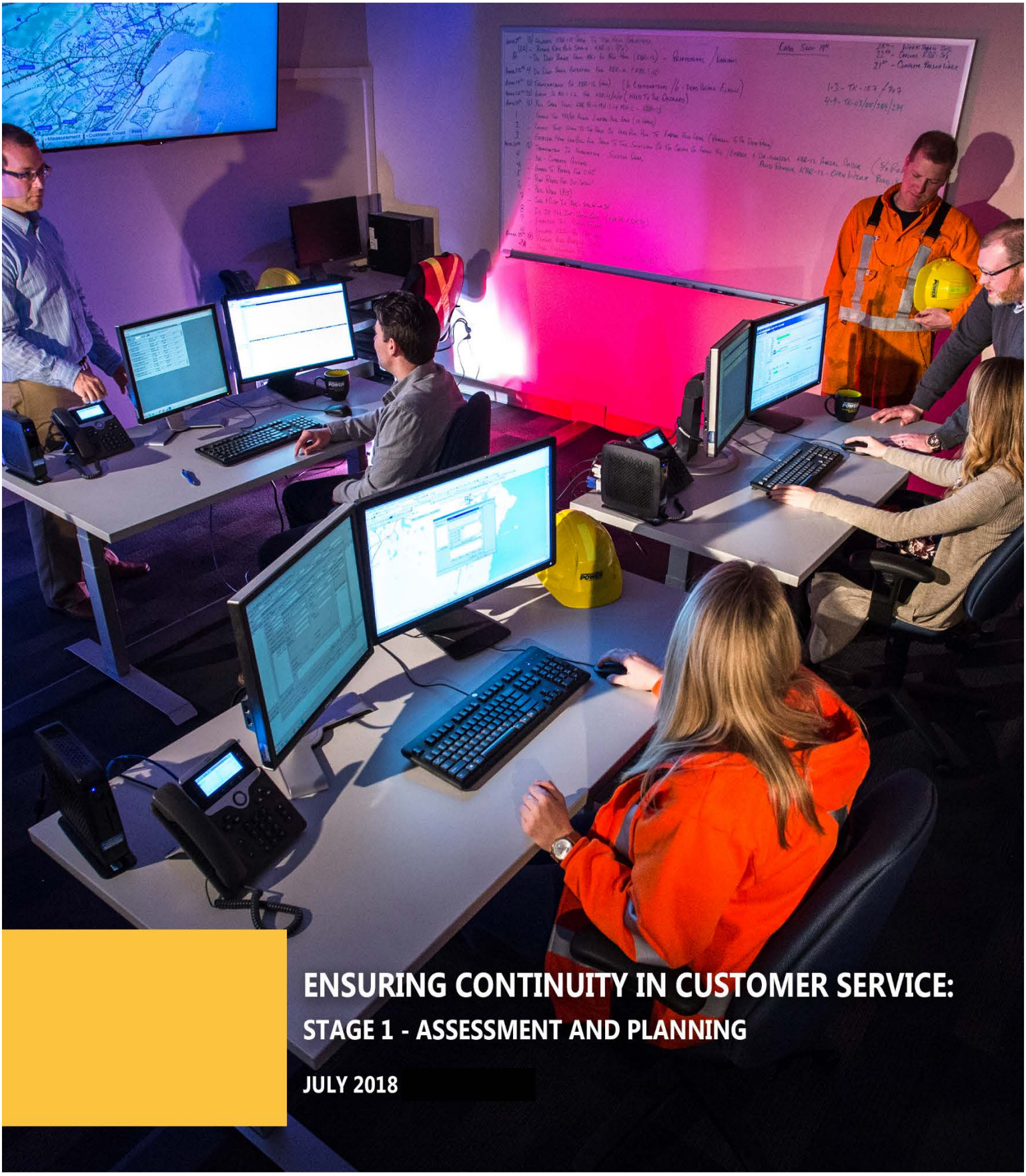
Q. Page 1-5, lines 15-16: Please provide details of the increased labour costs related to the planning of the replacement of the customer service system.

A. Newfoundland Power's Customer Service System was implemented 25 years ago and is approaching the end of its useful service life. The Company has developed a plan for assessing and planning for the system's replacement, entitled *Ensuring Continuity in Customer Service Delivery: Stage 1 – Assessment and Planning.* A copy of the plan is provided as Attachment A to this response.

Executing this plan will require employees from the Company's Customer Relations and Information Services departments to be assigned to the project on a full-time basis in 2019 and 2020. As such, the Company forecasts that temporary labour costs of $442,000 will be incurred in 2019 and $408,000 in 2020. This reflects the need to backfill affected positions to ensure core business functions continue to be completed.

The specific work to be executed as part of this project is detailed in Attachment A.

Ensuring Continuity in Customer Service: Stage 1 – Assessment and Planning



ENSURING CONTINUITY IN CUSTOMER SERVICE:

STAGE 1 - ASSESSMENT AND PLANNING

JULY 2018

WHENEVER. WHEREVER.
We'll be there.

NEWFOUNDLAND POWER
A FORTIS COMPANY

Table of Contents

1. Executive Summary

Newfoundland Power Inc. ("Newfoundland Power" or the "Company") is the primary distributor of electricity in Newfoundland and Labrador. The Company is responsible for delivering electricity and providing customer service to approximately 266,000 customers.

Since 1993, Newfoundland Power's approach to customer service delivery has been underpinned by its Customer Service System ("CSS"). The system supports all essential customer service functions, including customer account management and billing, customer communications and contact management, and program and service delivery.

The CSS has exceeded its expected service life of 20 years. Newfoundland Power expects to extend the system's service life to 30 years. Operation of the system beyond this timeframe presents increased functional and technical risks. These risks have been validated through a third-party assessment and are typical of billing systems implemented in the early 1990s.

Failure of the CSS would compromise Newfoundland Power's ability to complete essential customer service functions. Replacement of the system is a once-in-a-generation effort necessary to ensure continuity in customer service delivery.

The Company has developed a methodology for replacing the system based on industry best practices. The first stage of the methodology is Assessment and Planning. During this stage, Newfoundland Power will: (i) review existing customer service business processes, including any changes necessary to better serve customers; (ii) determine the functional and technical requirements of a replacement system to support these processes; and (iii) outline a plan for transitioning to a replacement system, including associated costs and timelines.

The Assessment and Planning stage began in 2018 and will be completed over 3 years at an estimated cost of approximately $1.3 million. The results of the Assessment and Planning work will inform a proposal to be contained within the Company's *2021 Capital Budget Application*.

2. Background

a. Customer Service Delivery at Newfoundland Power

Newfoundland Power is responsible for serving approximately 87% of all electricity customers in Newfoundland and Labrador. In 2017, the Company had approximately 266,000 total customers.[1] Providing efficient and responsive customer service is a principal business function of Newfoundland Power.

The Company's customer service delivery is comprised of 3 key pillars:

i. **Account management and billing** is a foundational element of providing service to customers. It involves reading over 254,000 customer meters, calculating and issuing approximately 3 million customer bills each year, managing all customer payments, and initiating collections processes, when necessary. The Company's approach to account management and billing has evolved over time to include options for customers such as paperless billing ("ebills"), the Equal Payment Plan, and online self-service options.[2] Such evolutions are necessary to continue meeting customers' service expectations.

ii. **Communications and contact management** is necessary to maintain customer relationships. Newfoundland Power receives over 2 million customer-initiated contacts each year.[3] Customers expect to receive timely and accurate information on their accounts, outages, and programs and services offered by the Company. Newfoundland Power maintains multiple channels to provide this information to customers, including telephone, email, a website, social media, and SMS texting. Customers are increasingly choosing digital

[1] All Newfoundland Power customer service data provided in this report was compiled as of year-end 2017.

[2] At year-end 2017, approximately 113,000 customers were enrolled in ebills, 43,000 customers were enrolled in the Equal Payment Plan, and over 97,000 customers had established accounts to use online self-service options.

[3] From 2013 to 2017, the Company received an average of approximately 2.4 million contacts from customers via telephone, email and the website.

communication channels to contact the Company.[4] Digital communication allows Newfoundland Power to provide customers with information on a round-the-clock basis.

iii. **Program and service delivery** includes customer conservation programs, customer financing programs, and requests for field work, such as tree trimming and new service connections. For example, Newfoundland Power has issued over 47,000 on-bill customer conservation rebates since 2009. The Company has also provided over $5 million in customer financing programs. Such programs and services support the delivery of reliable and responsive electrical service to customers. Newfoundland Power maintains the capabilities to provide these programs and services to customers throughout its service territory.

Newfoundland Power manages its overall customer service delivery in a manner that balances service responsiveness and cost effectiveness. The Company issues quarterly surveys to gauge customers' satisfaction with its service delivery. Over the last 20 years, customers have indicated an average satisfaction level of 88%. Over the same period, customer service costs were reduced by approximately 8%, while the number of customers increased by 54,000.[5] This operational efficiency has been supported by various technology-driven initiatives within the customer service function, including automated meter reading, paperless billing, and providing customer self-service options.[6]

[4] Over the last 5 years, visits to the Company's website more than doubled from approximately 1,005,000 in 2013 to 2,843,000 in 2017. Over the same period, email contacts from customers more than doubled from approximately 49,000 in 2013 to 124,000 in 2017.

[5] In 1998, Newfoundland Power had approximately 212,000 customers. This compares to approximately 266,000 customers in 2017. The Company's customer service costs were approximately $8.7 million in 1998 and $8.0 million in 2017. ($8,700,000 – $8,000,000) / $8,700,000 = 0.08, or 8%.

[6] These initiatives are described in Newfoundland Power's *2019/2020 General Rate Application, Volume 1, Application, Company Evidence and Exhibits, Section 2.2.2 Balancing Costs and Service,* pages 2-6 to 2-9.

b. Newfoundland Power's Customer Service System

i. System Functionality

The foundational technology underpinning Newfoundland Power's customer service delivery is the Company's CSS. The CSS was developed and implemented over 4 years at a total cost of approximately $10.2 million. It was launched in 1993 and, at the time, was the largest capital project in Newfoundland Power's history.

Implementation of the CSS modernized customer service delivery at Newfoundland Power. It allowed the Company to eliminate manual billing and account management processes and centralize its customer service function. This achieved operational efficiencies without reducing the level of service to customers.[7]

The CSS was developed with an expected service life of 20 years, but continues to provide broad-based customer service functionality today. Essential functions of the CSS include:

i. Storing, maintaining and protecting information related to over 266,000 active customer accounts and over 1 million inactive accounts, including account name, address, and contact details;

ii. Processing monthly metering data to automatically generate virtually all customer bills, including the automatic issuance of ebills to customers;[8]

iii. Tracking and applying customer payments and managing the Company's collections process, including generating automatic correspondence and calls to customers, when necessary;

[7] The centralization of the customer service function and resulting efficiencies were described in a Net Present Value Analysis filed with the Board on February 23, 1996.

[8] Billing for net metering customers and some large general service customers is currently completed through manual processes outside of the CSS.

iv. Connecting directly with the Company's website and telephone system to provide customer self-service options, including the ability for customers to view account balances, request payment arrangements, and report outages online;

v. Providing a record of customers' service history and previous contacts with the Company, which facilitates responding to a large volume of customer inquiries each year;

vi. Facilitating the delivery of programs and services to customers, including all on-bill customer conservation rebates, customer financing programs, and requests for field work; and

vii. Logging and tracking day-to-day work queues for customer service staff, such as customer billing adjustments, high billing inquiries, and energy conservation requests.

This functionality is essential to providing service to customers. Much of this functionality has evolved over the last 2 decades in response to changing customer expectations, industry practices and regulatory requirements. For example, the CSS was upgraded in 2003 to support the Equal Payment Plan for customers, in 2011 to deliver the Provincial Government's residential energy rebate, and in 2016 to deliver the Rate Stabilization Plan ("RSP") Refund to customers. Such modifications have resulted in a highly customized and complex system that is unique to Newfoundland Power. This complexity and customization is typical of systems implemented in the 1990s.[9]

[9] EY is a multinational professional services firm with expertise in information technologies. EY notes: *"In the early 1990s, commercial-off-the-shelf billing systems were not yet prevalent. The prevailing manner in which billing systems were implemented was to reutilize and build upon the most recently installed code base. While implementation methodologies certainly existed, the patchwork of regulations and customized business processes essentially created software systems that were more bespoke than standardized. CSS is such a system."* See EY, *CSS Technical Risk Assessment,* June 2018, page 10.

ii. Risks to Continued Operation

Critical failure of the CSS would practically limit Newfoundland Power's ability to provide responsive and efficient service to customers. Fundamental customer service functions, such as customer account management and billing, would be compromised if system failure were to occur.

As part of its routine technology planning, Newfoundland Power monitors emerging risks that could compromise the ongoing operation of the system and the delivery of service to customers. The Company has completed detailed assessments of the system in 1996, 2003 and 2013. Continued monitoring is prudent given the age of the system and its criticality to providing service to customers.

In April 2018, the Company contracted Ernst & Young LLP ("EY"), a multinational professional services firm, to assess the risks facing the CSS. EY conducted its assessment based on an established set of risk factors, available industry data, and interviews and workshops with system users. The results of this review are summarized below and provided in detail as Appendix A.

Table 1 lists the risk factors assessed by EY and the associated risk rating assigned by EY in 2018.

