# Nova Scotia Utility and Review Board

**IN THE MATTER OF** *The Public Utilities Act,* R.S.N.S. 1989, c.380, as amended

## Five-Year Reliability Plan 2025-2029

Nova Scotia Power

December 20, 2024

NON-CONFIDENTIAL

## TABLE OF CONTENTS

**1.0 INTRODUCTION ..... 4**
1.1 Goals of the Plan ..... 5
1.2 The Economic Value of Outages ..... 6
1.3 Looking Forward ..... 7
**2.0 HISTORICAL SYSTEM-WIDE RELIABILITY PERFORMANCE ..... 9**
**3.0 RELIABILITY PROGRAMS ..... 10**
3.1 Estimated Improvements in Reliability ..... 13
**4.0 STORM HARDENING – VEGETATION MANAGEMENT ..... 15**
4.1 Distribution Corridor Widening with Managed Rights of Way (ROW) ..... 16
4.2 Transmission Corridor Widening with Managed Rights of Way (ROW) ..... 18
4.3 Establish New Rights of Way (ROW) ..... 20
4.4 Trimming and Removal of Trees Around Existing Power Lines ..... 21
**5.0 STORM HARDENING – TARGETED EQUIPMENT REPLACEMENTS AND UPGRADES ..... 23**
5.1 Distribution System Equipment Upgrades and Replacements ..... 23
5.1.1 Distribution System Build-to-Roadside Program ..... 27
5.1.2 Distribution System Conductor Upgrades ..... 28
5.1.3 Distribution System Underground Upgrades ..... 28
5.2 Transmission System Upgrades and Replacements ..... 29
5.3 Substation Upgrades and Replacements ..... 29
**6.0 ADVANCED GRID MODERNIZATION PROGRAMS ..... 31**
6.1 Connected Assets ..... 31
6.1.1 Remote Terminal Units (RTUs) ..... 32
6.1.2 Downline Connectivity ..... 32
6.2 Fault Location Isolation and Service Restoration ..... 34
6.2.1 Distributed Energy Resources (DERs) ..... 34
**7.0 CONCLUSION ..... 36**
**APPENDIX A – DEFINITIONS ..... 38**

## TABLE OF FIGURES

Figure 1: Forecast Investment by Reliability Program 2025-2029 ($ million) ..... 5
Figure 2: Contribution to CHI by Outage Cause 2019-2023 (Including all Storms) ..... 9
Figure 3: Highest Priority Distribution Feeders in 2025 ..... 12
Figure 4: The Path to Improving SAIDI by 20% ..... 13
Figure 5: Distribution Vegetation Management Right of Way Widening (2025) ..... 17
Figure 6: Vegetation Condition on 78W-302 from Satellite Imagery ..... 18
Figure 7: Transmission Corridors Targeted for Widening (2025) ..... 19
Figure 8: New Rights-of-Way for Distribution Feeders ..... 21
Figure 9: 2025 Recloser Installations ..... 24
Figure 10: 2025 Trip Saver Installations ..... 25
Figure 11: 2025 Bring-to-Roadside Projects ..... 27
Figure 12: 2025 Conductor Upgrades by Region ..... 28
Figure 13: Remote Terminal Units Proposed for 2025 ..... 32
Figure 14: Downline Reclosers Planned for 2025-2026 ..... 33
Figure 15: Benchmark Investment Forecast by Reliability Program (2025-2029): ..... 36

## 1.0 INTRODUCTION

NS Power's top priority is delivering safe, affordable, and reliable electricity every day to power customers' homes, businesses, and communities. The Company is committed to improving the reliability and resiliency of the power grid and has developed a Five-Year Reliability Plan (the Plan) detailing $1.3 billion of investments in reliability programs. Informed by an in-depth analysis of outage causes, the Plan focuses on investments in the transmission and distribution systems through three core programs outlined below:

1. Storm Hardening - Vegetation Management,
2. Storm Hardening – Targeted Equipment Replacements and Upgrades, and
3. Advanced Grid Modernization

As the impacts of climate change have intensified over the past 10 years, NS Power has responded with $1.8 billion in system infrastructure investments over that period. It has enhanced its organizational structure to place greater focus on reliability improvements through the creation of a Reliability Team responsible for the implementation of reliability-driven work to reduce the duration and frequency of outages for customers.

In the Board's decision on the 2023 Annual Performance Standards (M11624), the Board directed the following:

> …that a comprehensive written version of NS Power's five-year reliability plan is needed to understand how service improvements will be achieved and against which progress in achieving the performance goals can be tracked. This plan must include specific actions and related timing, demonstrate why these specific investments were selected and quantify the level of reliability or resilience improvement expected from each investment.

In response to the Board's directive, NS Power has prepared this version of its Plan to provide the Board and Stakeholders with:

- A synopsis of what is causing the reliability challenges,
- A detailed plan with targeted reliability investments to mitigate the risks associated with the impacts of escalating weather events, and
- An overview of the expected improvements in reliability for customers as NS Power executes this Plan.

As shown in **Figure 1** below, NS Power's Plan includes approximately $1.3 billion of investment over the 2025-2029 period. This work will result in a more reliable and resilient grid that is better able to withstand and bounce back when the power system is operating under moderate levels of stress, and to a certain extent also from extreme weather events like hurricanes. This level of investment is approximately 12 percent more than the level of investment in the transmission and distribution system over the past five years (2019-2023).

**Figure 1: Forecast Investment by Reliability Program 2025-2029 ($ million)**

| Reliability Program | 2025 | 2026 | 2027 | 2028 | 2029 | Total Plan |
|---|---|---|---|---|---|---|
| Storm Hardening - Targeted Equipment Replacement and Upgrades | 152.4 | 181.1 | 198.7 | 192.4 | 191.8 | **916.4** |
| Storm Hardening - Vegetation Management | 45.0 | 45.0 | 45.0 | 65.0 | 65.0 | **265.0** |
| Advanced Grid Modernization | 9.2 | 7.9 | 7.9 | 15.3 | 37.6 | **77.9** |
| **Total** | **206.6** | **234.0** | **251.6** | **272.7** | **294.4** | **1,259.3** |

## 1.1 Goals of the Plan

The reliability and resilience investments included in this Plan are aimed at achieving the following two overarching goals:

1) **Improve the customer reliability experience by reducing SAIDI by 20 percent from the current five-year average of 5.10 and achieving the Performance Standards SAIFI target of 2.05.**[1]

2) **Continue to strengthen grid resilience to address climate change and achieve the Performance Standards for restoring service to customers within 48 hours after a Major Event.**[2]

NS Power's reliability programs are designed to enhance reliability while also making the grid more resilient to the impacts of climate change and increasingly severe weather events.

The investments outlined within the Plan will make the power system more resilient for all weather events. Storms with wind gusts exceeding 100 km per hour, like Hurricane Dorian (2019), Hurricane Fiona (2022) and Hurricane Lee (2023), will continue to challenge the reliability and resilience of the power system. However, this Plan is designed to reduce the overall impact of significant storms and improve restoration times.

Section 3 of the Plan outlines the forecast investment levels for each program and highlights the estimated benefits of NS Power's reliability programs.

