recommendations, the Agreement requires Central Hudson to implement the Foundational Strategic Recommendations identified in the Monitor Report to address potential risks associated with sustaining the stable state of the billing system and practices in the event of initiating new transformational projects or if the Company is faced with unforeseen challenges in the future. The Agreement requires Central Hudson to implement the Foundational Strategic Recommendations at shareholder expense.

The Agreement specifies that the Company has incurred approximately $8.75 million in NRAs related to its failure to meet customer service metrics established in its last rate plan and thereby precludes it from challenging this amount of NRAs in any proceeding. Finally, the Agreement acknowledges that Central Hudson has spent over $8.0 million of shareholder money in order to provide backbilling credits to customers and reiterates that the Company is bound to continue to comply with all applicable billing tariffs. The Commission finds that these resolutions are appropriate in the context of this proceeding.

Having now reviewed all of the facts in the record and the terms of the Settlement Agreement and the parties' submissions in this proceeding, the Commission holds that the Agreement is in the best interest of Central Hudson ratepayers. The Agreement provides Central Hudson ratepayers with the

substantial benefit of a plan for the Company to begin reading meters on a monthly basis in relatively short order and provides strong incentives for the Company to reach its meter reading goals. The Agreement protects Central Hudson ratepayers from the financial impacts associated with the millions of dollars spent by the Company related to its SAP System issues, and it provides a direct benefit to ratepayers through a $4.0 million Customer Benefit Fund and through other Company improvements, as recommended by the Independent Monitor. The Agreement also eliminates the ability of the Company to collect a surcharge from customers for the incremental costs (approximately $4.1 million) associated with monthly meter reading for the term of the next rate case, as was recommended by the Administrative Law Judges in the Rate Case.

The Agreement includes a robust set of remedies that provide an equitable and fair compromise between the parties and is consistent with the environmental, social, and economic policies of the Commission. The Commission finds that the Agreement's terms and conditions are within the range of reasonable outcomes that could be expected to be included in a litigated proceeding and provides a benefit to ratepayers consistent with applicable provisions of PSL §§25, 25-a, and 26. Therefore, consistent with the above discussion, the Commission hereby adopts and approves the Agreement.

The Commission notes that the Agreement and today's

order now supersede the July 2023 Interim Agreement. Of course, the Company must continue to thoroughly investigate all complaints of billing errors and shall continue to promptly refund overpayments to any and all customers who have been overcharged as defined by the Public Service Law, 16 New York Codes, Rules and Regulations parts 11 and 13, and Central Hudson's tariffs.

The Commission orders:

1. The terms of the Settlement Agreement, which is attached to this Order as Appendix 1, are adopted.

2. In the Secretary's sole discretion, the deadlines set forth in this Order may be extended. Any request for an extension must be in writing, must include a justification for the extension, and must be filed at least three days prior to the affected deadline.

3. This proceeding is continued.

By the Commission,

(SIGNED) MICHELLE L. PHILLIPS
Secretary

Appendix 1

Settlement Agreement

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

Matter 22-M-0645: Proceeding on Motion of the Commission Concerning Central Hudson Gas & Electric Corporation's Development and Deployment of Modifications to its Customer Information and Billing System and Resulting Impacts on Billing Accuracy, Timeliness, and Errors.

AGREEMENT

WHEREAS, this Agreement ("Agreement") is by and between the New York State Department of Public Service ("DPS" or "DPS Staff") and Central Hudson Gas & Electric Corporation ("Central Hudson" or the "Company"), each individually a "Signatory Party" and, collectively, the "Signatory Parties"; and

WHEREAS, this Agreement resolves any and all alleged violations arising out of the New York State Public Service Commission's ("Commission") Order to Commence Proceeding and Show Cause, issued December 15, 2022 ("2022 Order to Show Cause") in Case 22-M-0645; and

WHEREAS, on the same day, December 15, 2022, and in conjunction with the 2022 Order to Show Cause, DPS's Office of Investigations and Enforcement ("OIE") issued an Investigation Report ("OIE Report") describing Central Hudson's development and deployment of a new SAP-based customer information and billing system ("SAP System"); and

WHEREAS, the OIE Report alleged several violations of the Public Service Law, Regulations, and Commission Orders, as well as an overall lack of prudence by the Company related to the Company's development and deployment of the SAP System; and

WHEREAS, the 2022 Order to Show Cause directed Central Hudson to show cause why the Commission should not commence a prudence proceeding, civil penalty action, and/or administrative penalty proceeding; and

WHEREAS, the 2022 Order to Show Cause also directed Central Hudson to submit a plan to adjust its billing practices to conduct actual meter reads each month for its electric and gas service customers and to discontinue its practice of alternate month billing estimates; and

WHEREAS, on January 17, 2023, Central Hudson responded to the 2022 Order to Show Cause, denying the allegations of violations and timely submitting a Monthly Meter Reading Plan; and

WHEREAS, on July 27, 2023, DPS and Central Hudson entered into an Interim Agreement ("Interim Agreement"), which, among other things, required Central Hudson to: (1) appoint an independent third-party monitor ("Independent Monitor") to conduct targeted testing and verification of the SAP System to confirm billing accuracy; (2) continue to investigate all

complaints of billing errors; and (3) continue to promptly refund overpayments to all overcharged customers if and when any overpayments are identified; and

WHEREAS, in conjunction with the signing of the Interim Agreement, Central Hudson updated its Monthly Meter Reading Plan; and

WHEREAS, on or about March 1, 2024, the Independent Monitor submitted a final report to the Company and DPS Staff ("IM Final Report"), a copy of which is attached hereto as Exhibit A[1]; and

WHEREAS, the IM Final Report determined that Central Hudson has resolved critical billing issues and has reached a stable current state; and

WHEREAS, the IM Final Report identified certain foundational strategic issues that pose a significant risk to Central Hudson's ability to sustain a stable state in the event of initiating new transformational projects or if the Company were to face unforeseen challenges; and

WHEREAS, the Signatory Parties agree that the changes recommended in Section 3 of the IM Final Report under the heading "Foundational strategic recommendations" (the "IM Recommendations") would reduce risks and benefit Central Hudson customers; and

WHEREAS, the OIE and other DPS Staff have continued to investigate allegations related to the Company's SAP System through Case 22-M-0645; and

WHEREAS, in Case 21-M-0541, the Commission undertook a management and operations audit that recommended, among other things, that Central Hudson transition to reading customer meters on a monthly basis; and

WHEREAS, the Company has deployed regular monthly meter reading to approximately fifty percent of its customers, and expressed a commitment to further accelerate the timetable of its plans to deploy monthly meter reading across its entire territory by October 31, 2024; and

WHEREAS, the Signatory Parties agree that regular monthly meter reads will provide significant benefits to customers and greater confidence in Company billing practices; and

WHEREAS, the Company's updated Monthly Meter Reading Plan is annexed hereto as Exhibit B ("Updated Monthly Meter Reading Plan");

WHEREAS, Central Hudson has provided backbill credits to customers totaling over $8.0 million related to the SAP System transition investigation and continues to be subject to compliance with all applicable billing tariffs;

NOW, THEREFORE, in consideration of the mutual covenants, promises, agreements, and

[1] The written report absent attachments is attached hereto as Exhibit A. The entire document including attachments will be filed in DPS's Document and Matter Management System (DMM) under Case 22-M-0645.

representations set forth herein, the receipt and sufficiency of which are hereby agreed to and acknowledged, the Signatory Parties, intending to be bound, agree as follows:

1. **Costs Incurred Related to SAP System Upgrade and Enhancements**: The Company agrees to forego recovery of any and all expenses related to the implementation of the Company's SAP System including money expended in order to remediate customer information and billing system issues incurred between its SAP System go-live on September 1, 2021 through June 30, 2024. Said expenses (approximately $35.3 million) shall be entirely borne by the Company's shareholders. The Company also acknowledges that it incurred and will not challenge approximately $8.75 million in Negative Revenue Adjustments as a result of missed customer service metrics between SAP System go-live and December 31, 2023.

2. **Costs Related to Monthly Meter Reading**: The Company agrees to forego recovery of costs incurred by the Company through June 30, 2024, relating to the implementation of monthly meter reading totaling approximately $2.2 million.

3. **Costs Related to Implementation of IM Recommendations**: DPS Staff and the Company agree that the IM Recommendations reduce risk and benefit Central Hudson customers. Central Hudson has begun to implement and will complete implementation of the IM Recommendations, and Central Hudson agrees that the expenses incurred by the Company in implementing the IM Recommendations will be entirely borne by the Company's shareholders, the costs of which are included in Paragraph 1.

4. **Customer Benefits**: The Company agrees to commit funds, sourced entirely from the Company's shareholders, to fund the following programs to the benefit of Central Hudson's customers in the total aggregate amount of approximately $8.1 million:

    a. Monthly Meter Reads: The Company shall fund the incremental costs related to the transition to monthly meter reading between the period from July 1, 2024 through June 30, 2025, as originally requested by Central Hudson for rate recovery in Cases 23-E-0418 and 23-G-0419 totaling approximately $4.1 million. The Recommended Decision issued by the Administrative Law Judges in Rate Cases 23-E-0418 et al. on May 1, 2024 calls for costs for monthly meter reading to be collected through an applicable rate adjustment clause mechanism to be audited by Staff. Through this Agreement, the Company withdraws its request for recovery of these costs, which will therefore be borne by the Company's shareholders rather than Central Hudson's customers. Costs incurred by the Company on and after June 30, 2025, relating to monthly meter reading will be addressed in the Company's next rate case.
    b. Customer Benefit Fund: The Company shall commit $4.0 million in a customer benefit fund ("Customer Benefit Fund") to be used at the discretion of the Commission to benefit Central Hudson ratepayers.

5. **Potential Additional Customer Benefit**: The Company agrees to file a statement with the Secretary of the Commission certifying completion of its Updated Monthly Meter

Reading Plan on or before November 15, 2024. In the event the Company fails to meet the October 31, 2024 deadline specified in the Updated Monthly Meter Reading Plan, subject to conditions specified in the plan, the Company shall increase the Customer Benefit Fund by an additional $500,000 per month for each month it fails to meet such deadline, up to a maximum of $2 million. Any such increase shall be borne by the Company's shareholders.

6. **Release From Actions**:

   a. Resolution of Settled Matters: This Agreement fully, completely and finally resolves all issues, concerns, claims, and actions raised and/or asserted, or that could properly have been raised and/or asserted by either Signatory Party or otherwise, in connection with or as a result of the SAP System or other issues included in the December 2022 OIE report or Order to Show Cause and/or the implementation of the SAP System as of the date of this Settlement. ("Settled Matters").
   b. Waiver: DPS and the Commission fully and finally waive and relinquish any right to seek penalties or any other remedy at law or equity from Central Hudson, its directors, officers, employees, agents, shareholders, or affiliates arising out of or related to the Settled Matters.
   c. Voluntary Settlement: This Agreement has been entered into voluntarily by the Signatory Parties. The Signatory Parties have determined the Agreement constitutes a fair and reasonable resolution of all outstanding issues relating to Cases 22-M-0645 and 22-00743 and avoids litigation. This Agreement is not and should in no way be construed as a Commission finding or an admission by the Company of a violation of any law or regulation or order, or a Commission finding or an admission by the Company that these events are amenable to suit under Sections 24 and 25 of the Public Service Law, or a penalty action under Section 25-a of the Public Service Law. In addition, this Agreement is a settlement of potential claims or penalties stated in the Order to Show Cause in Case 22-M-0645 and should not be construed as an assessment of a fine or penalty.

7. **Governing Law**

This Agreement and the rights and obligations of the Signatory Parties shall be governed by and construed in accordance with the laws of the State of New York without regard to the principles of conflicts of laws thereof.

8. **Authorization**

The execution, delivery, and performance of this Agreement by each Signatory Party hereto is within its corporate or statutory powers, as appropriate, has been duly authorized by all necessary corporate or statutory action, and does not and will not: (1) require any governing or governmental consent or approval except as required in Paragraph 9 below; (2) contravene its organizational documents or enabling legislation; or (3) violate applicable law.

9. Effectiveness of the Agreement

This Agreement is subject to ratification or approval by the Commission and will have no effect in the absence thereof. If the Commission does not approve this Agreement in its entirety, without modification, Central Hudson may withdraw its acceptance by serving written notice on the Commission and shall be free to pursue its position without prejudice or consequence in Cases 22-M-0645 and 22-00743 or any other case or matter before the Commission. If the Commission approves this Agreement or modifies it in a manner acceptable to Central Hudson, the Signatory Parties intend that this Agreement thereafter be implemented in accordance with its terms.

10. Counterparts

This Agreement is being executed in counterpart originals and will be binding on each Signatory Party when the counterparts have been executed.

IN WITNESS WHEREOF, each of the Signatory Parties hereto has executed this Agreement as of the day and year written below.

STATE OF NEW YORK DEPARTMENT OF PUBLIC SERVICE

By: David M. Rossi Date: June 11, 2024

Title: Deputy Director, Office of Investigations and Enforcement

CENTRAL HUDSON GAS & ELECTRIC CORPORATION

By: Christopher Capone Date: 6-11-2024

Title: Chief Executive Officer

Exhibit A to Agreement

Central Hudson Independent Monitor Analysis Report dated February 2024.

CENTRAL HUDSON INDEPENDENT MONITOR ANALYSIS REPORT

February 2024

PA Consulting
1700 Lincoln Street, Suite 3550, Denver, CO 80203, USA

Table of Contents

1 Executive summary

Following an interim agreement between the New York State Department of Public Services (DPS) and Central Hudson Gas & Electrics ("Central Hudson" or "Company"), PA Consulting was engaged to perform independent monitoring of software system and process improvements Central Hudson implemented to their SAP Customer Information System (CIS) to resolve issues encountered by customers following go-live of this system in September 2021. This monitor engagement was fully supported by Central Hudson, and PA appreciates Central Hudson's cooperation throughout this engagement in assisting with providing requested documentation, scheduling in-person and virtual interviews, and attending sessions to review and discuss findings.

Through its analysis, PA determined that Central Hudson has resolved critical billing issues identified from the investigation conducted by the Office of Investigations and Enforcement (OIE) and has reached a stable current state based on our analysis of defect resolutions mapped to the issues identified in the OIE report. However, PA has also found foundational strategic issues that pose significant risk to Central Hudson's ability to sustain this stable state in the event of initiating new transformational projects or if it is faced with unforeseen challenges, such as the sudden customer transfer from Columbia, in the future. It is PA's opinion that these foundational strategic recommendations should be implemented before future projects with clear intent to broaden and adapt project-level efforts into company-wide standards.

PA has provided both foundational strategic recommendations, as well as recommendations specific to each of PA's areas of analysis, which are key to Central Hudson avoiding similar pitfalls and ensuring continued longevity of stability. Below is a summary of both our foundational strategic recommendations and specific findings from each area of analysis:

Summary of Foundational Strategic Recommendations

I. Software Development Lifecycle (SDLC) Improvements

   a. Separation of Product Owner role from IT to support effective gathering, translation, and enforcement of business requirements to technical teams.

   b. Creation of a Development Design Authority to support effective standardization and enforcement of software development standards and procedures.

c. Creation of a Testing Center of Excellence to support effective standardization and enforcement of platform testing standards and practices.

II. Operational and Process-Related Improvements

a. Refinement of key business metrics and development of reporting dashboards to improve clarity and transparency of business goals.

b. Refinement of cross-team communication channels to improve transparency and efficiency of business and development operations.

Summary of Analysis Findings by Focus Area

I. *Analysis of Current Software Testing Practices and Framework* – Central Hudson's actions in platform testing post go-live sufficiently addressed critical billing defects. While Central Hudson does employ the software testing best practices expected based on IEEE standards, they have not, at present, consolidated their testing framework into a single set of documentation. This presents challenges in efficient transparency and traceability of testing processes.

II. *Analysis of billing, EDI, and Integration Defects* – Central Hudson has largely resolved critical defects identified in the OIE report. A small percentage of defects evaluated did not have the traceability required for quantitative verification, but qualitative analysis showed a successful resolution for these defects as well. While Central Hudson does employ most software development best practices expected based on IEEE standards, they have not, at present, consolidated their software development standards into a single set of documentation. This presents challenges in efficient transparency and traceability of software development processes.

III. *Analysis of Estimation Algorithm* – Upon implementation, Central Hudson aligned their estimation procedures in SAP with industry best practices. Since the SAP and associated algorithms worked as designed, it's implied that there was no fault in the configuration but understanding if the SAP system, or any customer information and billing system, can handle a bi-monthly meter read type of configuration successfully would have been beneficial. Since SAP go-live, Central Hudson implemented numerous corrective actions to reduce the number of estimation-related BPEMs being generated and/or not being resolved which have shown positive impact.

IV. *Analysis of estimation-related BPEM Cases* – Central Hudson's implementation of SAP configuration changes has shown improvement in the overall reduction of estimation-related BPEM cases (e.g., specific BPEM cases that led to customer complaints). As these configuration changes were finalized in early 2023, BPEM volumes should continue to be closely monitored to verify the continued reduction of estimation-related BPEMs and other associated long-term impacts.

V. *Analysis of Monthly Metering Strategy* – Central Hudson's piloted Monthly Metering Strategy is being implemented in accordance with typical industry best practices. As Central Hudson is still in the early stages of piloting and analyzing monthly metering, further analysis will need to be conducted at a later date to fully confirm effectiveness.

2 Introduction

2.1 Engagement background

After the transition from mainframe to SAP CIS (termed internally at Central Hudson as "Project Phoenix") on September 1, 2021, a portion of Central Hudson customers began to receive inaccurate and delayed bills which were, in part, the result of billing system issues with the newly implemented CIS system. A subsequent management and operations audit performed by Overland Consulting, as well as an investigation from the OIE, were conducted of Central Hudson pursuant to Public Service Law.[1]

At the time of Overland Consulting's release of their audit report in April 2023, Central Hudson claimed that Central Hudson had resolved critical billing system issues proven by continued progress towards key business and system performance metrics.[2] To assure DPS, Central Hudson, and the community at-large that these issues have been resolved, DPS and Central Hudson mutually agreed that an independent monitor engagement would be beneficial. Through evaluation by DPS Staff, PA Consulting was selected to perform this independent monitor.

2.2 SAP implementation background

Central Hudson's expressed reasoning for their CIS transition was largely to accommodate proper handling of complex billing scenarios, such as Community Distributed Generation (CDG), Energy Supply Company purchasing (ESCO) and net metering of customer generated

electricity, as well as better-engaging customers, through a transition from their legacy on-premise CIS to a customer-based system. After receiving approval from the Public Service Commission (PSC) in June 2018 to perform this upgrade, Central Hudson continued to revise their approach and analyze options for system replacement before selecting SAP as their chosen solution in September 2019.[2]

Central Hudson sought a System Integrator (SI) to assist with the implementation of SAP CIS as well as post-implementation support. Central Hudson selected Ernst & Young (EY) to fulfil this role in January 2020. Central Hudson's engagement with EY extended through go-live and formally ended on March 31, 2023. Starting on December 1, 2021, Central Hudson also engaged with a separate subcontractor as subject matter experts to provide SAP and ISU support to "help resolve the core challenges in the business process and SAP solution with regard to the prioritized customer related issues."(DR-0051 Subcontractor statements of Work Attachments 1 & 2 CONFIDENTIAL) Central Hudson engaged with this subcontractor to provide assistance with BPEM optimization from February 1, 2023 through July 31, 2023 and this engagement evolved to the subcontractor assisting Central Hudson with general SAP Business Solution Optimization services from June 1, 2023 to January 31, 2024. Central Hudson has expressed an interest in continuing to work with the subcontractor past the current contract expiration date based on their performance of services thus far.[3]

2.3 Scope of analysis

The scope of PA's work in this Independent Monitor engagement was comprised of five (5) tasks to evaluate both the efficacy of corrective actions performed by Central Hudson to their implementation of SAP CIS as well as the overall sustainability of Central Hudson's billing practices and operations as of the publication of this report:

- **Task 1:** Review and analyze current software testing practices and framework
- **Task 2:** Review and analyze billing, FCS, and EDI integration issues
- **Task 3:** Review and analyze Central Hudson's estimation process including the algorithm, its usage, and impact for implementing SAP CIS
- **Task 4:** Perform current state evaluation and conduct root cause analysis for BPEMs

- **Task 5:** Review and analyze the impact of Central Hudson's planned monthly metering implementation strategy

PA Consulting evaluated Central Hudson's performance in the above areas against both software development standards outlined in ISO / IEC / IEEE 12207:2017 and utility industry best practices. Analysis methodologies, evaluation criteria, and recommendations for improvement specific to the above areas of focus are detailed in the corresponding sections.

2.4 Organization of this report

The information presented in this report is organized in the following manner:

- **Section III** discusses overarching strategic recommendations which Central Hudson must follow to ensure the full realization of benefits from the specific recommendations presented in following sections
- **Section IV (Task 1)** discusses Central Hudson's software testing practices, their relevance to the SAP billing defects identified in the OIE report, and presents recommendations for process improvement
- **Section V (Task 2)** discusses the efficacy of Central Hudson's remediations to billing, FCS and EDI integration issues identified in the OIE report, in addition to Central Hudson's general software development practices, and presents recommendations for process improvement
- **Section VI (Task 3)** discusses Central Hudson's estimation algorithm and its relevance to the SAP billing defects identified in the OIE report
- **Section VII (Task 4)** discusses a root cause analysis of Central Hudson's high level of BPEMs during implementation of SAP CIS, Central Hudson's remediation efforts since go-live, and the overall sustainability of Central Hudson's process for resolving BPEMs at the time of report publication
- **Section VIII (Task 5)** discusses the impact and efficacy of Central Hudson's monthly metering strategy

3 Foundational strategic recommendations

3.1 Purpose and importance

PA has identified three foundational strategic recommendations that are critical to ensuring the long-term sustainability of Central Hudson's software development efforts. It is PA's opinion that:

- These foundational strategic recommendations should be implemented before future projects with clear intent to broaden and adapt project-level efforts into company-wide standards.
- If Central Hudson does not implement these strategic recommendations, the Company will remain vulnerable to similar pitfalls and risk continued longevity of stability in the event of initiating new projects or if it is faced with unforeseen challenges, such as the sudden customer transfer from Columbia, in the future.
- If Central Hudson does not implement these strategic recommendations, the benefits of implementing the specific recommendations identified in the following sections cannot be fully realized.

3.2 Software Development Lifecycle (SDLC) improvements

Upon review of Central Hudson's software development procedures, PA found that, while certain components of the IEEE Software Development Lifecycle (SDLC) standards were present, PA recommends that Central Hudson implement, at a minimum, the following standards in consecutive sequence:

1. **Separation of Product Owner (PO) role from IT teams** – Central Hudson currently employs a "Tower" structure in which senior members of IT teams ("Tower Leads") are responsible for gathering / defining business requirements in addition to performing IT duties. As IT and PO roles are inherently separate and meant to complement each other, Central Hudson's current structure poses the following risks:
    - Business needs and requirements are not understood or well-defined resulting in systems that are not fit for purpose

- A lack of separation of concerns between those responsible for defining and prioritizing business needs and those responsible for implementing functionality that satisfies them
- Lack of a central role to aggregate and communicate business requirements

To mitigate these risks, PA recommends that Central Hudson implement the following:

- Creation of a business PO role responsible for both defining business requirements through internal stakeholder interaction and communication of these requirements to IT Tower Leads
- Creation of a centralized requirements repository made available to all stakeholders

2. **Creation of a Development Design Authority** – while some disparate documentation for Central Hudson's current software development processes exists, there is no cohesive guiding documented standard for developers. This poses the following risks:
    - Lack of clarity regarding general development standards and procedures
    - Lack of clarity regarding potential impact on system components when implementing updates or new components
    - Difficulty onboarding new members of IT teams

    To mitigate these risks, PA recommends that Central Hudson implement the following:
    - Implementation of an Enterprise Architect role responsible for the definition of standards and development of reference architecture across all systems
    - Designation of a Senior Solution Architect responsible for project-level communication of solution architecture needs and goals
    - Creation of a Development Design Authority consisting of the Enterprise Architect, the Senior Solution Architect, and a designated senior developer who are collectively responsible for creating and maintaining Central Hudson's cohesive development standards and practices

3. **Implement cohesive, standardized, and centralized testing standards and practices** – while documentation for Central Hudson's current software testing processes exists, there is no cohesive guiding documented standard for testing teams. This poses the following risks:
    - That requirements are implemented incorrectly or incompletely
    - The introduction of and inefficient resolution of system defects
    - Difficulty onboarding new members of Testing Teams

    To mitigate these risks, PA recommends that Central Hudson implement the following:
    - Cohesive, standardized, and centralized testing standards and practices
    - Implement requirements and testing traceability standards and practices such as, but not limited to, a cohesive, standardized, and centralized Requirements Traceability Matrix (or Matrices)

3.3 Operational and process-related improvements

1. **Utilize more tailored, direct metrics measuring specific aspects of performance improvements related to billing** – while Central Hudson has core metrics (five key external facing metrics) that are tracked and reported to external stakeholders, these are broad in describing various aspects of performance that provide the customer and / or internal operations with a limited view of overall performance. This poses the following risks:
    - Potential negative customer sentiment due to limited visibility into utility performance specifically related to billing concerns post-SAP implementation
    - Lack of clarity regarding the specific elements of performance improvement initiatives
    - Lack of visibility into underlying issues that could create a future problem if not resolved

To mitigate these risks, PA recommends that Central Hudson implement the following:

- Developing and/or publishing a scorecard/dashboard on internal, more detailed metrics that better align with the specific elements of Central Hudson's performance improvement efforts
- Provide this information to customers and key stakeholders to improve sentiment and increase buy-in for future initiatives and programs
- Establish regular cadence meetings with senior leaders within Central Hudson (including those outside of IT and Customer Operations) to closely monitor these more specific, tailored metrics to understand individual and collective performance.