Table 1:
CSS Risk Assessment – EY Ratings

Risk Factor	2018 Rating
Vendor Market Share	Moderate-High
Vendor Health	Moderate-High
Support	Moderate
Reliability and Security	Low-Moderate
Business Enabling Risk	Moderate-High

EY's risk assessment of Newfoundland Power's CSS yielded a "moderate-high" rating in 3 of 5 categories: (i) vendor market share; (ii) vendor health; and (iii) business-enabling risk.

Vendor market share and vendor health are indicators of the potential for technology obsolescence. As product sales decline and vendor investment dwindles, it is increasingly likely that a technology will no longer be upgraded or supported by its vendor. Such obsolete technology faces a higher risk of failure, including failure due to cybersecurity threats.

EY observed that the market share of the technologies underlying the CSS has diminished and individuals with the skills to support those technologies are in short supply.[10] Research conducted by EY indicates that Newfoundland Power is the only Canadian utility still running a legacy system without a vendor-provided upgrade strategy.[11] EY also confirmed that, in many cases, vendor investment in these technologies has either ended or is uncertain.[12]

Business-enabling risk is an indicator of the potential for functional obsolescence. Functional obsolescence means a technology will no longer meet certain business requirements or evolve with customers' changing service expectations. Completing upgrades and enhancements on functionally obsolete technology generally requires a significant investment of time and resources.

EY assessed Newfoundland Power's CSS to have a moderate-high business-enabling risk. The results of a user survey conducted by EY indicate the functionality provided by the system is "manageable," but the ability to upgrade and enhance the system is inadequate.[13] Some system limitations have already materialized. For example, billing for net metering and some large general service customers is currently completed through manual processes. This is due to the cost and complexity of adding such functionality to the CSS. EY expects the risk of functional limitations to increase over time as customers' service expectations evolve.[14]

[10] See EY, *CSS Technical Risk Assessment,* June 2018, pages 7-9.
[11] See EY, *CSS Technical Risk Assessment,* June 2018, pages 9-10.
[12] See EY, *CSS Technical Risk Assessment,* June 2018, pages 12-14.
[13] See EY, *CSS Technical Risk Assessment,* June 2018, pages 17-18.
[14] See EY, *CSS Technical Risk Assessment,* June 2018, page 19.

The CSS is also facing diminishing support capacity over the next 5 to 10 years due to expected employee retirements. The CSS has been supported using internal Company resources since 1998.[15] Twelve Company employees are currently skilled in supporting the system. It is expected that 5 of these employees will be eligible for retirement within the next 10 years.[16] The skills necessary to support the system are not commonplace in the labour market and are no longer offered as part of postsecondary programs.[17] Diminished system support would increase both technical and functional risks. Based on these factors, EY determined the CSS has moderate support risk.

Overall, given the risks facing the CSS, "EY recommends that Newfoundland Power formalize and deepen its examination of CSS modernization options to include a thorough evaluation of the costs and benefits of replacement and deployment options."[18]

This recommendation validates Newfoundland Power's view that such an examination is necessary to ensure continuity in customer service delivery.

c. Current Industry Experience

Within the commercial marketplace, Newfoundland Power's CSS is referred to as a "Customer Information System." Extensive third-party research exists on when, why and how utilities are replacing their existing systems.

Industry research indicates the risks faced by Newfoundland Power's CSS are similar to the risks faced by other North American utilities. For example, the Association of Edison Illuminating Companies ("AEIC") notes that many Customer Information Systems were built in the 1990s and

[15] The CSS vendor, Andersen Consulting, notified the Company it was discontinuing support of the CSS in 1997. Newfoundland Power subsequently upgraded the system architecture to allow the system to be supported internally. This architecture remains the basis upon which the CSS operates today.

[16] Two employees with a high level of expertise in CSS will be eligible to retire by 2023. Three additional employees with a high level of expertise will be eligible to retire by 2028. The average age of these employees at year-end 2017 was 53 years.

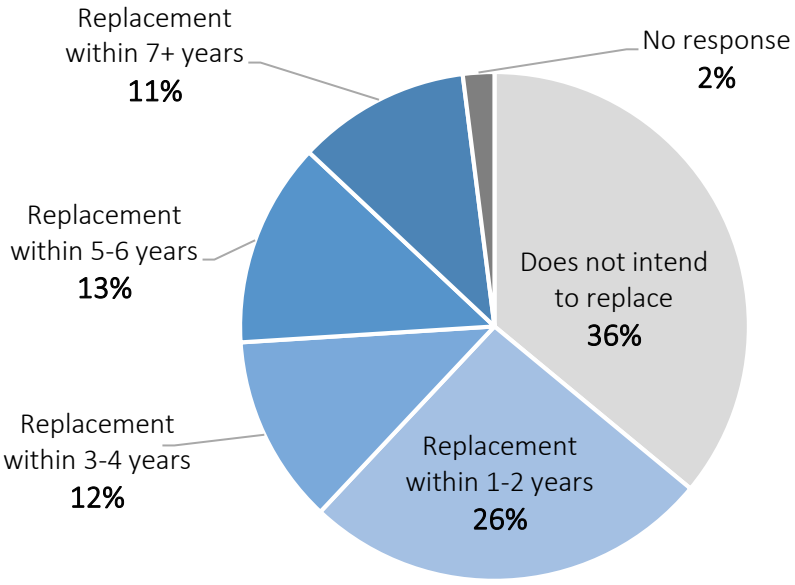
[17] See EY, *CSS Technical Risk Assessment,* June 2018, page 14.

[18] See EY, *CSS Technical Risk Assessment*, June 2018, page 21.

are commonly referred to as "legacy systems." The AEIC states that "the aging of these legacy systems, their related infrastructure, and the subject matter experts (SMEs) and system support personnel who know these systems and their business processes are key drivers for the business case to seek replacement systems."[19] This aligns with the experience of Newfoundland Power.

RIM Solutions, the research arm of TMG Consulting, surveyed North American utilities to determine whether they intend to replace their Customer Information Systems. The results of the survey are shown in Figure 1.[20]

Figure 1:
Industry Experience
Replacement of Customer Information Systems



[19] The AEIC was founded in 1885 and currently has 166 member companies. The AEIC encourages research and the exchange of technical information and best practices through various committees, including the AEIC Customer Service Committee. See AEIC, *CIS Strategy White Paper*, October 2017, page 5.

[20] TMG Consulting is a leading expert in utility information technologies, including Customer Information Systems. See TMG Consulting, *CIS Replacement Risk Mitigation,* April 2016, page 6.

RIM Solutions found that, in 2016, 62% of surveyed utilities intended to replace their Customer Information Systems. Fifty-one percent intended to replace their systems within the next 6 years.[21]

Current industry practice is to procure commercial, off-the-shelf Customer Information Systems that require minimal customization.[22] Such products can provide multiple customer benefits. For example, they are generally built with a modular design. This provides flexibility and allows a system to be cost-effectively upgraded as customer expectations and business requirements change. Commercial Customer Information Systems are also built to connect to other information technologies, such as Geographic Information Systems and customer communication channels. Such connectivity eliminates manual information-sharing processes, provides greater information when responding to customer inquiries, and enables customer self-service options.

Industry methodologies for replacing Customer Information Systems are well documented. Replacement projects are generally approached in stages. Initial stages consist of extensive "assessment and planning" work that focuses on outlining the requirements of the project and the process for moving forward. Subsequent stages involve "application development," whereby a software solution is procured, configured and implemented, and "post implementation," which involves stabilizing the system, concluding user training, and finalizing support arrangements.[23] Completing these stages is typically a multi-year effort, generally requiring 4 to 5 years.[24]

---

[21] The survey conducted by TMG Consulting indicated that 36% of utilities had already implemented a Customer Information System within the last 6 years. See TMG Consulting, *CIS Replacement Risk Mitigation,* April 2016, page 4.

[22] EY recommends minimizing customizations and notes: *"Customization (i.e. making changes to the standard code of the base package solution) is a surefire way to lose focus on value and squander resources, increasing cost and risk."* See EY, *Customer Plug in,* April 2015, page 30.

[23] Cognizant, a multinational information technology services company, outlines a methodology with 4 steps: (i) Business Case and Roadmap Definition; (ii) Pre-Implementation; (iii) System Development and Implementation; and (iv) Post Implementation (see Cognizant, *CIS Transformation: Unlocking the Value of Utilities' Customer Information Systems*, December 2013, page 5). TMG Consulting outlines a 4-step methodology that includes: (i) Planning; (ii) Procurement; (iii) Implementation; and (iv) Stabilization (see TMG Consulting, *CIS Replacement Risk Mitigation,* April 2016, page 2). EY uses a 3-stage process consisting of: (i) Strategy and Business Case Development; (ii) Planning and Preparation; and (iii) Implementation and Support (see EY, *CSS Technical Risk Assessment*, June 2018, page 22).

[24] See EY, *CSS Technical Risk Assessment*, June 2018, page 22.

Industry expertise indicates the average cost of replacing a Customer Information System for utilities that are similar in size to Newfoundland Power is approximately $31 million.[25]

3. Assessment & Planning

a. Assessment in Context

Replacing Newfoundland Power's 25-year-old CSS is a once-in-a-generation effort. Historically, the Company's customer service business processes and technology have been designed in tandem. Replacing the system therefore requires a fundamental assessment of how Newfoundland Power delivers customer service and how the underlying technology must be designed to ensure continuity within this function.

The Company has reviewed commonly accepted industry methodologies for completing such projects and developed a methodology based on industry best practices. Figure 2 shows the 3 stages of the Company's CSS replacement methodology, with a high-level summary of the key tasks to be completed as part of each stage.

Figure 2:
CSS Replacement Methodology

Stage 1: Assessment and Planning (2018 to 2020)	Stage 2: Application Development (2021 to 2022)	Stage 3: Post Implementation (2023)
• Assess current state of technology and business processes • Assess technical and functional requirements for target state • Create an application development plan • Assess data requirements and develop a plan for data transition	• Procure and configure solution • Test and validate solution • Migrate data • Connect system with other technologies • Pilot solution • Observe issues and implement corrections • Conduct staff training • Go live	• Monitor new system • Collect feedback and make improvements, as necessary • Complete transition to new system and retirement of the former • Conclude user training • Finalize support strategies

[25] Cost estimates for replacing Customer Information Systems are typically provided on a per-customer basis. In February 2018, EY indicated the average cost of replacement is $118/customer ($118/customer x 266,000 customers = $31 million).

The Company's CSS replacement methodology is designed to ensure continuity in the customer service delivery function. Stage 1, Assessment and Planning, will be completed over a 3-year period from 2018 to 2020. It will set the foundation for the replacement project by clearly articulating the business processes behind how the Company delivers customer service, the requirements for the underlying replacement technology, and a process for executing the project.

Following completion of the Assessment and Planning Stage, Newfoundland Power intends to put forward a proposal for replacing its CSS as part of its *2021 Capital Budget Application*. The proposal will detail the Company's approach to Application Development and Post Implementation. This timeline is consistent with implementing a new customer service solution within the next 5 years and was reflected in the Company's *2018 Capital Plan*.[26]

b. Assessment & Planning Milestones

Inclusion of an Assessment and Planning Stage within Newfoundland Power's CSS replacement project is consistent with industry best practices and the recommendation of EY.[27] There are 4 milestones within the Assessment and Planning Stage: (i) Current State Assessment; (ii) Target State Assessment; (iii) Application Development Planning; and (iv) Data Assessment.

[26] Newfoundland Power's *2018 Capital Plan* indicated: "While the current versions of hardware, software and database technology should be supported throughout this capital plan period, commencing in 2021, the Company has included a project to commence the replacement of its Customer Service System." See page 19 of the *2018 Capital Plan,* provided with the Company's *2018 Capital Budget Application.*

[27] The AEIC notes: *"Do not underestimate the importance of pre-work. Document as-is process flows clearly and comprehensively" and "spend time to document detailed business requirements"* (see AEIC, *CIS Strategy White Paper,* October 2017, page 9). TMG Consulting notes: *"Most CIS replacement experts believe that the planning phase of a CIS replacement project is most critical to its success and for good reason. It sets the stage for everything that follows: the procurement, implementation, stabilization and operation of the system"* (see TMG Consulting, *CIS Replacement Risk Mitigation*, April 2016, page 7). EY has recommended that Newfoundland Power "formalize and deepen its examination of CSS modernization options" (see EY, *CSS Technical Risk Assessment,* June 2018, page 21).

i. Current State Assessment

The goal of the Current State Assessment is to detail the business processes behind how Newfoundland Power currently delivers customer service, how these processes are supported by the underlying CSS technology, and the strengths and weaknesses of the current approach.

The Current State Assessment will review and document over 300 business processes through interviews, surveys and workshops with approximately 90 subject matter experts within the Company. Identifying and documenting these processes is necessary to determine the specific processes that must be supported by the replacement system. Consultations with Newfoundland Power customers will be completed to identify potential areas for improvement within the customer service delivery function.