## 1.2 The Economic Value of Outages

NS Power acknowledges the Board's direction in its Decision on NS Power's Storm Cost Recovery Rider Application,[3] that evaluating the Value of Lost Load (VoLL) by customer classes could provide valuable support for investment decisions. NS Power believes that assessing the specific economic impacts of customer outages must be tailored to Nova Scotia and derived through

[1] All references to SAIDI in the Plan reflect Performance Standards SAIDI, which excludes MEDs and EEDs. A 20% reduction in Performance Standard SAIDI from the current five-year average of 5.10 results in a Performance Standards SAIDI of 4.10 by the end of 2029. The Performance Standards SAIDI metric is set at 4.29 for 2024.
[2] A Major Event is defined as a significant weather-related or other disruptive event that results in at least one Major Event Day (MED). MED and other key terms are defined in Appendix 1.
[3] M11692 2025 Storm Cost Recovery Rider (SCRR)

customer engagement. In other jurisdictions in the United States and Canada, surveys have been distributed to customers to gather this information, which is then presented to regulators for approval and used by utilities to support investment decisions. NS Power supports this approach and is prepared to integrate these factors into the company's existing risk framework to prioritize investments. As directed by the Board, NS Power will study and report on the potential use of VoLL in the reliability investment planning process in the 2026 ACE Plan application.

## 1.3 Looking Forward

While this Plan is built on sound projections and data and aims to provide the Board and stakeholders with specific actions and related timing and quantification of the improvement to reliability and resilience, there are factors beyond NS Power's control that can impact the Company's ability to achieve the specific actions in this Plan. As a result, the Plan must be adaptable and flexible and be regularly reassessed as required to maintain alignment with changing conditions. All changes will be assessed based on NS Power's asset management framework.

The issue of weighing the cost of improving the resilience of the system as compared to the benefits was recently addressed by the Board in its 2022 Annual Capital Expenditure Plan Distribution Routine D008 ATO decision:[4]

> This highlights the need for open and frank dialogue between NS Power, its customers, and government about the level of performance that is desired and how much ratepayers are willing to pay for it. This is not to suggest that investments in resilient systems cannot be cost effective. But rate impacts must also be considered. A significant investment in system resiliency may cause immediate rate increases, whereas a business-as-usual option that may cost more in the longer term could result in more gradual, even if ultimately higher, rate increases.
>
> Additionally, no system can be built to withstand every possible threat. This is an unrealistic expectation. Resilience should be understood more as a question of degree. Investments in resiliency will not necessarily eliminate damage from

[4] M11169, NSUARB Decision, Nova Scotia Power 2022 ACE Plan Distribution Routines D0008 ATO, June 27, 2024, at paras. 39-40.

> disruptive events but could help to reduce damage and could also facilitate the recovery from a disrupted state to normal operations.[5]

These comments from the Board highlight what is an essential part of reliability and resiliency investment decisions. Balancing the benefits from these investment decisions with rate impacts is a complex challenge that requires careful consideration of both immediate and long-term implications. As noted by the Board, these decisions and the weighing of the costs and benefits require open and constructive dialogue among NS Power, its customers, and government to better align the desired level of system performance and the associated costs.

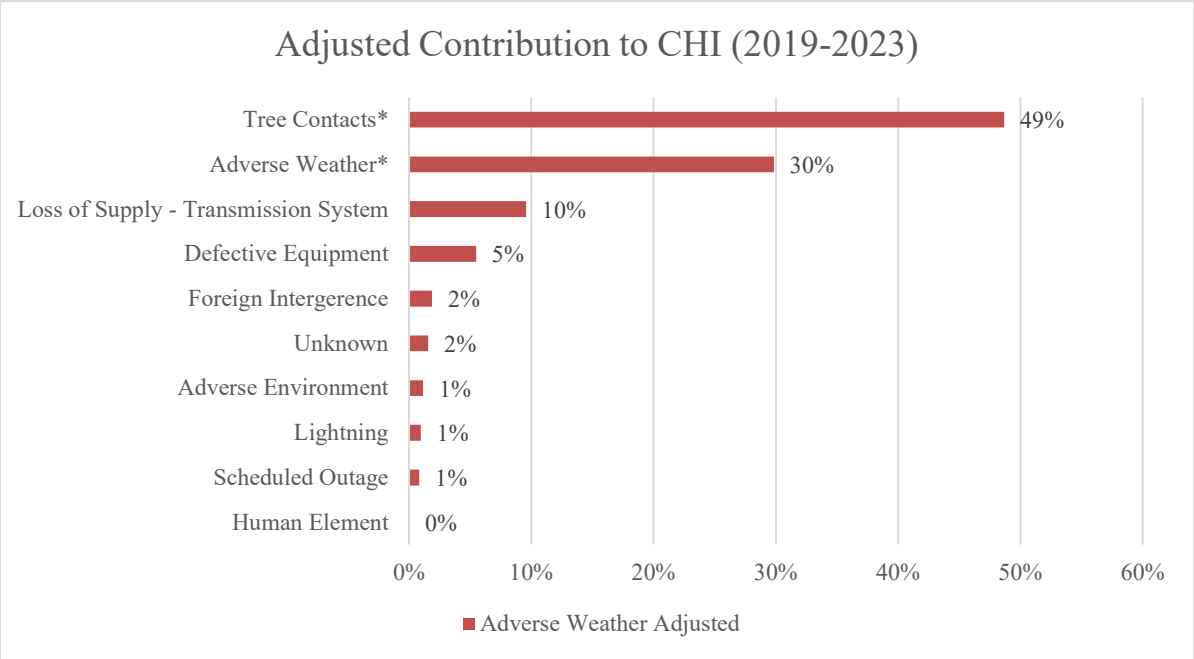
With this in mind, it is NS Power's hope that this Plan and the regulatory process related to it will help facilitate such dialogue and assist in making investment decisions that meet the needs of Nova Scotians today and in the future by providing an informed and appropriate balance between desired performance and costs.

[5] Mentioned first in Board's decision on M11169 (NS Power 2022 ACE Plan Distribution Routines D008 ATO, June 27, 2024 and then restated in M11458, NSUARB Decision, Nova Scotia Power 2024 ACE Plan, August 13, 2024 at para. 94.

## 2.0 HISTORICAL SYSTEM-WIDE RELIABILITY PERFORMANCE

Over the past five years, the causes of power outages and how they contributed to the customer hours of interruption (CHI) are shown in **Figure 2**. While there is year-over-year variation, NS Power's operations and vegetation management subject matter experts estimate that up to 40 percent of CHI coded as "Adverse Weather" can be further attributed to tree contacts. Consequently, approximately 50 percent of the total CHI over the past five years has been due to trees contacting power lines, particularly during adverse weather events. Given this has been the top contributor to the hours of power interruption experienced by customers, ensuring the Plan and its investments appropriately address this factor is key to reducing SAIDI and SAIFI over the next five years.

**Figure 2: Contribution to CHI by Outage Cause 2019-2023 (Including all Storms)**




*These cause codes have been adjusted from the original Electricity Canada methodology as discussed above to illustrate the additional contribution from tree contacts within Adverse Weather.

As detailed in the next section, this Plan has been developed to align with this analysis and allocate planned investment appropriately to target and address the impacts of tree contacts and adverse weather on the power system.

## 3.0 RELIABILITY PROGRAMS

Nova Scotia Power's Five-Year Reliability Plan includes three key reliability programs that address tree contacts and adverse weather (the primary causes of outages as outlined in the previous section), as well as the other causes of unplanned outages:

- **Storm Hardening - Vegetation Management:** This program includes investment to widen existing rights-of-way serving both the transmission and distribution systems, establish new rights-of-way where required, and trim and remove trees to increase the clearance from power lines. Reducing tree contacts is the number one way to prevent outages and reduce the overall duration when they do occur. This program is critical to minimizing tree contacts with power lines, which are often impacted during weather events.

- **Storm Hardening - Targeted Equipment Replacements and Upgrades:** This program includes investment to upgrade, modernize, or renew existing equipment and infrastructure through targeted replacement and additional assets to improve resiliency.