2. **Improve collaboration within operational improvement teams and the teams that are impacted** – Central Hudson has worked with various internal and external technical experts in an effort to improve performance post SAP implementation. While these experts provided solutions and a roadmap for implementation, the documentation provided for these solutions did not indicate the expected level of involvement of the impacted operational groups. This poses the following risks:
   - Lack of clarity between the solution developers and integrators
   - Potential future issues from third parties developing solutions without a full understanding of Central Hudson-specific operations, processes, customers, etc.

   To mitigate these risks, PA recommends that Central Hudson implement the following:
   - Establish working groups when conducting solution development that include stakeholders from the impacted operational group
   - Add necessary change management elements when implementing solutions to ensure immediate effectiveness

4 Analysis of Public Forum Transcripts

During this engagement, several public forums were held to give residents in Central Hudson's operating territory the opportunity to comment on Central Hudson's upcoming rate case. During these forums, many participants voiced complaints related to the scope of this engagement.

DPS provided both PA and Central Hudson copies of transcripts from these events, and PA collaborated with Central Hudson to perform an analysis of specific complaints which were directly related to the issues raised in the OIE report.

From analysis of the transcripts provided, 112 complaints from the Poughkeepsie, Catskill, Newburgh, and Kingston forums were identified for further analysis from Central Hudson. Central Hudson evaluated billing records, customer service reports, and other relevant customer metrics to determine whether specific complaints had been resolved. This collective analysis concluded the following:

- **60.7%** of complaints were investigated by Central Hudson and were ultimately found to be untraceable. This percentage included forum participants who fit the following criteria:
    - Did not provide enough specific detail about their issue to locate meaningful information.
    - No customer billing account could be found under the name provided.
    - Were representatives or other public figures who were speaking generally about constituent issues.
- **33.9%** of complaints have been resolved by Central Hudson.
- **5.4%** of complaints are unresolved:
    - 3.6% represent customers who have an open PSC case which is pending resolution.
    - 1.8% represent two (2) open complaints with Central Hudson which the company has identified are being actively worked on to reach a resolution.

A summary of results is included is included below in Table 1, and detailed evaluation of the transcripts can be found in Attachment 1: Public Forum Transcript Analysis CONFIDENTIAL.

In-Person Hearings								
			Poughkeepsie	Newburgh	Kingston	Catskill	Total	
Total Speakers			25	29	41	17	112	
Comments not about specific billing issue			5	15	15	6	41	**36.6%**
Customers identifying billing issue								
	PSC Case Open	Open	2	1	-	1	4	**3.6%**
	PSC Case Resolved/Closed	Resolved	2	1	9	3	15	**13.4%**
	No PSC Case but customer has reported issue to Company	Open	-	-	1	1	2	**1.8%**
		Resolved	6	5	6	6	23	**20.5%**
	No PSC Case and Customer has not reported issue to Company		1	2	-	-	3	**2.7%**
	Cannot locate account with name		7	2	5	-	14	**12.5%**
	N/A - general claims/claims on behalf of unnamed constituents		2	3	5	-	10	**8.9%**
Totals			**25**	**29**	**41**	**17**	**112**	**100.0%**

Table 1. *Results of public forum transcript analysis.*

5 Analysis of current software testing practices and framework

5.1 Summary of findings

Based on the IEEE 829-2008 standard and other industry best practices, the Task 1 workstream of the Independent Monitor Analysis conducted an evaluation of Central Hudson's current test plan, test case design, and traceability between testing components for post-go live SAP billing system hypercare and ongoing supportive maintenance.

Overall efforts since go-live have reduced the number of open defects significantly. Through its evaluation, PA has found the following deficiencies with respect to post-go live hypercare and ongoing maintenance support:

- Although plans had been implemented for specific test cases, PA found that Central Hudson did not have a cohesive, standardized test plan in place for post go-live SAP billing system hypercare and ongoing maintenance
- Testing activity documentation is not standardized across JIRA

- The Requirements Traceability Matrix (RTM) and JIRA testing documentation provided by Central Hudson demonstrated incomplete traceability between requirements, test cases, and defects, impeding the assessment of whether documented test cases and defects are sufficient in satisfying requirements for the SAP billing system[4] . While the findings from Task 1 make it insufficient to evaluate traceability based on testing framework and documentation, Task 2 reviewed open and closed defects, evaluating the effectiveness of defect management without traceability.
- Post go-live testing was not sufficiently supported with document versioning, up to date documentation of testing, and supporting stakeholder training documentation

Given the lack of a cohesive, standardized test plan for post go-live SAP billing system testing, we reviewed a test plan and documentation for the Dunning project to understand Central Hudson's ability to form and implement a concrete test plan. In contrast to the current state of the SAP billing implementation project, the Dunning project exhibited expected testing capabilities, including adequate test plans and sufficient traceability, indicating that the expected testing documentation and processes are used for the Dunning project at Central Hudson.[7]

The following list of corrective actions are recommended for any future modifications or IT rollouts by Central Hudson. These recommendations align with the IEEE 829-2008 standard and other industry best practices, including:

- Establishing a Testing Center of Excellence that will help improve and standardize software testing processes, methodologies, tools, and resources, enhancing the overall quality of software products and ensuring that testing activities align with business objectives
- Creating a comprehensive test plan encompassing testing objectives, scope, approach, schedule, resourcing, and defect management for post go-live SAP billing system hypercare.
- Establishing complete traceability between requirements, test cases, and defects by ensuring they are linked to each other on JIRA and their relationships are documented in the Requirements Traceability Matrix (RTM), a tool used to trace between all testing components. While it is not too late to set up traceability between testing components, it is important to implement to ensure a foundation is created for future organizational and technical changes.

- Documenting testing processes, establishing versioning of the RTM when changes are made, and creating training documentation for relevant stakeholders

5.2 Introduction

The objective of Task 1 was to review Central Hudson's current testing plan, test cases, and overall traceability to assess whether the existing processes adequately test that SAP billing system requirements have been satisfied. During initial meetings with Central Hudson and the DPS, it was confirmed that the review PA Consulting would undergo was prospective, and if an analysis of pre-go live actions was necessary to determine if current practices were in line with industry standards, PA would investigate further. After initial review however, PA found it was most insightful to review testing documentation relevant to the ongoing post go-live SAP billing hypercare and ongoing maintenance given its greater relevancy to the defects outlined in the OIE report.

When engaging with Central Hudson stakeholders and reviewing testing documentation that included a Requirements Traceability Matrix (RTM), and JIRA tickets, it became apparent that there was limited mechanism to trace between requirements and their associated test cases and defects, making it difficult to ascertain whether requirements were being adequately implemented by test cases and defects. Additionally, Central Hudson currently lacks an active and standardized test plan for ongoing post go-live SAP billing system hypercare. While Task 1 is looking at testing framework and documentation, Task 2 conducted a review of open and closed defects to evaluate defect management and resolution.

As a result, Task 1 focused on reviewing documentation and providing recommendations for creating a test plan and implementing complete traceability but was not able to analyze whether test cases adequately covered requirements and defects. In addition, due to the lack of an active test plan for post go-live SAP billing system hypercare, a test plan for the active Dunning project was reviewed in order to get an understanding of Central Hudson’s overall testing capabilities.

The evaluation of the testing documentation was conducted in accordance with IEEE testing standards. IEEE standards provide a framework that emphasizes quality, consistency, and best practices in testing processes. Adhering to these standards can contribute to the development of reliable and effective software systems while fostering collaboration and interoperability within an organization. For Task 1, testing documentation was evaluated against the IEEE-829-2008 standard and other industry best practices. Documentation provided by Central Hudson

included test plan templates, test plan documentation from the Dunning project, Requirements Traceability Matrix used for the SAP billing system prior to go-live, JIRA test cases and defects relevant to the OIE report. Interviews with Central Hudson stakeholders were scheduled on an as needed basis.

The following sections contain detailed findings and recommendations on the traceability between testing components, test cases, and test planning. Each section includes information on why that component is important in hypercare testing, Central Hudson's current state, the risks that may arise if not implemented, and best practice recommendations against IEEE standards.

5.3 Requirements Traceability Matrix (RTM)

Traceability in testing refers to establishing and documenting relationships between testing components, such as requirements, test cases, and defects, to ensure transparency and accountability throughout testing. Traceability is a critical aspect of testing and quality assurance, providing a systematic way to track and verify the relationship between different testing components throughout all aspects of a project lifecycle.

Traceability provides the following benefits:

- **Validation of requirements:** Establishing traceability allows stakeholders to verify that all test cases and defects are linked to a requirement(s) and that each requirement is adequately satisfied by test cases
- **Faster defect management and resolution:** Traceability helps stakeholders to quickly identify requirements and test cases associated with a defect, accelerating the defect management process
- **Impact analysis:** Traceability aids in impact analysis by showing the relationship between different testing elements. This allows stakeholders to assess impact of changes and plan accordingly.
- **Continuous improvement:** Stakeholders can analyze the relationships between testing components and identify areas of enhancement that will continue to improve the system

Maintaining traceability between testing components is also important during hypercare to ensure that ongoing testing efforts are satisfying requirements and that defects are easily identified, managed, and resolved.

The Requirements Traceability Matrix (RTM) is a document that acts as a bridge between the creation of initial requirements and their implementation. It provides a clear traceability path between requirements, test cases, and defects, linking them so that stakeholders can assess that there is sufficient coverage of test cases across requirements, ensuring that each requirement is adequately tested during the testing process. Additionally, the RTM enhances communication among stakeholders, facilitating a shared understanding of how requirements should be implemented.

Central Hudson is currently in the process of post go-live hypercare of the SAP billing system, and an RTM is still essential to maintain and keep up to date, ensuring that implementation aligns with initially defined requirements. It is also important that the RTM is used to get alignment amongst stakeholders on resolving identified post-implementation challenges, and feedback is continuously provided to improve the system during ongoing maintenance.

As mentioned in earlier sections, documentation used prior to SAP billing system go-live is considered out of scope, except for the RTM. This is because requirements and test cases have not changed since SAP billing system go-live and are still used in post go-live hypercare testing.

This section goes into the analysis of the RTM provided by Central Hudson [1]. There are three sections –RTM Structure, Versioning and Change Control, and Training and Usability. Each section contains information introducing the aspect, the current state of Central Hudson and key gaps, risks, and recommendations to bridge the gaps based on the IEEE standard.

5.3.1 RTM structure

This section provides insight into the structure of the RTM provided by Central Hudson, how information is captured in the RTM document, and the facilitation of linkages between requirements, test cases, and defects in the RTM document.

5.3.1.1 Inclusion of an objective in the RTM

Introduction

A stated objective is important when developing an RTM to provide purpose and direction for creation and use of the RTM during all phases of the project lifecycle. Having a stated objective in the RTM ensures that the RTM is in alignment with the goals of Central Hudson, is used to identify and prioritize critical requirements, and identifies key measures of success.

Central Hudson current state

In the Central Hudson RTM, there is no objective that states the goal of using the RTM. JIRA does not contain any relevant information related to the objective of the RTM.

Risks

The lack of a stated objective that contains information on the intended use of the RTM can lead to confusion and uncertainty about what is being traced and how that relates to the overall strategy of Central Hudson.

Best Practices

A clear objective included in the Requirements Traceability Matrix should articulate the purpose, goals, scope, and intended outcomes of the requirement traceability effort. Goals should include information around:

- **Traceability verification:** How the RTM will verify that each requirement is traced from initial specifications to implementation
- **Risk mitigation:** How the RTM will be utilized to identify and mitigate risks that may arise due to incomplete or incorrect traceability of requirements
- **Communication and collaboration:** How the RTM will be used and shared amongst stakeholders
- **Audit and compliance:** How the RTM will be used as a reliable document for auditing purposes and compliance with industry standards

5.3.1.2 Unique Identifiers

Introduction

Unique identifiers for requirements, test cases, and defects are important when creating a Requirements Traceability Matrix. Unique identifiers provide a mechanism to reference and distinguish testing components, i.e., requirements, test cases, and defects from each other. This way, each component can be identified, reducing the risk of confusion or misinterpretation of testing components.

Central Hudson Current State

In the RTM provided by Central Hudson, all individual testing components (requirements, test cases, and defects) are represented by a unique identifier which is used throughout the

document to refer to that component. Requirements are represented by a requirement ID which is in the format XXXX where X refers to a whole number. Additionally, each requirement contains a functional ID that is a unique identifier used to map it to a business process. Individual test cases are represented by a test case ID in the format PP-XXXX or PP-XXXXX where X refers to a whole number. Defects that result from a test case are represented by a defect ID in the format PP-XXXX or PP-XXXXX where X refers to a whole number. Test case ID and defect ID follow the format prescribed in JIRA.

Central Hudson has all the unique identifiers in place for ease of use of the RTM. In the RTM used during Project Phoenix prior to go-live, only requirements and test cases are represented, excluding defect information.

Risks

Without unique identifiers, it can be hard to distinguish similar or related components and can potentially lead to mistakes in design, implementation, and testing. Currently, testing is conducted manually but if automation tools are introduced to testing in the future, unique identifiers allow ease of integration of those tools into the process.

Recommendations

In addition to the unique identifiers that have already been implemented, our recommendation would be to include the defects, including their defect ID and information about defect management in the RTM to ensure better traceability. While this information was not included during go-live, this has been addressed in iterations of the RTM used on another project, specifically the Dunning RTM provided by Central Hudson via DR-0065 Attachment 4 Dunning Test Cases CONFIDENTIAL.[5]

5.3.1.3 Traceability in the RTM and JIRA

Traceability of testing components

As mentioned at the beginning of section 3, traceability is important to understand the relationship between requirements, test cases, and defects. IEEE standards recommend that traceability is bi-directional, i.e., requirements are linked to test cases and defects and vice versa. Bi-directional traceability is essential for ensuring the completeness, integrity, and quality of implementation and hypercare of software systems. Bi-directional traceability between requirements, test cases, and defects ensures that there is adequate coverage and that each requirement has been tested and validated. Having bi-directional traceability also makes it

easier to assess change impact on the requirement and associated artifacts if changes are made, ensuring a smooth change management process. Without bi-directional traceability, some requirements might not have a pathway to testing, leading to incomplete testing processes, inefficient change management, and non-compliance with regulatory standards.

Central Hudson current state

In the Central Hudson RTM, the requirements, test cases, and defects can be partially traced in one direction, specifically between test cases and defects on JIRA. Test cases are linked to defects one way, but defects contain no information on the test case it is linked to. Based on interviews with relevant stakeholders from Central Hudson, any requirements or test cases that were updated post go-live cannot be traced accurately as the RTM was not updated in the RTM post go live. Some test cases are also not linked to requirements in the RTM and dependencies between certain requirements or test cases are not clearly noted in either the RTM or JIRA. This indicates that current traceability is incomplete. For requirements and test cases updated prior to SAP billing system go-live, requirements are linked to test cases present in JIRA through the RTM, but the created test cases contain no information on what requirement is being satisfied through the test case.

Risks

The ability for an RTM to trace between requirements, test cases, and defects bi-directionally is crucial for ensuring all requirements are covered. The lack of complete traceability opens Central Hudson to risks, namely:

- **Incomplete verification and validation of requirements:** If RTM components are not traceable bi-directionally, that can result in incomplete coverage of requirements and poor implementation.
- **Poor impact analysis management:** Inability to conduct effective impact analysis management can result in mismanagement of changes leading to time going into re-work and implementation challenges
- **Reduced transparency:** Project stakeholders may lack a comprehensive understanding of the mapping of the RTM components making it challenging to understand progress and alignment with program or organizational objectives
- **Limited change control:** Bi-directional traceability supports effective change control by helping members understand the implications of changes on current requirements.

Without complete visibility into the implications of changes, errors and inconsistencies can be introduced into change management and the overall testing process.

Task 1 reviewed testing and traceability frameworks and documentation, Task 2 reviewed open and closed defects. While it is not too late for Central Hudson to set up traceability across their testing components, implementing them will avoid the risks mentioned above and set them up for future organizational and technical changes.

Recommendations

Our recommendation is to ensure that when updating the RTM, the requirements are connected to the test cases created in JIRA and that the test cases contain information about the requirements that they're satisfying, including details about the requirement like the requirement ID and the business process it is mapped to through the functional ID to ensure that there is a linkage between the requirements and test cases. Additionally, the test cases contain a link to the defects in JIRA but since the defect does not contain information about the test case it is linked to, we would recommend including information about the test case the defect is linked to including the test case ID to ensure a bi-directional linkage. Including the defects side by side in the RTM will also help with clear traceability between the requirements, test cases, and defects. Noting the dependencies between certain requirements, test cases, and defects are also important for traceability. This has been done on another project as seen in the RTM used for the Dunning project, so we recommend that it is implemented for defects that arise related to ongoing maintenance.

5.3.2 Versioning and change control

Introduction

Versioning and change control are crucial aspects of managing an RTM. Versioning ensures the integrity of the document, providing a documented history of changes and allows stakeholders to track changes made in the RTM over time and the rationale behind the change. For auditory purposes, versioning provides a documented trail of how the requirements have been managed and ensures that the project team can account for all changes made to the RTM during all aspects of the project lifecycle.

Central Hudson current state

From what we have gathered from stakeholder interviews and the RTM itself, there is some mode of version control that is used in managing the RTM. Versioning control capabilities are embedded into a SharePoint site from which versioning is managed. Prior to go live, a RAID

(Risks, Assumptions, Issues, and Dependencies) log was also utilized to track any changes made but was not kept up with post go-live. Changes have not been made to requirements so analysis cannot be made on quality of change control of the RTM. As mentioned in previous sections, Task 1 reviewed testing and traceability frameworks and documentation that Central Hudson had, Task 2 reviewed open and closed defects to evaluate defect management and resolution.

Recommendations

Based on our findings, we recommend that the RTM used prior to go-live is brought back into use and updated to reflect Central Hudson current state. Additionally, changes made between the two versions of the RTM are documented and version numbers are included on both documents, adding any additional introductory information relevant to the RTM. We recommend using the SharePoint functionality that enables version control to track versioning outside the document.

A formal requirement review process should be implemented, comprising of various stakeholders including the testing lead, IT lead, and respective tower leads to review existing requirements and test cases and determine if additional changes to the requirements, test cases, and/or overall structure of the RTM are necessary.

5.3.3 Training and usability

Introduction

A user-friendly RTM interface supported by documented training ensures that individuals regardless of their roles, can easily access and understand the information presented in the matrix. This is important because the RTM is meant to be used as a collaborative tool and its usability will affect its ability for stakeholders to engage with the tool and maintain it as a comprehensive tool accurately documenting the traceability between components. To facilitate a user-friendly RTM experience, there are a couple of things to consider. A clear design of the RTM includes information on the requirements, test cases, and their defects side by side with differentiated labels and headings for ease of navigation through the document. Extending this to JIRA, information reflected against components in the RTM must be the same as JIRA to maintain accurate traceability. Unique identifiers assigned to components must be consistently used throughout the document and JIRA.

Providing supplemental training on using the RTM and execution of test cases will ensure that requirements are adequately covered by appropriate test cases, testing is conducted efficiently and is consistently documented.

Central Hudson current state

The RTM provided by Central Hudson includes information on the requirements and test cases but does not include information on associated defects. In the Dunning RTM we reviewed, information about defects is also included. Task 1 was responsible for reviewing testing and traceability frameworks and documentation, Task 2 evaluated open and closed defects to evaluate defect management and resolution.

As mentioned in previous sections, during interviews with stakeholders, it was concluded that the RTM used prior to go-live of the SAP billing system was not kept up post go-live and hence training on using the RTM has not been provided. During SAP billing system go-live, 1-2 stakeholders utilized the RTM and made updates based on input from other stakeholders. The RTM document itself does not contain any information on navigating through the document.

From the documentation we received from Central Hudson, there is no current training material available to train individuals on designing and executing test cases. The only training material that exists is from prior to go-live and has been deemed out of scope, except for page 18[4].

Risks

The lack of a collaborative culture when tracing testing components can be detrimental to the overall testing process and can potentially open Central Hudson to a couple risks:

- **Inaccurate and incomplete traceability**: Poor usability and inefficient training can affect the maintenance and update of the RTM which can lead to a breakdown of the traceability between all components. This will introduce errors and inconsistencies throughout the project, making it difficult to assess the impact of any changes made to testing components down the line.
- **Communication breakdown among stakeholders:** If stakeholders are on different familiarity levels when it comes to the traceability, communication challenges and misinterpretations on the direction of the project can arise.
- **Decreased visibility and accountability:** A poorly designed RTM can lead to decreased visibility and accountability, making it challenging to track progress and address issues promptly as they come up.

Recommendations

We recommend that the RTM used prior to go-live is brought back into use and updated to reflect the current state of Central Hudson to align with post go-live SAP billing system hypercare. Additionally, we recommend that information about defects is included side by side with requirements and test cases, ensuring that related information is grouped together. Additionally, the RTM should be utilized and reviewed by stakeholders representing different parts of Central Hudson, ensuring that the design and use of the RTM is efficient for everyone. Training documentation on utilizing the RTM and its linkage to test case execution and defect management must be documented and accessible to all involved stakeholders.

5.4 Test case design

This section goes into the analysis of the design of test cases identified in the RTM and documented in JIRA. There are three sections – Test Case Unique Identifiers and Traceability, Test Case Summary Documentation, and Test Execution Documentation. Each section contains information about what information is expected, the current state of Central Hudson and key gaps, impact of the gaps, and recommendations to bridge the gap according to the IEEE 829-2008 standard and other industry best practices. Designing effective test cases is a crucial aspect to the testing process. Test cases that include information required to execute the test case, verification of the test results, and overall testing objectives summary and test execution documentation help in identifying defects easily and contribute to the overall testing effort.

5.4.1 Test case unique identifiers and traceability

Introduction

Assigning a unique identifier to each test case is important for several reasons when it comes to test case design. A unique identifier for a test case allows for easy identification and referencing of each test case and provides an unambiguous way to search for a particular test case through relevant tools and documentation. Unique identifiers also facilitate better tracking of test cases and their progress. When automated testing is introduced to increase the efficiency of testing, unique identifiers help link test cases to test scripts allowing for automation of test cases. Traceability is also another important aspect of testing that unique identifiers support. Test cases with unique identifiers can be easily linked to requirements and corresponding defects, ensuring that test cases are linked to other testing components which allows stakeholders to assess sufficient coverage of test cases across all requirements.

Central Hudson current state

As stated in section 2.2.2, the test cases provided by Central Hudson do use unique identifiers to denote their test cases. Test case identifiers are represented by the test case ID in the form PP-XXX or PP-XXXX where X refers to a whole number. This practice has been implemented prior to go-live of the SAP billing system and is still in practice. Test case IDs are also continuously referenced in supporting documentation like the Requirements Traceability Matrix (Section 2.2.2). Requirements and defects also contain their own unique identifiers. Test cases are linked to requirements through the RTM but are not linked on JIRA. Test cases are linked to defects, but defects are not linked to test cases.

Risks

While Central Hudson has unique identifiers in place for each test case, they are not fully utilized to be consistently used and traced across different components of the solution. This can create the risk of poor visibility across all of testing, making it difficult for stakeholders to ensure that all components have been tested, impacting overall traceability of the project.

Recommendations

Our recommendation is that Central Hudson continue to use the unique identifiers identified for test cases and establish linkages between requirements, test cases, and defects in both directions ensuring that the components are linked mainly through their respective unique identifiers. This will also help when automation is introduced to testing, ensuring that the identifiers are linked correctly and are able to execute test cases automatically.

5.4.2 Test case summary and supporting documentation

Creating test case summary and descriptions

The test case name and description play a crucial role in conveying the purpose, scope, and expectations of the test case. A well-written name and description for a test case contribute to clarity and effectiveness of the testing process. Overall, a well-written test case name should be brief and concise, containing an action verb followed by what functionality is being tested. The description of the test case should be able to explain in detail what functionality is being tested and how it will be tested. Descriptions of a test case typically contain an objective that outlines the goal of the test case, pre-conditions that must be satisfied prior to execution, steps for execution, input data that will be utilized in testing, and expected and actual results.

Central Hudson current state

These findings are based off the test cases and defects aligned to the issues outlined in the OIE report. In JIRA, there are varying levels of detail provided in the description about what functionality is being tested. Some tickets do not contain information of what is being tested in the ticket itself. The test cases contain a table that includes information on a summary of the steps to execute the test case, the test data that is being utilized and the expected result. Test case also includes information about the test environment that is necessary.

Risks

The risks of not having standard documentation describing the functionality of what is expected to be tested can lead to confusion around test coverage and if all requirements are being tested.

Recommendations

Our recommendation is to standardize documentation across test cases in JIRA. Description should include information on what functionality is expected to be tested in additional to the other information that has been mentioned in the previous section. We would also recommend including information on dependencies between test cases and other testing components, if relevant. Test case naming conventions and description should be agreed upon with stakeholders involved in creating and executing test cases to ensure alignment.

5.4.3 Test run execution documentation

Test run execution documentation

When designing and executing test cases, it is important that ownership of each test case component is established throughout the lifecycle of the test case. Information about the owner responsible for executing test cases, managing defects, and approval of test case must be documented in both JIRA and the RTM. Test cases should also display the results of the execution and any linked defects associated with failed test runs. Documentation should include supporting information needed to execute test case and that the test case has been successfully executed in order to support approval.

Central Hudson current state

Reviewing test cases in JIRA, test cases are supported by test execution documentation that is standardized across most tickets. Test cases are assigned an owner responsible for executing the test case and owners are linked to the execution of each run. Below the test step summary

table (Section 3.2), there is a table that contains information on test runs. The test run table contains a list of test runs with a unique ID in the format PP-XXXX or PP-XXXXX (where X is a whole number), the platform on which the test case is executed, the result of the test run, and associated defects, linked to the test case by their defect ID. Defects also contain an ownership process with documented approval by the owner, found in the comments of the test case on JIRA.