The Current State Assessment will also assess the technology underlying the CSS. Over 4,000 pages of design documentation, and several thousand pages of programming code, will be reviewed and updated to outline how well the CSS technology operates to support related business processes, including the system's connectivity to other operational technologies.[28] Technology risks will continue to be assessed throughout this work to inform the timing of subsequent project stages and any required changes to contingency planning necessary to minimize emerging risks.

ii. Target State Assessment

The goal of the Target State Assessment is to outline how Newfoundland Power will continue to provide customer service over the longer term and the functional and technical requirements of the underlying replacement technology. This will be completed by: (i) assessing the results of the Current State Assessment; (ii) developing a set of requirements for future business processes and technology; and (iii) scoring these requirements against the capabilities of commercial software products.

[28] A conceptual diagram of how the CSS connects to other technologies is provided in EY, *CSS Technical Risk Assessment,* June 2018, Appendix A.

Completing this assessment requires an understanding of the capabilities of commercial software products. With the assistance of an industry consultant, the Company will review industry standards, best practices and emerging trends. This information will be collected through interviews with software vendors, industry advisors, and utilities with recent experience replacing their systems. In addition to functionality, various technical criteria will be considered, including the: (i) performance and complexity of the underlying technology; (ii) ease of integration with other technologies; (ii) flexibility to implement new functionality over time; (iii) support and maintenance requirements; and (iv) cybersecurity capabilities.

The Target State Assessment will yield a set of alternative solutions to meet Newfoundland Power's requirements. Each alternative will be evaluated based on how it meets the Company's requirements, the benefits that would be delivered to customers, all associated resource requirements and costs, and implementation timeframes. Ultimately, the Target State Assessment will result in the development of a set of requirements for how Newfoundland Power will ensure continuity in customer service delivery.

iii. Application Development Planning

The goal of Application Development Planning is to identify how Newfoundland Power will implement a replacement Customer Information System that meets customers' service expectations and all regulatory and business requirements.

Based on the findings of the Target State Assessment, the Application Development Plan will outline:

i. Any changes to business processes that are required to ensure efficient and responsive customer service delivery over the longer term;

ii. The functional and technical requirements of the replacement system, including required connectivity to other Company systems, support and maintenance requirements, and cybersecurity requirements;

iii. A resourcing plan for developing and implementing the replacement system, including existing staff that will be assigned to the project and any hiring requirements;

iv. An estimate of the capital cost to implement the project and subsequent operating costs once the replacement system has been installed; and

v. A procurement plan outlining the processes to be used for purchasing the required hardware, software and vendor support for the project;

vi. A timeline for project execution, encompassing both the Application Development and Post Implementation Stages of the project.

The Application Development Plan will inform a project proposal to be contained within the Company's *2021 Capital Budget Application*.

iv. Data Assessment

The goal of the Data Assessment is to support a seamless transition of all necessary customer data to the replacement system. The transition of data is necessary to ensure the Company can continue to provide accurate and timely information to customers.

Newfoundland Power's CSS includes 25 years of customer data related to approximately 266,000 current customer accounts and over 1 million inactive accounts. There are nearly 500 million records contained across hundreds of database tables.

The Data Assessment will determine: (i) which data will be transitioned to the replacement system; (ii) any quality issues with the data and an approach for addressing those issues; and (iii) how the data will be transitioned to the replacement system, including necessary security requirements to protect customer and Company data. This work aligns with industry best practice.[29]

c. Project Costs and Timeline

The required Assessment and Planning work for replacing the Company's CSS will primarily be completed using internal labour. In addition, an industry consultant with experience completing similar projects will be contracted to provide recommendations and expertise throughout this work.

Table 2 provides a breakdown of the operating costs associated with the Assessment and Planning Stage of the CSS replacement project.

Table 2:
Assessment and Planning Costs
($000s)

	2018F	2019F	2020F
Current State Assessment	150	197	-
Target State Assessment	-	286	-
Application Development Planning	-	134	165
Data Assessment	-	-	373
Total	**150**	**617**	**538**

[29] EY notes: *"Failure to ensure data quality means that the transition to the new system is more complicated and lengthy, leading to potential delays in the overall project."* EY recommends that: *"Utilities need to spend adequate resources to ensure that the data quality in the new solution is of sufficient quality to process transactions and provide the reporting information the company needs to run its core business operations."* See EY, *Customer Plug in*, April 2015, page 32.

In total, this Assessment and Planning work is estimated to cost approximately $1.3 million over 3 years. These costs are described in Newfoundland Power's *2019/2020 General Rate Application* and are included in the Company's forecast operating costs within this Application.[30]

Table 3 provides a timeline for completing the Assessment and Planning Stage of the CSS replacement project.

Table 3:
Assessment and Planning Timeline
($000s)

Milestone	Completion Date
Current State Assessment	Q2 2019
Target State Assessment	Q4 2019
Application Development Planning	Q2 2020
Data Assessment	Q4 2020

The Assessment and Planning Stage of Newfoundland Power's CSS replacement project began in 2018 and is expected to be completed over approximately 3 years.

4. Conclusion

Customer service delivery is a principal business function of Newfoundland Power. For over 25 years, the Company's customer service delivery has been underpinned by the CSS.

The CSS was originally developed with an expected service life of 20 years. Newfoundland Power expects to extend the system's service life to 30 years. Operation of the system beyond this timeframe presents increased technical and functional risks. These risks have been validated through a third-party assessment. Critical failure of the system as a result of one or more of these

[30] See the *2019/2020 General Rate Application, Volume 1, Application, Company Evidence and Exhibits, Section 2.2.2 Balancing Costs and Service*, page 2-11.

risks would practically limit Newfoundland Power's ability to deliver responsive and efficient service to customers. Planning for replacement of this system is therefore necessary.

Newfoundland Power has developed a methodology for replacing its CSS based on industry best practices. This methodology will ensure continuity in the customer service delivery function over the longer term.

The first stage in the methodology requires extensive assessment and planning work to determine how the Company will continue to provide responsive and efficient customer service, the functional and technical requirements of the underlying technology, and a process for implementing the replacement system.

Details of the proposed technology to be implemented, including the associated costs, customer benefits and timeframes, will be provided as part of the Company's *2021 Capital Budget Application.* This timeline is conducive to implementing a new customer service solution within the next 5 years.

Appendix A: CSS Technical Risk Assessment

CSS Technical Risk Assessment

Newfoundland Power

June 2018

Building a better working world

Building a better working world

Dieppe
11 Englehart Street
Dieppe, NB E1A 7Y7
Tel: +1 506 853 3097
Fax: +1 506 859 7190

Fredericton
527 Queen Street
Suite 110
Fredericton, NB E3B 3T2
Tel: +1 506 455 8181
Fax: +1 506 455 8141

Halifax
RBC Waterside Centre
1871 Hollis Street
Suite 500
Halifax, NS B3J 0C3
Tel: +1 902 420 1080
Fax: +1 902 420 0503

Saint John
Red Rose Tea Building
5th floor
12 Smythe Street
Saint John, NB E2L 5G5
Tel: +1 506 634 7000
Fax: +1 506 634 2129

St. John's
Fortis Place
5 Springdale Street
Suite 800
St. John's, NL A1E 0E4
Tel: +1 709 726 2840
Fax: +1 709 726 0345

Ernst & Young LLP
Atlantic Canada
ey.com

17 June 2018

Frank Flynn
Manager, Enterprise Architecture and Solutions Delivery
Newfoundland Power
55 Kenmount Road
St. John's, NL
A1B 3P8

High-level technical risk assessment of CSS

Dear Mr. Flynn,

Ernst & Young LLP ("EY") has completed its assessment of the technical risks associated with the continued use of Newfoundland Power's Customer Service System ("CSS"). Our engagement was performed in accordance with the agreement dated 20 April 2018 between EY and Newfoundland Power.

The intent of this report is to address the three main areas of focus. Newfoundland Power requested a third party provider to:

- Conduct high-level research to document risks associated with the foundational technologies used to implement the current in-house supported and maintained CSS;
- Identify any growing risks associated with the prolonged use of the technologies; and
- Develop a recommendation with regard to a suitable course of action to help remediate concerns highlighted by the review.

This report summarizes our technical risk assessment results, findings and recommendations.

Thank you for the opportunity to work with you and your colleagues on this project.

Yours sincerely,

Ernst & Young LLP

Disclaimer

This report is intended for the information and use of Newfoundland Power. In preparing this report, EY relied on information by publically available sources and information provided by the client. EY has not audited, reviewed or otherwise attempted to verify the accuracy or completeness of such information. This report has not considered issues relevant to third parties and is subject to certain limitations. Any use such a third party may choose to make of this report is entirely at its own risk. We disclaim all responsibility for loss or damage, if any, suffered by any third party as a result of reliance on, decisions made or actions taken based on this report.

Table of contents

1. Executive summary

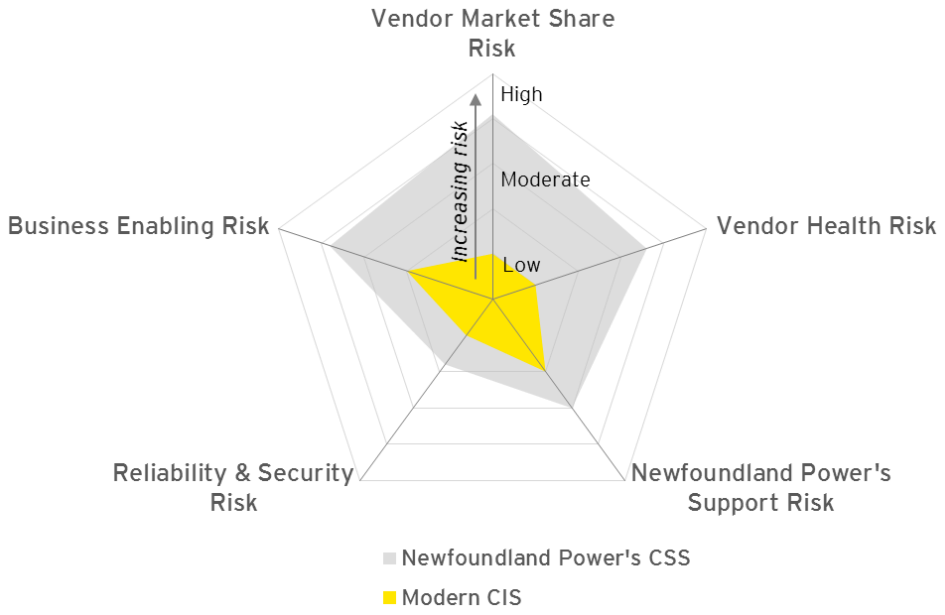
Newfoundland Power engaged EY to perform an assessment of the risks associated with the continued use of its Customer Service System ("CSS"). This work was performed during May and June of 2018. Results were compiled from research, interviews, a full-day workshop, surveys, direct observation of Newfoundland Power Customer Service Representatives ("CSRs"), and materials and reports provided by Newfoundland Power personnel.

The overall recommendation arising from the review is that Newfoundland Power should formalize and deepen its examination of CSS modernization options to include a thorough evaluation of the costs and benefits of replacement and deployment options. In addition, Newfoundland Power should develop contingency plans for CSS support and training to mitigate any unexpected loss of key personnel over the next five years.

These recommendations are supported by risk assessment results which indicate higher levels of risk across the dimensions evaluated, which include:

- Vendor market share risk
- Vendor health risk
- Newfoundland Power's support risk
- Reliability and security risk
- Business enabling risk

To provide a basis for comparison, we have also plotted the risk levels that we believe Newfoundland Power would experience if it were operating a modern, commercial-off-the-shelf customer information system ("CIS").



Note: **"CSS"** refers to Newfoundland Power's current technology platform and **"CIS"** or Customer Information System refers to a modern, commercial-off-the-shelf platform.

Vendor market share risk is moderate-high relative to a modern CSS for two reasons. The first is that Newfoundland Power's CSS is nearing obsolescence. The number of companies using systems based upon the same operational technologies that comprise CSS is small and shrinking. It is often thought that technologies such as an operating system are static, in reality they follow a well observed path from early adoption into market maturity and finally obsolescence. Obsolete technologies receive little new investment, gain no new customers, don't stay abreast with emerging standards and attract no new IT talent.

The second market share risk relates to CSS as a whole. CSS is part of the Customer/1 ("C/1") family of billing systems, which in the 1990's was a leading billing solution in the utility industry. By 2000, over 30 utilities including some of the largest in North America utilized Customer/1. Today that number has fallen dramatically, and we believe Newfoundland Power is the last Customer/1 user in Canada. This means there is no shared investment in improving the capabilities of C/1 – all R&D into improving C/1 will come solely from Newfoundland Power.

Vendor health risk for CSS is moderate-high but would be low with a modern CIS. Vendor health risk is high when the technology owner is financially unstable or has communicated no obvious desire to invest in the technology's future. In general, the vendors that own the foundation technologies that comprise CSS are financially sound, but the commitment to future investment is limited. In several cases, vendor support for key technologies for CSS has either already ended or is scheduled to end in the near future. For CSS component technologies with extended support plans, future investments are expected to be minimal.

Newfoundland Power's support risk is moderate for CSS and would be low with a new CIS. When we decompose CSS we find that each of the foundational technologies is supported by only one or two employees judged to have a high-level of proficiency (a total of four employees over five technologies). This level of support is lean but representative of how Newfoundland Power has supported its CSS for many years. EY has observed in its experience that utilities have considered this concentration of knowledge in a small number of employees, coupled with a high number of pending retirements and the inability to quickly train new employees on obsolete technologies as one of the key risks and reasons for considering a CIS replacement.