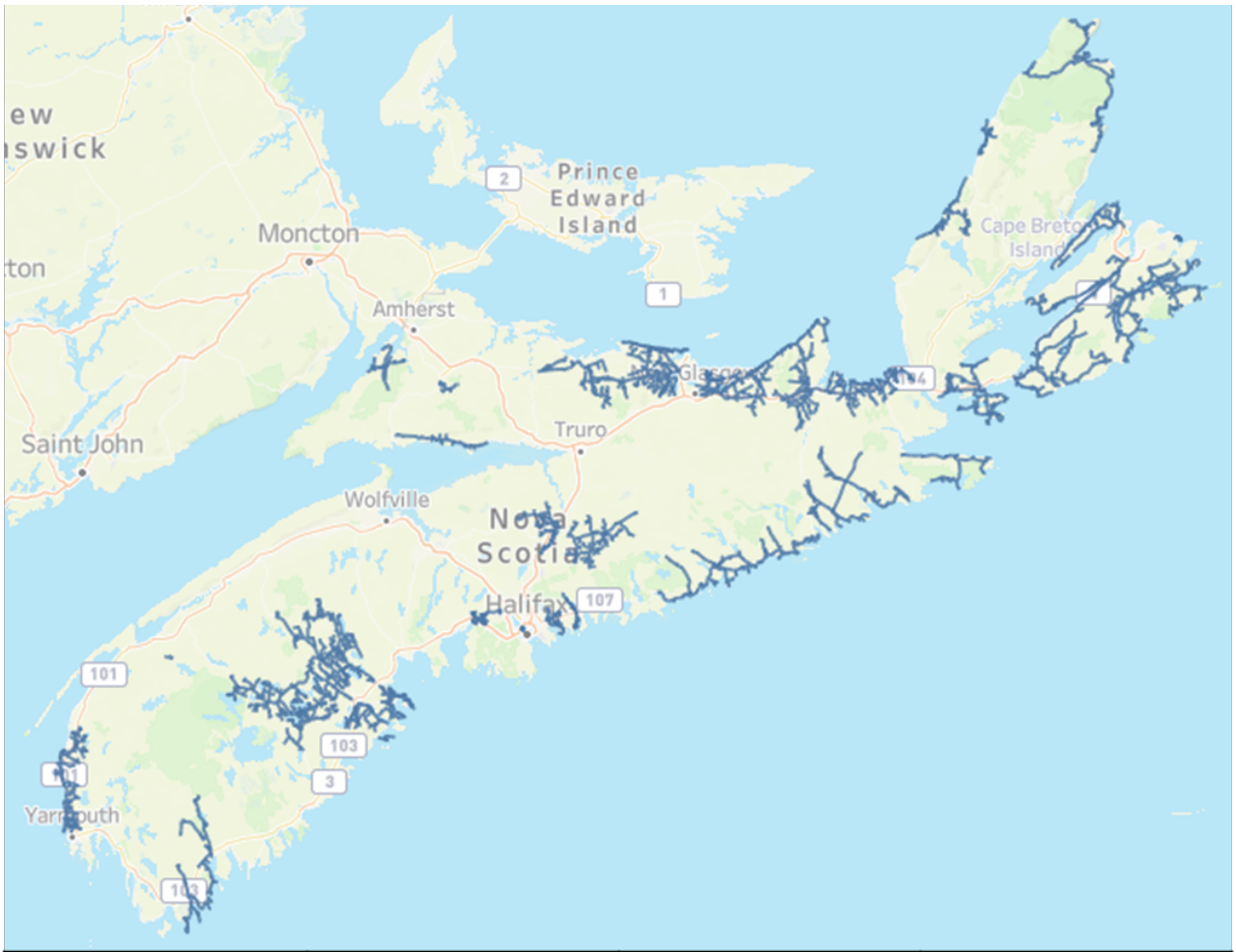
- **Advanced Grid Modernization:** This program focuses on addressing evolving demands, aging infrastructure, and growing integration of renewable energy sources. The Company deploys Grid Modernization investments across many foundational areas including enhancing connectivity to the transmission and distribution grid to reduce occurrence and length of outages and exploring advanced technology in vegetation management. These investments target advanced technologies such as smart meters, enhanced communication systems, upgraded substations, and self-healing devices to improve system reliability and efficiency.

The priority areas across the province for investments in these programs are determined through NS Power's asset management framework. As part of that framework, historical reliability

performance is one of the variables that determines the overall reliability risk and guides where investments need to be prioritized.

At the time of filing of this Five-Year Reliability Plan, the priority areas for investment in 2025 include the following feeders shown below in **Figure 3**.

**Figure 3: Highest Priority Distribution Feeders in 2025**




| Western Region | Metro Region | Northeast Region | Cape Breton Region |
|---|---|---|---|
| 14V-303 70W-311 80W-301 | 137H-412 104H-421 82V-402 | 100C-421 30N-412 4C-441 | 57S-401 57S-402 11S-411 |
| 16W-301 70W-313 91W-411 | 113H-433 126H-311 | 4N-313 57C-426 82V-401 | 3S-403 59C-402 103C-314 |
| 23W-302 73W-411 93V-313 | | 88H-401 50N-410 56N-414 | 22C-403 22C-404 81S-305 |
| 25W-301 76V-301 | | 6N-302 96H-411 96H-412 | 85S-401 58C-403 |
| 57W-401 78W-301 | | 24C-442 4C-430 37N-411 | |
| 57W-402 78W-302 | | | |

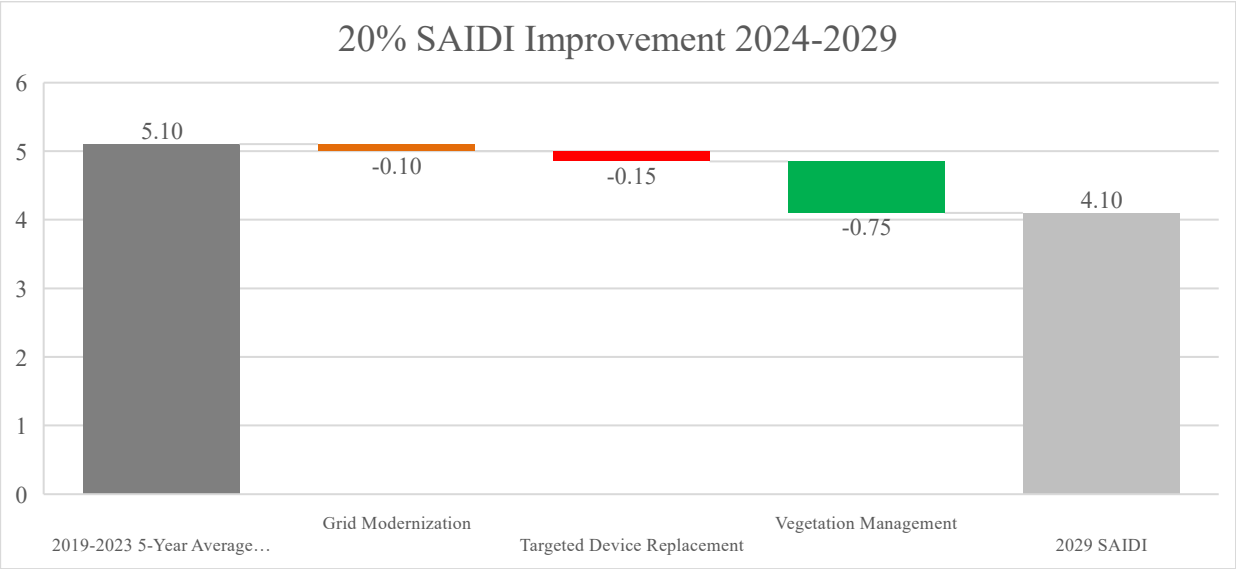
The feeders in **Figure 3** represent approximately 10 percent of NS Power's distribution feeders across the province. While these are the primary areas of focus in 2025, NS Power will continue to reassess these priorities on an ongoing basis over the course of 2025 and this Plan. NS Power will also continue to respond appropriately to new areas of priority as they emerge.