Recommendations

The above-mentioned practices are in line with IEEE 829-2008 testing standard and other industry best practices, therefore our recommendation for Central Hudson is to continue to execute test cases as is being done currently. However, we recommend that documentation to train users is updated to support current practices, to ensure that test execution is being carried out efficiently and that appropriate linkages are in place.

5.5 Test planning

A test plan provides a framework and roadmap that outlines objectives, scope, resources, timelines, and methodologies to ensure that all stakeholders are aligned and that testing efforts are organized.

5.5.1 The potential risks of not having a test plan in place

Without a comprehensive test plan, Central Hudson exposes themselves to risks. The most common risk is the possibility of errors or system failures slipping through undetected. These errors may range from minor inconveniences such as superficial visualization defects to more severe disruptions like billing inaccuracies, data loss, or interruptions in business operations. Insufficient testing planning and structure can leave an organization vulnerable to operational inefficiencies, potentially causing delays in billing, customer disputes, and an overall decrease in productivity.

The risk of financial implications of these errors can be significant. Inaccurate billing, for instance, can result in revenue losses, customer dissatisfaction, and potential legal issues. The reputation of the company may also be put at risk due to a poor customer experience. An inadequate testing plan and cohesive process may lead to data corruption, duplication, or loss, which can be detrimental to an organization's financial and operational stability. Data integrity is essential for accurate billing and reporting. A common example of this is system incompatibility.

Failing to address compatibility issues between existing systems and the SAP billing system can lead to data discrepancies, operational disruptions, and inaccurate billing processes.

5.5.2 The criticality of a test plan in hypercare and ongoing maintenance phase

Testing during the hypercare phase and through ongoing maintenance of the SAP billing system, or any software integration project, is a critical step to ensure the smooth operation of the system. Having and following a test plan that follows IEEE standards and industry best practices during system hypercare is critical to ensuring that issues are identified, resolved, and documented in a consistent and comprehensive way.

As hypercare is a period immediately after system implementation, during which unexpected issues or defects are likely to surface, resources can be scarce and swift actions may be necessary to fix system defects. A test plan provides a structured approach to systematically identify, document, and prioritize these issues, allowing for their efficient resolution. During this phase, a structured approach is crucial to ensure that any issues or defects are identified, prioritized, and resolved promptly. A test plan provides the necessary structure to execute this process systematically. Given this, not having a test plan in place during hyper care may likely result in undetected defects related to billing, leading to incorrect invoices, customer disputes, and potential financial losses.

Along with this, the hyper care phase often involves limited resources. Without a test plan, testing efforts may lack direction, and resources may be misallocated. A test plan, particularly the sections on timeline and resource allocation, helps in efficiently allocating resources to address the most critical issues that impact billing accuracy and customer satisfaction. A definition of roles and responsibilities ensures that no issues go undetected or unresolved. This is enabled through clear pass/fail criteria and defect prioritization methodology outlined in the test plan. This framework guides the team in determining which issues are most critical and need immediate attention and helps in focusing scarce resources on high-impact problems.

Lastly, effective documentation and reporting are essential during hyper care to track the progress of issue resolution, provide transparency to stakeholders, and analyze the effectiveness of hyper care efforts. A test plan guides the documentation and reporting processes and provides a framework for these documentation requirements.

5.5.3 Central Hudson alternative test plan documentation

In conducting an in-depth investigation of Central Hudson's testing practices and methodologies, we embarked on a comprehensive review process. Our primary objective was to gauge the effectiveness and adherence to industry standards in their test planning and execution. To this end, we analyzed a test plan from the Dunning project, a separate project within Central Hudson, due to the absence of a current and updated test plan for the project in question. This approach enabled us to evaluate Central Hudson's overall capabilities and track record in test planning.

Our analysis of the Dunning project test plan revealed several findings:

- **Defined testing objectives:** The alternative test plan defines its objectives but falls short in detailing how the testing activities will directly contribute to achieving these goals. While it mentions that testing will be conducted in phases, there is a lack of explicit linkage between these phases and the overall testing objectives.
- **Clear scope of testing:** The scope of testing within the alternative test plan is defined, providing an outline of what the testing process intends to cover
- **Testing approach and strategy document:** The plan references a separate testing strategy document outlining the approach for ongoing testing efforts. However, the documentation provided by Central Hudson did not contain the level of detail required to assess the quality or effectiveness of this approach.
- **Test schedule and phases:** The plan includes a schedule for different testing phases but could benefit from more granularity, specifically regarding the tasks within each phase and the assignment of responsibilities amongst relevant stakeholders
- **Entry and exit criteria:** Although entry and exit criteria are provided, they are not aligned with specific phases of testing but rather with the overall completion of the testing process
- **Resource allocation:** The plan adequately details the resources allocated for testing, aligning with the IEEE 829-2008 standard
- **Test environment and data management:** The document mentions test environment and data management but lacks comprehensive details on the management process and the responsible parties for maintaining the testing infrastructure throughout the project

Despite it being for a separate project, the Dunning project test planning documentation indicates that Central Hudson currently possesses and has implemented a test plan template aligning with IEEE standards in other projects. This suggests Central Hudson can develop and implement a test plan for ongoing testing, however such a plan is not documented or in use for current testing activities outlined in the scope of this assessment.

5.5.4 Recommendations

Initially, we encountered a previous test plan that was employed during Project Phoenix. However, this plan was deemed obsolete post SAP billing system go-live by Central Hudson. This plan was thus deemed irrelevant to our current scope. It is our conclusion that Central Hudson has no documented Test Plan for the ongoing testing efforts related to reporting, resolving, and testing defects related to the OIE report.

Central Hudson should define a clear Test Plan that contains a structured approach to testing in hypercare and ongoing maintenance of the SAP billing system. Neglecting the creation of a detailed test plan may lead to scope creep, missed deadlines, and resource mismanagement, endangering the success of any future systems, updates, or fixes. In line with IEEE testing practices and SAP industry standards, this section delves into the essential aspects of test planning and execution.

5.5.4.1 Testing objectives

Clear definition of testing objectives

The clear definition and documentation of testing objectives are critical components of a test plan, particularly when testing implementation of SAP billing systems. These objectives serve as the guiding principles for the entire testing process, ensuring that the integration project remains focused and aligned with its goals. In the context of SAP billing system integration, examples of specific objectives could include validating the accuracy of billing calculations, testing the system's performance under various load conditions, and verifying the reliability of data transfer between the SAP system and Central Hudson databases.

Central Hudson current state

In several conversations with testing stakeholders and investigation of documentation, we have concluded that Central Hudson does not have any documented objectives to guide their current testing activities.

Risks

Without defined objectives, testing efforts may lack direction. This could potentially lead to inefficiencies, missed critical issues, and incomplete coverage of SAP billing functionalities. For instance, if a testing objective related to billing accuracy is not clearly defined in ongoing testing activities, there may be ambiguity about the extent of testing required, which can lead to incomplete or inconsistent testing efforts. In addition, a lack of specific test objectives can result in misunderstandings and misalignments among team members and stakeholders, especially given the size and dispersed management of the Central Hudson testing teams. Without clear objectives, different teams and team members might have varying expectations of what needs to be tested, which can lead to inconsistent efforts and conflicting interpretations of test results.

Recommendations

To ensure effective implementation of clear objectives for ongoing testing, it is recommended Central Hudson take into consideration the following best practices:

- **Functional Requirements:** Align testing objectives with the functional requirements of the SAP billing system. Identify key functionalities and features that must be thoroughly tested to ensure accuracy and reliability.
- **SMART Objectives:** Formulate objectives that are Specific, Measurable, Achievable, Relevant, and Time-bound (SMART). These objectives should be specific in what they aim to achieve, measurable to determine success, attainable with available resources, relevant to the project's goals, and time-bound to set a clear timeline for completion.
- **Alignment with Project Goals**: Ensure that test objectives are directly aligned with the overall goals of the integration project. This alignment helps maintain focus and relevance throughout the testing process.
- **Regular Review and Validation:** Continuously review and validate the objectives during the project's lifecycle. Be prepared to revisit and update objectives as project requirements evolve or as insights are gained through testing.

5.5.4.2 Scope of testing

Definition and documentation of scope of testing

Thoroughly outlining the scope of testing is a pivotal aspect of a software test plan, particularly when it comes to testing the integration of SAP billing systems. The IEEE 829-2008 standard and other industry best practices highlight the importance of clearly defining the scope of testing to ensure that all relevant aspects of the system under examination are addressed. This scope definition sets the boundaries for testing activities and establishes a clear framework for the entire integration project. In the context of SAP billing system integration, the scope may encompass various facets, such as functional modules to be tested, data migration processes, user interfaces, and the interaction of the billing system with other Central Hudson systems.

The scope of the testing section within a test plan should include information on what is being tested and what is not, including the functionalities, features, and aspects of the software system under examination. This section serves as a guide to ensure that all relevant areas are adequately tested, leaving no room for ambiguity.

Central Hudson current state

In several conversations with testing stakeholders and investigation of documentation, we have concluded that Central Hudson does not have any documentation outlining scope of testing to guide their current testing activities.

Risks

The risk of "scope creep" emerges, where the project extends beyond its original objectives. In the context of SAP billing system integration, this could mean additional functionalities, features, or components are introduced into the project without proper evaluation, leading to delays, increased costs, and potential misalignments with the project's goals.

Additionally, without thorough scope definition, it becomes challenging to manage stakeholder expectations and ensure that all essential aspects of the SAP billing system are adequately assessed. Misunderstandings or misalignments among team members and stakeholders can arise, complicating the testing process and potentially leading to inconsistencies in testing efforts and conflicting interpretations of test results.

Most importantly, there is a risk of overlooking critical aspects of the SAP billing system. Inadequate scope definition may result in certain functionalities or processes not being tested,

which can leave vulnerabilities or defects undetected. For instance, failing to test a specific billing calculation algorithm might lead to inaccuracies in customer billing, affecting the utility's revenue and customer satisfaction.

Recommendations

To ensure effective scope definition in a test plan, Central Hudson should adhere to the following best practices:

- **Clear inclusion and exclusion:** Define what is within the scope of testing and what falls outside. A well-documented scope statement should specify both in-scope and out-of-scope items, leaving no room for ambiguity.
- **Traceability:** Ensure that there is traceability linking the defined scope and the project's objectives together. This traceability helps confirm that all testing activities align with the intended goals of the integration project.
- **Regular review and validation:** Continuously review and validate the scope throughout the project's lifecycle. Be prepared to revisit and update the scope when necessary due to evolving project requirements or insights gained during testing.

5.5.4.3 Testing schedule and timeline

Outlining a comprehensive testing schedule and timeline

Outlining the testing schedule and timeline is a fundamental aspect of a test plan. The establishment of a well-structured and detailed testing schedule provides a roadmap for the entire testing process and ensures that testing activities are conducted in an organized, efficient, and timely manner. IEEE standards stress the necessity of a comprehensive test schedule as a critical component of any test plan.

The schedule and timeline section of a test plan should outline when each testing activity will occur, including milestones, deadlines, dependencies, and the sequence of tasks. This section provides information on what a clear roadmap should include for the entire integration project, ensuring that various testing activities are organized, executed, and monitored in a coordinated and efficient manner.

Central Hudson current state

After interviews with stakeholders and review of provided documentation, we have concluded that Central Hudson did not have a documented testing timeline during hypercare outlining any milestones or deadlines.

Risks

The primary risk of not clearly outlining and including a schedule in a test plan is the possibility of delays. Without a well-defined schedule, testing activities may not be synchronized with the overall project timeline, leading to missed deadlines and a delayed integration process.

Another risk is resource inefficiency. In the absence of a clear schedule, resources such as testing personnel, testing environments, and equipment may not be allocated effectively. This can result in resource bottlenecks, inefficiencies, and unnecessary costs.

The lack of a well-structured schedule can also hinder the timely detection and resolution of issues. If testing activities are not proceeding as planned, defects and inaccuracies may go undetected, posing a risk to the reliability and accuracy of the SAP billing system. This can lead to billing errors, operational disruptions, and customer dissatisfaction.

Recommendations

To ensure a comprehensive test plan, it is recommended Central Hudson adhere to the following best practices when creating and integrating a testing schedule and timeline into their plan:

- **Define milestones:** It is common to break the project into manageable milestones, each with its associated testing activities and timelines. This approach allows for better tracking of progress and early issue detection.
- **Allocate resources appropriately**: Ensure that resources are allocated in accordance with the project's testing schedule. Match the availability of personnel, testing environments, and tools with the project's timeline to avoid resource bottlenecks.
- **Regular monitoring:** Continuously monitor the testing schedule and compare it with the progress made. If deviations or delays are detected, take proactive measures to address them, such as reassigning resources or adjusting the schedule.
- **Transparent reporting:** Provide clear and transparent reporting on the status of testing activities and progress against the schedule. This helps in keeping stakeholders informed and enables timely decision-making.

5.5.4.4 Resource allocation

Clear resource allocation

Resource allocation is a fundamental component of a software test plan, and its importance cannot be overstated, especially in the context of testing integration into SAP billing systems. IEEE standards emphasize the need for a clear and well-structured resource allocation section within the test plan, as it directly impacts the successful execution of testing activities.

The resource allocation section of a test plan should include specific information about the allocation of human resources, hardware, software, and other essential assets required for testing. It is crucial for defining who will be responsible for various testing tasks, what tools and equipment will be used, and how these resources will be made available throughout the testing process.

Central Hudson current state

Through interviews with stakeholders, we have concluded that the testing team has no central resource allocation documentation. Testing is completed within various teams with dispersed management. Each team has its own resourcing strategy, and teams do not follow a standardized framework for testing approach.

Risks

Without a well-defined resource allocation plan, numerous risks can emerge. For example, there is a heightened risk of resource bottlenecks. In the absence of clear allocation guidelines, there may be conflicts over resource availability, leading to inefficiencies and delays in testing. This can have a cascading effect on the overall project timeline, potentially resulting in missed deadlines and increased costs.

Furthermore, a lack of resource allocation details can impede effective collaboration and communication among team members and stakeholders. Misunderstandings and confusion may arise regarding who is responsible for specific tasks or which tools should be used, leading to inconsistencies in testing efforts and potentially compromised testing quality.

Recommendations

To ensure effective resource allocation in a test plan, it is recommended Central Hudson adhere to the following best practices:

- **Clearly define resource requirements:** Specify the types and quantities of resources needed for testing, including personnel, hardware, software, and testing environments. This ensures that all necessary elements are identified.
- **Assign roles and responsibilities:** Clearly define the roles and responsibilities of individuals or teams involved in testing. This includes test managers, testers, and any other stakeholders responsible for resource allocation and management.
- **Establish resource schedules:** Outline when and for how long specific resources will be allocated for testing. This helps prevent conflicts and ensures that resources are available when needed
- **Regular monitoring:** Continuously monitor resource allocation throughout the testing process, adjusting as necessary to address changing needs or unexpected issues

5.5.4.5 Testing approach

Outline of testing methodology

The testing methodology is a crucial and integral component of a software test plan, with its significance emphasized in IEEE standards. In the context of testing integration into SAP billing systems at Central Hudson, a well-defined testing methodology is essential to guide and execute the testing process systematically and effectively.

The testing methodology section within a test plan outlines the specific techniques, approaches, and procedures that will be employed during testing. It provides a structured framework for planning, designing, executing, and evaluating tests. This section is fundamental to ensuring that testing activities are conducted coherently and that the intended objectives are met.

Central Hudson current state

After documentation review and discussions with stakeholders, we have concluded that there is no standardized or documented approach or methodology to ongoing testing efforts. Given testing is completed in dispersed teams, approaches and criteria may vary depending on the testers involved. While there is a general standard for defect reporting and resolution workflow facilitated by Jira configuration, there is no documented methodology for testing activities.

Risks

The importance of a well-defined testing methodology becomes evident when considering the potential risks of not having one. One primary risk is the potential for inconsistent and ad-hoc

testing practices. In the absence of a defined methodology, testing efforts may lack structure and a systematic approach, leading to fragmented, inefficient, and potentially ineffective testing.

Another risk is that of missed testing activities. Without a clear testing methodology, critical testing techniques or procedures that are specifically relevant to SAP billing system integration may be overlooked. This omission can result in incomplete test coverage, potentially leaving vulnerabilities or defects undetected, which could lead to billing inaccuracies and operational disruptions for Central Hudson.

Recommendations

To mitigate risks and ensure effective implementation of a testing methodology in a test plan, it is crucial to adhere to the following best practices:

- **Methodology selection:** Select a testing methodology that aligns with the nature and objectives of the SAP billing system integration project. For instance, in complex projects like SAP integration, a risk-based testing methodology or a combination of methodologies may be appropriate.
- **Detailed procedures:** Specify detailed testing procedures, including test design, test case creation, test execution, defect tracking, and reporting. This level of detail ensures that testing is conducted systematically.
- **Tools and resources:** Identify the testing tools and resources that will be used in accordance with the chosen methodology. Ensure that the testing team is well-trained in using these tools.
- **Quality assurance:** Integrate quality assurance measures to monitor adherence to the defined testing methodology. Regular review and validation of testing activities are essential to maintain alignment with the methodology.
- **Continuous improvement:** Encourage continuous improvement by gathering feedback and insights from testing activities. Adjust the testing methodology as necessary to address evolving project requirements and testing challenges.

5.5.4.6 Defect management and prioritization

Outline of defect prioritization criteria and process

Defect prioritization criteria or methodology is a critical component of a software test plan, and its importance is underscored by IEEE standards. In the context of testing integration into SAP

billing systems at Central Hudson, a well-defined defect prioritization methodology is essential to systematically categorize, assess, and address identified defects based on their severity and impact.

The defect prioritization methodology section within a test plan outlines the specific criteria, rules, and procedures that will be used to prioritize defects discovered during testing. It provides a structured framework for identifying the most critical issues and allocating resources effectively to address them.

Central Hudson current state

Central Hudson has a generic defect prioritization matrix that is reused for every technology implementation project. This matrix however does not currently reside in an active test plan for SAP Billing System implementation but is still currently referenced when managing defects.

Central Hudson's prioritization matrix categorizes defects into 'Critical', 'Major', 'Minor', and 'Trivial' levels, providing basic definitions and examples for each, aligning with IEEE standards that advocate for clear and differentiated levels of defect severity. However, the definitions lack specificity, which is crucial for defect classification in a specialized area like SAP billing systems in the utility sector. For instance, terms like "system is down" or "severely affects" are generic and could lead to varying interpretations. In the context of a billing system, more quantifiable and context-specific criteria, such as impact on billing accuracy or regulatory compliance, would be more appropriate.

While the examples provided offer some guidance, they are somewhat generic. Tailoring these examples to reflect specific challenges pertinent to a utility's billing system, such as issues in usage data integration or time-of-use billing calculations, would enhance the matrix's relevance and utility.

Risks

One primary risk of unclear defect prioritization matrix is the inability to address critical defects promptly. Without a clear methodology for prioritizing defects, there may be confusion about which issues should be tackled first, leading to delays in resolving critical problems that can impact billing accuracy and customer satisfaction.

Another risk is resource misallocation. In the absence of a defined methodology, resources such as testing teams and developers may be directed to address less critical defects, diverting them from resolving higher-priority issues. This can lead to inefficiencies, longer resolution times, and increased costs for the utility.

Recommendations

While Central Hudson does have defect prioritization criteria defined, it is recommended that the following best practices are implemented for improvement when creating a test plan:

- **Refine definitions:** Make definitions more specific and quantifiable
- **Incorporate diverse examples:** Provide a wider range of examples for each priority level
- **Include user experience and business impact:** Expand criteria to consider user experience and business implications
- **Guidelines for consistent application:** Develop more detailed guidelines to ensure consistent application across different teams and projects
- **Regular review:** Encourage regular review and validation of defect prioritization to ensure that it remains aligned with project goals and changing requirements

5.5.4.7 Pass/fail criteria

Definition of pass/fail criteria

The establishment of pass/fail criteria is a critical and indispensable element of a software test plan, with its significance outlined in IEEE standards. When it comes to testing integration into SAP billing systems, a pass/fail criteria section is essential for systematically determining the success or failure of testing activities.

A well-defined pass/fail criteria section within a test plan outlines the specific conditions and requirements that must be met for a test case, test cycle, or the overall testing process to be deemed successful. It provides a framework that objectively assesses the outcomes of testing and making informed decisions regarding system readiness.

Central Hudson current state

After interviews with stakeholders and investigation of provided documentation, it has been concluded that Central Hudson does not have outlined pass/fail criteria for determining the requirements to be met for test cases or defect resolution to be deemed successful.

Risks

Defining pass/fail criteria is critical to the successful ongoing testing and defect resolution efforts of any system implementation. This becomes evident when considering the potential risks of not

having this criteria in place. One primary risk is subjectivity and ambiguity in determining the testing outcome. Without established criteria, there can be confusion or disagreements about whether a test has passed or failed, potentially leading to disputes among testing teams and stakeholders.

Another risk is the misinterpretation of testing results. In the absence of clear pass/fail criteria, there may be a lack of alignment between testing outcomes and the project's overall objectives. This misalignment can result in inaccurate assessments of the system's readiness for integration, potentially leading to issues with billing accuracy, operational disruptions, and customer satisfaction.

Recommendations

To mitigate these risks and ensure effective implementation of pass/fail criteria in a test plan, it is essential to adhere to the following best practices outlined by IEE 829 standards and industry best practices:

- **Objective and measurable criteria:** It is critical to define pass/fail criteria using objective and measurable terms. For example, criteria can be based on specific performance benchmarks, error thresholds, or functional requirements.
- **Alignment with requirements:** Ensure that the pass/fail criteria align with the project's requirements and objectives. This alignment helps in making decisions that are in line with the project's goals.
- **Clear documentation:** Document pass/fail criteria comprehensively within the test plan, providing clarity about what constitutes a successful test outcome
- **Thresholds and tolerances:** Specify tolerance levels or thresholds for criteria that allow for some variability or deviation while still classifying the test as a pass. This accommodates small, acceptable variations.
- **Reporting and communication:** Establish a system for reporting test results and communicating pass/fail outcomes to stakeholders. Transparency in reporting helps in making informed decisions.

5.5.4.8 Reporting and documentation

Standardized test reporting and documentation

Test reporting and documentation are integral and essential components of a software test plan, and their significance is highlighted in IEEE standards. When testing the integration into SAP billing systems at Central Hudson, a well-structured test reporting and documentation section is crucial for recording, communicating, and managing testing activities systematically.

The test reporting and documentation section within a test plan outlines the specific requirements for documenting test cases, test results, defects, and other essential information related to testing. It provides a structured framework for capturing data, facilitating communication among stakeholders, and ensuring that testing activities are transparent and well-documented.

Central Hudson current state

After interviews with testing stakeholders and analysis of provided documentation, we have concluded that there is no standardized testing reporting and documentation criteria in ongoing testing activities. Throughout Jira, defects are reported and resolved with varying levels of detail.

Risks

The importance of well-defined test reporting and documentation becomes evident when considering the potential risks of not having them. One primary risk is a lack of transparency and accountability in the testing process. Without proper documentation, it becomes challenging to trace what tests were conducted, what issues were identified, and how they were resolved, potentially leading to confusion and disputes among testing teams and stakeholders.

Another risk is the inability to track progress effectively. In the absence of clear documentation, it is challenging to monitor the status of testing activities and assess whether the project is on track to meet its objectives. This lack of visibility can lead to project delays, missed deadlines, and issues with billing accuracy and customer satisfaction.

Recommendations

To mitigate these risks and ensure effective implementation of test reporting and documentation in a test plan, it is crucial to adhere to the following best practices:

- **Documenting Test Cases:** Specify the format and structure for documenting test cases, ensuring that they are well-organized, clear, and include all necessary information
- **Recording Test Results:** Define the format for recording test results, including both successful and failed tests. This documentation should include details such as the test environment, execution steps, and expected and actual results.

- **Defect Tracking:** Describe the process for documenting and tracking defects, including the criteria for defect classification, prioritization, and resolution
- **Traceability:** Emphasize the importance of traceability by documenting how test cases relate to specific requirements and how defects are linked to failed test cases
- **Regular Reporting**: Establish a schedule for test reporting, indicating when and how often reports will be generated and shared with stakeholders. This ensures that project progress is communicated transparently.

5.5.4.9 Test environment and infrastructure

Management of test environment and infrastructure

The test environment and infrastructure section is a pivotal and fundamental element of a software test plan, and its importance is emphasized in IEEE standards. In the context of testing integration into SAP billing systems, a well-defined test environment and infrastructure section is essential for ensuring that the testing environment is adequately set up, configured, and managed to support testing activities effectively.

The test environment and infrastructure section within a test plan outlines the specific requirements for the testing environment, including hardware, software, data, and network configurations. It provides a structured framework for creating an environment that mirrors the production environment and is conducive to accurate and comprehensive testing.

Central Hudson current state

After discussion with stakeholders and documentation review, it has been concluded that test environment and infrastructure management is not outlined or standardized in the current testing activities.

Risks

The importance of a well-defined test environment and infrastructure becomes evident when considering the potential risks of not having one. One primary risk is the inability to replicate real-world conditions for testing. Without a defined test environment, it may be challenging to create an environment that accurately simulates the production environment, potentially leading to issues that are only discovered after integration, such as inaccuracies in billing calculations.

Another risk is resource misallocation. In the absence of clear guidelines for the test environment, there may be inefficiencies and delays in configuring and managing the necessary

infrastructure. This can lead to delays in testing, increased costs, and missed deadlines, affecting billing accuracy and customer satisfaction.