Modern CIS projects commonly require up to five years when one accounts for the time spent planning, mobilizing and implementing. Ready access to the IT and business professionals with deep knowledge of the legacy system is paramount to the new CIS project's success. Should Newfoundland Power ultimately elect to replace its CSS, EY would recommend starting the initiative before its resource pool of CSS-knowledgeable IT and business personnel is further diminished through retirements or unexpected departures.

Reliability & security risk is low-moderate for CSS and would be low with a modern CIS. CSS does not pose an immediate operating risk to Newfoundland Power. The system is stable, unplanned outages are infrequent, and there were no apparent security issues associated with the foundational technologies noted during our research or our interviews. From a security perspective, there is a risk that as the market share of the foundational technologies

shrinks further, the network of companies and users that might detect a security threat on those technologies will likewise decline, making Newfoundland Power potentially more vulnerable over time.

Business enabling risk is moderate-high relative to a modern CIS due to the difficulty implementing any enhancements, whether ordered by external entities or simply expected by Newfoundland Power's customers. Legacy, monolithic systems like CSS lack a true modular design, and even modest changes are costly due to the extensive design considerations and testing requirements. The cost-benefit hurdle becomes even higher when one considers that CSS is not a long-term viable solution.

Meeting future expectations and requirements will require Newfoundland Power to continue its progress toward becoming a more digitally enabled, integrated utility, with people, processes and systems that can exchange information more seamlessly. EY has observed in its experience that most utilities have determined that their legacy billing system will not fully support that vision.

2. Background and introduction

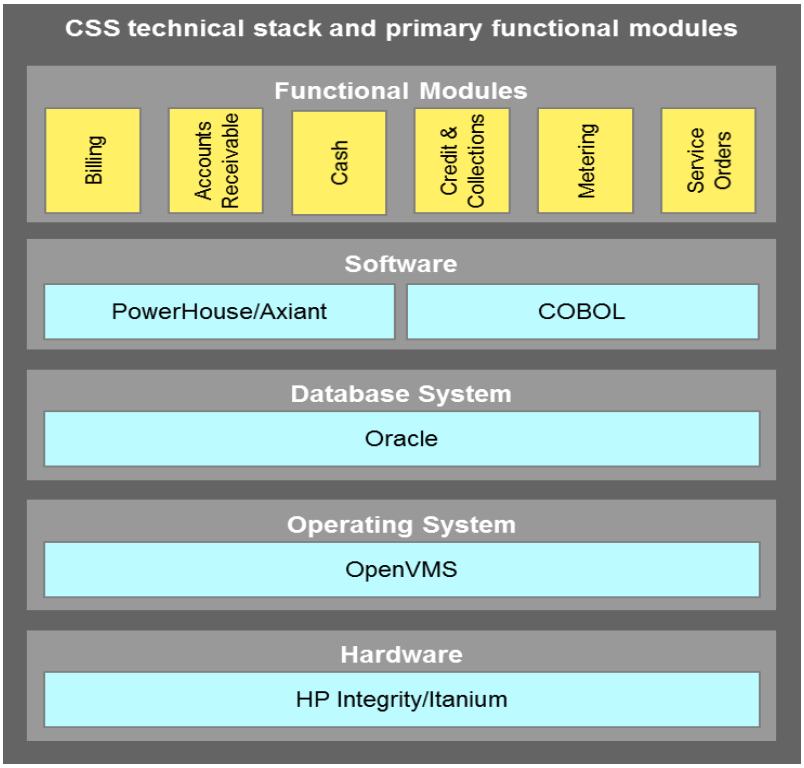
Newfoundland Power currently runs a Customer Service System ("CSS") which belongs to the family of Customer/1 billing systems, a once leading solution marketed and implemented by Andersen Consulting, primarily in the 1990s. The system went live in 1993 and has been highly customized over the last 20+ years. Newfoundland Power made significant renovations to the system in 1998 by adopting a client server architecture. CSS is currently comprised of a light client application front-end running on the Customer Service Representatives' ("CSRs") desktops and an application server/database server running on a single production server.

CSS is the primary system used by Newfoundland Power to support customer billing and by its CSRs to support and manage interactions with customers. It currently supports approximately 45 CSRs, both local and remote. Our observation of CSRs indicated that CSS supported their function efficiently.

The daily CSS batch process begins at approximately 5:00 pm and generally finishes a few hours later. On average the system generates approximately 14,000 bills per cycle (19 cycles per month). Separate servers host development and test environments as well as Disaster Recovery ("DR").

The foundational technologies used for Newfoundland Power's CSS are depicted in the figure below:

Figure 2.1: CSS foundational technology stack



The Operating System (OS) hosting the CSS is OpenVMS version 8.4. The system is composed of a number of modules running on Axiant 3.4 and PowerHouse 8.4. The application modules make calls to the Oracle Database running version 10.2.0.5 using the Oracle ProCOBOL precompiler. Batch modules are primarily written in HP COBOL version 2.9 with some modules offloaded to a windows server written in VB.Net.

The hardware for the CSS is primarily from Hewlett Packard Enterprise (HPE). The application servers and database servers for both production and non-production systems are hosted on HPE Integrity BL860c i2 Server Blades. These servers have 32GB RAM and dual internal 146GB drives. The servers also features dual Itanium 9320 1.33 Ghz quad core processors. The primary storage used is an HPE 3PAR StoreServ 7000 storage array. Production data volumes are hosted on Solid State Drives (SSD) while development data volumes are hosted on Fast Class 10K Hard Disk Drives (HDD).

General statistics for technologies used are summarized in the table below:

Table 2.1: CSS foundational technology statistics

Table 2.1: CSS foundational technology statistics				
Foundational technology	**Technology type**	**Modules**	**Reports**	**Estimated lines of code**
Online Axiant	Software	209	n/a	136,000
Online COBOL	Software	45	n/a	98,000
Batch COBOL	Software	347	n/a	537,000
Batch PowerHouse QTP	Software	96	7	6,000
Batch PowerHouse QUIZ	Software	362	421	37,000

One of the characteristics of utility billing systems is the large number of interfaces to other systems and Newfoundland Power's CSS is no exception. CSS is integrated with nearly 40 other operational systems for Newfoundland Power. These integrations are done via database connections and file transfers to the application server/database server. BizTalk middleware is used for complex orchestrations between applications such as the customer website and CSS. All other integrations query/write to the production database (or a copy of it) or move files to/from the application server.

An illustration of these integrations can be found in Appendix A.

3. Project scope and approach

The scope of the assessment was to:

- Conduct high-level research to document risks associated with the foundational technologies used to implement the current in-house supported and maintained CSS;
- Identify any growing risks associated with the prolonged use of the technologies; and
- Develop a recommendation with regard to a suitable course of action to help remediate concerns highlighted by the review.

EY's experience evaluating legacy systems indicates that "technical risk" is best assessed by examining a set of factors, or risk dimensions, so that the evaluation can move beyond anecdotal evidence to specific risks. Further, once these specific risks are identified, potential mitigation steps can be devised.

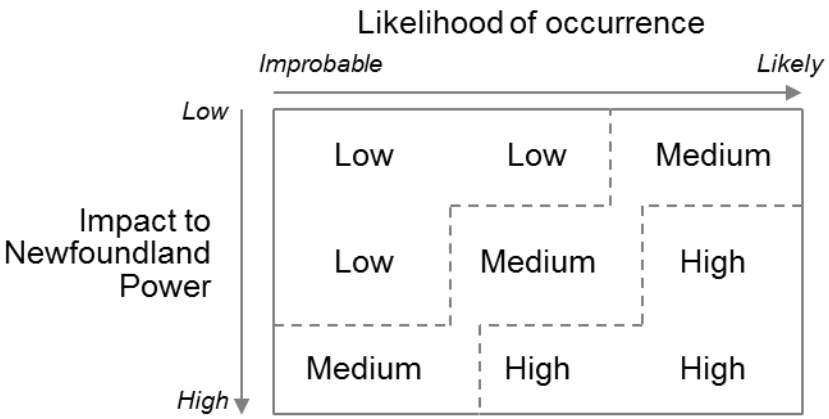
For this assessment, five risk dimensions were evaluated. These are described in table 3.1.

Table 3.1: Description of risk dimensions

Risk dimension	Measured how?	For what purpose?
Vendor market share	▸ Evaluated market share (%) of each foundational technology ▸ Determined prevalence of Canadian utilities which use a system similar to Newfoundland Power's CSS ▸ Determined remaining market share of other North American utilities that installed systems similar to Newfoundland Power's CSS (Customer 1)	▸ To gauge the availability of CSS talent in the industry ▸ To determine what % of other utilities continue to operate their legacy CSS ▸ To determine why other utilities may have replaced their legacy CSS
Vendor health and future	▸ Considered financial health indicators of the companies that own the foundational technologies ▸ Identified plans, where possible, of vendors to extend the live or reinvest in the foundational technologies	▸ To determine the likelihood of the vendors to continue supporting the foundational technologies ▸ To determine the effect on CSS if vendors discontinue support for the foundational technologies
Newfoundland Power's support capacity	▸ Identified the number of people with CSS expertise, from both a functional and a technical perspective ▸ Determined the likely longevity of those employees, assuming each would retire at 60	▸ To gauge the ability of Newfoundland Power to continue supporting CSS should key individuals elect to leave or retire
Reliability & security	▸ Interviewed CSS users to determine if the system experiences outages and impact ▸ Interviewed IT support personnel regarding CSS planned and unplanned outages and impact ▸ Researched known security risks associated with the foundational technologies	▸ To determine if CSS poses a current risk to Newfoundland Power, either through poor performance or potential security vulnerabilities

Table 3.1: Description of risk dimensions		
Risk dimension	**Measured how?**	**For what purpose?**
Business enabling	► Surveyed key business and technical CSS users regarding the ability of the system to support current and future business and customer needs as well as anticipated Public Utilities Board ("PUB") requirements ► Observed CSS users to gauge their ability to perform their primary tasks	► To determine if CSS poses a risk to Newfoundland Power's mandate to provide effective customer service now and into the future

Each risk dimension was then rated on from low to high by considering both the likelihood of occurrence and the potential impact to Newfoundland Power.



These ratings are subjective and are drawn from research conducted as part of this engagement and EY's experience in performing similar assessments and participating in CIS projects.

4. Risk evaluation results

4.1 Vendor market share risk

Our overall rating for vendor market share risk is moderate-high, versus a new CIS which would be low risk. This conclusion was reached by evaluating vendor market share from three vantage points. First, we reviewed and augmented materials compiled by Newfoundland Power to determine the market share of each foundational technology that comprises CSS. Next, we looked at what other Canadian utilities were using to bill and manage customers. Finally, we reviewed the landscape of utilities that had installed Customer/1 billing systems to determine which were still in use.

Market share and related observations for the foundational technologies

Multiple components of the CSS technology platform are nearing obsolescence. Data provided by International Data Corporation show the customer base for the foundational technologies used by the CSS are very small and continue to decrease[1].

OpenVMS - Gartner[2] is cautioning corporations who use the OpenVMS operating system[3]. Hewlett Packard Enterprise ("HPE") has stopped selling the operating system[4]. Market share has declined to 0.3%, compared to 12.8% to 23.1% for competing systems[5]. The intellectual property for OpenVMS is now owned by a company named VMS Software which provides the operating system sales and support. VMS Software has certified the latest generation Itanium hardware (now only sold by HPE).

COBOL - An IT Market Clock for software programming languages, compiled by Gartner, defined COBOL as one of the oldest programming languages in use among mainstream IT organizations[6]. Gartner has given COBOL their second lowest score, indicating that individuals with this skill are in short supply and demand for the skill is falling.

IBM claims 200 billion lines of COBOL code are still in use today by various industries. Organizations are spending millions on COBOL development and maintenance. Although few universities still offer COBOL courses, the language remains crucial to businesses and institutions around the world. Experienced COBOL programmers can earn more than US$100 an hour when they get called in to patch up glitches, rewrite coding manuals or make new systems work with old[7].

The market share of COBOL has declined by 5.5% in the last 12 months. Market share is 1.22% compared with a 78.62% market share owned by PHP and 9.49% owned by Java applications[8].

PowerHouse - The software programming languages used to design and modify the CSS are no longer commonplace in the industry[9]. PowerHouse was introduced over 35 years ago as a fourth generation language (4GL) for rapid application development. UNICOM Global still markets the PowerHouse suite, which includes Axiant, as a development environment[10], however sales figures are scant and EY could find no evidence of any of our other utility clients using PowerHouse. In fact, leading IT analysts such as Forrester[11] no longer include information on PowerHouse or Axiant in their annual low-code application development comparisons. Both the TIOBE Programming Community index and the Programming Language Popularity Index are two leading measures of the popularity of programming languages[12]. None of the primary software programming languages used for the CSS design and modification are included in the index lists. Lastly, PowerHouse and Axiant are absent from any job listings on Indeed Canada[13], a popular job posting website.

Server platform - Gartner also provides a similar IT Market Clock for server computing platforms[14]. It has identified the CSS architecture as legacy technology and have stated the business case for further development and support by the vendor is becoming compromised[15].

Gartner does not expect the longevity of new Integrity server sales to last beyond 2023. It has recommended all companies using the Integrity server platform should be developing contingency plans for future migration or replacement. HP Integrity servers have a current market share of 0.5%. Per Gartner, the market share of Integrity servers declined by 23.5% globally in shipments and 18.3% in vendor revenue. HP is encouraging its customers to switch from Integrity to x86 based Xeon chips, which holds a current market share of more than 90%[16].