The reliability improvements that NS Power estimates from these investments over the course of this Plan are outlined in the following section.

## 3.1 Estimated Improvements in Reliability

NS Power estimates that the programs included in this Plan will deliver an improvement in Performance Standards SAIDI of approximately 20 percent and achievement of the SAIDI metric included in the Standards by 2029. The projected impact of the three reliability programs is illustrated in **Figure 4** below which highlights the anticipated trajectory of Performance Standards SAIDI performance as these programs are executed. This 20 percent reduction in Performance Standards SAIDI equates to a one-hour reduction in outage duration over the course of one year by 2029. These investments will also enhance the functionality of the distribution system, enabling it to efficiently manage and support new load.

**Figure 4: The Path to Improving SAIDI by 20 Percent**




Every outage event has a resultant impact on the frequency of outages and the overall duration of outages. Consequently, and based on historical correlations between SAIDI and SAIFI performance, NS Power estimates that the Performance Standards SAIFI metric will also improve

by approximately 16 percent and will be below the current performance standard target of 2.05 by 2029. Every mitigating measure that avoids or reduces the impact of an outage has a related benefit/reduction to the overall frequency and duration of outages experienced by customers.

SAIDI and SAIFI are often positively correlated because an increase in the frequency of outages (SAIFI) typically leads to an increase in the total duration of outages (SAIDI). Both metrics are influenced by weather conditions, design of the power system and the operational realities of how reliability investments and outage management practices impact SAIDI and SAIFI. Investments that are made to improve reliability and resilience (e.g. automated reclosers that detect transient faults like tree contacts on a line and automatically restore power without the need for manual intervention) simultaneously reduce the frequency of outages (SAIFI) and their duration (SAIDI). The correlation factor between NS Power's SAIDI and SAIFI metrics over the past 20 years is 79 percent, meaning that there is a very strong relationship between these two variables and that reduction in one of these metrics (SAIDI) going forward is highly likely to result in a similar level of reduction in the other metric (SAIFI).

## 4.0 STORM HARDENING – VEGETATION MANAGEMENT

**2025-2029 Forecast Investment:** $265.0 million

**Estimated Performance Standards SAIDI Reduction:** 0.70 to 1.25 hours

The Storm Hardening - Vegetation Management Program is designed to proactively reduce tree contacts with power lines, which is the primary cause of outages under normal, moderate and severe weather conditions. By increasing the width of distribution and transmission corridors and executing proactive vegetation control strategies, the program aims to reduce power interruptions and improve system reliability in the following ways:

- Greater access for crews conducting routine maintenance and/or post-storm repairs,
- Clear rights-of-way allow for easier visual and drone inspections, helping identify risks before they cause outages,
- Preventing contact with trees that have experienced ice accumulation causing them to bend or break onto conductors or equipment,
- Fewer power line conductor failures,
- Fewer equipment failures from the forces created when trees land on power lines, and
- Faster restoration overall.

The program includes the following targeted strategies, explained further below:

- Distribution Corridor Widening with Managed Rights-of-Way,
- Transmission Corridor Widening with Managed Rights-of-Way,
- Establishing New Rights-of-Way (ROW), and
- Trimming and removal of trees around existing power lines.

As outlined in M11921 New Distribution Rights-of-Way Phase 10,[6] NS Power uses its Asset Management Mechanism and Feeder Risk Profiles to prioritize tree cutting. For distribution feeders, the criticality assessment considers factors such as electricity usage (kWh), regulatory consequences, customer count, redundancy, and ease of access. The condition score incorporates performance results, vegetation condition, load conditions, and feeder inspection data.

The condition rating of 1 to 5 indicates the overall vegetative condition of a feeder, with 1 meaning low vegetation proximity to the conductor (power line) and 5 indicating close proximity. NS Power assigns a condition rating for each section of the power line based on inspection data and work order history. This condition rating, combined with the criticality rating, determines which sections are targeted as priorities for vegetation management work to be completed.

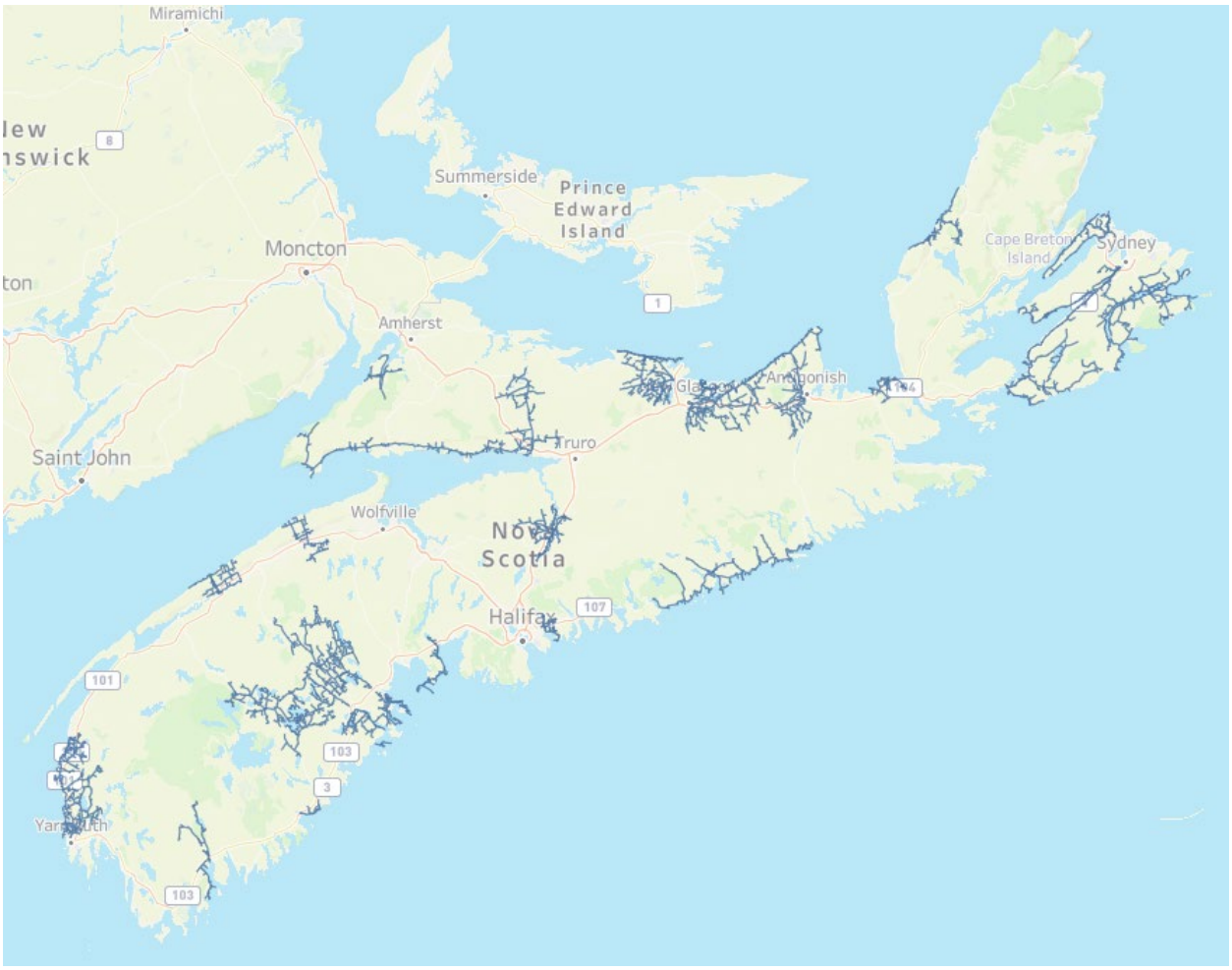
### 4.1 Distribution Corridor Widening with Managed Rights-of-Way (ROW)