Recommendations

The establishment and support of a proper testing environment is crucial for diagnosis, remediation and testing of bug fixes, it is a crucial element of any test plan. To mitigate risk and ensure effective documentation in a test plan that aligns with IEE 829 standards and industry best practices, it is crucial to adhere to the following recommendations:

- **Environment Configuration:** Specify the hardware, software, and network configurations required for testing. Ensure that the test environment closely mirrors the production environment, including data and interfaces
- **Resource Allocation:** Define the allocation of resources, including testing servers, databases, and network resources, to ensure that they are available and properly configured when needed
- **Data Management:** Outline the procedures for managing test data, including data generation, migration, and anonymization. Ensure that test data accurately represents real-world scenarios.
- **Integration Requirements:** Clearly define the integration requirements for the test environment, including connections to external systems and services
- **Infrastructure Maintenance:** Describe the processes for maintaining and monitoring the test environment throughout the testing process to ensure that it remains stable and representative of the production environment

5.5.4.10 Risks and assumptions

Documentation of risks and assumptions

The inclusion of a risk and assumptions section is a crucial and integral part of a software test plan, with its importance emphasized in IEEE standards. In the context of testing integration into SAP billing systems, a well-defined risk and assumptions section is essential for identifying potential challenges, uncertainties, and dependencies that could impact the testing process.

The risk and assumptions section within a test plan outlines the specific risks, uncertainties, dependencies, and assumptions that may affect the testing effort. It provides a structured

framework for risk identification, assessment, and mitigation, as well as for clarifying any assumptions made during the planning process.

Central Hudson current state

After review of documentation and interviews with testing stakeholders, we have concluded that Central Hudson does not have a defined risk mitigation and assumptions documentation for ongoing testing activities.

Risks

The importance of a well-defined risk and assumptions section becomes evident when considering the potential risks of not having one. One primary risk is the lack of risk awareness and preparedness. Without an established section for risks, there may be insufficient attention to potential issues that can affect the project, such as unanticipated data dependencies or challenges related to system integration. These issues can lead to project delays, inaccuracies in billing, and customer dissatisfaction.

Another risk is the potential for misaligned assumptions. In the absence of documented assumptions, there may be misunderstandings or misinterpretations among team members and stakeholders regarding the project's underlying assumptions. These misunderstandings can result in disagreements and inconsistencies in the testing process, leading to disruptions and delays.

Recommendations

To mitigate these risks and ensure effective implementation of a risk and assumptions section in a test plan, it is crucial to adhere to the following best practices:

- **Comprehensive Risk Identification:** Conduct a comprehensive assessment to identify potential risks that may impact the project, such as data availability issues, resource constraints, or system compatibility challenges
- **Risk Assessment:** Evaluate the potential impact and likelihood of each identified risk. Prioritize risks based on their severity and develop mitigation strategies for high-priority risks
- **Assumption Clarity:** Clearly document any assumptions made during the planning process, including dependencies on external systems, availability of data, and resource allocations. Ensure that assumptions are understood and agreed upon by all stakeholders

- **Regular Updates:** Continuously monitor and update the risk and assumptions section as the project progresses. New risks may emerge, and assumptions may evolve, so it is essential to keep this section current.
- **Communication:** Encourage transparent communication about identified risks and assumptions among team members and stakeholders to ensure a shared understanding of potential challenges and dependencies

6 Analysis of billing, FCS, and EDI integration defects

6.1 Summary of findings

The purpose of this analysis is to review any changes to the metering, billing, and integration solutions of Central Hudson that were directly related to the issues documented in the OIE report since the launch of Project Phoenix, assess the effectiveness of these changes, identify any ongoing issues with the solution, and recommend actions to remediate these issues. To conduct a thorough analysis of the state of Central Hudson's data and billing solutions at go-live and any changes to it to present, an iterative process of document request and interviews were conducted. This analysis began with documentation requests regarding: development process, development standards, documentation standards, FCS, EDI, and SAP S4, PI, and PO. Upon reviewing the initial documents, gaps in information and clarifying questions were gathered and further requests were made as well as interviews held with document owners and functional owners of the solution. This continued as an interactive process until a complete definition of the state of Central Hudson's development and data flow operations at go-live until the current state had been formed.

In tandem with document analysis and interviews, a review of the three systems comprising Central Hudson's data flow solution as well as their work management system, JIRA was done to assess their respective current states. Descriptions of these approaches can be found in sections:

- **JIRA:**
    - 2.2.1 JIRA Issue Review
- **SAP S4:**

    - 3 ABAP Code Analysis
- **FCS:**
    - 4 Meter Data Collection Analysis
- **SAP PI and PO:**
    - 5 EDI Analysis

Key Findings:

1. Meter Data Flow Architecture Analysis
    - While Central Hudson provided functional specifications and relational diagrams of their discreet components, they lack a holistic detailed documentation of their system.
    - Relational Diagrams describing the connection points between Central Hudson's functional components were not supported with technical details such as descriptions of each component's function and reliable references or links to functional specifications.
2. Development Operations Analysis
    - Tower Leads are both product owners and solutions architects.
    - Scope of work in Jira has been categorized and grouped in a disparate fashion.
    - Quality of development-related content in Jira tickets is inconsistent.
    - Testing and traceability in Jira have not been consistently nor completely implemented.
    - Current solution design architecture has not been kept up to date since go-live.
    - Current development standards have not been codified.
3. Continuous Integration and Delivery
    - Central Hudson informed PA that the Company does not utilize standard CI/CD practices.
4. ABAP Code Analysis
    - Overall, for OIE categories 1-9 were within industry standard norms and no specific deficiencies were found through PA's analysis.

- SAP transport traceability is unavailable (examples available in Attachment 4 – JIRA Issues Without Transport Numbers).
- OSS notes with SAP are unlinked in Production environment.

5. Root Cause Analysis
    - Root cause analysis documentation did not always include root cause in the analysis.
6. Meter Data Collection Analysis
    - Routes are being assigned and completed in an acceptable fashion.
    - PA's analysis showed that data from FCS systems is being correctly ingested into S4.
    - Skip code usage policy needs more stringent enforcement.
7. EDI Analysis
    - No Implementation of Standard EDI / Interface Message Lifecycle Management reporting tools monitoring events such as:
        i. Invoice sent.
        ii. Invoice ACK sent.
        iii. PO sent.
        iv. PO ACK sent.
        v. PO received.
        vi. Please see Attachment 3 – EDI Reporting for an example expected reporting interface.
    - Business stakeholder approval chain on JIRA tickets was unclear.
        i. Example issues: PP-15995, PP-17887
    - A complete list of issues can be found in Attachment 2 - JIRA and Platform Change Analysis Tracker.
    - Evidence of different test scenarios missing in defect documentation such as screenshots of the issue, logs, and similar outputs.
    - General tracking and traceability of PI/PO changes was not sufficient.

6.2 Meter data flow architecture analysis

6.2.1 Approach

For a holistic review of Central Hudson's data flow architecture an analysis of both the governance and documentation of said architecture has been conducted. Any existing design documentation, diagrams, and configuration documents were requested regarding FCS, EDI, and SAP S4, PI, and PO. Additional document requests and interviews were an interactive process until a complete definition of Central Hudson's data flow architecture had been formed. A high-level, holistic, solution architecture for Central Hudson's data flow solution was created as a result. A review of the holistic solution architecture, documentation governance, and operational architecture was then conducted to identify any ongoing issues and recommend remediation actions for any issues found.

6.2.2 Solution architecture history

In preparation for the go-live of Project Phoenix, SAP systems were created and configured with existing systems to support Central Hudson's new customer billing solution. To collect AMR and manual read meter data, Itron's FCS (Field Collection System) is used. Handheld devices are connected to the FCS hub on site at the end of each read session by meter readers, aggregated on a mounted file server on-premises. This mount is then configured with Azure site-to-site VPN and ExpressRoute to dispatch the meter read data files to the SAP S4 instances file storage for incoming meter data. Collecting AMI data is done through Itron's MDM IEE AMI integration module via cellular connection and is immediately dispensed to Central Hudson's SAP S4 instance via SAP's AMI Integration for Utilities. Both AMI and AMR data streams are handled by SAP PI for ingestion into their S4 HANA database via an ABAP code proxy within HANA as soon as new data is available. SAP PI also handles Central Hudson's customer choice integrations with each ESCO on their network, transferring all relevant documents in cadence with service and billing events.

Central Hudson's implementation of SAP S4 is deployed in a managed service through SAP Hana Enterprise Cloud (HEC/ECS) in a software as a service (Managed IaaS) model. SAP PI is

also a service managed by SAP delivered to Central Hudson. Central Hudson's ability to manage the SAP infrastructure is limited in scope. For example, expanding the environment to include additional tiers for staging and the compute capacity of the environment in the form of application servers, nodes, and their compute sizes. It is Central Hudson's responsibility to coordinate with SAP to schedule vital system wide updates and upgrades as improvements and fixes to the service are released.

Functional requirements were led by business decisions made by Tower Leads who presided over specific functional components of Central Hudson's metering, integration, and SAP S4 systems. Each Tower Lead created functional architecture and documentation when given business requirements which were then parsed by a solution architect to produce technical documentation for each component of Project Phoenix. This technical documentation resulted in project plans and architecture documents to guide the development of Project Phoenix and described the system at go-live:

DR-0004 Project Plans per Operational Function CONFIDENTIAL[8]

The development of Project Phoenix was split into projects defined by the functions and systems component to their operational solution. Central Hudson's Tower Leads were then to convert the business requirements of each scope of work into fully detailed project plans to be executed before go-live in August of 2021. These documents together describe the full detailed design and intended configuration of Central Hudson's operational systems.

DR-0049 FCS Integration Diagram CONFIDENTIAL[19]

Upon being uploaded to Central Hudson's on-site data storage system, meter data is made available and then ingested by SAP PI to be stored in a HANA database via an ABAP proxy. This document depicts the transfer of data files between these points and defines how the on-premise systems are securely connected to SAP.

Figure 1. *FCS integration diagram.*

DR-0014 EDI Integration Flowchart CONFIDENTIAL[13]

This document outlines the files necessary to send between Central Hudson ESCO systems. It describes a basic flow of the file types from Central Hudson's SAP PO service, to OpenText's BizManager middleware, to the ESCO's systems, and finally the reverse route back to Central Hudson's SAP PO service.

Figure 2. *EDI integration flow.*

Different File Types:

- 810: invoice transaction set for URR customers
- 820: remittance transaction; sent on cycle 05 and cycle 15 of each month
- 867MU: monthly usage transaction
- 867HU: historical usage transaction
- 814C: change
- 814D: drop
- 814E: enroll
- 814R: reinstatement
- 814HU: historical usage request
- 997: acknowledgment file

Figure 3. *Complete meter data flow solution architecture.*

IT Organizational Structure

Central Hudson's IT department structures itself by what Central Hudson refers to as "Towers" split between Functional and Technical groupings representing domains of development comprised by the following:

- Functional Towers
  - Device Management
  - FICA (Financials)
  - Billing
  - Retail Choice
  - Customer Service/Solution Architecture
- Technical Towers
  - Release Management
  - Integrations
  - Development
  - BASIS/Infrastructure
  - Security
  - Testing

Each Tower has a “Tower Lead” role which manages a specific area of development within the SAP domain itself. Tower Leads are responsible for ensuring proper end-to-end flow of data for their respective processes including, but not limited to, incoming data, outgoing data, and any software integrations necessary to support data in transit or at-rest. Upon completion of core code changes to ABAP, the Retail Choice Tower then executes any integration steps needed to fulfil the scope of work regarding retail choice testing. Any external teams related to the current issue are notified of the impending change and any action needed from their teams. Central Hudson’s Director of Application Development serves a “Cross-Tower” role which oversees and is ultimately responsible for the successful, collective operations of each Tower.

Infrastructure Maintenance and Decision Making

Central Hudson engages with SAP directly for general maintenance activities utilizing a standard Managed IaaS business model. Service requests are sent from Central Hudson to SAP for downtime activities including, but not limited to, deploying Operating System (OS), security patches, and other general system updates. Any maintenance conducted by SAP will first be approved internally by Central Hudson who will then notify stakeholders and users of the upcoming system downtime.

PA concluded through its analysis that SAP itself has not implemented any major changes to Central Hudson’s CIS instance since go-live. Changes implemented to the instance have included, generally, infrastructure performance upgrades, security patches, and other minor system changes.

Change Management

At a high level, development decisions at Central Hudson are made on a ticket-by-ticket basis by the appropriate Tower Lead. Central Hudson also holds a defect triage twice per day between the SAP and AMS teams who evaluate tickets created via ServiceNow and decide which tickets will be pushed forward to Jira.

Documentation

Central Hudson provided the following documentation which collectively represents a standard set of development and system specifications. These documents have not been updated or

maintained since go-live. Rather, system alterations and code changes, as Changes Requests and Bugs in JIRA, are discreetly documented within SharePoint. The following documents are listed in order of logical hierarchy:

- **DR-0008/0010 Enterprise Software Applications CONFIDENTIAL**[11] – A complete list of enterprise level applications used by Central Hudson was provided to fulfil these data requests. This list includes the names of these applications, their software their versions, and migration paths (application environments from development to production). This document complies with industry standard for documentation as a high-level source of truth for the enterprise technology stack.
- **DR-0006 Functional Specifications CONFIDENTIAL**[10] – This collection of documents comprehensively outlines a detailed specification of each component of Central Hudson's billing solution within SAP. These documents comply with industry standard for documentation and change management.
- **DR-0005 SAP Configurations by Function CONFIDENTIAL**[9] – This collection of documents lists and details each configuration set up and change in SAP prior to go-live of Project Phoenix. These documents comply with industry standard for documentation and change management.
- **DR-0004 Project Plans by Feature for Project Phoenix CONFIDENTIAL** – These documents outline scopes of work to be completed as a component of Project Phoenix. Each document is derived from the above functional requirements documentation and developed into a detailed outline through development, configuration, and test scenarios. These documents comply with industry standard for documentation and change management.
- **DR-0021 Training Through Production Development Architecture CONFIDENTIAL**[14] – Central Hudson's training, development, testing, and production environments are outlined in this document. This diagram was designed at the enterprise service level grouping service environments by their service provider: CH Internal Network, SAP HANA Enterprise Cloud, and SAP Cloud Platform. This document complies with industry standard for documentation as a high-level source of truth for the development to production pathway of platform changes.
- **DR-0009 Meter and Billing Data Source/Sink Document by Workstream**[12] – This document outlines the endpoints in which data enters and exits components of Central

Hudson's billing solution. Each interface is grouped by workstream and includes details such as: sender, direction, vendor platform, receiver communication channel, and trigger for a data movement event. This document complies with industry standard for documentation as a source of truth for outlining the data interconnections of the system.

6.2.4 Meter data flow architecture findings

While Central Hudson provided functional documentation in part, a holistic detailed documentation of Central Hudson's system does not exist.

While DR-0004 CONFIDENTIAL and DR-0006 CONFIDENTIAL provide detailed design for the architecture of each business function and its integration requirements to others, there is no detailed diagram describing the relation of all these elements as one holistic system, nor any maintained documentation of platform and code and configuration changes. As confirmed by Central Hudson, updated platform and functional specifications exist as incremental changes documented in JIRA tickets which are linked to documents stored in SharePoint that contain the codified specification.

Relational Diagrams describing the relationships between functional components were not supported with technical details.

The scope of Central Hudson's holistic architectural documentation is limited to surface level detail. The maintained documentation lacks the information provided in DR-0004 CONFIDENTIAL and DR-0006 CONFIDENTIAL.

6.2.5 Recommendations

- PA recommends that Central Hudson incorporate an Enterprise Architect role responsible for the definition and modelling of high-level solution architecture across all systems
- PA recommends that Central Hudson designate a Senior Solution Architect responsible for project-level communication of solution architecture needs and goals

6.3 Development operations analysis

6.3.1 Approach

To holistically analyze the code changes since go-live and their effectiveness at addressing the purpose stated in their respective Jira tickets, as well as their effectiveness in addressing the issues listed in the OIE report, PA reviewed Central Hudson's developmental organization and operations. Understanding the ownership and documented policy of transforming business requirements into scopes of work, solution architecture, and delivery is critical to identifying any gaps or deficiencies in development-focused solutions. This knowledge in turn drives development practices and work efficacy at Central Hudson.

The development analysis of Project Phoenix includes an end-to end review of the development lifecycle as well as development best practices. As part of overall development operations analysis, PA performed a thorough review for Jira issues plausibly pertaining to the eleven enumerated OIE Report issues. For clarity and avoidance of doubt, Jira is an industry-standard issue tracking tool present in Central Hudson's enterprise landscape and used on an ongoing basis to track Central Hudson's defects. Jira is the main repository for Central Hudson's development work management and is the nexus for success in addressing both change requests and bugs in Central Hudson's billing solution. PA completed a thorough review and analysis of Jira tickets to assess work done against OIE issues, their linked root causes, and the effectiveness of implemented solutions. PA determined if issues were affirmed fixed, not fixed, or a fix could not be affirmed but no issue is seen at present.

6.3.2 Organizational analysis

Project Ownership

Tower Leads preside over the entire development process from end to end as it pertains to their functional component in Central Hudson's system. Tower Leads are the effective solution architects responsible for creating functional specifications and as product owners who prioritize scopes of work and are responsible for the entire delivery of the solution or fix. In the case of cross-discipline engagements, multiple Tower Leads may collaborate, but one Tower Lead is the sole owner. The success of inter-team integration is placed upon the main Tower Lead for a piece of work.

The responsibilities of transforming business requirements into platform implementations are split amongst two teams under oversight from the respective Tower Lead:

Functional Team

- Responsible for transforming business requirements into functional solution architecture for SAP
- Responsible for managing post-development testing conducted by the Technical Team

Technical Team

- Responsible for completing change requests and bugs as prioritized by the Tower Leads
- Conducts walkthrough meetings with functional owners of the Jira tickets to ensure there is a shared understanding
- Responsible for transforming functional architecture into technical architecture
- Responsible for executing program or code changes

6.3.3 SAP development best practices[16][17]

DR-0024 CHARM lifecycle and DR-0025 CONFIDENTIAL Naming Convention Document were provided in response to requesting documentation of Central Hudson's development policy and best practices. DR-0024 outlines the CHARM lifecycle for code defects and their remediation in Central Hudson's SAP environment. This document confirms to industry standards for a lifecycle and treatment of reported defects, although does not outline specific testing guidelines, etc. and is purely a process diagram. DR-0025 CONFIDENTIAL describes in detail naming convention policy for RICEFW objects specifically in the SAP system. This document also complies with industry standards and is suitable for use in Central Hudson's application of SAP.

6.3.4 Jira issue review

Jira Issue Scope and Selection[18][20]

As we began without a mapping of such Jira issues to OIE Report issues, we attempted to establish our own by querying Jira based on keywords in the OIE Report and leveraged the contents of DR-0040 CONFIDENTIAL & DR-0062 CONFIDENTIAL, together yielding some 167 Jira issues. Later we received a mapping from Central Hudson which yielded a net new 258 Jira issues, bringing the total to 424. These comprised 283 bugs, 46 change requests, and 95 tasks; 389 of which were done and 35 were incomplete.

JIRA Ticket Mapping Methodology

1. Use OIE issue keywords, synonyms, and report keywords to build a list of terms to feed a complex JIRA query for each issue
2. Use resulting tickets' titles and descriptions to build secondary list of terms and feed complex query for each issue
3. Aggregate all tickets returned with final query using primary and secondary term list for each OIE issue

Jira Issue Analysis

Each of the 424 Jira issues identified was exported to our proprietary tracker where we dispositioned various factors including the enterprise systems involved e.g. Core SAP, FCS, Biztalk, PI, etc. and whether they were technical or functional in nature, assessed the degree of quality of the Jira content itself on a series of criteria, and determined whether an ABAP code review was necessary (see section 3. ABAP Code Review) and the process, content, and final outcome of the code review. General and specific findings were derived from this analysis (see section 2.3 Findings.)

6.3.5 Findings

Tower Leads are both Solution architects and Product Owners

Updates to solution architecture and system specification documentation are handled on a functional basis and are contained in disjoint documents in SharePoint, most often accessed through their posting into JIRA tickets. As IT and PO roles are inherently separate and meant to complement each other, Central Hudson's current structure does not employ an essential role

for successfully defining and maintaining business requirements. This role also ensures traceability of platform change to business requirements as well as enforcement of functional performance indicators. Additionally, there does not exist a holistic functional definition of how these systems interrelate due to the collaborative nature of the Tower Leads and there being no hub person responsible for this task.

Root cause analysis documentation did not always include root cause in the analysis report

DR-0040 CONFIDENTIAL is a collection of documents outlining the root cause analyses that were conducted in response to the issues outlined in the OIE report, but are not directly mapped to them. These documents detail issues experienced on the platform at go-live, but several issues reviewed as part of the root cause analysis section of the report did not include the root cause of the issue in the analysis. Additionally, the analyses were not linked to overarching business requirements defined by Central Hudson nor to the issues detailed in the OIE report.

Scopes of work in JIRA have been categorized and grouped in a disparate fashion

PA's evaluation of Central Hudson's organization of tasks by project in Jira showed that tasks were not grouped in a way that enabled meaningful traceability on a project level. While PA was able to extract information required for its analysis utilizing soft-string matching techniques through Jira Query Language (JQL) searches, Central Hudson did not consistently and currently does not effectively employ usage of Jira's out-of-the-box tools such as ticket labels and tags to associate analysis and pieces of work with relevant business goals. During PA's analysis tags and labels were not able to effectively be used to map pieces of work to relevant issues and business goals. It is important to note that:

- Central Hudson did provide PA with a mapping of Jira tickets that Central Hudson identified as having a high positive impact on the issues identified in the OIE report (DR-0062 CONFIDENTIAL)
- The "Dunning" project, which is currently in progress, displays project planning qualities that are representative of industry standards and best practices

Quality of Development-Related Content in JIRA Tickets is inconsistent.

- The following information was not called out in most Jira tickets:

    - A problem statement describing the issue causing the bug or a business need necessitating a change request
    - A root cause if addressing a deficiency in the system
    - The proposed solution or remedy for the ticket
    - Acceptance criteria for the platform changes to have satisfied the initial purpose of the ticket
- Solution Design Documentation was not correctly linked to Jira tickets and when it was directly added, it was insufficient. A lack of contextual documentation, callouts to screen shots, and appropriate description of steps have resulted in documentation that is unable to entirely affirm corrective actions.

Testing and Traceability in JIRA has not been consistently nor completely implemented.

- Ongoing progress is tracked in three separate tabs under the Activity section: Comments, History, and Activity. Major action, decisions, state changes, and the like should be logged in the comments/reflected in the description. This information is commonly available spread across this History, Activity, and Work Log tabs. This inconsistency inherently creates confusion in evaluation of ticket status as, without a singular point of visibility, one must look at each tab to understand what progress has been made on the ticket.
- Bugs tracked because of testing defects are linked unidirectionally. Users can access the bug ticket from the original issue, but not in the reverse direction. Without the visibility of parent issues at the bug level, the context of the issue fix is lost, and the only information provided is solely in the bug ticket.
- Test cases, scenarios, and their associate issues are unidirectional where implemented. Central Hudson has not implemented this linking at all until very recently.
- Jira PP-17449: Testing exception without comment as to whether it will be fixed separately under other Jira or what the disposition is (Test results mention an exception for installation [redacted] when mass drop tcode used" and don't specify follow-on work being necessary, this leaves some doubt regarding completeness).
- A significant portion of Jira tickets do not contain a comprehensive list of the relevant transport requests or other work items (including non-SAP) comprising the fix.

Continuous Integration and Delivery Does Not Exist as a Practice.

- Upon PA's inquiry, Central Hudson stated that they maintain no standardized unit tests for general testing and approval of each incremental platform change.
- Upon PA's inquiry, Central Hudson stated that they maintain no standardized integration tests for functional systems. Integrations are handled on a per-ticket basis by the respective tower lead and are tested in accordance with the appropriate ticket.

Current Solution Design Architecture has not been kept up to date.

Since go-live, we have not been made aware of any updates to the holistic architectures depicted in DR-0004 Project Plans by Feature for Project Phoenix CONFIDENTIAL or DR-0006 Functional Specifications CONFIDENTIAL. In-part, solution architecture and functional specification documentation have been made relative to each JIRA ticket containing a platform change, but links to the SharePoint locations to where they are stored no longer correctly point to the files they have once referenced.

Current Development Standards are not codified.

- Both internally and working with different vendors across the life of Project Phoenix, Central Hudson has relied on a naming convention documentation and senior oversight to ensure code quality.
- Senior developers give new developers direct guidance on exactly how they want the job to be done.
- Senior developers will watch new developers closely in the beginning of their tenure and assess their work.
- Developers are expected to have an active relationship with their peers and leadership to obtain knowledge and remove blockers.

6.3.6 Recommendation roadmap

Grouping of Work

- Create a functional backlog that is managed and used to choreograph work within development increments.
- Group work under incremental projects defined by business requirements.
- Implement standardized criteria to enforce consistent linking of related issues.