Although the technology components for CSS are currently supported, a declining market share is generally an indicator of risk that a product may no longer continue to be offered by its vendor in the future. Over time, it will be less viable for the independent software vendors to offer and support the legacy technology used by the CSS. Generally, many of these legacy technologies are at risk of becoming obsolete in the coming years.

CSS/CIS market share in Canada

Newfoundland Power is one of 20 Canadian utilities that serve more than 100,000 electric retail customers. We excluded utilities serving less than 100,000 from our analysis as they generally have less extensive requirements and therefore often purchase and operate less robust billing systems.

Through our jurisdictional scan, the data shows that the vast majority of Canadian utilities have implemented new CIS systems. Of the 20 Canadian utilities reviewed, Newfoundland Power is the only one using a legacy system with no upgrade path provided by the original vendor.

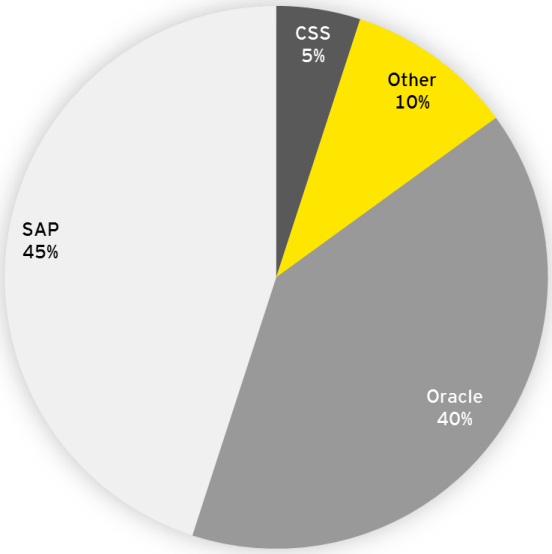
Table 4.1: Canadian utilities with current CIS system

Utility	Province	Type	# of customers	Current CIS
Newfoundland Power	NL	Private	270K	Customer/1
Nova Scotia Power (Emera)	NS	Private	500K	Cogsdale
New Brunswick Power	NB	Public	336K	SAP
Hydro Quebec	QC	Public	4.1M	SAP
Hydro One	ON	Private	1.3M	SAP
Toronto Hydro	ON	Municipal, private	770K	Oracle (upgrade in progress)
PowerStream (Alectra)	ON	Municipal, private	250K	Oracle
Hydro One Brampton (Alectra)	ON	Municipal, private	160K	Oracle
Enersource (Alectra)	ON	Municipal, private	220K	Oracle
Horizon Utilities (Alectra)	ON	Municipal, private	300K	Oracle
London Hydro	ON	Municipal	200K	SAP
Peel Water	ON	Municipal	350K	Oracle
Durham Water	ON	Municipal	250K	Oracle
Algonquin Power	ON	Municipal	500K	SAP (In progress)

Utility	Province	Type	# of customers	Current CIS
Manitoba Hydro	MB	Public	500K	Banner
SaskPower	SK	Public	468K	SAP
ENMAX	AB	Municipal	835K	SAP
EPCOR	AB	Municipal	335K	SAP (In progress)
ATCO	AB	Private	233K	Oracle (In progress)
BC Hydro	BC	Public	1.8M	SAP

Represented graphically, one can immediately see that modern systems dominate the Canadian landscape.

Figure 4.1: Current CSS Canadian market share (%) as a % of installs



Customer/1 use in North America

In the early 1990's, commercial-off-the-shelf billing systems were not yet prevalent. The prevailing manner in which billing systems were implemented was to reutilize and build upon the most recently installed code base. While implementation methodologies certainly existed, the patchwork of regulations and customized business processes essentially created software systems that were more bespoke than standardized. CSS is such a system.

CSS is part of the Customer/1 family of billing systems that were marketed, implemented, and often supported by Andersen Consulting starting in the late 1980s. Early versions were mainframe based and written in COBOL. Many leading utilities implemented Customer/1, and several still operate it today. However, in the past two to three years, several of these utilities have either migrated off Customer/1, begun formal evaluation projects, or made a decision to replace and are in the midst of their implementation projects.

The following table illustrates the disposition of Customer/1 installations in North America.

Table 4.2: Disposition of Customer/1 installs in North America						
Utility	Holding Co.	State/ Province	Current CIS	Evaluating/ implementing	Target system	Likely on C/1 in 5 years?*
AEP	AEP	OH	C/1	X	TBD	No
Dayton P&L	AES	OH	C/1			Yes
CILCO	Ameren	IL	C/1			Yes
Illinois Power	Ameren	IL	C/1			Yes
Connecticut Nat Gas	Avangrid	CT	C/1			Yes
Orange & Rockland	ConEd	NY	C/1	X	Oracle	No
Virginia Power	Dominion	VA	C/1			Yes
Carolina P&L	Duke	NC	C/1	X	SAP	No
Florida Power	Duke	FL	C/1	X	SAP	No
Western Resources	Evergy	KS	C/1	X	Oracle	No
BG&E	Exelon	MD	Oracle			N/A
ComEd	Exelon	IL	C/1	X	Oracle	No
PECO	Exelon	PA	C/1	X	Oracle	No
Newfoundland Power	Fortis	NL	C/1			TBD
Ontario Hydro	Hydro One	ON	SAP			N/A
Midwest Energy	Midwest Energy	KS	C/1			Yes
Brooklyn Union	National Grid	NY	C/1			Yes
Niagara Mohawk	National Grid	NY	C/1			Yes
FP&L	NextEra	FL	C/1	X	TBD	TBD
SDG&E	Sempra	CA	C/1	X	SAP	No
Southern Co Gas	Sempra	CA	C/1			Yes
Atlanta Gas Light	Southern Company	GA	C/1	X	TBD	No
Southern Company	Southern Company	GA	C/1	X	TBD	No
Wisconsin Electric	We Energies	WI	Open-C			N/A
Wisconsin Gas	We Energies	WI	Open-C			N/A
Wisconsin PS	We Energies	WI	C/1	X	Open-C	No
Northern States	Xcel	MN	Peace			N/A
PS of Colorado	Xcel	CO	Peace			N/A

* N/A refers to a utility that has already moved to another system

The market share of Customer/1 is falling rapidly, and within five years only nine of the original 29 listed here are likely to still be operating it. The specific reasons for replacement are not uniform, but of the clients EY has worked with, all have cited similar drivers, namely:

- Inability of the legacy system to cost-effectively meet new customer and regulatory demands
- Difficulty attracting, retaining, and replacing the IT personnel operating and maintaining the system
- Security concerns related to IT obsolescence once the underlying technologies are no longer patched and supported by the vendors

All three of these concerns are also relevant to Newfoundland Power.

4.2 Vendor health risk

Our overall rating for vendor health risk is moderate-high, versus a new CIS which would have low risk. For each foundational technology vendor, EY conducted high-level research to review their financial stability and gauge their commitment to future investment and development into the technology. While several of the foundational technologies are reaching obsolescence, the vendors which own them are financially stable, and some are making modest attempts to extend the lives of these technologies.

Table 4.3: Foundational technology vendor health summary

Foundational technology	Technology type	Owner (licensee)	Financial stability	Investment commitment
Axiant	Software	Unicom Global	Stable[17]	No defined roadmap[18]
HP COBOL	Software	Hewlett Packard Enterprise	Stable[19]	Ended
HP COBOL	Software	VMS Software (VSI) licensee	Private – no data	High [20]
PowerHouse	Software	Unicom Global	Stable	No defined roadmap [21]
Oracle on OpenVMS	Database	Oracle	Stable[22]	Low
OpenVMS	OS	Hewlett Packard Enterprise	Stable	Ended
OpenVMS	OS	VMS Software (VSI) licensee	Private – no data	High [23]
Itanium	Processors	Intel	Stable[24]	Ended

OpenVMS

Hewlett Packard Enterprise (HPE), who owns OpenVMS, plans to continue to support OpenVMS on its Integrity i2 line of servers "through at least 2020[25]". HPE is moving away from OpenVMS as a long-term solution for its customers but is not abandoning them. Lorraine Bartlett, Vice President of Marketing Strategy and Operations for HP's Business Critical Systems unit said "while we do have a targeted end date, that doesn't mean support will definitely end [26]".

In 2014, HP signed an exclusive license to VMS Software Inc. ("VSI") to continue to develop and support OpenVMS. VSI is funded by the investors of Nemonix Engineering, a long time provider of support and maintenance for OpenVMS systems. VSI hopes to expand the OpenVMS footprint and sell it to new customers. VSI has already implemented support for Intel's Itanium eight-core Poulson chips and plans on supporting the operating system on new server lines including support for x86 processor based systems. Support on x86 infrastructure is a significant challenge but necessary for the future of OpenVMS. The effort has been underway for several years and VSI currently does not have a firm date for completion[27].

OpenVMS could also be supported using emulators or containers on modern infrastructure. Newfoundland Power has indicated a valid reluctance to run OpenVMS and its applications using this approach due to the introduction of another layer of technology and possible incompatibilities as well as the associated risks.

PowerHouse and Axiant 4GL

PowerHouse, originally developed by Cognos, was acquired by IBM in February 2006 and later acquired by UNICOM Global in December 2013. The family of tools includes Cognos PowerHouse 4GL server, Cognos Axiant 4GL and Cognos PowerHouse. Similar to PowerHouse, Axiant 4GL was developed by IBM Cognos and was acquired by UNICOM Global in December 2013.

PowerHouse software hasn't been enhanced in over 10 years[28] and licensing costs for existing software will likely increase over time as the supply of skilled people to support and maintain PowerHouse dwindles.

COBOL

The Common Business-Oriented Language was developed nearly 60 years ago and has been gradually replaced by newer, more versatile languages such as Java, C and Python. In the United States, the financial sector, major corporations and parts of the federal government still largely rely on it because it underpins systems that were built in the 70s or 80s and never fully replaced[29].

HP COBOL is an integrated product with OpenVMS and is typically upgraded and enhanced in conjunction with OS upgrades. VSI plans to continue to support HP COBOL with updates to maintain compatibility with OS upgrades[30].

Oracle on OpenVMS

In March 2011, Oracle announced it would end support for Itanium processors, including those products running on OpenVMS. By September 2012, Oracle was forced to continue to provide support for Itanium via a lawsuit by HPE. Oracle resumed supporting its database on OpenVMS in 2012 but that version lags behind versions for other environments. The current release for OpenVMS is 11.2.0.4 while Linux and Windows have had 12c since 2013.

Oracle ended extended support for version 10.2 (the version used by Newfoundland Power) back in 2013[31], but added limited extended support (severity 1 fixes only) that extended support to July 2017. Newfoundland Power is currently planning to upgrade to Oracle database version 11.2 which has a slightly longer support timeline (extends into 2018). Oracle has announced that they will eventually end all extended support for 11.2 and have not committed to a release date for 12c on OpenVMS[32].

HPE Integrity/Itanium

HPE's Integrity line of servers is based on the Intel Itanium processor. Once a hopeful contender for 64 bit processors, Itanium never lived up to expectations. Intel announced in May 2017 it was ending development on the Itanium family of processors. HPE has said it will keep support for Integrity servers up and running until 2025 but will also try to get customers to move to servers based on x86 processors[33].

Long-term prospects for the Itanium processor ran aground when Microsoft ceased support in 2010. Red Hat had already announced plans to drop support for Itanium based systems the year prior, and Oracle followed with similar announcement in 2011. Once these major server makers stopped offering hardware based on Itanium processors software development stalled. HPE was the last holdout.

Some companies have chosen to remain on Integrity servers for as long as feasible. A significant risk of doing so is the fact that independent software vendors (ISVs) are dropping support for the applications hosted on Integrity servers. The lack of innovation around Itanium will limit a company's ability to take advantage of new technologies such as virtualization, cloud computing and new storage technologies that can reduce data centre costs.

4.3 Newfoundland Power's CSS support capacity risk

Our overall rating for CSS support capacity risk is moderate, versus a low rating which would accompany a new CIS. This area is a significant risk to Newfoundland Power as there is a very high level of concentration of technical proficiency for the CSS in a small number of people, increasing the risk for continued support capacity.