**2025-2029 Forecast Investment:** $66 million

This program will expand the width of distribution corridors that currently have a managed right-of-way to reduce tree encroachment risks and enhance clearance standards. Over the course of this Five-Year Plan, NS Power is currently forecasting a total investment of $66 million in distribution right-of-way widening. In 2025, it is anticipated that NS Power will complete approximately 315 km of work and prioritize widening of the rights-of-way in approximately 40 communities. Vegetation management work is prioritized by analyzing historical outage data related to tree contacts and adverse weather, focusing on feeders or areas with the poorest performance. Previous vegetation cutting schedules are also reviewed to determine if additional maintenance is required, ensuring that high-risk feeders are addressed effectively. **Figure 5** shows the feeders planned for distribution widening in existing rights-of-way.

[6] M11921, NSPI Responses to NSUARB Information Requests, New Distribution Rights-of-Way Phase 10, pages 9-10.

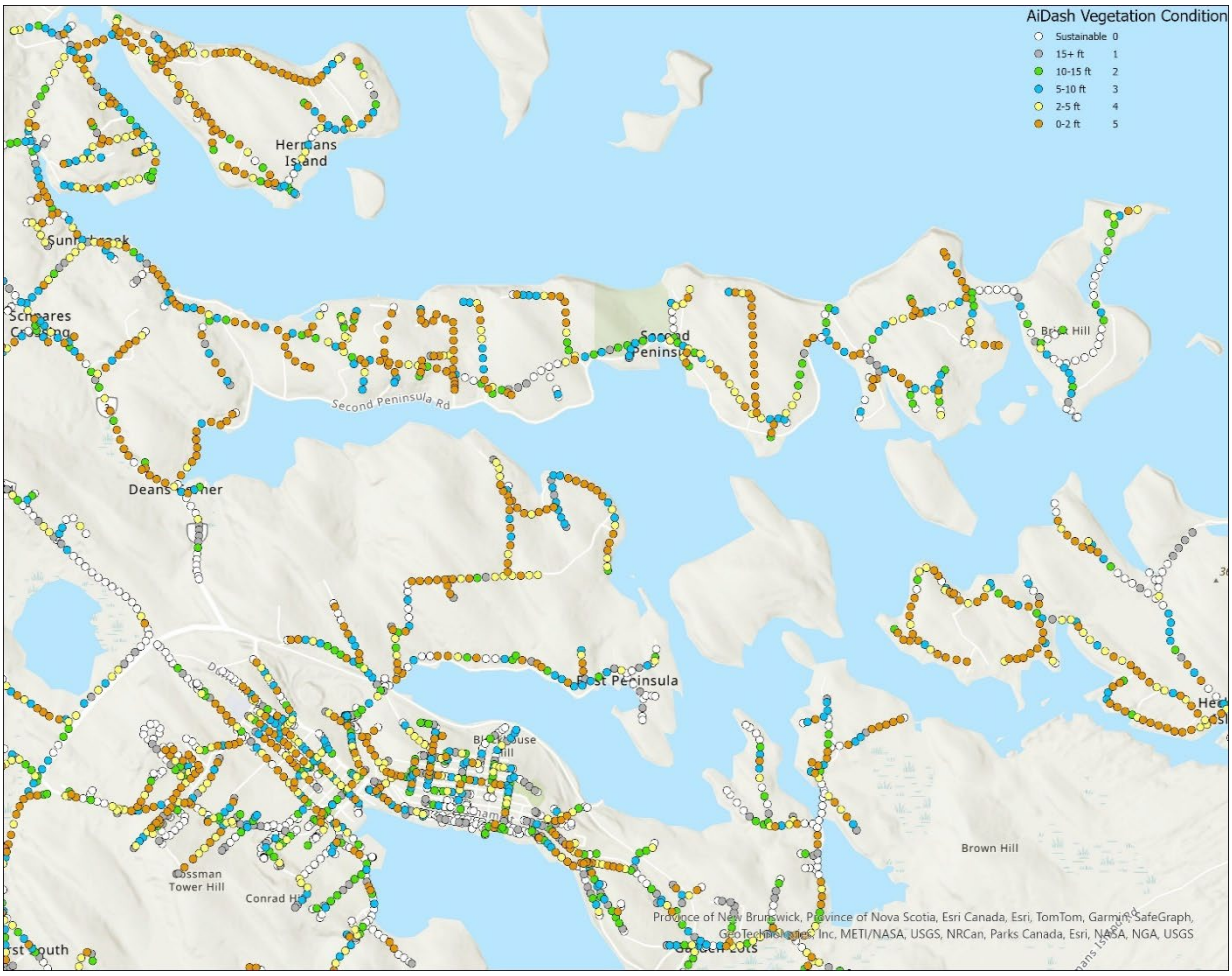
**Figure 5: Distribution Vegetation Management Right of Way Widening (2025)**




In 2025, NS Power will begin leveraging satellite imagery to further assess vegetation conditions by analyzing the proximity of vegetation to conductors. By combining this data with historical outage information, NS Power will enhance its ability to pinpoint vegetation problem areas within poorly performing circuits, enabling more targeted and precise vegetation management. As this technology is deployed, the evolving data and insights will continuously inform and help refine the workplan, ensuring resources remain focused on areas of highest risk and worst historical performance.

**Figure 6** shows the satellite scan of vegetation along a section of priority feeder 78W-302. This scan highlights where vegetation is in close proximity to the conductors, providing a baseline to prioritize targeted vegetation management work on this feeder.

**Figure 6: Vegetation Condition on 78W-302 from Satellite Imagery**




## 4.2 Transmission Corridor Widening with Managed Rights of Way (ROW)

**2025-2029 Forecast Investment:** $15 million

Similar to the distribution program, this program focuses on transmission lines and widening corridors with existing managed ROWs to improve reliability for critical transmission assets. As

outlined in the 2025 ACE Plan, NS Power is planning to invest $3.0 million in 2025 to widen transmission rights-of-way. Over the course of this Plan, NS Power is currently forecasting a total investment of $15 million in transmission right-of-way widening. In 2025, transmission widening is anticipated to take place in six transmission corridors in the following areas:

**Figure 7: Transmission Corridors Targeted for Widening (2025)**


| Transmission | Geographic location of the Line |
|---|---|
| L-6511 | Between New Glasgow and Glen Dhu |
| L-7003 | Between Onslow and Port Hastings |
| L-7004 | Between Dalhousie Mountain and Port Hastings |
| L-7005 | Between Onslow and Port Hastings |
| L-7008 | Between Brushy Hill and Bridgewater |
| L-7009 | Between Brushy Hill and Bridgewater |