JIRA Best Practices

To enable traceability and holistic knowledge of the current system, its defects, and any in-flight work, create and enforce a best practices document outlining current policies and work management policies. Specific policy improvements have been identified, but are not limited to, the list below:

- Do not use one key to represent a collection of issues. Use every applicable key and create new keys for specific projects, scopes of work, functional component, and business requirements.
- Consistently populate the relationships between multiple Jira keys in the designated fields
- Minimum content called out in ticket description:
    - Give an accurate problem statement
    - List the root cause if known. If not, create root cause analysis ticket to identify the component(s) of the platform in need of remedy
    - List the Acceptance criteria
    - List the proposed solution
    - List the accepted resolution
    - Attach test results and approval
    - Mark the activity step that it has been imported to production once UAT passed and code is slated for deployment
- Standardize traceability of work tracking by enforcing utilization of one Jira ticket component, Comments, where any major events are tracked. The work tracked should always be traceable against the called-out items listed in the description and the description call outs updated as work is completed

- Enforce Jira tickets containing an accurate and comprehensive list of the relevant transport requests or other work items (including non-SAP) comprising the fix
- Do not close Jira tickets until the relevant transport requests have been tested and imported to production
- Testing: DR-0065 JIRA Test Execution CONFIDENTIAL
    - Create documentation on how to create these tests and require them to be made
    - Enforce a more detailed use of PSR (Problem Step Recorder) or similar recording software when creating screenshot and commented documentation

6.4 ABAP code analysis

6.4.1 Approach

For each Jira issue where ABAP code was involved, the associated transport request numbers were inspected to view the list of programs and/or function module names that were prospectively to be migrated to production as part of the fix. Source code of those programs or function modules was opened and viewed to see if indeed the fix had arrived in production, and the actual changed source code lines were carefully inspected, along with any inline comments about them, to ascertain and characterize the nature of the fix. Within obvious limitations of contextual awareness as to how this code may relate to the overall SAP ecosystem, we applied 40 years of combined ABAP coding experience and expertise to attempt to opine on the efficacy of each fix, what its potential for downstream risks or ramifications may be, and whether the fix was of satisfactory quality from an ABAP syntax, algorithmic, and best practices perspective.

6.4.2 Functional description/introduction

424 Jira issues were selected for code review, distributed among the issue categories as follows:

			Status		Quality of Completed Tickets			
OIE Category or Doc Reference	Description	Code Reviewed	Complete	Incomplete	Satisfactory or Immediate Issue Addressed	Unsatisfactory	Lacking Traceability Required for Validation	Comments
001	Dissonance between meter read date and billing date and the different commodity rate that's used	13	12	1	12	0	0	
002	Accuracy issues related to Retail choice customers	29	29	0	27	1	1	Some turned out to involve configuration rather than code; one portal related
003	Validate that issues with Solar customers (generation data, double billing from estimation, double billing from budget bills)	9	9	0	9	0	0	A data fix was made in production for one issue, but root cause was not disclosed so could not assess whether recurrence prevented
004	Bills for CDG customers were delayed because CDG subscribers that were billed before their CDG host was billed "did not get the necessary credit."	5	5	0	5	0	0	
005	CDG hosts experienced issues with their host summary report and Central Hudson had to perform manual reviews to add missing data. This also led to delays in providing the CDG developer with information	28	22	6	22	0	0	

	about their subscribers							
006	Bill print issues – Central Hudson stated that several bill print issues have surfaced to date, including the Summary at a Glance section of budget bills and the annual adjustment presentation, which was not accurate	22	22	0	22	0	0	
007	Net metered bills – There was a misalignment between the bimonthly meter reads, the billing of net metering, and the SAP requirement of a monthly meter reading necessary to issue a budget bill	3	3	0	3	0	0	
008	CDG (Community distributed generation) bills – When a CDG customer received a CDG subscriber credit, the billing document reverted to $0 or negative, resulting in an incorrectly updated budget differential	12	11	1	11	0	0	
009	Issues with number of budget billing	5	5	0	5	0	0	

	installments as a result of rebills							
010	Any issues related to integration configuration and ensure that data flowing properly between SAP and field collection systems, ESCOs, net generation module, and any others	140	134	6	134	0	0	This category was comprised of exclusively of EDI rather than source code issues, EDI files were not searchable. See *Section 5. EDI Analysis* for findings and commentary.
011	EDI issues for ESCO customers (e.g. "challenges associated with updating supply scenario dates" and "a sales tax configuration that was not operating properly"	42	37	5	35	0	2	Some issues turned out to involve configuration rather than code, or data fixes where root cause was not disclosed so could not assess whether recurrence prevented
DR-0040 CONFIDENTIAL (Non-DR-0062 CONFIDENTIAL)	N/A	92	76	16	60	0	16	For five of the issues said to be complete, the comments reported that the ticket was still being worked; and the work in progress was not of a state that could be assessed. For the three said to be in progress, the work was assessed as satisfactory.
DR-0062 CONFIDENTIAL	N/A	24	24	0	21	1	2	For two of the issues that claimed to be complete the work was not found in

								production, and the69 documentation of the Jira itself was deemed poor. [@Panorama input here as to remaining three.]
TOTAL		424	389	35	366	2	21	

Table 2. *Jira Issue Statistics Table Per OIE Issue*

6.4.3 Findings

Overall, for OIE issue categories 001-009 and 011, the ABAP code observed was within industry standard norms. No glaring deficiencies were observed in the coding or technical methods used. In some cases, code was commented in accordance with best practices and in other cases not commented in a way that reviewers could identify the purpose and methodology used during the development of the code. Additionally, PA observed the frequent use of hard-coded values rather than the best practice of using variables or named constants to store these values. OIE category 010 involved EDI rather than ABAP and this has been addressed under Section 5, EDI Analysis below.

Granular analysis on a per-ticket level may be reviewed in Attachment 2: JIRA and Platform Change Analysis Tracker.

On changes not being found in production, here is an example of how this was discerned:

While analysing Jira ticket number: PP-15968 referencing Transport number DS4K932086, inspection of the transport log did not show this transport number as imported to the production environment.

SAP Transport Traceability is unavailable

Industry standard SE* t-codes do not make import logs available to show which transports were brought into production. Although Central Hudson has the ability to trace their transports without these specific SE* t-codes, it is not being done by industry best practices.

OSS notes with SAP are unlinked in production

OSS notes have been and are currently being used to log correction notes in SAP to a fine industry standard. However, the previous testing notes have been unlinked due to a refresh/reinitialization of the environment. The production IDOC's were not accessible by the PA team, but were available upon request by Central Hudson. This disables the development and testing teams from being able to trace correction notes from previous work within SAP.

6.4.4 Recommendation roadmap

ABAP Code Development

- Ensure that changes are commented in transport log comments at top of program or other source code entity having transport number, SAP note number, developer name, date, and description
- Ensure that changes are commented inline at places they occur in source code with transport number, developer name, and "<ins>" or "<del>" for inserted or deleted code lines respectively
- Always use named constants or variables instead of hardcoded literal values
- Follow a written set of ABAP development guidelines more comprehensive than naming standards. This includes, but is not limited to: development methodology for algorithmic and technical methods choices, covering everything from use of particular ABAP keywords, to database and runtime optimization techniques

Root Cause Analysis Documents

Document the actual root cause of an identified platform issue.

6.5 Meter Data Collection Analysis

Figure 4. *FCS solution architecture.*

Central Hudson's meter data collection system is an implementation of the Itron product, FCS (Field Collection System). The majority of meter read data is collected through AMR and manual inspection of customer meters. As seen in the lower track of the figure above, meter reads are aggregated on the workforce's handheld devices and then uploaded from an onsite terminal to a file storage system as xml. The minority of meter reads are done through a cellular AMI network depicted in the upper track in the diagram above. The AMI meters report their data through Itron's MDM middleware service and then are transferred through a secure connection to Central Hudson. The incoming AMI data is handled by SAP AMI Integration for Utilities. Incoming meter data from Central Hudson's on-premise file server (CIFS) comes to the SAP application server via an Azure ExpressRoute tunnel and then ingested through SAP PI on to an ABAP proxy along with AMI data.

6.5.2 Approach

To understand the overall architecture in its current state, a data flow diagram from Central Hudson's on-premise file servers to their SAP HANA instance was provided and attached as DR-0049 FCS Integration Diagram CONFIDENTIAL. This diagram provided direction for

interviews with the following leaders in Central Hudson: Director of Application Development, Mike Mckeehan, Project Manager, Joe Pesante, and Metering Services program manager, Tom Su. It also served as a starting point for the diagram shown above. To assess the current state of the system, access to the systems comprising the FCS pipeline, mainly FCS, was acquired to conduct in-depth review. Access to the on-premise file server for meter data as well as SAP HANA was also acquired to affirm data integrity reported by FCS.

The review conducted via the FCS interface included the following:

Components of Dashboard Views:

- The default view depicts the completion of meter reads of all routes as a percentage per cycle on the left. Completion is shown as pie charts per cycle of various percentages of read status: Read, Missing, Skipped, and Forced Complete. The right view shows similar pie charts, but rather the route assignment status proportions by cycle. These statuses include: Unassigned, Assigned, Loaded, Unloaded, Posted, and Error. These statuses refer to the state of the meter read data collected on route assignments in each cycle from becoming assigned to be read until it is posted into the SAP filesystem.
- An alternate view shows the completion of meter reads per route groupings (Fishkill, Poughkeepsie, etc.) for the current cycle. The data is depicted as bar graphs for each route group showing three scenarios:
    - The top two graphs show a comparison of number of in process meter reads to exported meter reads holistically by date. This is split into two views for scheduled read date and critical read dates of the meter reads.
    - The third graph compares the amount of time spent progressing meter reads and the estimated amount of time left to complete the reads.

Components of the Basic Operation Center:

- Route status by cycle table (Can be viewed in its own tab for greater detail)
    - A table showing a row for each route, represented by Route ID, for each cycle ordered by cycle number. This is the same data driving the dashboard views described above. The following columns show route completion characteristics in this table:

        - RouteID: Shows a unique alphanumeric ID used as a primary key to identify assignable routes for Central Hudson's meter reading solution.
        - Cycle: Shows a two-digit number as a primary key to identify cycles in which particular routes are to be read.
        - Route Status: Depicts an icon representing completeness of meter reads and their upload to S4.
        - Meter Count: Shows the number of meters in a route for a given read cycle.
        - Percent Complete: Shows a decimal percentage of the number of meters that have has complete reads.
        - Meter No Output Count: Shows the number of meters that Central Hudson observed no data output from in a route for a given read cycle.
        - Missed Reads: Shows the number of meters that Central Hudson missed reading data in a route for a given read cycle.
        - Skip Count: Shows the number of meters that Central Hudson skipped reading data in a route for a given read cycle.
- Data collector/user table
    - This table shows a singular-column list of each data collector represented by their collector ID or a singular-column list of each system user represented by their last, then first name.
- Assignment completion by route and cycle table
    - This table lists all route assignments by route ID and then groups them by cycle number. It is meant to show the status of loading meter data into the on-premise filesystem and then posting it to SAP. The following columns are provided by this table:
        - RouteID: Shows a unique alphanumeric ID used as a primary key to identify assignable routes for Central Hudson's meter reading solution.
        - Cycle: Shows a two-digit number as a primary key to identify cycles in which routes are to be read.
        - Assigned To: This column returns the first and last name of the user assigned.
        - Data Collector: This column returns the alphanumeric ID associated to the collector device to be used to read meter data.

- File ID: This column returns a single character ID for the file in which the read data is stored for that particular route and cycle.
- Work Filter: This column shows whether data read in a particular route has been processed or not. If route data has not been processed, “Unprocessed” is listed here. If the data has been processed, there is no value present.
- Loaded: This column returns the status of meter data as either loaded or not loaded to the on-premise file system. This is done by using a check mark icon for the done state and a red circle for the not done state.
- Posted: This column returns the status of meter data as either posted or not posted to the SAP file system. This is done by using a check mark icon for the done state and a red circle for the not done state.

Reports Ran:

- Skip Code list
  - This report is comprised of a list of all skip codes used in metering system. Each code describes a scenario where the meter was not able to be read except for a final code that denotes free-form text to be input to describe a scenario not included in the scope of the provided codes. Because of the infrequent use of free-form inputs for reasons not covered by these codes, the current list appears to be sufficient.
- Missed and Skipped Meter Readings
  - This report provides a comprehensive list of missed and skipped meter readings with customer info, skip code, and free-form text if applicable since the first reading cycle of this year. A review was done to validate the status of the dashboard reporting the skips and force completes. An analysis was done to identify the general profile of free-form text inputs as well as affirm appropriate usage for repeated/grouped skips in a cycle.
- Route Data
  - This report outputs the data extracted from each meter per route and per cycle. This is the data supporting the dashboard view of the route statuses.

Further Considerations

A review of Oracle Fusion Middleware SOA for workforce management was considered, but deemed non-impactful to any issues we are viewing and out of scope. Specifically, this software is used for individual work order management rather than route assignment and data management.

6.5.3 Findings

Route completion

- Reports and dashboards regarding route assignments show no issues. All data is being reported as loaded and posted on schedule.
- Reports and dashboards regarding route data processing show no issues processing data in on-premise filesystems and uploading to SAP. All rows that have been processed for listed routes and cycles display no errors.

Data ingestion into S4 HANA

- Reports and dashboards regarding importing AMR and manual read data from on-premise filesystems to SAP display no issues. All rows depicting an attempted upload of data show successful completion for listed routes and cycles with no errors.
- Through PA's JIRA analysis of issues pertaining to the OIE report, tickets regarding AMI meter data were grouped and analysed as part of this review as well. PA found the fixes to be adequate, however lacking root cause analysis as stated in Section 5.3: Development Operations Analysis.

Skip Code Usage Policy Requires Enforcement

- PA conducted a review of anomalies in free-form skip codes and frequently skipped meters/groups of meters and found the following:
    - The meter read data groups where we have seen repeated skip code usage were reviewed for their codes related to meter access. They have been

confirmed to be instances of multi-unit instalments where meter access has a single point of failure.

- The majority of scenarios where free-form entries are made in FCS are covered by existing skip codes.
- There exists a small minority of free-form skip codes that do not contain any text or text that is not helpful.

6.5.4 Recommendation Roadmap

Platform

Nothing to-be-improved has been identified in terms of issues with the platform or it's physical implementation as it stands.

Operational

Recommend addressing the minor abuse of free-form entries by expanding skip codes, enforcing addressable skip codes, enforcing using existing skip codes.

6.6 EDI Analysis

6.6.1 Approach

PA performed a holistic analysis of Central Hudson's Jira platform, SAP systems (S4 & PI/PO), and OpenText Bizlink to determine the exact cause of any potential EDI issues. PA requested the relevant IDOCs from Central Hudson necessary to support this analysis, however, Central Hudson was unable to extract historical test information due to environment refreshes in SAP (SS4). IDOC's were provided for production changes when requested. For example, IDOC number 4202068 for Jira ticket PP-17571 was provided upon request. Through analysis of related Jira tickets and inspection of Central Hudson's EDI systems, PA was able to determine that fixes implemented by Central Hudson resolved the associated issues identified in the

tickets. The EDI-related Jira tickets analyzed can be viewed in Attachment 2: JIRA and Platform Change Analysis Tracker, under the “Issue Tracker” tab filtering for the category ID’s (column A) 010 and 011.

DR-0014 CONFIDENTIAL was provided as current state architecture documentation for Central Hudson’s EDI solution and can be referenced in Section 6.2.2 Solution architecture history. The below diagram was produced by PA to depict the platform as it pertains to this report.

Figure 5. *EDI solution architecture*

Current Infrastructure and implementation

Central Hudson utilizes OpenText BizManager which is an industry standard product used for searching INBOUND & OUTBOUND EDI files. BizManager is an essential tool that acts as the gateway for company-wide EDI transactions and communicates with the SAP system via PI/PO.

6.6.3 Findings

Business stakeholder approval on JIRA tickets was unclear

PA's analysis found that Central Hudson did not make use of a specific field in Jira tickets specifying the business approver. While a certain ticket may state that it is fixed, PA was not able to ascertain in many cases whether the actual functionality was approved by the business stakeholders. Examples of this are Jira tickets: PP-18641, PP-15047, and PP-17814. Further examples can be viewed in Attachment 2 - JIRA and Platform Change Analysis Tracker. Validation from business stakeholders regarding the functionality and efficacy of code changes must be made clearly visible, or the fix can be interpreted as incomplete.

Many Jira tickets analysed showed a status of “DONE,” but it is unclear from analysis of the comments section whether the issue is truly resolved. PA has provided the ticket below as an example of this finding:

JIRA ticket PP-18164 required direct confirmation with Central Hudson to affirm the root cause was solved.

No Implementation of Standard EDI / Interface Message Lifecycle Management reporting tools

EDI Lifecycle management is essential for organizations such as Central Hudson who have a large volume of EDI/FlatFile/XML messages INBOUND & OUTBOUND. Generally, EDI Lifecycle management is the pulse and health of the company in terms of revenue, collections, operations, problems & issues. If a company doesn’t constantly monitor these messages, and doesn’t have a remediation plan to fix the issues as they come up, the company is at risk of revenue and collections issues. It is important to note that Central Hudson’s implementation of EDI only concerns retail choice data transactions. Most revenue and operations of Central Hudson’s do not run through their EDI systems.

All EDI/FlatFile/XML messages have a lifecycle, and it is the job of the EDI manager to see that all EDI/FlatFile/XML messages in the lifecycle of the business process have been completed and acknowledged (ACK) successfully. Messages which are not completed successfully or have not been acknowledged (ACK), need to be called out in an exception report. For example, an EDI 810 message originates in SAP as a billing document with number XYZ1234 which gets sent to [redacted] for conversion from an [redacted] format. Once the 810 EDI file is created, [redacted] then sends it to [redacted] to be sent out to the customers. The customer once receiving the EDI 810 Invoice must send out an EDI 997 ACK message back to Central Hudson.

OpenText provides out-of-the-box reporting solutions which show the EDI message lifecycle to facilitate analyst evaluation of the completion and closure of the business process cycle. Implementation of this, or similar, solutions are industry standard and will show, for example, which EDI 810 messages have been “ACKED” or not and whether the EDI 810 Invoices have been “Accepted”, vs. “Rejected” by the Trading Partners. PA’s analysis did not show the presence of a reporting tool of this kind implemented at Central Hudson.

Defect documentation, such as screenshots of the issue and similar confirmation of the resolution were missing from most JIRA tickets

Usually, a list of images with labels and no call outs are provided to show final state, but no acceptance criteria or context are provided.

Evidence of different Test Scenarios missing

Through its analysis, PA was unable to find documents containing the different test scenarios for each EDI issue.

The example Jira ticket provided below has a status of “DONE” and is approved in the comment section, but the ticket contains no evidence of which Test Scenarios were executed as part of testing.

An example of this is Jira Ticket PP-17571 and further examples can be found in Attachment 2 - JIRA and Platform Change Analysis Tracker.

General tracking and traceability of PI/PO changes was not sufficient

Central Hudson’s SAP PI/PO system uses CTS and File transport Imports within a CHARM (SAP Change Request Management) lifecycle. Per SAP standard practice Central Hudson should select one of these methods to enable proper traceability. In addition, PA found that changes implemented to the PI/PO program did not have Transport numbers attached in associated Jira tickets. These tickets can be seen in Attachment 4 – JIRA Issues Without Transport Numbers. Without the association of transport numbers to these tickets, tracking of PI/PO changes or updates is not possible. Lastly, many Jira tickets analysed by PA did not have the XML files attached as proof of mapping change test results which made validation past employee confirmation of change results impossible in these cases.

6.6.4 Recommendation Roadmap

- Create End to End Testing spreadsheet with original Incident#, Requirement it satisfies, Stakeholder Approval, Passed/Failed etc.

- Create different Test scenarios if it is not already there for each EDI message being tested and validated.
- EDI message Lifecyle report can be generated and shared with the management team to get an insight of the EDI errors and to address the problems.
- Create an exception report if the EDI 997 ACK is not received by Central Hudson.
- Create a stitching report which maps all IDs from interface logging and monitoring systems as well as from development tracking and ticketing systems such as Jira and ServiceNow. A stitching report is used for obtaining an end to end visibility of different landscapes by creating a Stitching/Dashboard report which ties all IDs together from different systems so that Issues/Bugs/Transport IDs/Change/RICEF Requests from one system can be tracked with their counterparts related to other systems.
- Create a generic “reference ID” to act as a unique identifier for each item in the stitching report.

7 Estimation algorithm analysis

7.1 Estimation algorithm and process

7.1.1 Estimation algorithm history

Prior to the integration of SAP’s Customer Relationship & Billing business process (“SAP process”), Central Hudson operated with a series of bill estimation algorithms (“methods”) to calculate a customer’s interim bill based on prior usage history. This methodology included numerous ‘methods’ of calculating estimates and followed certain selection logic to determine which ‘method’ would be used based on the amount of historical customer usage data available (e.g., if the required information needed to calculate the interim usage for ‘Method 1’ is not available, Central Hudson’s legacy CIS system would continue to the next ‘method’).[21]

Upon SAP implementation and go-live, Central Hudson discontinued the use of the previous estimation algorithms / methods (and associated selection logic) and began utilizing the standard SAP estimation algorithm and process; an out-of-the-box process that is inherent to the SAP system and widely used across the utility industry. The SAP estimation process consists of three independent algorithms which are selectively calculated based on the customer’s meter history; specifically, how much usage data has been captured and/or recorded, similar to Central Hudson’s legacy CIS system. This change in estimation algorithms

did not cause an impact on customer billing as the estimation algorithms for Central Hudson's legacy system and SAP are both rooted in utilizing historical data to estimate current usage. Each algorithm and the associated selection criteria is detailed in the table below.

Algorithm Selection Criteria	Algorithm Details
If customer usage data = 0 ***(Customer does not have any history, new install, etc.)*** ****First month can be an 'actual' read or an estimate using the default usage set at the installation as the basis for the estimation calculation***	$\frac{\text{month 1* (actual reading)}}{\text{number of days in month 1}} = \text{usage per day} \times \text{number of days in month 2} = \textbf{estimated usage}$
Customer usage data < 6 months ***(Customer has less than 6 months' usage data history)***	$\frac{\text{previous consumption period}}{\text{previous consumption period days}} = \text{usage per day} \times \text{next data month days} = \text{estimated usage}$ previous month reading + estimated usage = **estimated meter read**
Customer usage data > 12 months ***(Customer has more than 12 months' usage data history)***	$\frac{\text{previous consumption period (same month prior year)}}{\text{previous consumption period days (days per month previous year)}} = \text{previous period usage per day} \times \text{next data month days} = \text{estimated usage}$ previous month reading + estimated usage = **estimated meter read**

Table 3. *SAP estimation selection criteria and algorithms.*

****Note**: "Month 1" is used here to indicate the 'period of prior consumption' and not the first month of actual meter reading.*

7.1.2 Estimation algorithm process in SAP[22]

Central Hudson designed the below billing and invoicing process for registered meters during Project Phoenix. As a note, this diagram does not display the entire meter-to-cash billing process as it's focused on the estimation-related portion.

Figure 6. Central Hudson 'to be' flowchart in Project Phoenix documentation (DR-0011: "Billing Calculation Documentation" CONFIDENTIAL).

This figure shows two items as the inputs. The first being – ***batch job preparation*** – this is the interim month estimation which is prepared for every account. The second is – ***meter reading data*** – which is the download of the actual usage data from field collection tools (e.g., handhelds) or customer provided-data using SAP's meter reading upload feature where customers can upload and verify their monthly usage data. If an actual reading is present, SAP uses that as opposed to the estimate. SAP then takes the input data and processes the bill to invoice which is eventually output to the customer.

During the SAP billing and invoicing process, SAP will take the input data (actual or estimate) and assign one of three results. It will evaluate, based on historical customer usage data, utilizing those pre-set algorithms, if the actual meter reading or estimated usage amount:

1. Is accurate or "plausible,"
2. Does not align with historical consumption data and is therefore "implausible," or
3. Contains a formal error and will not be saved in SAP

In the first two instances, the input data will be accepted, saved, and progressed to the next step. For 'plausible' cases, nothing will be triggered within SAP and the billing and invoicing process will continue as normal. For the 'implausible' cases, SAP will immediately generate a Business Process Exception Management (BPEM) case. BPEM cases are assigned specific "case categories" which are codes that provide detail on the individual BPEM ticket.

Estimation-related case categories are MR04 (bill is estimated to be too high in reference to historical data) and MR15 (bill is estimated to be too low in reference to historical data). Once the BPEM case is generated, Central Hudson is notified and provided with detailed information on the specifics around the 'implausible.' Once Central Hudson is notified, a 7-day countdown begins where the customer service department can resolve the BPEM case by addressing the error causing the BPEM notification. An example of resolving a BPEM case is to have a meter reader go back into the field and conduct a second meter reading to confirm initial data entry (i.e., fixing a data entry error). If resolution is not achieved within that 7-day window, the case will automatically progress to the next stage and an estimated bill will be created for the customer.

7.1.3 Estimation algorithm usage

Unique to the utility industry, Central Hudson conducts bi-monthly (once every two months) meter readings (also called "meter reads") as opposed to monthly meter reads. Central Hudson has maintained this practice since 2016. Customers are on a set schedule to determine which month they receive an actual reading vs. an estimated bill. Central Hudson currently has roughly 140,000 customers that receive bi-monthly meter reads and therefore, estimated bills. Below is a table providing the breakdown of Central Hudson's customer groups identifying the frequency of meter reads and associated billing.

Customer Group	Bi-monthly		Monthly	
	Meter Read	Billing	Meter Read	Billing
Electric and Gas Residential Customers	X			X
Net-metered non-budget	X	X		
Net-metered budget	X			X*
Demand			X	X

Table 4. *Central Hudson customer groups and associated billing frequency.*

***Note**: Net-metered budget customers receive a bill every single month with their installment. The bill in the "interim month" simply contains budget information and does not contain meter reading details as no estimate or meter reading took place.*

7.1.4 Bi-monthly estimates vs. estimated-related BPEMs

As PA Consulting conducted ongoing monitoring and evaluation efforts, it became evident that the term "estimate(s)" was used in multiple different contexts creating several, independent meanings of the word. It is important to distinguish two key meanings (i.e., uses of the term) as these each have an independent root cause, represent different segments of data, and respond differently to the implementation of certain corrective actions.