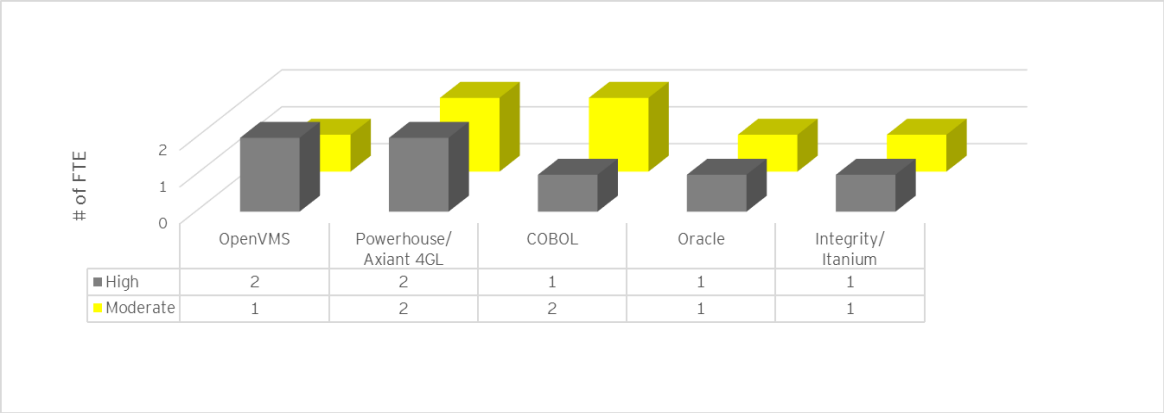
This risk is not easy to mitigate. Employees within Newfoundland Power who are familiar with CSS business processes may lack the aptitude or interest to become CSS technical experts. Similarly, hiring specialists in the foundation technologies from outside the company is of limited value as gaining the institutional knowledge of what CSS does and why would require many months to reach proficiency. EY could not find any Canadian university that offers courses relating to PowerHouse, OpenVMS or Axiant in any available computer science or IT syllabus highlighting that the specific skillsets required to maintain CSS would be difficult to find in the Newfoundland and Labrador market.

Two support capacity exercises were conducted by EY with Newfoundland Power CSS key stakeholders. The first exercise identified individuals that had core technical knowledge and

responsibility for the five foundational technologies. Each technology was listed and names were assigned based on a high and moderate expertise level.

The results show that the support capacity of the underlying technical components is adequate right now, however the same, small group of staff support both the technical and functional upkeep for CSS. From a pure technical support perspective, two primary individuals support three foundational technologies, while three or four others have moderate-low knowledge. The breakdown of high-moderate technical proficiency is shown in figure 4.3:

Figure 4.3: Support capacity by foundational technology

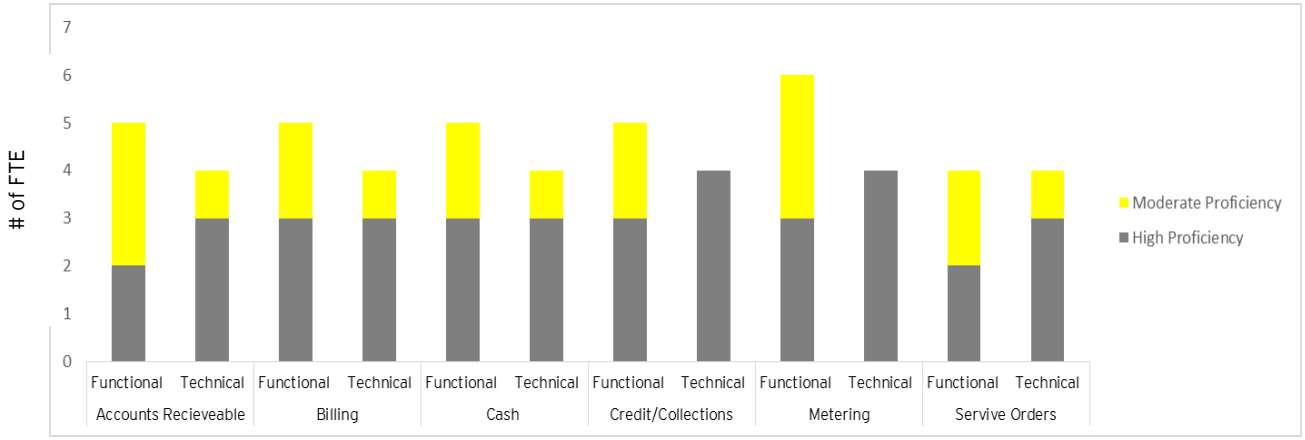


The second support capacity exercise asked stakeholders to assign staff based on business function. Six functions were identified:

1) Billing
2) Accounts Receivable
3) Cash
4) Credit and Collections
5) Metering
6) Service Orders

Individuals were classified in each area based on two criteria: 1) technical knowledge (writing code etc.) and 2) functional knowledge (power users of the system). As illustrated in figure 4.4, a total of 12 employees were identified in the results as having high to moderate knowledge (either technical of functional) in the areas specified.

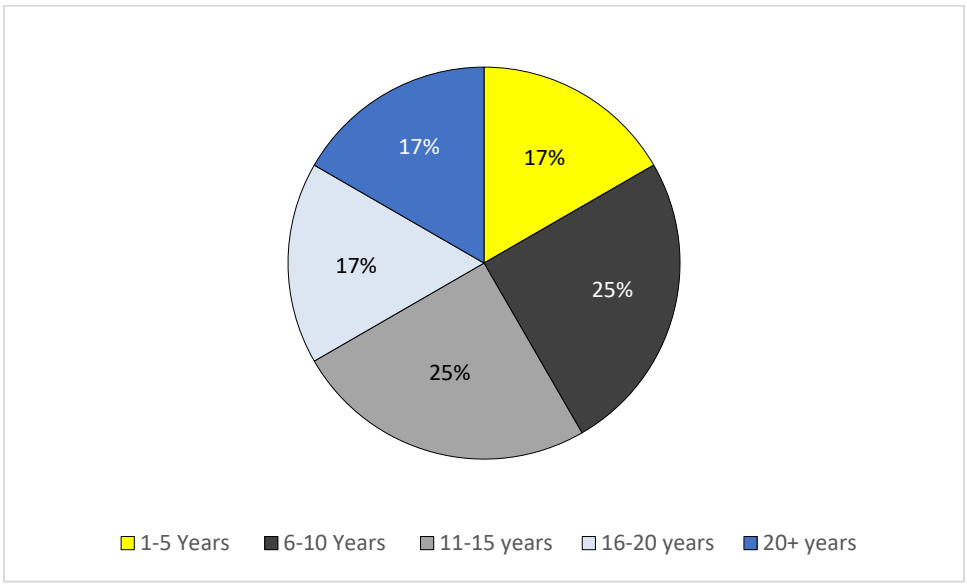
Figure 4.4: Support capacity by function (# of FTE)



Writing new code to modify a highly customized, legacy system raises another issue of considerable concern to utilities. Personnel familiar with the architecture, design, and operation of these systems and therefore with the talent and skill to manage and maintain them, are becoming scarce. Within Newfoundland Power, several may soon retire, and some have recently retired.

As shown in figure 4.5, assuming an average age of retirement of 60, based on the current ages of identified employees, 42% of the individuals identified as key support personnel in this survey may retire within 10 years.

Figure 4.5: Support capacity by year of retirement



4.4 Reliability & security risk

Our overall rating CSS reliability and security risk is low-moderate, versus a low rating for a new CIS. CSS does not pose an immediate operating risk to Newfoundland Power. From a reliability standpoint, the system is stable and unplanned outages are infrequent. In fact, the majority of people we interviewed could not recall a long, unplanned outage. While the core of CSS is complex and largely built from outdated languages, Newfoundland Power has rewritten some existing functions (e.g. bill print) and added other new capabilities in newer languages such as .Net. This has added resiliency to the overall system while also expanding the available pool of people who can modify and maintain those modules.

From a security perspective, it is important to note that EY did not conduct an in-depth security assessment of CSS as it was not part of the scope. However, EY obtained information conveyed during interviews and the workshop. Information provided indicates that CSS appears to be adequately protected from external intrusions.

Security issues to aging systems often arise due to the lack of support and security patches from the vendor. In this scenario, and particularly given the shrinking market share of the foundational technologies, the network of companies and users who might detect a security threat will likewise decline, making Newfoundland Power potentially more vulnerable over time.

4.5 Business enabling risk

The overall rating for business enabling risk is moderate-high, versus a low rating for a new CIS due to the difficulty implementing any enhancements, whether ordered by external entities or simply expected by Newfoundland Power's customers.

Our methodology for determining business risk included surveying key business and technical users. We utilized a survey so that users could submit their answers anonymously, and then the aggregated results were discussed as a group to eliminate interpretation errors and generate further understanding. EY did not survey all end-users (e.g. CSRs), the survey was administered only to members of Newfoundland Power's team that has been examining CSS options. This included 5 business users and 3 technical users.

When surveyed, the survey respondents scored CSS as "manageable" when it came to its current functionality and its ability to support operational efficiency, respectively. In the tables that follow, the range of responses is indicated by the horizontal bar, with the average score represented in the circle. Scores ranged from 1 point for "Inadequate" to 5 points for "Good". The full results of the technical and functional survey can be found in Appendix B.

	Inadequate	Significant limitations	Manageable	Fair	Good
CURRENT FUNCTIONALITY/ SUITABILITY	Only satisfies few of the requirements	Major enhancement needed	Significant modifications required	Minor modifications required	Completely acceptable as is
Indicate the completeness of the set of functions/features that are provided by the application for current requirements. For example, how much do you need to work outside the application to complete a process					

	Inadequate	Significant Limitations	Manageable	Fair	Good
OPERATIONAL EFFICIENCY/PROCESS SUPPORT	Array of opportunities for increasing operational efficiency and productivity		Somewhat labour intensive but majority of activities are automated		Limited opportunities for further streamlining the organization
Indicate level of automation and appropriate support of business processes, or the opportunity to increase operational efficiencies of the business organization with respect to this application. For example, how labor intensive is the application.					

However, these same survey participants scored CSS as between "inadequate" and "significant limitations" when it came to cost effectively incorporating enhancements. In fact, we see this today with the inability of CSS to support net metering customers.

	Inadequate	Significant limitations	Manageable	Fair	Good
EASE OF INTRODUCING PRODUCTS/SERVICES ENHANCEMENTS	Can Only incorporate new requirements with high effort/cost		Can incorporate new requirements with moderate cost/effort		It is very easy to make changes, with low effort/cost
Indicate how easily (effort/cost) the application can adapt to changes in business requirements.					

During interviews, some elaborated that changes to CSS are so costly and time consuming that it's difficult to cost-justify some enhancements. In EY's experience, this is often the case with legacy, monolithic CSS platforms: the lack of modularization makes any change

potentially complex and testing efforts much more complex than with a new CIS. The 2011 Government mandated Residential Energy Rebate provides a good example. This fairly modest change to CSS to provide an 8% energy rebate to eligible customers required 26 weeks of effort for an IT team of four to design, code and unit test the change.

This risk is likely to rise over time due to rising expectations from Newfoundland Power's customers. Perceptions of "good customer service" are changing both within and outside of utilities. Multiple factors such as smart meters, renewable energy, social media and increasingly tech-savvy customers are serving to reset expectations higher, and causing utilities to rethink their customer engagement and service strategies. Customers increasingly want utilities to engage with them in a proactive, personalized fashion using a communication channel of their choice. Meeting these future expectations and requirements means Newfoundland Power becoming a more digitally enabled, integrated utility, with people, processes and systems that can exchange information more seamlessly. Most utilities have determined that their legacy billing system will not fully support this vision.

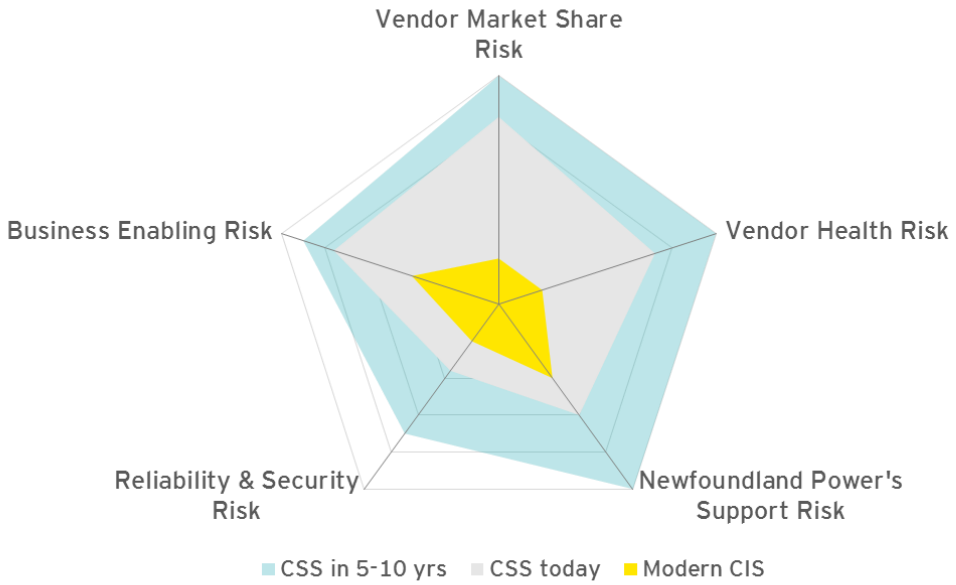
5 Risk rating summary and recommendations

CSS does not pose an immediate operational risk to Newfoundland Power, however there are significant risks associated with continuing to operate and maintain CSS which EY believes should be addressed in the near-term:

- **Vendor market share risk**: CSS and its foundational technologies have very low market share, which creates a high risk for Newfounland Power due to the lack of available skills and investment beyond what Newfoundland Power elects to fund.
- **Vendor health risk**: While the vendors that own the foundational technologies are financially stable, there's little evidence of any further enhancements or viable upgrade paths which creates a moderately high risk for Newfoundland Power as obsolescence approaches.
- **Support capacity risk**: Today there is a small, capable team supporting CSS, but the concentration of knowlodge in such a small number of employees, particularely when potential retirements are taken into account, creates a future ongoing support risk for Newfoundland Power.
- **Reliability and security**: One bright spot for CSS is that it is reliable and secure. However, that reliability stems, in part, from limiting enhancements to the CSS. Also, without the availability of security patches to some of the foundational technologies, we believe the security risks to CSS will grow.
- **Business enabling risk**: CSS is poorly positioned to support Newfoundland Power in the emerging digital environment, where customers expect more personalized information about their usage in a channel and time of their choosing.

