Reference: 2.1 2024 Substation Refurbishment and Modernization

Q. What actions has Newfoundland Power taken since the Substation Refurbishment and Modernization Plan was introduced in 2007 to assess whether the execution of the plan has been effective and is consistent with good utility practice?

A. ***A. Substation Strategic Plan***

Newfoundland Power's *Substation Refurbishment and Modernization Plan* is an element of the *Substation Strategic Plan* (the "Plan") included in Newfoundland Power's *2007 Capital Budget Application*.[1] The Plan changed the way substation capital projects were planned and executed at Newfoundland Power.

Newfoundland Power remains compliant with the original plan through condition-based assessments of individual substations on various criteria, including:

(i) Oil sampling and analysis to determine the condition and need to replace transformers;
(ii) Components that are identified as deteriorated or prone to failure, such as switches that are over 30 years old;
(iii) The condition of physical infrastructure, such as wood poles experiencing deterioration and steel structures experiencing corrosion;
(iv) The presence of obsolete equipment, such as electromechanical relays; and
(v) Requirements for varmint proofing to prevent outages caused by small animals and birds.

The scope of individual *Substation Refurbishment and Modernization* projects have increased since 2007 based on the condition of the Company's substations as determined through annual inspections.[2] A review of Newfoundland Power's substation assets completed in 2023 confirmed that continued implementation of the Plan is appropriate given the age and condition of the Company's substation assets.[3]

Asset condition analysis and trending information continue to be incorporated into the *2024 Substation Refurbishment and Modernization Plan*. These assessments have informed the decision making in the management of these assets and influenced investment approaches on the various substation asset classes. There has been an increased focus on critical assets such as power transformers, wood poles, and digital protection relays to improve the decision-making process involving these assets.

---

1 See Newfoundland Power's *2007 Capital Budget Application*, report *2.1 Substation Strategic Plan*, page 6.

2 In the past, the scopes of these projects were expanded to include new requirements for items such as substation monitoring, security and ground grids. In its *2023 Capital Budget Application*, the Company reorganized the components of its substation refurbishment and modernization projects to align with the Provisional Guidelines. As a result, *Substation Protection and Control Replacements* and *Substation Ground Grid Upgrades* have been included as separate programs and projects in the Renewal and Service Enhancement classifications, respectively.

3 For the results of this review, see Newfoundland Power's *2024 Capital Budget Application*, report *2.1 2024 Substation Refurbishment and Modernization*, *Section 2.2 Substation Asset Assessment*.

The Company reviews the Plan each year as part of the annual capital planning process. The primary purpose of the annual review is to prioritize substation refurbishment and modernization projects based on the methodology outlined in the Plan and to reflect the results of the Company's substation inspections, which occur eight times annually.

B. Effectiveness of the Plan

The effectiveness of the Plan can be demonstrated in the age profile of some of the Company's substation equipment. For example, the age profile of circuit breakers has improved as a result of the Plan, as well as the *PCB Bushing Phase-out* and *Replacements Due to In-Service Failures* projects and programs.[4] Additionally, the age profile of the Company's protection relays has also improved with the modernization of protection devices which began in the early 2000s.[5]

The Plan has also been effective as it continues to serve its intended purpose of realizing productivity and reliability benefits for customers.

From a cost perspective, execution of the Plan has coordinated substation refurbishment and modernization projects with other major substation projects. Examples include coordination with *Additions Due to Load Growth* projects and *PCB Removal* projects.[6] This coordination achieves efficiencies in project planning and execution. For example, it reduces costs to customers associated with the installation of portable substations.[7]

The Plan has also been effective in ensuring the reliable operation of the Company's substations in serving customers. Substations are maintained to operate to a high standard of reliability.[8] In the five-year period from 2018 to 2022, transmission and substation outages combined have contributed to an annual average of less than 30 outage minutes per customer.[9]

Execution of the Plan has increased the level of remote control and monitoring in Newfoundland Power's substations.[10] Since 2014, the Company has completed the remote control and monitoring of all distribution feeders through the *Substation Refurbishment and Modernization* project. This allows Power System Operators to

---

4 See Newfoundland Power's *2024 Capital Budget Application,* report *2.1 2024 Substation Refurbishment and Modernization*, *Section 2.2 Substation Asset Assessment*.