1. **Bi-monthly estimates** are the result of Central Hudson's bi-monthly meter reading process where a customer receives an estimated bill during interim months when a meter read is not conducted and is not considered an 'actual.' As defined in Case 22-M-0645 '*Proceeding on Motion of the Commission Concerning Central Hudson Gas & Electric Corporation's Development and Deployment of Modifications to its Customer Information and Billing System and Resulting Impacts on Billing Accuracy, Timeliness, and Errors*,' Central Hudson defined a bi-monthly estimate as "For interim months without an actual meter read, the bills would be based on estimates "derived using algorithms that reflect the likelihood that circumstances and usage may well change between the first and second month of a two-month meter reading interval."
2. **Estimation-related BPEMs** are the result when the data from a meter reading, either an actual meter read or an estimate is determined as 'implausible' by SAP when comparing the entered data with SAP's inherent historical usage data algorithms and is flagged for additional review and corrective action.

The distinction between the two is not only critical to identify the root cause and corrective action, but is key in understanding which process customers are experiencing frustration with. It is PA Consulting's understanding that customer complaints have been received by the NY DPS regarding "estimates" or "the estimation process." This is in alignment with the customer sentiment and associated messages presented to Central Hudson through various feedback loops including the contact center, public forums, survey responses, and other ad hoc ways that were utilized since SAP go-live.

An attempt was taken by PA Consulting to understand and distinguish which customer complaints identified as 'estimates' could be attributed to an actual estimation-related issue (bi-monthly estimate or estimation-related BPEM) but due to complex estimation and billing process, in addition to the absence of a customer complaint tracking process put in place by

Central Hudson, this is not possible. In addition, customers are not expected to understand this distinction and therefore would not be able to provide feedback regarding the distinction between the two accurately.

An estimation-related BPEM is purely the notification mechanism to inform Central Hudson that something with the result of the estimation algorithm for a particular customer does not meet the set criteria and is deemed implausible. Since the change in estimation algorithms was determined to not cause any issues, it's clear that bi-monthly meter reads and the associated estimation process is the root cause. The estimation process uses historically estimated data and is therefore, not accurate.

It is fair to say that customers are frustrated with both issues, the bi-monthly estimates, as well as the estimation-related BPEMs. The customer frustration with the bi-monthly estimates is caused by the estimations, and estimated bill's, accuracy. The customer frustration caused by estimation-related BPEMs is likely due to the extensive backlog created shortly after SAP go-live of implausible BPEMs which were not worked down in a timely manner and therefore allowing inaccurate estimated bills to reach customers.

7.2 SAP integration impact on estimation algorithm and process

As stated in the December 2022 New York State Department of Public Service Report "*In the Matter of an Investigation by the DPS Office of Investigations and Enforcement Into Central Hudson Gas & Electric Corporation's Development and Deployment of Modifications to its Customer Information and Billing System and Resulting Impacts on Billing Accuracy, Timeliness, and Errors*," Central Hudson faced immediate problems with the SAP estimation process. This is evident by the number of estimation-related BPEM cases generated in the first month after go-live followed by the subsequent months. In September 2021,16,684 new estimation-related BPEM cases were generated. The next month, October 2021, 17,558 new estimation-related BPEM cases were generated followed by 22,202 new cases in November 2021. In December 2021, the number of estimation-related BPEMs generated reduced slightly to 19,567. The figure below shows the number of estimation-related BPEMs (BPEM case categories MR04 and MR15) generated each month after SAP implementation through the end of 2021.

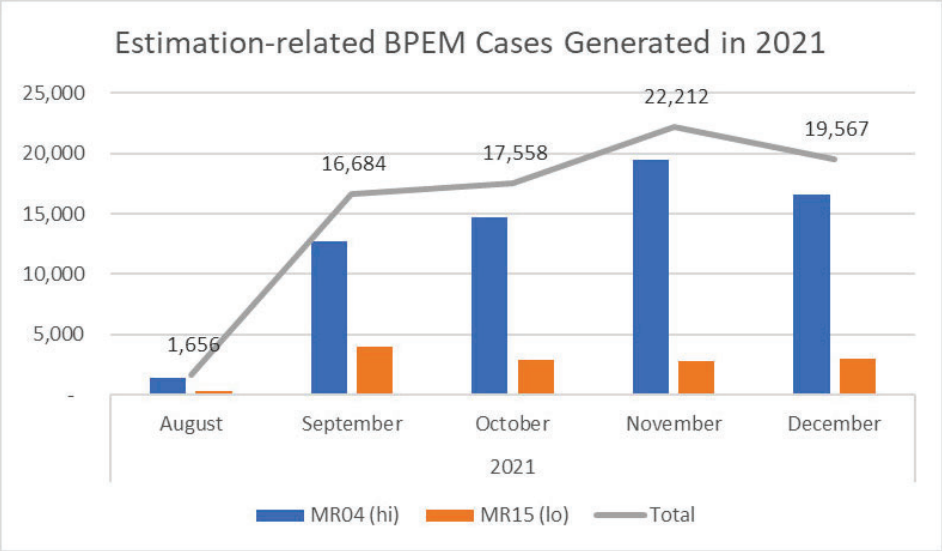

Figure 7. *Estimation-related BPEM cases generated in 2021.*

As part of this engagement, PA reviewed the application of the SAP estimation process to Central Hudson's unique bi-monthly meter reading protocol to determine whether the integration of the SAP system, including the use of different estimation algorithms (from legacy CIS to SAP CIS), created an uptick in bill estimation implausibles and associated customer complaints. Below shows the number of estimated bills generated by month beginning in January 2018 through November 2023. The peak number of estimated bills occurred roughly three months after the implementation of SAP. Beginning in 2022, the rate of estimated bills being generated experienced a relative decline, with a few exceptional peaks, until the first correction action was implemented in March 2023. April experiences a drastic reduction in estimated bills and the following months remain at that level.

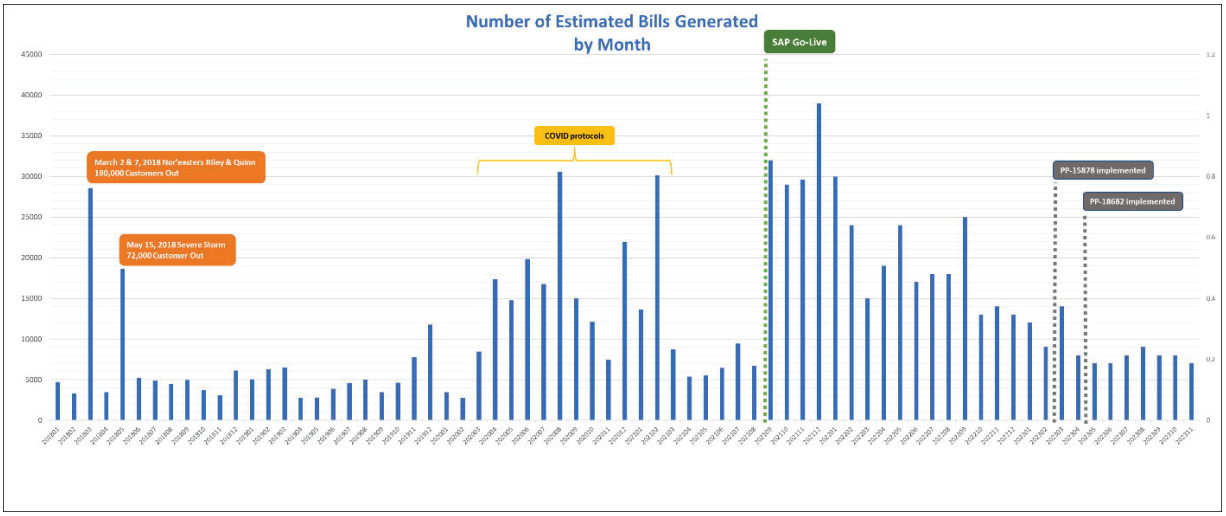

Figure 8. *Number of estimated bills generated by month (January 2018 – November 2023).*

An interesting finding in the data above shows the number of estimated bills generated directly after SAP go-live is similar to the number of estimates generated during the March 2018 Nor'easters Riley & Quinn which caused a total of 180,000 customer outages. Since Central Hudson does not track the number of customer complaints that come in due to estimates, PA Consulting was unable to determine if Central Hudson received the same amount of customer complaints during both periods, or more during one period (e.g., customers complained more during / after storms or post-SAP integration). It is typical within the industry to experience an influx of customer feedback during and immediately after storm events. For system integration issues, you would see the typical peak of customer complaints once the issues reached and impacted the customers. Since each customer is on a different schedule to when they receive an estimated bill, it's difficult to tell when each customer would have been specifically impacted and therefore, when a complaint could have come in (e.g., second month after SAP go-live or third, etc.).

Central Hudson was asked to identify the root cause of, "if the estimation algorithm(s) remained the same before and after the implementation of SAP, why were there more customer complaints after SAP implementation than before?" Central Hudson provided the below data in response. The below graph shows the number of estimated bills generated by month during the referenced timeframe overlaid by the associated commodity price. Central Hudson stated that it believes, 'external factors like commodity pricing had a considerable influence on the amount of customers complaints received directly after SAP go-live that contributed to negative customer sentiment.' PA Consulting did not follow up on this statement since any customer complaint data to verify this assertion is not available. In the utility industry, it is common to see external factors be inaccurately attributed to something due to misidentifying the root cause of the true issue from the customer perspective.

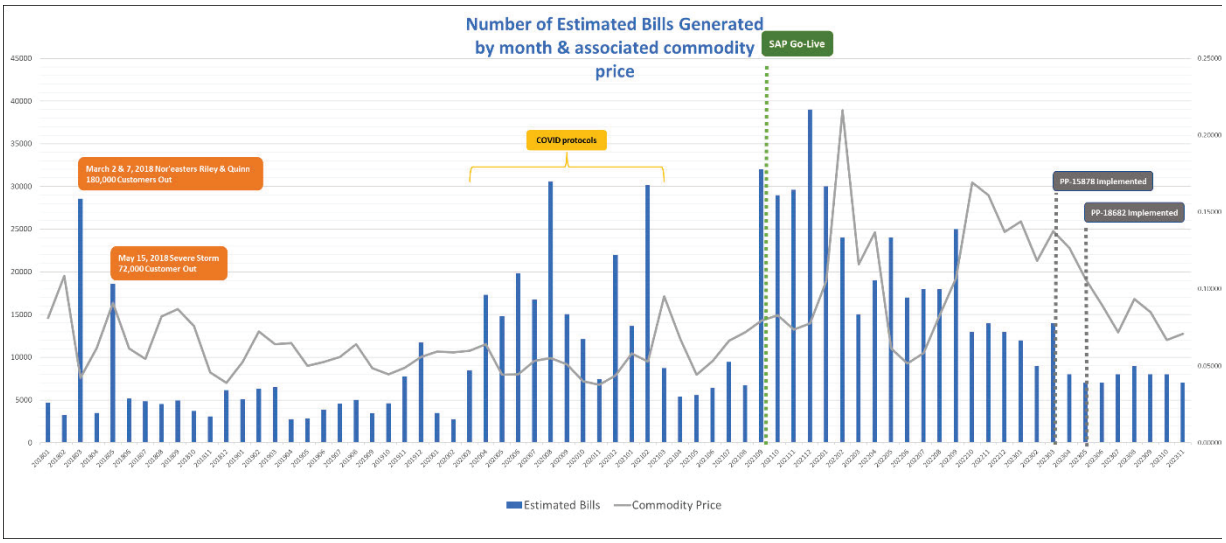

Figure 9. *Commodity price by month (January 2018 – November 2023).*

7.3 Findings and recommendations

PA Consulting reviewed and evaluated the provided documents, in addition to meeting with various Central Hudson representatives, to determine the effectiveness, sustainability, and future achievability (if applicable) to any corrective actions. Central Hudson provided the following documentation that detailed historical corrective action addressing estimation-related BPEM cases:

- Subcontractor statements of work / signed contracts including scope of engagements
- JIRA tickets including details on specific completed SAP configuration or other system- or process-related changes
- 2023 BPEM Optimization Plan
- 2023 Monthly Meter Reading Plan

7.3.1 SAP integration flaws

The primary cause of estimation “errors” (estimation-related BPEM generated from implausibles) after SAP go-live does not involve the SAP system itself or its inherent estimation algorithms. SAP is designed to operate with ‘actual’ monthly meter / usage data every month. Since Central Hudson only reads meters every other month, a configuration was added to support this frequency change in SAP. Configuring SAP to operate with bi-monthly estimates is a novel concept in the utility industry. To our knowledge, there is no other utility that operates with bi-monthly meter reads and therefore, no application of SAP with this type of custom

configuration. This makes it difficult to compare this type of configuration against other applications to understand if there was a defect in the configuration. Since the process worked as designed, it's implied that there was no fault in the configuration but understanding if the SAP system, or any customer information and billing system, can handle this type of configuration successfully would have been beneficial.

As PA Consulting did not find any integration flaws or SAP operating errors, the root cause of estimation-related variances in customer bills is due to the estimation process itself. When Central Hudson was required to move from bi-monthly billing to monthly billing, the interim month estimation process was established. While SAP is designed to create estimates for 'exceptional' reasons (e.g., skipped meter read due to lack of access), this process is not designed to be used every other month. By using estimates, and an associated true-up method for the interim month, there is no bill that is not based on an estimate.

7.3.2 SAP implausible backlog finding

While customers experienced dissatisfied service after SAP go-live, the cause of those customer complaints cannot be attributed to specific reasons due to the lack of complaint tracking. In contrast to the legacy system, which did not flag BPEMs, SAP began flagging and notifying Central Hudson with an exponential number of generated cases upon go-live. This is likely attributed to the bi-monthly estimate itself, that Central Hudson was not able to keep pace with resolving the number of generated BPEM cases within the 7-day work down requirements. PA Consulting inquired about the level of training and number of resources Central Hudson had in place prior to SAP go-live; however, the number of trained resources required to effectively work down the estimation-related BPEMs that caused a backlog would not have been economical.

The below figure shows the number of estimation-related BPEM cases that were resolved (including their resolution rate) year-over-year. This specifically analyzed two things: the first being the average BPEM resolution days by employees and by 'batch billing' (SAP's auto close feature), and the second shows the average work down rate less the 7-day window between those two groups. This data shows that the estimation-related BPEM work down rate by both employees and batch billing significantly improved in 2023 from 2021.

Year	Case Closer	Number of MR04 BPEMs	Avg Days to Resolve	Average Work down Rate (less the 7-day window)
2021	97 Employees	73,023	44.38	**37.38**
	Batch Billing	4,654	46.90	**39.90**
2022	200 Employees	202,281	5.31	**-1.69**
	Batch Billing	22,751	7.33	**0.33**
2023	58 Employees	93,909	6.25	**-0.75**
	Batch Billing	112,369	1.16	**-5.84**

Figure 10. *Estimation-related BPEM cases work down rate (2021 - 2023).*

7.3.3 Estimation implausible resolution findings

Since SAP go-live, Central Hudson implemented numerous corrective actions to reduce the number of estimation-related BPEMs being generated and/or not being resolved within that 7-day window. The first corrective action Central Hudson took to actively reduce the amount of estimation-related BPEMs being closed within that 7-day window (and therefore not generating an estimate) was **enabling SAP's auto closing feature**. auto close feature allows the system to automatically close an estimation-related BPEM case if resolution was achieved and the plausible criteria has been met. SAP runs this auto close process nightly which quickly resolves outstanding estimation-related BPEMs. The largest benefit of SAP's auto close feature is the efficiency is closing estimation-related BPEMs by moving the closing action from required manual intervention to an automated system.

The second correction active taken to reduce the number of estimation-related BPEMs was the **BPEM Optimization Initiative**. Central Hudson engaged the technical expertise and experience of a separate subcontractor to assess all BPEMs (including BPEMs outside of estimation-related), categorize, prioritize them against key business objectives / outcomes, perform a root cause analysis and recommend / execute the corrective actions to address the root cause. This initiative began in March 2023 and targeted BPEM case categories that were highly contributing to the excessive backlog of overall BPEMs (and therefore, customer complaints) including estimation-related BPEMS (MR04s & MR05s). The initiative continued through July 2023 and included solutions to SAP configuration changes not only to BPEM MR04 and MR05 case categories, but extended to additional BPEM case categories that were contributing to an extensive backlog and/or creating inefficiencies. Below lists the specific SAP configuration changes as corrective actions taken by Central Hudson during the BPEM Optimization Initiative. The table also includes the details of the auto close feature corrective action taken by Central Hudson prior to the BPEM Optimization initiative.

Auto Cancel Batch program not working correctly		
Date: February 2023	**Action**	**Is this effective? Sustainable?**
Documentation: JIRA PP-15878	Majority of meter reads for Res. customers are getting implausible because the current actual index is less than previous estimated. The cancel re-bill does not work for these customers as the customer has history of more than 2 consecutive estimates in previous consecutive periods. As per cancel re-bill program works for customer with up to two previous estimates. Not for more than 2. Hence such customers are stuck in the loop of current actual less than previous estimate, actual stays implausible for six days and is estimated on the 7th day. This loop should be broken either by manually cancel rebilling the customer OR *by enhancing the cancel rebill program logic to go further back in history until an index less than current actual is found, and then cancel rebill the customer for this period.*	Yes, fixing the bug in SAP's cancel / rebill function enabling the feature to function properly is an effective and sustainable solution to reduce the amount of estimation-related BPEMs.
Phase 1: Implement Corrective Actions for MR04 and MR15 BPEMs		
Date: March 2023	**Action**	**Is this effective? Sustainable?**
Documentation: JIRA PP-18566	Implement the approved corrective actions for the MR04 BPEMs based on the RCA sessions between subcontractor and Central Hudson Customer accounting team. March sprint: Develop processor rule to automatically route CDG, Demand Meters, Net meter, etc. to group Batch Job to Change BPEM Description for following 6 types of MR04 and MR15.	Yes, this corrective action included the integration of SAP's auto close feature which an effective and sustainable solution to reduce the backlog of estimation-related BPEMs.
Phase 2: Modification to MR04/MR15 Thresholds		
Date: April 2023	**Action**	**Is this effective? Sustainable?**
Documentation: JIRA PP-18682	SAP Hi/Lo threshold updated to align with legacy threshold Demand threshold not changed.	Yes, adjusting the SAP threshold to align with the legacy threshold limits is an effective and sustainable solution.

Table 5. *Corrective Actions related to SAP Configurations*

In addition to SAP configuration changes that were implemented, Central Hudson also developed and implemented the below process and operational-related corrective actions to improve performance regarding estimation-related BPEMs.

Staff Augmentation		
Date: 2022 *Documentation: Conversations with contact center Manager (J. Doane in November 2023)*	**Action**	**Is this effective? Sustainable?**
	In effort to work down the extensive backlog of estimation-related BPEMs, Central Hudson increased their workforce (both internally and with subcontractors) to support BPEM reduction efforts throughout 2022.	Yes and no. Central Hudson created a new billing department that supported the BPEM work down effort. This is not their entire role, and the creation of this new department is not directly tied to this effort. In that case, this is sustainable. For temporary subcontractors that came on board to solely help with BPEM work down and did not retain a position with Central Hudson, this is not a sustainable solution.
Monthly Meter Reading Plan		
Date: July 2023 *Documentation: July 2023 Updated Plan*	**Action**	**Is this effective? Sustainable?**
	Central Hudson has evaluated and developed a plan to adjust its billing practices and to conduct monthly meter reads, thereby eliminating alternate month bill estimates.	It is too soon to tell if converting to monthly meter reading is an effective and/or sustainable solution to estimation-related BPEMs, estimation errors, or customer complaints. There are two reasons for this: 1) there are no established mechanisms to track performance improvement in customer complaints/dissatisfaction once the begin receiving monthly meter reads, and 2) results of the monthly meter reading will begin to quantitatively appear in the data around 12 months after its implemented due to the estimation algorithm using the previous year's data.

Table 6. *Corrective Actions related to Central Hudson Billing Operations.*

7.3.4 Results from SAP configuration changes

The impact of the SAP configuration changes led to a direct reduction in the number of estimation-related BPEMs generated throughout 2023. The corrective actions supporting the improvement of estimation-related BPEMs occurred in May 2023 and, after a two- to three-month lag to cycle through an interim estimation and then actual meter reading period, the number of estimation-related BPEMs generated saw a reduction. This continued into the next month proving sustained effectiveness. This is shown in the figure below.

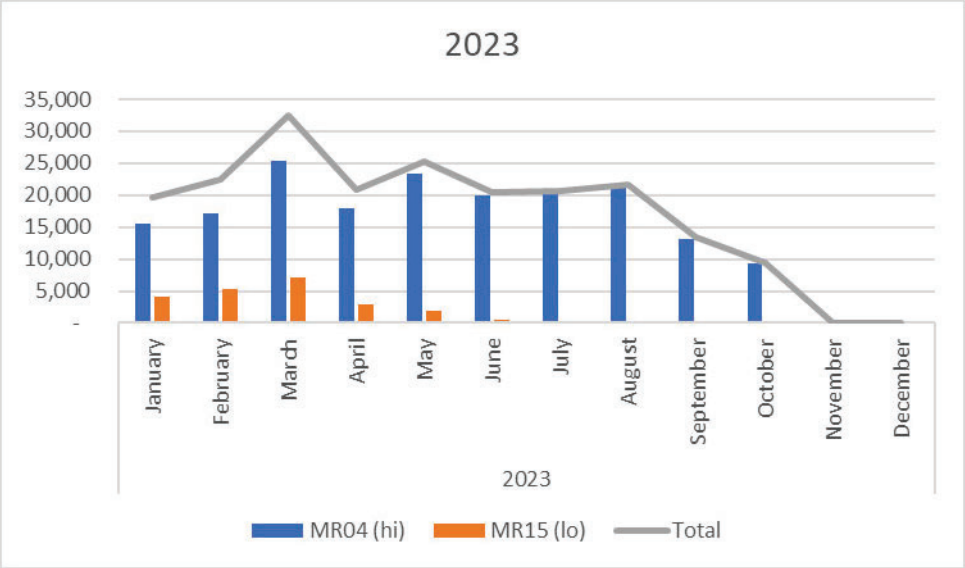

Figure 11. *Estimation-related BPEMs generated in 2023.*

Additionally, the enablement of SAP's auto close feature shows a key aspect of performance improvement that's indictive of overall effectiveness. Enabling SAP's auto close feature does not reduce the generation amount of estimation-related BPEMs but instead, it reduces the amount of manual work required to close each individual BPEM and increases the rate of timely, accurate bills. Central Hudson has both manual employees and automated features closing BPEM cases related to estimation. The automated features work significantly faster, more efficiently, and can handle a larger workload than manual employees. Manual employees will likely always be required in this process design as some BPEM-related instances cannot be resolved through automation; however, increasing the number of auto closed cases and reducing the amount of manually cases is beneficial to Central Hudson customers as it makes the overall resolution process more efficient. This is shown in the figure below which details the number of estimation-related BPEMs assigned to both non-automated and automated closers, and their associated resolution rate by month through 2023. As you can see, the resolution rate for both groups greatly increased throughout the year but batch billing is able to handle almost twice the amount of non-automated resources.

2023											
Case Closer	**Category**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**
Non-Automated (58 Employees)	*No. of estimation-related BPEMs*	16,215	15,488	18,925	10,855	8,419	4,580	4,283	7,235	4,612	3,297
	% of total estimation-related BPEMs	83%	69%	58%	52%	33%	22%	21%	33%	34%	35%
	Resolution rate	2.15	0.75	2.12	2.23	-1.49	-2.25	-2.73	-3.50	-3.65	-4.65
Automated (Batch Billing)	*No. of estimation-related BPEMs*	3,412	6,921	13,551	10,051	16,802	15,893	16,304	14,408	8,822	6,205
	% of total estimation-related BPEMs	17%	31%	42%	48%	67%	78%	79%	67%	66%	65%
	Resolution rate	-1.76	-5.54	-6.20	-6.61	-6.86	-6.84	-6.31	-6.49	-6.41	-6.16
Total no. of estimation-related BPEMs		19,627	22,409	32,476	20,906	25,221	20,473	20,587	21,643	13,434	9,502

Figure 12. *Performance of automated and non-automated case closings through 2023.*

Looking at the year over year data, the number of estimation-related BPEMs saw a reduction only in 2023; however, as listed above, the first series of corrective actions were not put in place until March 2023. An important note - each of these cases do not indicate that an estimated bill went out to the customer, this only shows how many cases were generated by SAP determining the meter read was 'implausible.'

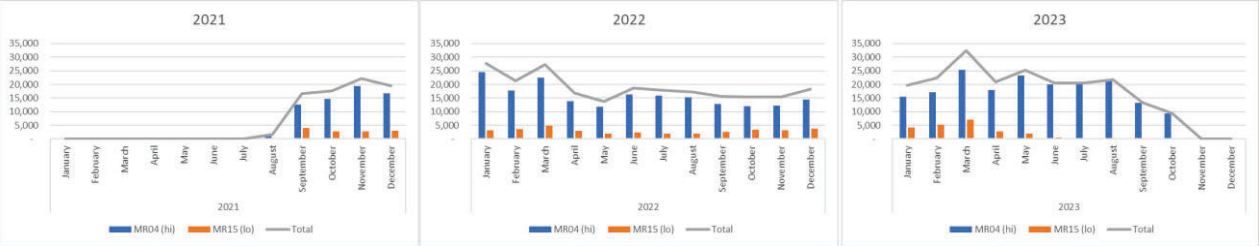

Figure 13. *Estimation-related BPEM cases generated (September 2021 - October 2023).*

7.3.5 Results from monthly meter reading solution

The monthly meter reading solution is designed to address bi-monthly estimates. In theory, the monthly meter reading plan will address bi-monthly estimation and therefore, improve customer sentiment; however, it is too soon to see quantitative results showing improvement. Due to the implausible BPEM algorithm comparing the actual read to data from the past 12 months of a customer's usage history, it will take at least 1 year before monthly meter reading has any influence on the reduction of implausible BPEMs. As the monthly meter reading program is segmented into phases, the full incremental improvement on implausible BPEMs may not be realized until early 2026. Central Hudson's plan for monthly meter reading will positively impact customers and bring the number of estimated bills down significantly.