These risks are not static and will increase over time. Figure 4.6 provides a snapshot of the risks Newfoundland Power assumes today (in grey) versus a modern, commercial-off-the-shelf ("COTS") package (in yellow). The light blue shape illustrates how those risks could increase over the next 5 to 10 years assuming no significant changes to CSS's underlying architecture and technologies.

Figure 4.6: CSS risks over time



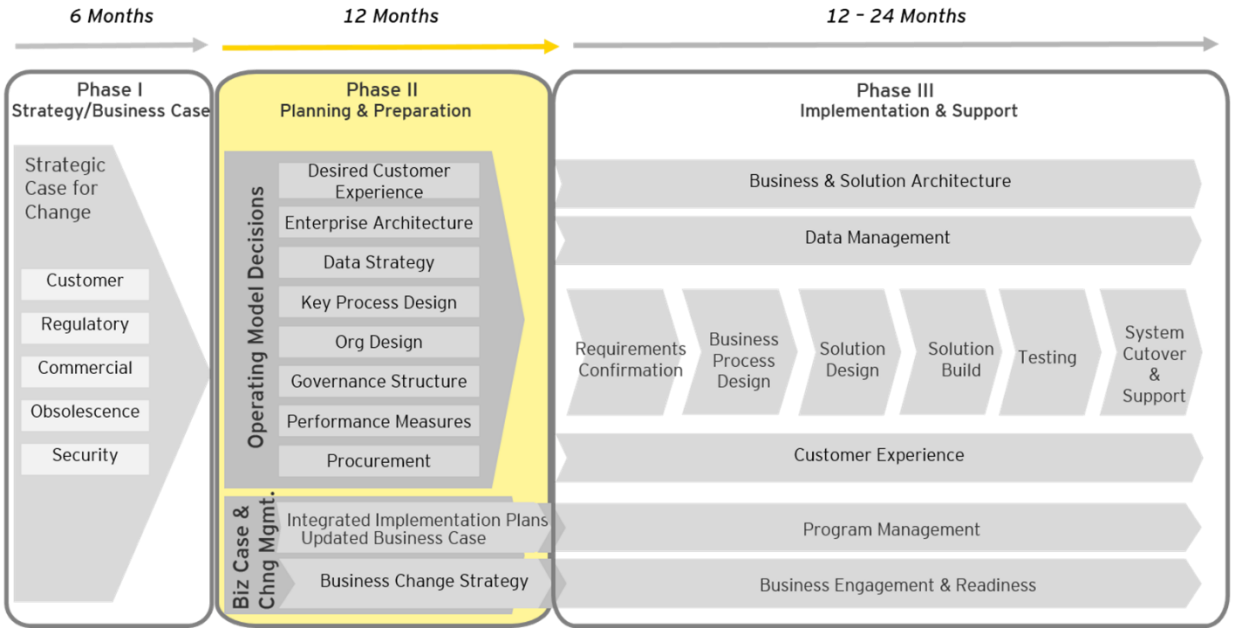
These risks point to the need to eventually replace CSS. Based upon our experience with other utilities, EY does not believe that there is a viable life-extension strategy for Newfoundland Power that could mitigate these risks satisfactorily.

Newfoundland Power presently has a window where it can take the appropriate time to thoroughly evaluate its CSS replacement options.

Recommendation 1: EY recommends that Newfoundland Power formalize and deepen its examination of CSS modernization options to include a thorough evaluation of the costs and benefits of replacement and deployment options

In EY's experience, the life cycle of a CSS/CIS replacement program spans multiple years and typically consists of a three-phased approach as illustrated below in Figure 4.7.

Figure 4.7: Typical CSS/CIS replacement program timeline



The length of these phases, plus the gaps that generally exists between phases, equate to the total elapsed time frame of 4-5 years that EY generally observes for CSS/CIS replacements from initial planning to go-live. Given the approaching obsolescence of the foundational technologies and the nearing retirements, EY recommends Newfoundland Power begin its assessment and planning activities soon.

Recommendation #2: Due to increasing risk associated with the CSS support model, EY also recommends that Newfoundland Power develop contingency plans for CSS support and training to mitigate any unexpected loss of key personnel over the next five years.

As noted earlier, there are no easy-fixes to generating additional support capacity for legacy systems. Consistent with industry best practice, Newfoundland Power has begun to investigate this issue with the aim of developing a rolling five-year support plan for CSS.

[1] International Data Corporation (IDC) is a global provider of market intelligence, advisory services and events for the IT, telecommunications, and consumer technology markets. Data provided by IDC show sales of core CSS technology components (Itanium based servers and OpenVMS operating systems) in Canada from 2013 – 2017 have negative compound annual growth rates of -26% and -23% respectively.

[2] Gartner Inc. is an American research and advisory firm providing IT related data, analysis and performance indicators for IT and business leaders.

[3] OpenVMS is a computer operating system for use in general-purpose computing and is the successor to the VMS Operating System that was produced by Digital Equipment Corporation, which was first released in 1977.

[4] Hewlett Packard Enterprise Company (commonly referred to as HPE) is an American multinational enterprise IT company based in Palo Alto, California.

[5] This information was obtained from iDatalabs, a computer technology market analysis company. The information indicated the following market shares for operating systems: (i) OpenVMS – 0.34%; (ii) Canonical Ubuntu – 23.07%; (iii) Debian – 13.17%; and (iv) CentOS – 12.80%.

[6] Gartner IT Market Clock for programming languages analyzes programming languages used in IT organizations worldwide to discover emerging languages for potential systems of innovation, to track mainstream languages with a view to spotting approaching obsolescence, and to justify migration from legacy assets that are incurring technical debt.

[7] https://www.reuters.com/article/us-usa-banks-cobol-idUSKBN17C0D8?feedType=RSS&feedName=technologyNews&utm_source=Twitter&utm_medium=Social&utm_campaign=Feed%3A+reuters%2FtechnologyNews+%28Reuters+Technology+News%29

[8] https://idatalabs.com/tech/programming-languages

[9] A programming language is a set of rules and instructions used by a software developer to write programs that allow humans to interact with a computer system to perform tasks. The CSS uses a number of legacy computer programming languages including PowerHouse, COBOL, Axiant 4GL and Digital Command Language ("DCL").

[10] https://teamblue.unicomsi.com/products/powerhouse-4gl/#

[11] Forrester Research is an independent technology and market research company that provides advice on existing and potential impact of technology, to its clients and the public. Forrester Research was founded in July 1983.

[12] The TIOBE Programming Community index is an indicator of the popularity of programming languages. The index is updated once a month by querying internet search engine results for reference of software programming languages. The Popularity of Programming Language Index is created by analyzing how often language tutorials are searched on Google.

[13] https://ca.indeed.com

[14] Gartner IT Market Clock for Bimodal Compute Platforms positions 29 asset classes of compute platform, server and SDx technologies according to their current position in their market lives and relative commoditization levels.

[15] https://vmssoftware.com/pdfs/VSI_Roadmap_20171215.pdf

[16] https://www.enterprisetech.com/2017/12/15/gartner-worldwide-server-revenue-grew-16-q3-shipments-5-1/

[17] https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=214280424

[18] No publically available product roadmap for new features

[19] https://www.moodys.com/credit-ratings/Hewlett-Packard-Company-credit-rating-372000

[20] https://vmssoftware.com/pdfs/VSI_Roadmap_20171215.pdf

[21] No publically available product roadmap for new features

[22] https://www.moodys.com/credit-ratings/Oracle-Corporation-credit-rating-561300

[23] https://vmssoftware.com/pdfs/VSI_Roadmap_20171215.pdf

[24] https://www.reuters.com/finance/stocks/overview/INTC.OQ

[25] http:// www.computerworld.com/article/2483794/operating-systems/hp-plans-to-close-the-book-on-openvms-in-2020.amp.html

[26] www.computerworld.com/article/2483794/operating-systems/hp-plans-to-close-the-book-on-openvms-in-2020.amp.html

[27] https://vmssoftware.com/pdfs/VSI_Roadmap_20171215.pdf

[28] https://www.computerworld.com/article/2497657/operating-systems/openvms--r-i-p--1977-2020-.html

[29] https://idatalabs.com/tech/products/cobol

[30] https://vmssoftware.com/pdfs/VSI_Roadmap_20171215.pdf

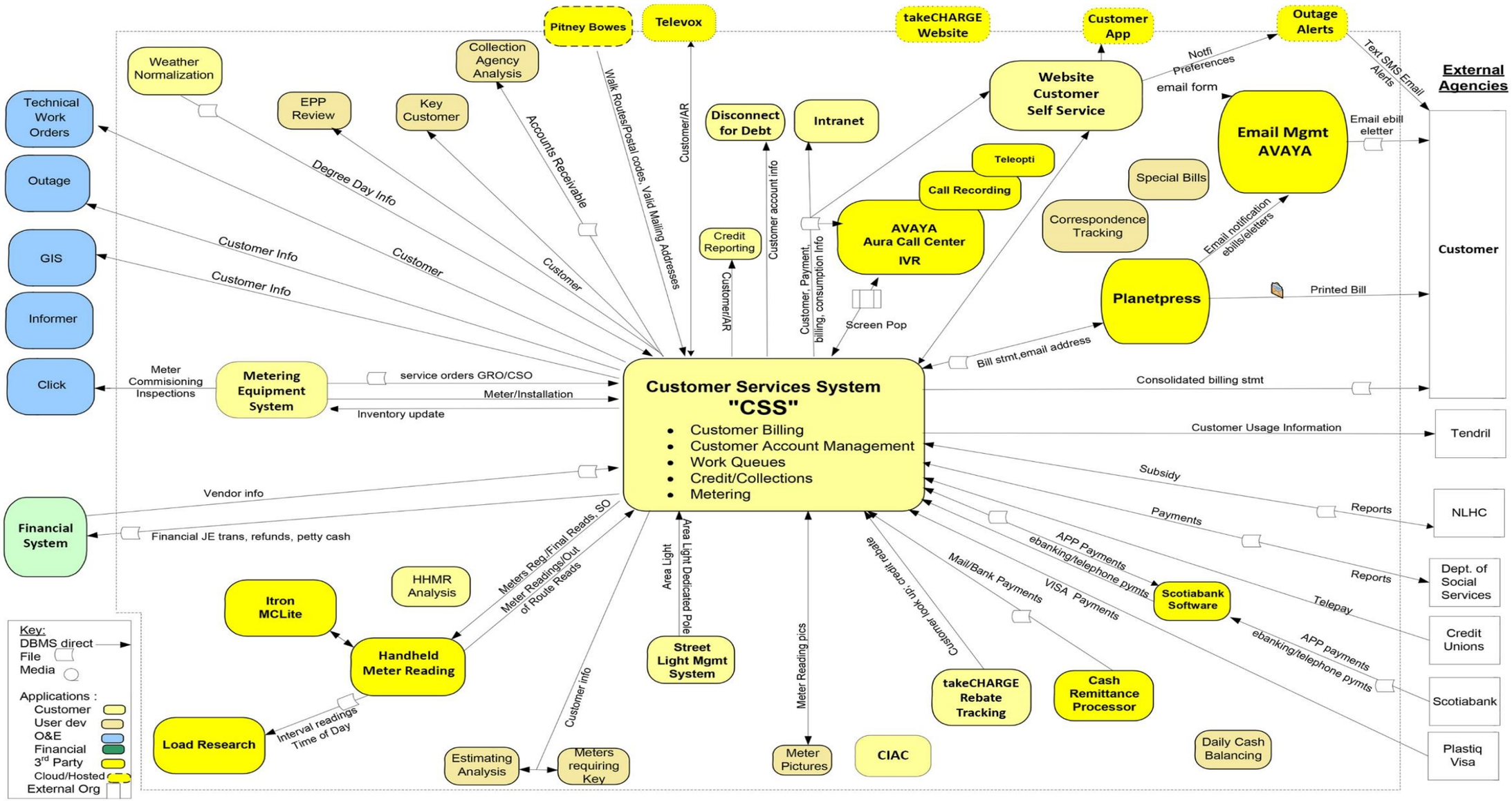
[31] http://www.oracle.com/us/support/library/lifetime-support-technology-069183.pdf

[32] http://www.oracle.com/us/support/library/057419.pdf

[33] https://www.pcworld.com/article/3196080/data-center/intels-itanium-once-destined-to-replace-x86-in-pcs-hits-end-of-line.html

Appendices

Appendix A- CSS Integration Diagram



Appendix B- Technical and Functional Survey Results

Survey methodology- Our methodology for determining business risk included surveying 5 business users and 3 technical users from Newfoundland Power's team that has been examining CSS options. We utilized the below survey so that users could submit their answers anonymously, and then the aggregated results were discussed as a group to eliminate interpretation errors and generate further understanding.

In the tables that follow, the range of responses is indicated by the horizontal bar, with the average score represented in the circle. Scores ranged from 1 point for "Inadequate" to 5 points for "Good". If the user felt they did not have enough knowledge to accurately answer the question, they indicated "Not Applicable".