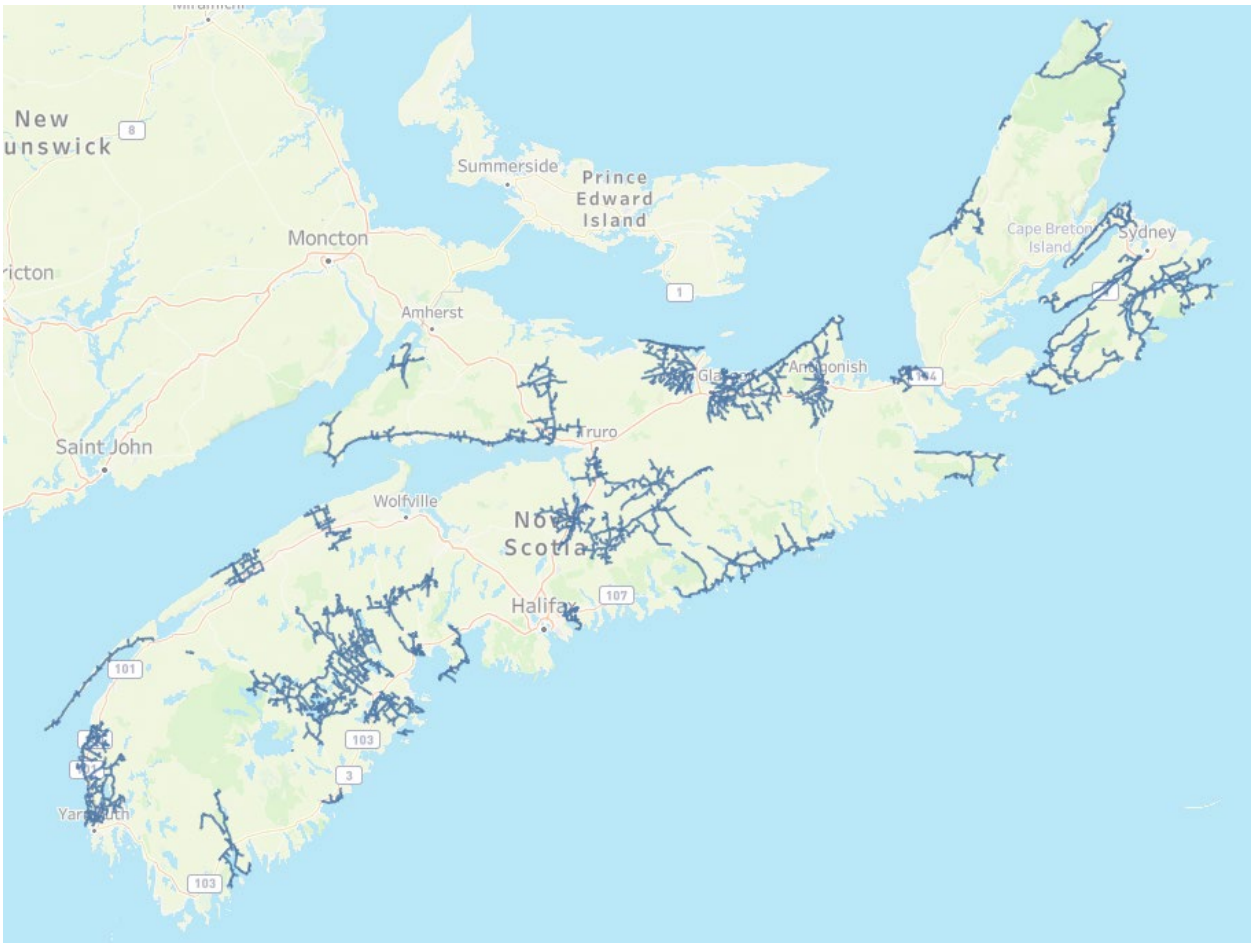
Right-of-way widening in these areas will continue to improve the transmission system's ability to withstand significant weather events where trees falling within the ROW can pose a risk to NS Power's infrastructure. Widening these ROWs mitigates the tree fall-in risk for the vast majority of trees on the edge of the ROW.

### 4.3 Establish New Rights-of-Way (ROW)

**2025-2029 Forecast Investment:** $86 million

This program establishes new ROWs for distribution feeders where rights-of-way have not previously existed. NS Power targets feeders where traditional vegetation management practices (e.g. trimming and removing trees) have a limited impact on preventing tree contacts that result from trees outside the right-of-way falling into the power lines. As part of this program, NS Power aims to establish rights-of-way with 20 feet of clearance from the conductor.

**Figure 8: New Rights-of-Way for Distribution Feeders**




## 4.4 Trimming and Removal of Trees Around Existing Power Lines

**2025-2029 Forecast Investment:** $98 million

Trimming and/or removal of trees from around existing power lines is included under this portion of the Storm Hardening – Vegetation Management program. The work completed to trim and remove trees is aligned with the vegetation condition. The growth cycles also inform how the work is prioritized. The program is focused on areas that cannot be widened, such as in many urban areas that have tree canopies. As much as possible, work is scheduled such that the trees are cut back prior to reaching conductor height. The work plans for trimming and removal of trees will also be further enhanced by the addition of intelligence from satellite imagery. The satellite

imagery data is being integrated into the work planning and prioritization process for 2025, and NS Power's current plan is to trim and remove trees on approximately 3,200 spans (177 km) of existing power lines in 2025.

## 5.0 STORM HARDENING – TARGETED EQUIPMENT REPLACEMENTS AND UPGRADES

**2024-2029 Forecast Investment:** $916 million

**Forecasted Performance Standards SAIDI Reduction:** 0.13 to 0.24 hours

NS Power's Storm Hardening - Targeted Equipment Replacements and Upgrades Program is designed to strengthen the power system and enhance its ability to provide reliable service across a range of operating conditions, including periods of adverse weather. By focusing on the highest-risk assets and areas, this program implements targeted measures to improve resilience, reduce unplanned outages, and ensure the system can adapt to evolving challenges (e.g. worsening weather conditions). This program includes the following areas of focus, further detailed below:

- Distribution System Equipment Upgrades and Replacements,
- Transmission System Upgrades and Replacements, and
- Substation Upgrades and Replacements.

### 5.1 Distribution System Equipment Upgrades and Replacements

**2024-2029 Forecast Investment:** $487 million

This program is focused on modernizing and enhancing NS Power's distribution system to improve reliability and resilience, meet growing demand, and ensure compliance with evolving regulations. Key initiatives include replacing aging infrastructure (e.g. hydraulic reclosers, conductors, step-down transformers), relocating equipment and infrastructure (e.g. relocating lines to roadside locations for better accessibility), and installing advanced protective devices like reclosers and trip savers to minimize outages. Investments under this program also include upgrades to underground infrastructure, upgrading equipment to support load growth in high-demand areas, and ensuring compliance with environmental regulations.

In 2025, $9.2 million is planned to be invested to modernize and replace aging or obsolete equipment such as hydraulic reclosers, older devices that contain PCBs and step-down transformers. These multi-year programs are designed to improve reliability and ensure environmental compliance is maintained. NS Power plans to replace 39 devices identified as containing or potentially containing PCBs, including 16 step-down transformers, 18 downline primary metering tanks, and 5 voltage regulators. In addition, over 600 pole-top transformers will be replaced. Approximately 400 of these pole-top transformers are being replaced to address environmental and reliability priorities, and approximately 200 are being replaced solely to address the environmental risk associated with the concentration of PCB in those transformers.