7.3.6 Recommendations for further corrective action

As part of this engagement, PA recommends Central Hudson take the following actions to improve performance regarding estimations:

- Benchmark with similarly sized / geographic utilities who utilize SAP CIS to gain insights into their history, lessons learned, successes, etc.
- Develop a means to track customer complaints received regarding bi-monthly estimates. Monitor those complaints to determine if monthly meter reading provides effective resolution

8 Analysis of BPEM cases

8.1 Current state of Central Hudson BPEMs

Similar to estimation-related 'implausibles' there are other instances within SAP's meter-to-cash process where a BPEM case is generated. BPEM cases ("BPEMs") are given a unique case category identifier to determine where within the meter-to-cash process the BPEM was generated and what might likely be the cause. It is important to note that while BPEMs are typically seen as 'errors' to the system, this is not the case. Throughout this monitoring and evaluation, in addition to consulting with SAP experts, PA Consulting understands BPEMs to serve three general purposes:

1. BPEM as a true error
2. BPEM as a ticket creation/work management tool
3. BPEM as an exception notification/alert

8.1.1 BPEM as a true error

Certain BPEMs are generated because of a 'true error' found by the SAP system during its routine process. An example of this is the input of inaccurate meter reading data into SAP from the field – if a meter reader reports a customer's usage as something that doesn't adhere within SAP's validation algorithms (i.e., meter reader accidentally enters a letter instead of a number), a BPEM is generated, and that case is not progressed forward. This BPEM is coded as a 'true error' since the SAP system will not accept values outside of its predetermined range.

8.1.2 BPEM as a ticket creation/work management tool

Other BPEMs are generated for the purpose of work management – like ticket creation to be routed to the appropriate party responsible for case management. An example of this is BPEM C226 – 'Copy of Bill Request.' This is a BPEM that is generated by a Customer Service Representative (CSR) in response to a customer contacting Central Hudson and requesting a

copy of their bill. This is not an inherent feature to SAP and therefore, can only be tasked and completed by a Customer Service Assistants (CSA). When the customer requests the bill copy, the CSA who handles front office requests enters this into SAP and a BPEM is generated. At that point, a CSR who handles back-office requests will receive the BPEM and close the case once it has been resolved. In this example, there is no 'true error' and instead, Central Hudson is leveraging SAP's functionality as a work management system to effectively track and report customer requests and resolutions.

8.1.3 BPEM as an exception notification/alert

The last subset is BPEMs that serve as an alert or a true exception notification. These BPEMs don't necessarily contain a 'true error' that requires resolution not does it need to be 'routed' to a specific department for action. An example of this is BPEM C258 – 'Customer Provided Meter Reading.' Central Hudson allows customers to submit their own meter readings in replacement of estimations so when this is entered into the system, SAP generates a BPEM case. There is no resolution required for this BPEM and the BPEM does not necessarily need to be reviewed. SAP created the BPEM as a notification for data reporting purposes and to create an accurate history log.

Appendix A includes a complete table of each BPEM case category, its associated description, and indication on whether it impacts the billing process. Some BPEMs do not directly impact the billing process and are related to service orders, as an example. Below is a table of BPEM case categories that directly impact billing and therefore, were the focus of this assessment.

Case Category	BPEM Description	Subcategory
BB01	Budget Billing Amount over Tolerance	Budget Billing
BB04	EITR bill doc dates don't fall into EABP dates, skip function	Budget Billing
BB05	Invoicing requires all contracts to be on Budget Billing	Budget Billing
BB06	Budget installment amount cannot be calculated	Budget Billing
BL14	Customer not Billed no existing exception found	Billing
BL01	Operand is missing	Billing
BL02	Contract is blocked for billing By User	Billing
BL04	Billing Document Out sorted	Billing
BL09	Termination in Variant Inconsistent Sub-trans	Billing

Case Category	BPEM Description	Subcategory
BL10	Error updating operand in installation	Billing
BL11	No rate found for rate category	Billing
BL14	Billing period spans a rate change	Billing
BL17	Proration greater than 24.0	Billing
BL18	BVI calculation factor greater than 0.1	Billing
BL24	Billing is terminated due to proration factor less than 0.5	Billing
BL25	Device is missing in the billing period	Billing
BL26	The billing period is short, wait till the next billing period	Billing
BL29	Billing order not in selection process	Billing
BL30	Not possible to update installation facts	Billing
BL31	Billing order has incorrect status for billing	Billing
BL32	Installation has previous contract to be billed	Billing
BL33	Meter reads are missing or implausible	Billing
BL34	Move in read is missing	Billing
BL36	Gas Procedure is missing	Billing
BL37	Account determination not possible	Billing
BL38	No meter reading results exist	Billing
BL39	No value found for price	Billing
BL45	Installation group	Billing
BL49	Sub-transactions are inconsistent	Billing
BL50	Division not possible: divisor is 0	Billing
BL51	Error updating installation facts	Billing
BL53	Choose a shorter period	Billing
BL54	Profile value is missing	Billing
BL55	No register allocations for role	Billing
BL56	Temp. area missing for degree day weight	Billing
BL57	Inconsistent gas date for meter reading	Billing
BL58	Allocate a profile to logical register	Billing
BL74	Multiple billable billing orders exist	Billing
BL96	Negative differences are not permitted	Billing
BL97	Update not possible for operand	Billing
BL98	Gaps in definition for tax determination indicator	Billing
BL99	Price1, price cat2, pricing level3 does not exist	Billing
BLA0	No MR result marking end of billing period	Billing

Case Category	BPEM Description	Subcategory
BLA1	Rate category change happened off cycle	Billing
MR04	Exceeds Maximum Limits	Meter Reading
MR08	Previous MR implausible	Meter Reading
MR15	Below Tolerance Limits	Meter Reading
MR41	Meter Reading Skipper for Contract Change Order	Meter Reading
PR05	Bill Print Large Amount Validation (>$10MM)	Printing

Table 7. *BPEM case categories that impact billing.*

Each BPEM case category has an independent resolution process with an associated expected resolution timeframe. As with the estimation-related BPEMs, if resolution is not achieved within the specified timeframe, the specific BPEM case will either continue to the next stage or will remain in the current stage in perpetuity based on the individual logic applied to the case category. Prior to SAP, Central Hudson had a detailed report containing a similar error-tracking log generated through batch outside of their preceding customer information system. With the integration of SAP, Central Hudson users are now able to view and manage exceptions directly in the system.

8.1.4 BPEM generation post SAP go-live

Similar to the estimation-related BPEMs, Central Hudson faced immediate problems with the amount of BPEMs created by SAP. This is evident by the number of BPEM cases created in the first month after go-live and then subsequent months. In September 2021, 83,792 BPEM cases were created. The next month, October 2021, 85,742 new BPEM cases were created followed by 125,554 in November 2021, and 107,432 in December 2021 totalling 407,945 in four months (~100,000 BPEMs generated per month). In consultation with technical experts, there are no widely accepted standard for how many BPEMs should be generated per month, year, etc. Each utility has their unique processes for how they handle every specific billing-related matter and no two are the same. The general rule of thumb to determine how many BPEMs are 'acceptable' is – no more than the organization can handle within one day.

The below graph shows the number of BPEMs that were created from SAP go-live through October 2023. As you can see, the amount of overall BPEMs being created year-over-year has reduced. In 2023, each month saw a reduction in BPEMs from the same month in the prior year.

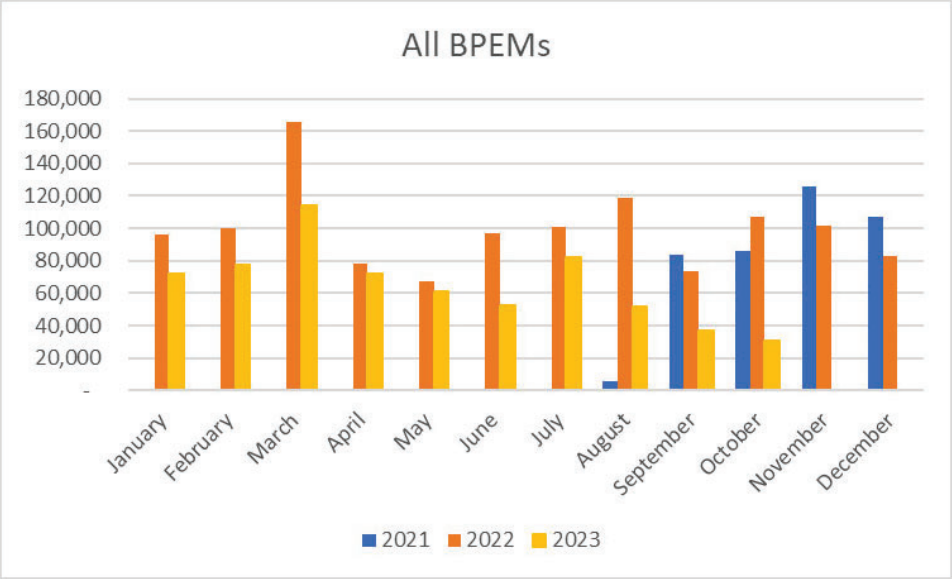

Figure 14. *All BPEMs generated since SAP go-live (September 2021 - October 2023).*

For a more detailed view, the below graph shows the number of three key BPEMs (MR04, BL02, IN01) and their historical generation amount since SAP go-live. These are key as they relate directly to the billing process and will cause a delay in customers receiving a bill. Similar to above, there's a reduction in the amount of key BPEMs (MR04, BL02, IN01) being created year-over-year. A trendline was added to graph to show the overall trend and direction to evaluate progress and corrective action performance. In 2023, the trendline of key BPEMs (MR04, BL02, IN01) being generated is decreasing showing a positive performance improvement from BPEM reduction efforts.

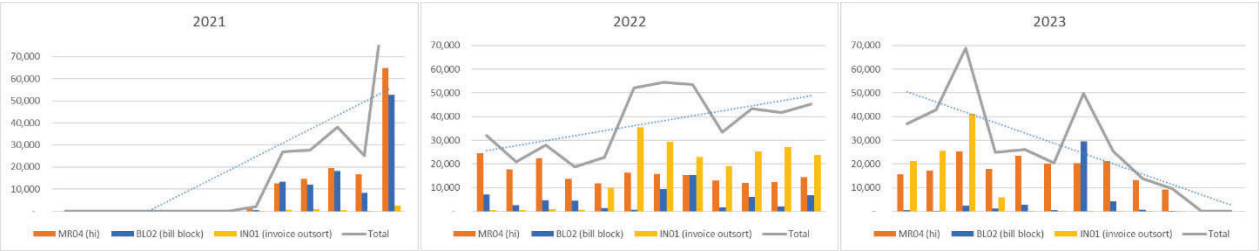

Figure 15. *Key BPEMs generated since SAP go-live (September 2021 - October 2023).*

8.2 Root cause analysis results

As part of this engagement, DPS asked PA Consulting to review and conduct a root cause analysis on BPEMs to understand and identify defects that rose once SAP was implemented. An increased amount of BPEMs, specifically BPEMs that directly correlate to a customer receiving an inaccurate or late bill, is implicated in causing customer complaints post SAP go-

live. DPS also asked PA Consulting to review corrective actions put in place by Central Hudson at any point post go-live and determine the effectiveness and sustainability of those actions.

8.2.1 Root cause analysis on all BPEMs

Initially, Central Hudson began with 286 BPEM case categories and over time, this was reduced to 230 BPEM case categories. Figure 15 above shows the overall reduction in BPEMs across all case categories – including cases either do or do not directly impact billing.

Central Hudson experienced a quick influx of BPEMs shortly after go-live at a rate of ~20,000 BPEMs generated per month. This rate of generation remained constant for over twelve months. Not only did the initial influx stress the Central Hudson implementation team but there were not enough staffed resources to 'work down' BPEMs at a rate that prevented a catastrophic backlog nor would this have been economical. Holistically, there are no SAP configurations or defects in the BPEM process that contributed to problems at Central Hudson after go-live. The BPEM module operated as it's intended to, the errors arose from specific pieces of data being manipulated in new ways which then created an extensive backlog. Individually, there are specific SAP configurations that needed to be modified in specific BPEM case categories for various reasons, but these were not due to 'bugs' or 'inherent defects.'

8.3 Findings and recommendations

PA Consulting reviewed and evaluated the provided documents, in addition to meeting with various Central Hudson representatives, to determine the effectiveness, sustainability, and future achievability (if applicable) to any corrective actions. Central Hudson provided documentation the following documentation that detailed historical corrective action addressing BPEM cases:

- Subcontractor statements of work/sign contracts including scopes
- JIRA tickets including details on specific completed SAP configuration changes
- BPEM Optimization Plan

8.3.1 SAP integration flaws

An initial cause of increased BPEM cases directly after SAP implementation was due to a bug found in SAP in its cancel/rebill function which led to the incorrect processing of cancel/rebills, including the failure to process full reversals (reversing invoice and not bill document or all bill

documents related to invoice). This bug was detected on February 16, 2022, and fixed on February 14, 2023 (JIRA PP-15878).

8.3.2 BPEM case and backlog corrective actions

The initial response to reduce the amount of BPEMs being generated as well as reduce the backlog of outstanding BPEMs, Central Hudson conducted the various corrective actions:

- Pivoted the scope of the Project Phoenix system integrator to solely focus on BPEM resolution
- Added subcontractor, iWeb Technologies as technical experts support the BPEM reduction effort
- Increased the amount of internal Central Hudson resources to support the BPEM reduction effort including:
  - Established an expanded Customer Billing team which now includes 25 FTE positions in August 2022
  - Began the process of adding 36 Full Time Employees (FTE) to the contact center in March 2023
- Increased training and available support resources to the call center
  - Developed and rolled out the 'Cultivating Confidence' enhanced training initiative focused on training for Contact Center staff in January 2023

In addition, Central Hudson launched a 'BPEM Optimization' initiative that began in February 2023. This initiative focused on prioritizing BPEM case categories, identifying correction actions, and implementing those solutions. As part of the BPEM Optimization initiative, Central Hudson and a subcontractor identified numerous solutions to various BPEM case categories to effectively reduce the frequency of each being generated. Below is the list of each root cause analysis with the BPEM case category identified as well as a brief description of the issue faced.

MR08 (Previous MR Implausible) needs to be auto closed when account is billed to current		
Date March 2023 *Documentation: JIRA PP-18028*	**Action**	**Is this effective? Sustainable?**
	System needs to AUTO close MR08 when account is billed to current.	Yes, enabling SAP's auto close feature is an effective and sustainable solution.
Create RCA for MR41 BPEM case category		

	Action	Is this effective? Sustainable?
Date: March 2023 *Documentation: JIRA PP-18610*	Create the RCA document for the BPEM category MR41. This will be a part of sprint 2.	This is the creation of a root cause analysis for BPEM MR41; not the solution.
Implement Corrective Actions for Standard Bill Print - Phase 1		
Date: March 2023 *Documentation: JIRA PP-18569*	**Action**	**Is this effective? Sustainable?**
	Implement the approved corrective actions for the regular billing based on the RCA sessions between subcontractor and Central Hudson Customer accounting team.	Yes, implementing the approved corrective action identified in the RCA sessions with subcontractor and the Central Hudson Customer Accounting team is an effective and sustainable solution.
Implement Corrective Action for BL04 BPEM - Phase 1		
Date March 2023 *Documentation: JIRA PP-18562*	**Action**	**Is this effective? Sustainable?**
	Implement the approved corrective actions for the BL04 BPEMs based on the RCA sessions between subcontractor and Central Hudson Customer accounting team. Changes: replaced existing standard SAP billing out sort with a new custom billing out sort. The custom logic will trigger after existing amount thresholds are exceeded (2,000 for residential, 15,000 for small commercial, 30,000 for industrial) and look up the billed amount from billing document in the same period previous year if available. If not available, it will look up the billed amount from previous billing document. These amounts are multiplied by a threshold percentage and compared with current billing amount. The comparison amounts are divided by number of billing days to address discrepancies in number of days in billing periods found across billing documents. If the current billing amount are outside of calculated thresholds, the billing document will out sort.	Yes, customizing the billing out sort and associated logic is an effective and sustainable solution.
Create RCA for BL29 BPEM case category		
Date: April 2023 *Documentation: JIRA PP-18615*	**Action**	**Is this effective? Sustainable?**
	Create the RCA document for the BPEM category BL29. This will be a part of sprint 2. Changes: Based on PP-18029, BPEM Auto Close program, the posting date from the latest invoice document is pulled to compare with BPEM case creation date. If the invoice document posting date is greater than the BPEM case creation date, which means the particular error that trigger	Yes, adjusting the auto close logic to trigger for case creation/closing dates is an effective and sustainable solution.

	the case creation is resolved, the case will automatically close.	

BL04 bill out sort not happening on contract change billing documents

	Action	Is this effective? Sustainable?
Date: April 2023 *Documentation: JIRA PP-17982*	BL04 is not including contract change bill docs for out sort. Need to add this type to the BL04 process.	Yes, adding contract change to billing out sort is effective and sustainable.

Create RCA for BL02 BPEM case category

	Action	Is this effective? Sustainable?
Date: April 2023 *Documentation: JIRA PP-18616*	Create the RCA document for the BPEM category BL02. This will be a part of sprint 2. Changes: Process document to be created to leverage existing Fiori tools to mass add/remove bill blocks as opposed as manually adding/removing bill blocks individually through ES21 contract screen.	Yes, adding the ability to add/remove bill blocks as a group rather than individually is an effective and sustainable solution.

BL29 (Billing order not in selection process) needs to be AUTO closed when the account is billed to current

	Action	Is this effective? Sustainable?
Date: May 2023 *Documentation: JIRA PP-18029*	System should AUTO close BL29 (Billing order not in selection process) when the account is billed to current. Changes: In BPEM Auto Close program, the posting date from the latest invoice document is pulled to compare with BPEM case creation date. If the invoice document posting date is greater than the BPEM case creation date, which means the particular error that trigger the case creation is resolved, the case will automatically close.	(This is the follow up of JIRA PP-18615). Yes, adjusting the auto close logic to trigger for case creation/closing dates is an effective and sustainable solution.

Implement Corrective Action to BL29 Case Category Auto Close

	Action	Is this effective? Sustainable?
Date: May 2023 *Documentation: JIRA PP-18872*	Changes: In BPEM Auto Close program, the billing period end date from the latest bill document is pulled to compare with BPEM case creation date. If the billing period end date is greater than the BPEM case creation date, which means billing was processed successfully after the BPEM creation, the case will automatically close.	(This is the follow up of JIRA PP-18615). Yes, adjusting the auto close logic to trigger for case creation / closing dates is an effective and sustainable solution.

Create RCA for BL39 Case Category

	Action	Is this effective? Sustainable?
Date: May 2023 *Documentation: JIRA PP-18862*	BPEM Case Category BL39 No value found for price. Root Cause: Electric supplier price value is missing or installation operand EQSUPPRC have	Yes, adjusting the auto close logic to trigger for case creation/closing dates is an effective and sustainable solution.

	the wrong price. Changes: Auto close to close older cases where account have billed past BPEM case creation case. Cases not closed by the auto close program will be manually closed based on a process document.	

Create RCA for BB06 Case Category

Date: May 2023
Documentation: JIRA PP-18861

Action	Is this effective? Sustainable?
BB06 Budget instalment amount cannot be calculated. Case Category Text: In Case Calculated BB Plan amount by system is zero, system is terminating the invoice processes abruptly and causing failure of invoicing batch jobs. This calculated zero amount is used to divide as denominator in run time of invoicing batch job and transaction. An exception is applied to validate calculated zero BB Plan amount and skip the division and write error into application log.	Yes, modifying the configuration to allow values to be divisible by 0 and not be terminated is an effective and sustainable solution.

Implement Corrective Action for BB06 BPEM Case Category

Date: May 2023
Documentation: JIRA PP-18992

Action	Is this effective? Sustainable?
Implement the corrective actions for BB01 BPEM category based on the approved RCA document. BB06 Budget instalment amount cannot be calculated. Changes: Update auto close program to close BB06 BPEM cases where the system is trying to create a new payment plan for contracts already moved out.	(This is the follow up of JIRA-18861). Yes, modifying the configuration to allow values to be divisible by 0 and not be terminated is an effective and sustainable solution.

Auto close BB01 BPEMs

Date: May 2023
Documentation: JIRA PP-18901

Action	Is this effective? Sustainable?
This is a request to auto close the BB01 BPEMs if the account has successfully invoiced after the BPEM was created. Changes: In BPEM Auto Close program, the posting date from the latest invoice document is pulled to compare with BPEM case creation date. If the invoice document posting date is greater than the BPEM case creation date, which means the particular error that trigger the case creation is resolved, the case will automatically close.	Yes, enabling SAP's auto close feature by adjusting the settings for when it operates is an effective and sustainable solution.

Implement Corrective Actions for BL37 BPEMs - Phase 1

Date: May 2023
Documentation: JIRA PP-18568

Action	Is this effective? Sustainable?
Implement the approved corrective actions for the BL37 BPEMs billing based on the RCA sessions between	Yes, addressing the backlog due to discrepancies in data caused by choice enrollment/unenrollment is

	subcontractor and Central Hudson Customer accounting team. Change: Created a process guide to help clear out backlog. These cases are caused by discrepancies in data caused by choice enrolment/unenrolment process.	an effective and sustainable solution.

Create RCA for BL34 BPEM Case Category

Date: June 2023
Documentation: JIRA PP-19000

Action	Is this effective? Sustainable?
Create the RCA document for the BPEM category BL34. This will be a part of sprint 4. BL34 Move in read is missing. Changes: Move-in meter reading result is missing or implausible. Accounts that have billed past their move-in date will have their cases auto closed. Missing move-in meter readings will be estimated and implausible will be released accordingly to DM logic.	This is an effective solution while Central Hudson transitions to monthly meter reading. This is not sustainable in the long run but will be addresses by monthly meter reads.

Create RCA for BB04 BPEM Case Category

Date: June 2023
Documentation: JIRA PP-19001

Action	Is this effective? Sustainable?
Create the RCA document for the BPEM category BB04. This will be a part of sprint 4. BB04 EITR bill doc dates don't fall into EABP dates Changes requested: Auto close program to close cases where accounts have been invoiced past BPEM creation date. This was implemented and tested in JIRA defect PP-17997.	This is the creation of a root cause analysis for BPEM BB04; not the solution.

Implement Corrective Action for BB04 BPEM Case Category

Date: June 2023
Documentation: JIRA PP-19214

Action	Is this effective? Sustainable?
Implement the corrective actions for BB04 BPEM category based on the approved RCA document. Changes requested: Auto close program to close cases where accounts have been invoiced past BPEM creation date. This was implemented and tested in JIRA defect PP-17997.	Yes, enabling SAP's auto close feature by adjusting the settings for when it operates is an effective and sustainable solution.

Implement Corrective Action for BL39 BPEM Case Category

Date: June 2023
Documentation: JIRA PP-18993

Action	Is this effective? Sustainable?
Implement the corrective actions for BL39 BPEM category based on the approved RCA document. BL39 No value found for price. Changes: Update auto close program to close BL39 BPEM cases where underlying issue is resolved and account is billed past BPEM creation date.	Yes, enabling SAP's auto close feature by adjusting the settings for when it operates is an effective and sustainable solution.

Create RCA for BLA0 BPEM case category		
Date: July 2023 *Documentation: JIRA PP-19206*	**Action**	**Is this effective? Sustainable?**
	Create the RCA document for the BPEM category BLA0. This will be a part of BPEM sprint 5. BLA0 No MR result marking end of billing period. Changes: Auto close program to close backlog where account has billed past BPEM creation date. Estimation and manual effort to work missing MR results.	This is the creation of a root cause analysis for BPEM BLA0; not the solution.
Implement Corrective Action for BLA0 - No MR result marking end of billing period		
Date: August 2023 *Documentation: JIRA PP-19450*	**Action**	**Is this effective? Sustainable?**
	Implement Corrective Action for BLA0 - No MR result marking end of billing period. Auto close program to close backlog where account has billed past BPEM creation date. Estimation and manual effort to work missing MR results.	Yes, enabling SAP's auto close feature by adjusting the settings for when it operates is an effective and sustainable solution.
Implement Corrective Action for BL34 BPEM Case Category		
Date: August 2023 *Documentation: JIRA PP-19250*	**Action**	**Is this effective? Sustainable?**
	Implement the corrective actions for BL34 BPEM category based on the approved RCA document. BL34 Move in read is missing. Changes: Auto close program to close backlog where account has billed past BPEM creation date. Estimation and manual effort to work missing MR results.	Yes, enabling SAP's auto close feature by adjusting the settings for when it operates is an effective and sustainable solution

Table 8. *Corrective Actions related to SAP Configurations.*

8.3.3 Results from SAP configuration changes

The impact of the SAP configuration changes led to a reduction in the number of overall BPEMs generated in 2023 as shown in Table 9. The SAP configurations that impacted billing-specific BPEMs also led to a reduction in the number of billing-specific BPEMs generated in 2023. Below shows the number of billing-related BPEMs generated per month in 2023 including a relative performance scale. Cells shaded in green indicate the best month's performance for that specific BPEM. As shown, the majority of BPEM case categories saw improvement towards the end of 2023.