Technical Adequacy Questionnaire							
	Not Applicable	Inadequate	Significant Limitations	Manageable	Fair	Good	Comments
SCALABILITY & ADAPTABILITY							
Ease of Incorporating New Requirements or Making Changes		Extremely difficult (No documentation, dependency listing, change may cause unknown breaks or impact other applications)	Quite difficult (Negligible documentation for application or details about dependent applications/systems)	OK (Some areas of weakness in known areas)	Reasonably easy but may be time consuming	Very easy and quick	
Indicate the ease with which it is possible to change or correct this application and determine the effect this will have on other programs/applications.				3.1			
Scalability		Future projections will exceed current capacities, even considering modifications	System may scale but would require extensive application changes	System will scale in short-term (e.g., adding or upgrading hardware)	Some capital investments required	System has sufficient scalability to meet future needs	
Indicate the degree of scalability, and level of modifications and associated investments required.	1			3.4			

OPERATIONS

Operability / Manageability		Extremely difficult, uses a lot of staff	Quite difficult	OK, but some areas of weakness	Reasonably easy	Very easy and quick	
Indicate the ease to run and operate this application including outages. For example, does it require minimal operator intervention?	2				4.3		
Reliability in Operation		Very unreliable	Somewhat unreliable	A few problems from time to time	Usually reliable	Very reliable	
Indicate the level of reliability of this application in operation? (e.g., Do outages occur and are re-runs required or are there any other abnormal circumstances?)							5.0
Performance		Response times do not meet requirements	Response times meet requirements majority of the time	Response time acceptable	Response times occasionally exceed requirements	Response times exceed requirements	
Indicate the degree to which speed/responsiveness meet requirements.	1			3.2			
Problem Resolution		Extremely difficult	Quite difficult	OK, but some areas of weakness	Reasonably easy	Very easy and quick	
Indicate the ease with which it is possible to determine and rectify problems.	1			3.5			

SUPPORT							
Application Change Frequency		Weekly	Bi-weekly	Monthly	Four times a year (or less)	Once a year (or less)	
How often are changes implemented?	1			3.1			(AS NEEDED)
Development/Support Resource Availability		Understaffed	Staff for some of the key application requirements	Just enough staff for key application requirements	Reasonably well staffed for most of application requirements	Staff is more than adequate to implement dev initiatives or support application	
How well is the application team staffed to meet development initiatives and requirements?				3.0			
Recruitment of Resources Availability		Unavailable	Some skills available but many not	Most skill sets available but some are not available	All skill sets available but a select few are difficult to find and hire	Staff for all skills required easily recruited and hired for application requirements	
How available are resources in the market that can be recruited to meet development initiatives and requirements?	1			2.7			
Technical Documentation		No documentation	Missing or outdated information on key areas	Generally OK, but missing some detail	Reasonably detailed	Detailed and up-to-date documentation	
Indicate the availability of documentation for this application.	2				4.3		Functional documentation is better than technical

ARCHITECTURE/INTEROPERABILITY							
Data Shared Across Applications		Completely separate	Application data is primarily standalone with some sharing via file transfer (internal to <Client>)	Data is shared somewhat (other Applications have accounts to pull data)	Exposed to Data Sources/Other Applications have accounts to our database and data access layer exists but is not standard	Data is shared and all access is controlled through a data access layer	
To what degree is data integrated with other applications?	1						
Interfaces		Very difficult - Custom or batch integration needed	Difficult - custom solution needed	Possible but some constraint (Interfaces available but limited)	Easy and ready to use interfaces available	Very easy - (Web Service Interface fully supported)	
Indicate the ease with which this application can interface with additional applications.	1						
Modern/Mainstream Technologies		Obsolete	Dated, or not enterprise class	Older, but still supported by vendors	Modern	Mainstream	
How would you characterize the technologies that are used to build and support the application? Please refer to company's current strategic technology listing, which sets out guidelines for technology use.	1						

Compliance to Enterprise Standards		Does not comply with any standards	Few components conform to standards	Partly conforms to current standards	Mostly conforms to current standards	Fully compliant with current standards	
Indicate the degree to which the application conforms to the Enterprise Architecture design standards.	2			3.2			
TECHNOLOGY RISKS							
Disaster/Recovery Environment		DR Plan is not documented	DR Plan is documented but has not been implemented/ tested	DR Plan is implemented but has not been tested or passed any of the test requirements	DR Plan is implemented and has passed 90% of test requirements	DR plan is fully implemented and tested	
Indicate the level of sophistication around the DR Plan for this application (as appropriate or agreed for this application)	1						5.0
Failover & High Availability		No redundancy across application components	Limited redundancy across application components	Manual Redundancy (Cold Standby)	Stateless Failover (with minimal loss of data/application session)	Stateful Failover (No Data Loss, No Network Loss, No App Availability Loss)	
Indicate the degree that this application is considered highly available within the same geographic location (data center).	1				4.4		
Portability		No portability for application components	Limited portability for application components	Most application components supported on other OS/hardware configurations	All application components supported on multiple OS/hardware configurations from a select set of vendors.	All application components supported on multiple OS/hardware configurations from popular vendors.	
Indicate the degree that application components could be run on other OS/hardware configurations.	2		2.2				

OVERALL ASSESSMENT							
Support of Current Business		Unacceptable today	Requires major modifications	Generally OK with some noted weaknesses	Few weak spots	Meets 100% of requirements	
Taking all factors (design, technology, performance, etc.) into consideration, what is your view of the technical adequacy of this application for supporting **current** business requirements?	1				4.1		
Support for Future Business		Inadequate: Requires replacement now	Inadequate: Needs replacement in next 3 years	OK, but some noted areas of weakness. Requires significant work in next 3 years	No functionality constraints. Expected life >7 years	Designed with the future in mind	
Taking all factors into consideration, what is your view of the technical adequacy of this application for supporting **future** business requirements? (Volume? New businesses? New organizations? New processes? eSpeed?)				3.4			

Functional Adequacy Questionnaire

	Not Applicable	Inadequate	Significant Limitations	Manageable	Fair	Good	Comments
APPLICATION FUNCTIONALITY/ COMPLEXITY							
EASE OF INTRODUCING PRODUCTS/SERVICES ENHANCEMENTS		Only can incorporate new requirements with high effort/cost		Can incorporate new requirements with moderate cost/effort		It is very easy to make changes, with low effort/cost	
Indicate how easily (effort/cost) the application can adapt to changes in business requirements.			1.5				
CURRENT FUNCTIONALITY/SUITABILITY		Only satisfies few of the requirements	Major enhancement needed	Significant modifications required	Minor modifications required	Completely acceptable as is	
Indicate the completeness of the set of functions/features that are provided by the application for current requirements. For example, how much do you need to work outside the application to complete a process	2			3.2			
OPERATIONAL EFFICIENCY/PROCESS SUPPORT		Array of opportunities for increasing operational efficiency and productivity		Somewhat labor intensive, but majority of activities is automated		Limited opportunities for further streamlining the organization	
Indicate level of automation and appropriate support of business processes, or the opportunity to increase operational efficiencies of the business organization with respect to this application. For example, how labor intensive is the application.	2			3.2			

LEVEL OF INTEGRATION		Lack of integration prohibits full functionality	Lack of integration results in data input duplication	Exchanges of data with other systems requires manual intervention	Minor gaps exist but do not affect the user	Application is tightly integrated with other applications	
Indicate the degree to which the application is integrated with other systems, and to what extent manual data transfers or re-keying of information is required, or to what extent multiple systems are used to perform daily activities.	1						
APPLICATION QUALITY& PERFORMANCE							
DATA QUALITY		Unreliable		Some inconsistencies, but overall acceptable		Very reliable	
Indicate how reliable the system in terms of quality issues is. For example, higher degree of data validation results in higher reliability.	1						
AVAILABILITY/RELIABILITY		Application is unstable - number of production issues/app outages is high (more than 1 per week)	Number of production issues/app outages is moderately high (1-3 per month)	Application is relatively stable - number of production issues/app outages is limited (1-3 per quarter)	Application is very stable - number of production issues/app outages is low (1-3 per year)	Application is highly stable - no production issues/app outages within the last 12 months	
Indicate the degree to which the application is available when needed and reliable in operation.							

BUSINESS RISKS							
SECURITY		Identifiable weaknesses		Security controls in place, but informally implemented		Highly secure - only authorized users have access	
Rate to what extent the application has the controls in place to prevent unauthorized access, whether accidental or not, to systems and data.							5.0
REGULATORY COMPLIANCE		None		Medium Customization		High Customization	
Rate how much customization was done over the life of the application to make it compliant?					3.8		
OVERALL ASSESSMENT							
CURRENT ADEQUACY IN MEETING BUSINESS NEEDS		New application required	Major enhancement needed	Significant modifications required	Minor modifications required	Completely acceptable as is	
In summary, evaluate the adequacy of the application in supporting your *current* business needs.					4.3		
FUTURE ADEQUACY IN MEETING BUSINESS NEEDS		New application required	Major enhancement needed	Significant modifications required	Minor modifications required	Completely acceptable as is	
In summary, evaluate the adequacy of the application in supporting your *future* business needs.				2.9			3-5 YEARS OUT

Appendix C - EY technical team bios for this assessment

Richard Charles

Principal, Advisory Services
EY's Power and Utilities Customer Practice Leader-Americas

Background

- Richard is a Principal in the Advisory Services practice of Ernst & Young LLP focused on the Power and Utilities sector.
- Richard leads EY's Customer practice within P&U.
- He has more than 30 years' experience working with utilities, energy retailers, and suppliers to the industry. This breadth of experience has given him a deep understanding of utility operations, regulatory and compliance regimes, and the key trends shaping the industry today.
- Since 2000, his primary focus has been the intersection of the customer and technology within investor-owned and municipal utilities.
- He obtained a BS degree in Electrical Engineering from Northwestern University and a MBA from the Kellogg Graduate School of Management.
- He sits on the planning committee for CS Week.
- He is a frequent author and speaker on IT strategy and customer adoption.

Professional experience (Selected)

- Worked with over 10 large IOUs to develop CIS strategies (e.g., risk mitigation, extension, and replacement).
- Led an initiative to transform a large retail energy provider's customer care and billing operations through the evaluation and selection of a new CIS, the supporting technologies, and the systems integrator; provided regulatory support and ongoing executive coaching during the implementation.
- Provided regulatory testimony and support to justify CIS initiatives.
- As president of Five Point, nurtured the development of its Advisory services practice into a leading IT strategy provider, focused predominantly on CIS/CRM; these capabilities, along with the balance of Five Point's utilities practice were successfully transitioned to EY in May 2014.
- As Head of Client Services at Vertex Business Services, managed a portfolio of over 50 clients to provide a range of BPO, ITO, consulting and full meter-to-cash services from Vertex. Responsibilities included P&L management of the accounts, service renewals and extensions, and managing the team of Client Executives responsible for effectively engaging with clients. In this capacity, frequently worked with clients on the technology utilization, including IVR.

Steven Verlander

Senior Manager, IT Advisory Services
Power & Utilities Practice

Background

- Steven Verlander is a Senior Manager in the Advisory Services practice of Ernst & Young LLP. He leverages more than 25 years of experience developing software and running data centers.
- Prior to joining EY, Steven held the position of VP of Technology Innovation for Five Point Partners, a consulting firm that was acquired by EY. His expertise was in cloud infrastructure and performance optimization.
- Steven also has many years of independent consulting experience assisting clients like Delta Airlines develop online operational systems for flight planning / monitoring and weather graphical systems. He also worked with HP on search and indexing applications.
- A technologist at heart, Steven has made it a priority to stay on top of leading edge technology solutions. In his early days of consulting, he provided contributions to very early versions of the Linux operating system. Today, Steven spends his time advising on cloud infrastructure and big data technologies. Some of his favorites are Hadoop and the various related tools such as HBase, Map-Reduce, and Hive. He also leverages experience in multiple cloud technologies offered by most major cloud vendors.

Professional experience (Selected)

- Currently assisting with planning of a technology transformation for a large utility in the Northeast. The customer is anticipating replacing several mainframe CIS systems with an integrated and modern CIS solution.
- Currently the technology lead for an Oracle Customer Care and Billing (CC&B) system upgrade for a large utility in the Northeast. The upgrade includes consolidating two separate legacy CC&B systems and migrating to new hardware.
- Provided consulting to a large energy utility in the Southeast regarding cloud considerations for migrating multiple legacy CIS systems to a single CIS system. Analysis included identifying cloud benefits, cloud risks, risk mitigation, and security implications.
- Working with customer IT staff at a west coast water utility, advised and designed a cluster based database system (Oracle RAC) and cluster hosted application (WebLogic) for a Customer Care and Billing (CC&B) 2.4 production system. Assisted customer in infrastructure needs using a combination of cloud resources and local virtual machine (VM) environments. Performed real-time testing and performance tuning to accelerate system response times.
- Advised west coast power utility on the customization and implementation of Oracle's Customer Self Service (OUCSS) product involving custom software development on ADF and Fusion Middleware. Investigated and advised on performance issues related to Oracle Utilities Mobile Workforce Management (MWM) 2.1 product.

EY | Assurance | Tax | Transactions | Advisory

About EY

EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients.

For more information about our organization, please visit ey.com/ca.

ey.com/ca