5 Ibid.

6 For example, there have been seven *Additions Due to Load Growth* capital projects that have been combined with *Substation Refurbishment and Modernization* capital projects since 2007. As well, coordinating *PCB Bushing Phase-out* projects with substation refurbishment and modernization projects has occurred 11 times.

7 There have been 29 instances where the capital project was aligned with power transformer maintenance, which required the installation of a portable substation. The typical cost to install a portable substation is approximately $50,000. Avoiding the installation of portable substations in 29 instances reduces costs to customers by approximately $1.5 million (29 x $50,000 = $1.5 million).

8 Individual substations provide service to an average of approximately 2,400 customers, with the largest substation providing service to over 10,000 customers.

9 In addition, coordinating major substation projects reduces the requirement for planned customer outages.

10 This includes the installation of monitoring equipment on substation power transformers and circuit breakers. It also includes under-frequency control of substation breakers and reclosers.

prevent or respond to certain customer outages without the assistance of field crews.[11] These remote capabilities reduce both the time and cost of responding to customer outages.

Overall, the continued execution of the Plan has allowed Newfoundland Power to maintain its substations in a manner consistent with the least-cost delivery of reliable service to customers.

C. Good Utility Practice

Good utility practice involves a structured and comprehensive approach to preventative and corrective maintenance for critical substation assets. Maintenance programs are intended to keep critical assets in good working order, prolong their life and reduce in-service failures.

Newfoundland Power's substations are inspected eight times annually. These inspections identify preventative and corrective maintenance necessary to ensure the reliable operation of critical substation assets.[12]

Inspection results are incorporated into the Company's annual update of the Plan. Under this plan, the maintenance cycle for major substation equipment is coordinated with the individual substation refurbishment and modernization projects. This coordination provides productivity and service benefits for customers.

To align with good utility practice Newfoundland Power incorporates industry guidelines into the Plan which include:

(i) *IEEE C37.91 - IEEE Guide for Protecting Power Transformers*
(ii) *IEEE 80 – IEEE Guide for Safety in AC Substation Grounding*
(iii) *IEEE 979 – Guide for Substation Fire Protection*
(iv) *IEEE 980 – Guide for Containment and Control of Oil Spills in Substations*

Decisions on the condition of assets incorporate recommendations made by industry institutions such as the International Council of Large Electric Systems and the Electric Power Research Institute.

---

[11] This includes the ability to remotely access relay settings and fault event data from protection devices.

[12] The most recent review of Newfoundland Power's asset management strategies was conducted in 2014 by The Liberty Consulting Group ("Liberty"). Liberty concluded, "*Newfoundland Power's substation inspection, corrective maintenance, and preventive maintenance practices are consistent with good utility practices.*" See Liberty's *Report on Island Interconnected System to Interconnection with Muskrat Falls addressing Newfoundland Power Inc.*, December 17, 2014, page 51. Liberty also concluded, "*Newfoundland Power uses an effective combination of periodic O&M inspection and maintenance programs and capital transmission, distribution, and annual capital substation capital rebuild and modernization projects to address condition, reliability, and operating issues with its transmission, distribution, and substation assets.*" See Liberty's *Report on Island Interconnected System to Interconnection with Muskrat Falls addressing Newfoundland Power Inc.*, December 17, 2014, page 49.

Newfoundland Power regularly participates in industry interest groups such as the Centre for Energy Advancement through Technological Innovation's Stations Equipment group. This group is intended to optimize substation plant assets and develop new cost-efficient and reliable equipment applications for a changing electricity industry. This group provides webinars, facilitates surveys, and supplies research for ongoing industry challenges.

Newfoundland Power ensures it aligns with good utility practice by regularly referring to current and relevant industry data as well as contributing and participating in industry interest groups.