YEAR	MONTH	BB01	BB04	BB05	BB06	BI14	BL01	BL02	BL04	BL09	BL10	BL11	BL14	BL17	BL18	BL24	BL25	BL26	BL29	BL30	BL31	BL32	BL33	BL34	BL35	BL36
2023	January		1,685		31		4	360	613	12		1	4				403	7	3,718	74				371	61	21
	February		1,562		38		1	138	790	8		-	-				710	10	2,503	12	1			384	49	2
	March	73	1,225		127		5	2,390	1,014	5	1	-	4				1,012	3	3,449	35	-	1		488	50	6
	April	304	375		40		2	1,175	686	1	1	-	1				1,261	15	3,166	17	1	-		472	65	5
	May	573	354		50		17	2,848	649	6	-	-	-	1			1,171	7	2,642	17	2	-		553	81	1
	June	790	228		39		6	349	291	3	-	2	2	-			1,447	1	2,188	31	17	-		623	259	1
	July	775	256		243		5	29,567	330	20	-	1	1	-			588	12	2,509	31	2	-		781	121	2
	August	977	217		101		252	4,094	265	14	-	7	3	-	38		272	3	2,138	19	4	1		880	169	3
	September	773	304		55		148	626	246	3	3	18	-	2	283		161	4	2,633	22	-	-		809	77	2
	October	651	168		56		2	261	304	8	-	-	-	2	75		127	3	1,828	13	1	-		545	55	1
2023 Total		4,916	6,374		780		442	41,808	5,188	80	5	29	15	5	396		7,152	65	26,774	271	28	2		5,906	987	44

YEAR	MONTH	BL37	BL38	BL39	BL45	BL49	BL50	BL51	BL53	BL54	BL55	BL56	BL57	BL58	BL74	BL96	BL97	BL98	BL99	BLA0	BLA1	MR04	MR08	MR15	MR41	Total
2023	January	61	2	1						52		5			28					2		14,821	1,746	3,885	885	28,853
	February	27	5	1	2			3	1	50		7			19		1			9		17,859	2,161	5,465	223	32,041
	March	34	1	3	2		1	3	-	48		4			15		-			10		25,864	4,161	7,098	310	46,942
	April	59	1	-	2		-	1	1	44		4			15		-			5		18,029	3,160	2,867	23	31,798
	May	46	-	49	3		-	3	-	66		4			21		-			4		23,330	5,107	1,922	-	39,527
	June	24	2	1	13		-	1	-	49		3			17		-			8	1	20,042	2,360	428	-	29,226
	July	112	1	-	18		-	6	-	25		5			25		-			4	1	20,269	1,549	323	-	57,582
	August	57	2	-	12		-	10	-	26		3			21		-			6	1	21,267	1,400	374	-	32,636
	September	107	10	-	6		-	3	-	54		4			19		-			6	-	13,159	935	262	-	20,734
	October	49	59	-	6		-	9	-	16		5			19		-			4	-	13,029	719	382	-	18,397
2023 Total		576	83	55	64		1	39	2	430		44			199		1			58	3	187,169	23,298	23,006	1,441	337,736

Table 9. *Reduction in billing-related BPEMs from Central Hudson corrective action.*

8.3.4 Recommendations for further corrective action

As part of this engagement, PA recommends the additional corrective actions to improve performance regarding estimations:

- Benchmark with similarly sized/geographic utilities who utilize SAP CIS to gain insights into their history, lessons learned, successes, etc.
- Request a meeting with SAP to gain insight into the optimal BPEM mix
- Corrective actions developed by any contractor should include the coordination and feedback of the call center, or any associated parties it impacts

9 Analysis of monthly metering strategy

9.1 Overview of monthly metering plan

In January 2023, Central Hudson proposed a plan to implement monthly meter reading in the entire service territory. In July 2023, Central Hudson updated the initial plan to expedite the implementation timeframe and conduct monthly meter reading sooner than originally planned. The goal of the plan is to largely to reduce and eventually decommission the interim estimation process. Customers have expressed negative sentiment towards the estimation process and their associated estimate bill during the interim month.

9.1.1 Monthly meter reading plan components

The monthly meter reading plan has the following core components that PA Consulting evaluated when reviewing the plan for completeness and effectiveness:

- **Phased approach**: Central Hudson is taking a phased approach to implementing monthly meter reading. They began the pilot portion of the program in August 2023 with

an initial monthly meter read of 1,000 customers. This increased to 10,000 customers with the combination of the pilot portion and phase 1. Three subsequent phases follow the initial phase after a complete two month pause to collect and record all results of monthly meter reading to ensure effectiveness on the following phases. Only one complete implementation pauses are built into the current rollout schedule, the other verification periods will occur in parallel to the next phases' rollout.

- **Cost**: The total cost of the program is estimated at $4M. This cost includes required hardware (equipment, trucks, etc.), people (meter readers), and process improvements (SAP configuration changes). Central Hudson filed for rate recovery to support the cost of this program. Central Hudson has not identified a contingency plan is the rate recovery is not approved.
- **Data**: As Central Hudson's territory transitions from bi-monthly meter reads to monthly meter reads, the amount of data coming in per month will increase substantially. Central Hudson developed and implemented a testing plan to ensure that SAP, and any associated program required for monthly meter reading, will work effectively with this larger amount of data. Central Hudson conducted extensive testing that exceeded over 3,500 hours - user acceptance testing exceeded 1,992 hours and project management testing exceeded over 1,552 hours. In addition, Central Hudson has identified various staffing scenarios to ensure that the billing team has enough bandwidth to support this new influx of data.
- **Benefits**: While Central Hudson stated that monthly meter reading will remove the necessity of interim month estimates, there could still be potential scenarios where estimates are generated. Additionally, the benefit of monthly meter reading will experience an extreme time delay due to the nature of the estimation process and algorithm. Transitioning from an interim month estimate to an interim month meter reading will take up to a year.

9.2 Review of monthly meter reading pilot

Monthly meter reading results will not be seen until one year after implementation due to the nature of the estimation algorithm and its associated timeframe. In conversations with Central Hudson, the pilot/phase 1 portion went successfully, and it is too soon to identify results, lessons learned, efficiencies, etc.

9.2.1 SAP configuration changes related to the monthly meter reading plan

One SAP configuration change will take place in the future to successfully enable monthly meter reading – Central Hudson's code to configure SAP to operate with bi-monthly meter reads will no longer be utilized. SAP is inherently designed to perform with monthly meter reads and Central Hudson has conducted extensive testing in bypassing the custom code and utilizing SAP's standard code.

9.3 Findings and recommendations

In theory, Central Hudson's monthly meter reading plan will address customer's frustrations who receive estimates during the interim month. This is likely the case since the customers will be receiving actual reads every month, unless an exception occurs, and customer sentiment is negatively tied to only the estimate. SAP is used at utilities across the industry and is designed to operate with monthly meter reading data. It's logical to assume that bypassing the estimation process itself, by moving to monthly meter reads, that this will greatly alleviate customer frustrations regarding inaccurate bills. Without data however, it is too soon to review and analyze results and/or forecast future outcomes reflecting any performance changes regarding the estimation process/customer complaints received.

PA Consulting recommends establishing a robust monitoring system to efficiently track and report the progress of the monthly meter reading implementation program by:

- Developing progress and performance metrics to measure the program's implementation; indicators/metrics could include:
    - **Tracking customer complaints regarding interim estimates**: customer complaints related to interim estimates are currently not tracked; therefore, the resolution of these issues is not able to be evaluated. Developing a means to identify which customer's express complaints with interim estimates would be beneficial to ensuring the monthly meter reading solution is effective.
    - **Tracking monthly bills for customers that previously experience interim estimation errors**: After identifying which customer's expressed complaints, monitoring those customers and ensuring they receive accurate bills post-monthly meter reading implementation is an easy, effective way to measure programs success.

- **Spend per route for implementing monthly meter reading**: Measure the costs incurred per route (or other consistent segment) to identify opportunities for efficiencies or areas of overrun that will need to be accounted for in future phases.

10 References

10.1 Introduction

1. In the Matter of an Investigation by the DPS Office of Investigations and Enforcement Into Central Hudson Gas & Electric Corporation's Development and Deployment of Modifications to its Customer Information and Billing System and Resulting Impacts on Billing Accuracy, Timeliness, and Errors. Case number 22-M-0645, December 2022.
2. Comprehensive Management and Operations Audit Of Central Hudson Gas & Electric Corporation. Overland Consulting. Case 21-M-0541, April 2023.
3. **DR-0051 Attachments 1 & 2** Subcontractor Statements of Work CONFIDENTIAL – Attachment one is a document that outlines the stages of the engagement with Central Hudson and their start/end dates. Attachment two is subcontractor's initial SOW with Central Hudson.

10.2 Task 1 – Analysis of current software testing practices and framework

4. **DR – 0029** Attachment 1 Central Hudson Requirements Traceability Matrix CONFIDENTIAL – Project Phoenix. This document contains a list of mappings between requirements and test cases utilized during Project Phoenix.
5. **DR – 0065** Attachment 4 Dunning Test Cases CONFIDENTIAL. This document contains a list of mappings between requirements, test cases, and defects relevant to the ongoing Central Hudson Dunning project.
6. **DR – 0062** JIRA tickets mapped to OIE issue. This document contains a list of JIRA defect ticket information related to issues referenced in the OIE report released in December 2022.

7. **DR – 0032** Attachment 1 Central Hudson Test Plan CONFIDENTIAL. This document contains template of a test plan that is used to guide testing activities at Central Hudson.

10.3 Task 2 – Analysis of billing, FCS, and EDI integration defects

8. **DR – 0004** Project Plans by Feature for Project Phoenix CONFIDENTIAL – This collection of documents describes the scopes of work to be completed for the success of Project Phoenix.
9. **DR – 0005** SAP Configurations by Function CONFIDENTIAL – This collection of documents describes the specific configurations and changes to them by operational function prior to the go-live of Project Phoenix.
10. **DR – 0006** Functional Specifications CONFIDENTIAL – This collection of documents details, but is not limited to, the requirements, design, integration considerations, and testing scenarios of each functional component of Project Phoenix.
11. **DR – 0008/0010** Enterprise Software list, versions, and migration paths CONFIDENTIAL – This document is a list of each enterprise software used by Central Hudson in their billing solution. This document outline the name, version, and environments available to migrate changes from development to production.
12. **DR – 0009** Data source/sink document by workstream – This document is an excel file that lists each incoming and outgoing data endpoint by workstream and outlines the details of the content being transmitted.
13. **DR – 0014** EDI Integration Flowchart CONFIDENTIAL – This document is a diagram depicting the flow of documents between Central Hudson's billing system and the systems of ESCO's. This file shows the specific EDI file number within the flow diagram, its direction, and between which layers they are transferred.
14. **DR – 0021** Training Through Production Development Architecture CONFIDENTIAL – This document is a diagram describing the different platform environments used by Central Hudson from training through to production. This document describes Central Hudson's HEC, on-premise, and SAP Cloud systems.
15. **DR – 0022 and DR – 0026** Tower Lead List – This document is a list of the current tower leads of Central Hudson and the specific operational areas they cover.
16. **DR – 0024** Change Request Management (CHARM) lifecycle

17. **DR – 0025** Naming Convention Document (coding best practices content) CONFIDENTIAL
18. **DR – 0040** Subcontractor RCA Documents CONFIDENTIAL – This collection of documents describe major issues found with Central Hudson's SAP implementation, their root cause, and remediate actions to take.
19. **DR – 0049** FCS Integration Diagram CONFIDENTIAL – This document is a flow chart the outlines the flow of meter data from Central Hudson's on-premise file servers to their SAP S4 instance.
20. **DR – 0062** JIRA tickets mapped to Overland Report issues CONFIDENTIAL – This document is an excel file that maps high-impact JIRA tickets to the issues described in the OIE report.

10.4 Task 3 – Estimation algorithm analysis

21. Central Hudson Gas & Electric Corporation's Petition Requesting the New York State Public Service Commission Approve Central Hudson Gas & Electric Corporation's new procedures for bill estimates. Case number 21-M-0045, December 23, 2020
22. DR – 0011 Billing Calculation Documentation CONFIDENTIAL – This document details the requirements, design, integration considerations, and testing scenarios of Central Hudson's billing process.

11 Appendix

11.1 Appendix A

Table 10. *All BPEM Case Categories.*

BPEM Category	BPEM Description	Impacts Billing?
MR08	Previous MR implausible	Yes
BB01	Budget Billing Amount over Tolerance	Yes
BL25	Device is missing in the billing period	Yes
MR41	Meter Reading Skipper for Contract Change Order	Yes
C258	Customer provided meter reading	No

BPEM Category	BPEM Description	Impacts Billing?
W021	Meter Replacement Failure	No
C226	Copy of Bill Request	No
IN08	Different data in billing document	No
C260	Refund Requests	No
MR33	TOU: Mismatch OnPeak and OffPeak cons with Total KWH	No
C235	Regular Bill Correction	No
MR24	TOU Time Block Validation	No
C097	SIC 1520 on Premise Transferred to New Customer	No
C255	Meter read schedule	No
BL18	BVI calculation factor greater than 0.1	Yes
C111	Service Denied - Owner Owes Bill / Past Due Amount	No
C248	Installment Change Request	No
C247	Bill Correction Required - Budget	No
C222	HEAP Budget Opt Out	No
C239	Misapplied Payments	No
BB06	Budget installment amount cannot be calculated	Yes
C240	Returned Checks	No
C092	LIBDP upon Move-out	No
C264	Account support	No
BL54	Profile value is missing	Yes
C253	Move date dispute/ correction	No
C076	Service Denied - Deposit	No
C224	Complaint - Request Supervisor for Callback	No

BPEM Category	BPEM Description	Impacts Billing?
C225	Responding to Tree Trimming Letter	No
MR35	FCS: Demand Meter FND and LFT indexes don't match	No
BL35	No contract allocated to the installation	No
C093	Move-Out - Create new installment plan on new CA	No
C251	Bill Correction Required - ESCO	No
W036	Meter Change Request - WHR to DEM	No
C089	Drop - Reinstatement or Cancellation of a Drop	No
C249	Bill Correction Required - CDG	No
C256	Letter of Established Service	No
C262	Street Light Out	No
C261	Area Light Out	No
C250	Bill Correction Required - Collective	No
PR01	Error occurred printing print document	No
C254	LSE Form	No
C238	Issue Customer Refunds	No
C228	Payment History Request	No
C237	Rate Change	No
BL38	No meter reading results exist	Yes
MR28	Move monthly Non-Dem meter Cust to demand billing	No
C243	Explain - Demand Billing	No
C266	Tree Trimming follow up request	No
W038	Meter Change Request - WHR to TOU	No
C220	Bad Debt Settlement Request	No
C077	Service Denied - Written App / ID Required	No
C265	Meter Access Issue - Call Back Request	No
C259	Rate Inquires	No
BL51	Error updating installation facts	Yes
C257	Letter of Credit	No
FI37	Account is locked for posting	No

BPEM Category	BPEM Description	Impacts Billing?
BL11	No rate found for rate category	Yes
C263	Follow up to recent SMI	No
C218	Transfer BB setup PARR	No
C245	Theft of Service	No
FI09	HEAP payment to enroll in LIBDP; no installation facts	No
BL31	Billing order has incorrect status for billing	Yes
C227	Usage History Request	No
W015	Disconnect order was complete before move-out date	No
C208	Landlord / Owner Sold Property - Shared Meter	No
C200	ERT Opt Out Enrollment Form	No
C205	New Landlord - Shared Meter	No
C213	Bad Debt Satisfied Letter	No
C252	OBF Inquires	No
FI22	Collector Actions: Onsite Other	No
W030	To CSR - Appointment needed	No
W041	To Gas Crew	No
BL10	Error updating operand in installation	Yes
BL17	Proration greater than 24.0	Yes
C078	Service Denied - Owes Bill / Written App / ID Required	No
C109	Precise ID Alert Found on Customer	No
C223	Interconnection Status Request	No
C244	Explain - TOU Billing	No
MR31	Customer with two consecutive 0 Usage on Demand	No
C094	Move-in - Start Billing on Certain Area Lights	No
C105	Move-in/Transfer - Old Customer LNP and Dunn Lock	No
C206	New Landlord - No Shared Condition	No
C210	Energy Efficiency Rebate Status Update	No

BPEM Category	BPEM Description	Impacts Billing?
W003	Warning Tag - Outreach Department	No
BB05	Invoicing requires all contracts to be on Budget Billing	Yes
BL33	Meter reads are missing or implausible	Yes
BL53	Choose a shorter period	Yes
C102	Shared Meter Department Update	No
C212	Energy Efficiency Rebate Form Request	No
FI50	Company Use Account Not Maintained for Conn Obj	No
IDXD	MPM: General Process Error Resolutions (PE)	No
IN02	The existing billing documents cannot be invoiced	No
SM01	Shared Meter Landlord Penalty	No
SU01	Sundry Bill	No
BL24	Billing is terminated due to proration factor less than 0.5	Yes
BL96	Negative differences are not permitted	Yes
C091	Drop - Mistakenly Created by CSR	No
C211	Energy Efficiency Rebate Detail Inquiry	No
FI02	OBF loan file from concord missing initial loan	No
FI38	Account determination not possible	No
W010	Send To CSR for CSRO 186	No
W014	GAS Corrector change	No
W044	To District Director	No
BLA1	Rate category change happened off cycle	Yes
C219	Customer paid Bad Debt in Full	No
SU02	FOS Damage Claims	No
BL49	Subtransactions are inconsistent	Yes
BL50	Division not possible: divisor is 0	Yes
BL55	No register allocations for role	Yes
BL57	Inconsistent gas date for meter reading	Yes
BL98	Gaps in definition for tax determination indicator	Yes
C096	No Automatic Owner Allocation - Letter to Landlord	No

BPEM Category	BPEM Description	Impacts Billing?
C100	Move-in - Shared Meter Status	No
C107	Transfer - Customer on LSE	No
C116	Transfer Security Deposit to Other Account	No
C201	Direct Debit Enrollment Form	No
C207	Automatic Owner Allocation Enrollment Form	No
FI40	Tax code is invalid	No
W037	Meter Change Request - TOU to WHR	No
BL97	Update not possible for operand	Yes
C114	PSC Complaint	No
C214	Customer Natural Gas Interest	No
W005	Warning Tag - Extenuating circumstances	No
BL58	Allocate a profile to logical register	Yes
C075	Service Denied - Owes Bill / Deposit	No
C106	Move-Out - Customer on LSE	No
PR05	Bill Print Large Amount Validation (>$10MM)	Yes
BL26	The billing period is short, wait till the next billing period	Yes
BI14	Customer not Billed no existing exception found	Yes
C209	Landlord / Owner Sold Property - No Shared Condition	No
C234	Create Reconnect Order Through Move-In	No
W025	Meter Change Request - Dem to WHR	No
W047	Service Order completion failed in SAP	No
FI05	Identity theft case reported no move in request	No
C202	Direct Debit Cancellation	No
C236	Final Bill Correction	No
W020	Claims Indicated by field	No
W026	Send To Estimating	No
W028	To Customer Accounting	No
C088	Move-out - Stop Billing for Specific Area Light on Installation	No

BPEM Category	BPEM Description	Impacts Billing?
C079	Service Denied - DSS Commitment	No
IN09	SIM: Device/register multiple meter reading	No
W051	To Engineer	No
FI36	Balance is not $0, posting not possible	No
W050	To Meter Foreman	No
FI54	No Acct Determ possible for libpd credit	No
C008	Move-in - LSE Qualification and Enrollment	No
W045	To Service Supervisor	No
C204	Commercial Service Application	No
C203	Residential Service Application	No
BL99	Price1, price cat2, pricing level3 does not exist	Yes
W049	Shared Meter Sales Correction	No
BL01	Operand is missing	Yes
BL34	Move in read is missing	Yes
BL56	Temp. area missing for degree day weight	Yes
BL32	Installation has previous contract to be billed	Yes
C081	Deposit / Commercial App / Business Certificate / ID Required	No
W016	Send letter for Inactive Gas Retirement	No
W029	To Line Foreman	No
IN04	Posting for account determination not allowed	No
C084	Inactive Account with Peak Perks Credit Value	No
FI51	Cannot Determine Unique Revenue A/c for Item n Amt	No
W039	To Tree Crew	No
C229	Complaint - Reliability Issues	No
BLA0	No MR result marking end of billing period	Yes
W001	Appointment Missed for Service Order	No
C080	Service Denied - Landlord / Tenant Agreement	No
C230	Complaint - Meter Not Getting Read	No
MR29	Move Bi-mon Non-Dem meter Cust to demand billing	No

BPEM Category	BPEM Description	Impacts Billing?
BL14	Billing period spans a rate change	Yes
C074	Service Denied - Owes Bill / Past Due Amount	No
C215	Complaint - High Bill - PV	No
C082	Premise Inspection	No
BL45	Installation group	Yes
C221	Review Credit Balance (Refund)	No
W042	Meter Removal Failure	No
C233	Legacy Meter Reading Adjustment	No
C232	Legacy Customer Moves Adjustment	No
C098	Identity Theft Found during Move Process	No
W004	Warning Tag - 10 Day	No
FI53	Posting per x for company code 1500 already closed	No
BL74	Multiple billable billing orders exist	Yes
MT25	Billing- cannot create billing determinants	No
BL36	Gas Procedure is missing	Yes
BL30	Not possible to update installation facts	Yes
W011	Meter Lock order changed to Readover	No
BL39	No value found for price	Yes
BL09	Termination in Variant Inconsistent Sub-trans	Yes
W012	Meter Install for new business	No
C117	Notifi Deregistration	No
MT22	Net-metered account- cannot estimate for the Marketer Suspension.	No
MR25	Move Cust to non-demand Billing; Move to Bimonthly	No
W007	Transformed Pole number passed is invalid	No
W027	Return to Field	No
MR22	Create field order to check unknown usage	No
C090	Drop - Last Read Date Overlooked	No
BL37	Account determination not possible	Yes
C241	Explain - General Billing	No

BPEM Category	BPEM Description	Impacts Billing?
MT20	Meter Read not Received	No
MR17	No Access to meter: Initiate Legal action process	No
C242	Explain - Bill Correction	No
FI45	Misc. Credits (Sales Correction)	No
MR27	Move Bi-monthly Dem. meter Cust to demand billing	No
C095	Move-Out during Winter Period (Nov 1 - Apr 15)	No
C217	Complaint - High Bill	No
MR04	Exceeds Maximum Limits	Yes
W002	Appointment Kept for Service Order	No
IDXR	MPM: Repeat Process Step automatically (PE)	No
MR16	No Access to meter: Send form letter to customer	No
MR18	No Access to meter: Flag to meter reading sprvsr	No
MR26	Move monthly Dem. meter Cust to demand billing	No
PR03	Print Doc Special Handling Bill	No
PR02	Print Doc Out of Balance	No
MR15	Below Tolerance Limits	Yes
BB04	EITR bill doc dates doesn't fall into EABP dates, skip function	Yes
BL02	Contract is blocked for billing By User	Yes
BL04	Billing Document Out sorted	Yes
MT18	824 Negative Application Advice	No
MR32	Customers with 2 consecutive 0 usage readings	No
W009	Send To CSR	No
IN05	Preceding document not yet invoiced	No
BLA4	New bill document exists for this contract	No
BL29	Billing order not in selection process	Yes
IN01	Invoicing document has been out sorted	No
IN06	Invoicing lock	No

Exhibit B to Agreement

Updated Revised Monthly Meter Reading Plan dated June 11, 2024 ("Updated Revised Plan")

Central Hudson Gas & Electric Corporation ("Central Hudson" or the "Company") filed a monthly meter reading plan on January 17, 2023 ("Original Monthly Meter Reading Plan") in response to the order of the New York State Public Service Commission ("Commission") in Case 22-M-0645 *Proceeding on Motion of the Commission Concerning Central Hudson Gas & Electric Corporation's Development and Deployment of Modifications to its Customer Information and Billing System and Resulting Impacts on Billing Accuracy, Timeliness, and Errors*, issued and effective December 15, 2022.

By order issued on August 18, 2023, the Commission adopted the terms and conditions of a July 27, 2023 Interim Agreement entered into by Central Hudson and the Department of Public Service. Attached to the Interim Agreement was a revised monthly meter reading plan dated July 20, 2023 ("Revised Plan"), which reflected an accelerated timetable for the implementation of monthly meter reading that provided that the vast majority of the Company's customer base would be transitioned to monthly meter reading by the end of calendar year 2024, subject to certain specified contingencies.

After a successful pilot and testing, the Company launched a phased in monthly meter reading implementation plan during the first quarter of 2024.

The below sets forth an updated and amended schedule for the Updated Revised Plan:

June 1, 2024:	Approximately 51%, or over 150,000, of Central Hudson's customers have been transitioned to monthly meter reading pursuant to the Revised Plan. Of the remaining Central Hudson customers, approximately half are in the process of being transitioned to monthly meter reading. As a general matter, customers have been, and continue to be, transitioned to monthly meter reading on an operating division-by-operating division basis.
Third Quarter 2024:	Central Hudson will commence, continue and/or complete the transition to monthly meter reading for the vast majority of its customers.
October 31, 2024:	The Company will complete the implementation of monthly meter reading for the vast majority of the Company's customer base by October 31, 2024, which reflects a two-month acceleration of the timetable reflected in the Revised Plan (and a 15-month acceleration as compared to the Original Monthly Meter Reading Plan). It is the Company's intention to transition all customers to monthly meter reading by this date, subject to the below and/or any meter access issues that the Company may encounter beyond its control.

Central Hudson continues to believe that the implementation of monthly meter reading for all customers is in the best interests of its customers. On a rolling basis, the Company will continue to evaluate the accuracy of monthly meter reads and resulting bills and, if any material issues are identified, such issues will be promptly resolved.

The Updated Revised Plan is subject to the Company:

- not encountering any material external impacts (*i.e.*, the default or failure of an ESCO) or other significant system, technology or operational issues that are beyond the Company's control and that cause a disruption to its customer base for a prolonged period of time including but not limited to adverse storm events or other emergency events, significant unforeseen impacts to the Company's ability to maintain sufficient human resources, or the discovery of currently unknown issues regarding the accuracy of monthly meter reads and resulting bills;
- not being ordered to commence another billing or other system upgrade that would conflict with its resources in order to execute the Updated Revised Plan; and
- not being legislated by any government agency with proper authority to do anything inconsistent with the Updated Revised Plan.