The 2025 Distribution System Equipment Upgrades and Replacements program also includes the installation of new protective devices, such as reclosers and trip savers, to enhance the reliability of the grid. Reclosers automatically detect and respond to faults, isolating affected areas and minimizing the number of customers impacted by outages. These devices also reduce outage durations and improve restoration times, helping to prevent cascading outages and enhance overall grid resilience. The reclosers to be installed in 2025 are included in **Figure 9** below:

**Figure 9: 2025 Recloser Installations**

| Region | Feeder | Communities Impacted |
|---|---|---|
| Northeast | 24C-442 | Canso and surrounding area |
| Northeast | 50N-410 | Merigomish and surrounding area |
| Cape Breton | 22C-404 | Isle Madam |
| Cape Breton | 81S-303 | Glace Bay, Port Morien |
| Metro | 127H-411 | Waverley and Fall River |
| West | 55V-314 | Berwick, Aylesford and Burlington |
| West | 55V-314 | Berwick, Aylesford and Burlington |

In 2025, NS Power anticipates installing 16 trip saver devices across the province. Trip savers are protective devices installed on smaller sections of the distribution system where fuses would traditionally be used. Similarly to reclosers, trip savers quickly detect and isolate faults, allowing for the restoration of power to unaffected areas while minimizing the duration of outages.

**Figure 10** includes the trip savers anticipated to be installed in 2025. Fourteen of the trip savers will be installed on the highest priority feeders.

**Figure 10: 2025 Trip Saver Installations**

| Feeder | Trip Savers Installed |
|---|---|
| 56N-414 | 1 |
| 81S-301 | 1 |
| 6N-301 | 1 |
| 57W-401 | 2 |
| 78W-301 | 1 |
| 57S-401 | 1 |
| 85S-401 | 1 |
| 4N-313 | 1 |
| 70W-311 | 1 |
| 113H-433 | 1 |
| 80W-301 | 1 |
| 91W-411 | 4 |

By targeting these locations, the trip-saver program will improve fault isolation and restoration efforts in key areas, ensuring a more stable and reliable power supply for customers. These installations, along with replacements of aging or damaged infrastructure, are part of NS Power's commitment to preparing the grid for future challenges and evolving customer needs.

To meet the growing number of customers and the evolving demands on the distribution system, NS Power is adding new equipment and infrastructure in areas experiencing or anticipated to experience significant growth. These projects address capacity challenges, while also ensuring reliable service for expanding communities.

Two key projects are planned for 2025 to create new distribution feeders:

- Prospect Road, Halifax: A 2.7 km, three-phase line will be constructed to serve the communities along Prospect Road. This project includes the installation of approximately

54 poles and 10.8 kilometers of primary and neutral conductor, enhancing capacity and reliability in this rapidly expanding area.

- 99H Substation, Dartmouth: A new feeder is anticipated to be commissioned from the 99H substation in the North End of Dartmouth to address significant growth in Shannon Park, Wyse Road, and Downtown Dartmouth. This development will alleviate capacity constraints on existing feeders and support the increasing demand in these areas.

These projects are instrumental in accommodating increasing load while maintaining the reliability and efficiency of the distribution network.

As part of NS Power's Plan to improve reliability and resilience, NS Power is updating some of its overhead distribution design standards to align with the latest CSA C22.3 overhead line standards. These updates include specifying larger class poles, resulting in stronger installations in many cases. Advanced pole modeling software is being used to study the effects of wind, ice, equipment, and attachment loads on pole integrity. The analysis completed with this modeling software provides a more accurate assessment of how poles respond to external forces (e.g. high-speed wind gusts), ensuring poles that are capable of withstanding heavy weather and extreme wind conditions and specified and installed.

In addition, NS Power has developed coastal framing standards to storm-harden new and existing power lines in harsh coastal environments. These standards include stronger insulators designed to withstand greater wind loading and utilize clamp-style attachments for a more secure hold compared to conventional tie wire. Together, these enhancements improve the resilience of the distribution system against severe weather conditions.

The following three subprograms are part of the overall Distribution System Equipment Upgrades and Replacements program.

### 5.1.1 Distribution System Build-to-Roadside Program

**2025-2029 Forecast Investment:** $12 million

The purpose of this program is to bring distribution lines closer to the roadside (re-routing them from off-road areas where they are not easily accessible). Relocating infrastructure to roadside reduces the likelihood of tree contacts, since the roadways are clear, and allows the associated equipment to be inspected and assessed more easily. Additionally, Power Line Technicians (PLTs) can patrol and access the distribution feeders more quickly in the event of an outage and thus restore power more effectively.

In 2025, it is anticipated that approximately eight kilometers of distribution line will be re-built closer to the roadside. Details of the projects anticipated to be completed in 2025 can be found in Figure 11 below.

**Figure 11: 2025 Bring-to-Roadside Projects**

| Feeder | Project Name | Description |
|---|---|---|
| 100C-421 | Havre Boucher Rebuild | Bringing 1.4 km of three phase line from cross-country to roadside. |
| 85S-401 | Parks Canada Halfway Brook to Neils Harbour | Bringing 0.75 km of line to roadside, with the new road and bridge being built by Parks Canada. |
| 103C-314 | Chéticamp Back Road Bring to Roadside | Bringing approximately 1.0 km of three-phase line along the Cabot Trail at the Grand Étang River to roadside. |
| 512W-311 | Lake Torment Rebuild | Upgrading 7.5 km of 12 kV line to 25 kV, including bringing 0.5 km of conductor to roadside. |
| 126H-312 | Lawrencetown Route 207 Realignment | Bringing approximately 1.0 km of line to roadside on Route 207 in Lawrencetown. |
| 131H-422 | Etter Road Rebuild | Bringing 1approximately 1.0 km of primary and neutral conductor to roadside on Etter Road in Mount Uniacke. |
| 19C-204 | Durrells Island Conversion | Bringing 1.6 km of primary and neutral conductor to roadside on Durrells Island. |
| 33N-201 | Canaan Road Conversion | Bringing 1.3 km of primary and neutral conductor to roadside between New Canaan and Halfway River East. |

### 5.1.2 Distribution System Conductor Upgrades

**2025-2029 Forecast Investment:** $26 million

The Distribution Conductor Upgrades program focuses on the proactive replacement and modernization of aging infrastructure to reduce the risk of outages and improve reliability and resilience of the distribution system.

In 2025, it is anticipated that approximately 39 kilometers of distribution line will be reconductored. **Figure 12** outlines the feeders that will have portions of the existing conductors replaced or upgraded along with how many kilometers are estimated to be completed.

**Figure 12: 2025 Conductor Upgrades by Region**

| Region | Feeders to be Reconductored | km Reconductored |
|---|---|---|
| Cape Breton | 2 | 5.4 |
| West | 5 | 9.7 |
| Metro | 18 | 10.6 |
| Northeast | 7 | 12.8 |

### 5.1.3 Distribution System Underground Upgrades

**2024-2029 Forecast Investment:** $37 million

Another focus area of the Distribution System Equipment Upgrades and Replacements Program is distribution underground upgrades, supported by $6.2 million investment in 2025. This includes targeted replacements of underground devices, pad-mount transformers and switches, as well as vault and manhole upgrades to address aging infrastructure and enhance resilience. In 2025, work

will begin on the replacement of approximately 800 meters of primary underground cable on 1H-403 in downtown Halifax that has been identified as being at risk of failure due to condition. Additionally, the underground upgrades program includes replacement of approximately 50 pad-mount transformers.

## 5.2 Transmission System Upgrades and Replacements

**2025-2029 Forecast Investment:** $196 million

In 2025, a targeted transmission investment of $33 million will fund a range of initiatives aimed at improving reliability and making the transmission system more resilient. These initiatives include over $14.7 million for traditional replacements and upgrades to reinforce core infrastructure (transmission structures and conductors, for example), along with more than $3.6 million dedicated to unique, site-specific projects, including water crossing upgrades, line realignments and targeted line rebuilds. Additionally, $4.8 million is allocated to key programs aimed at ongoing maintenance and asset life extension programs, including wood pole retreatment, steel tower refurbishment and removal of older lines from service that are being retired. More details on these transmission system investments are included in the 2025 ACE Plan.

## 5.3 Substation Upgrades and Replacements

**2025-2029 Forecast Investment:** $233 million

This program supports a range of initiatives to replace existing substation assets such as transformers, breakers and switches. Additionally, $12 million is designated to construct new substations, or expand/rebuild existing substations.

In 2025, it is anticipated that four substation transformers will be replaced serving the communities and surrounding areas of Nictaux, Springhill, Mahone Bay, and Dartmouth. At the Middlefield substation, enhanced protection and sectionalizing capabilities are being added to improve

reliability by enabling the ability to isolate faults to a specific area, reducing outage impacts and enabling faster restoration.

Additionally, the purchase of a spare substation transformer is necessary to provide additional coverage for several units across the province which are showing signs of deterioration. The spare transformer will provide backup for a number of contingency scenarios involving these targeted units.

This investment also includes three new substations in Bridgewater, Stellarton, and Susie Lake, as well as the continuation of construction on the new Mount Uniacke substation. The addition of these four substations will enhance system capacity and reliability in these growing communities. These investments will support increased demand, improve operational flexibility, and strengthen the overall resilience of the electrical grid.

## 6.0 ADVANCED GRID MODERNIZATION PROGRAMS

**2025-2029 Forecast Investment:** $78 million

**Forecasted Performance Standards SAIDI Reduction:** 0.06 to 0.11 hours

In addition to the grid modernization that is becoming inherent in some of the traditional equipment upgrades described above in section 5.0, the integration of additional real-time monitoring and automation will enable NS Power to better detect and address issues on the power grid more quickly. For example, smart grid technologies can help pinpoint causes of power outages with greater precision and improve recovery times during power outages by reducing the time spent locating a fault and allowing for a more efficient dispatch of resources. Additionally, enhanced visibility and control over Distributed Energy Resources (DERs) allows utilities to better balance supply and demand, manage fluctuating grid conditions, and integrate intermittent renewables improving stability and power quality. These improvements will ultimately reduce the frequency and duration of outages, ensuring that customers experience a more reliable and consistent energy supply.

The following two subprograms, (6.1) Connected Assets and (6.2) Fault Isolation and Service Restoration, are part of the overall Advanced Grid Modernization program.

### 6.1 Connected Assets

**2025-2029 Forecast Investment:** $65 million

NS Power is expanding the implementation of telecommunications connectivity providing telemetry and controls to intelligent field devices throughout the grid, including Remote Terminal Units (RTU) and communications to distributed protection equipment. This allows for improved awareness of outages, expedited knowledge of fault locations and remote operation capabilities as well as enhanced data allowing for more in-depth asset management activities. Currently, it is widely recognized that the deployment of Supervisory Control and Data Acquisition (SCADA)

connectivity to the grid will help enable Grid Modernization and correspondingly, this will be a key area of investment.

### 6.1.1 Remote Terminal Units (RTUs)

**2025-2029 Forecast Investment:** $ 21 million

Throughout 2024-2029, NS Power intends to deploy up to 58 additional RTUs to substation sites in a combination of existing device replacements or upgrades as well as new deployments. In 2025, RTU projects will focus on the following areas:

**Figure 13: Remote Terminal Units Proposed for 2025**

| RTU | | |
|---|---|---|
| **Region** | **Area / Community** | **Substation** |
| Cape Breton | Port Hastings | 2C |
| Cape Breton | Southwest Margaree | 58C |
| Cape Breton | Cleveland | 22C |
| Northeast | Tatamagouche | 4N |
| West | Hebron | 16W |
| West | Bridgewater East | 89W |
| West | Bridgetown Rural | 70V |
| West | Kingston | 63V |
| West | Ohio Road | 25W |
| West | Central Argyle | 19W |
| West | Wolfville Ridge | 83V |
| West | Indian Path | 80W |

### 6.1.2 Downline Connectivity

**2025-2029 Forecast Investment:** $44 million

Expanding on Section 6.1, adding a communications path from a downline recloser to the ADMS environment can provide reliability benefits including faster fault location during power outages, reduction of delays caused by driving distance between devices due to remote SCADA operation, and improved asset management data as well as safety benefits of reducing line-of-fire with remote operation.

Throughout 2025-2029, NS Power intends to deploy connectivity to downline reclosers. Proposed 2025 / 2026 projects include deployment of connectivity on up to 28 downline reclosers and the company is planning projects in subsequent years with intention to scale deployment based on learnings in field deployment and Control Center integration with previously executed projects. The 2025 / 2026 locations include deployments in the following areas:

**Figure 14: Downline Reclosers Planned for 2025-2026**

| **Downline Connectivity** | | |
|---|---|---|
| **Region** | **Area / Community** | **Feeder / Substation (part of)** |
| West | Three Mile Plains | 79V-401 |
| Metro | Musquodoboit Harbour | 87H-313 |
| | | 87H-313 |
| Northeast | Dickie Brook | 24C-442 |
| Northeast | Ruth Falls | 96H-412 |
| | | 96H-412 |
| | | 96H-412 |
| West | Waterville | 55V-313 |
| Metro | Lucasville | 131H-422 |
| Cape Breton | Ingonish & Cape North | 85S-401 |
| Cape Breton | Coxheath & Eskasoni | 11S-411 |
| Metro | Lakeside | 103H |
| Metro | Kearney Lake | 129H |
| Metro | Hammonds Plains | 137H |
| Metro | Armdale | 2H |
| Metro | Kempt Rd | 104H |

In addition to these efforts, NS Power is investing in advanced technologies and system upgrades to enhance the supporting systems that enable downline connectivity. These include modernizing communication networks to ensure fast and reliable data transfer, upgrading system controls to support more precise device coordination, and implementing advanced grid management software for enhanced monitoring and decision-making.

## 6.2 Fault Location Isolation and Service Restoration

**2025-2029 Forecast Investment:** $13 million

Fault Location, Isolation and Service Restoration (FLISR) is a system of distribution protection devices sited to allow automatic and remote re-configuration of the distribution grid to improve feeder reliability by reducing interruption impacts to the minimum number of customers possible. Wide-ranging visibility and control of the distribution network is a foundational investment towards grid modernization goals and enablement of communication and remote operation capabilities can improve reliability metrics both during normal operations and when the distribution system is highly stressed during storms and other major events. Industry case studies and statistics show that investment in Centralized and De-centralized self-healing grid projects can impact reliability by reducing Customer Interruptions (CI) and Customers Hours of Interruption (CHI).

Building on the deployment of distributed connected assets, as discussed in Section 6.1, some of these locations will contribute to future self-healing grid projects as the company aims to build on successfully operationalized pilot projects that have demonstrated a 61 percent reduction in CHI in the area covered by the deployed project.

### 6.2.1 Distributed Energy Resources (DERs)

As the country moves towards a net-zero future, and as Distributed Energy Resources (DER) proliferates throughout energy grids, flexibility of the grid will become increasingly important.

Energy will often be generated and timed when weather patterns and customers decide, not when the grid demands. The patterns on which utility customers consume electricity are changing, requiring new methods and capabilities to manage the grid. Enhanced data and automation will enable management capabilities. DER visibility and control will support mitigation of negative grid impacts while unlocking new integrated value chain opportunities.

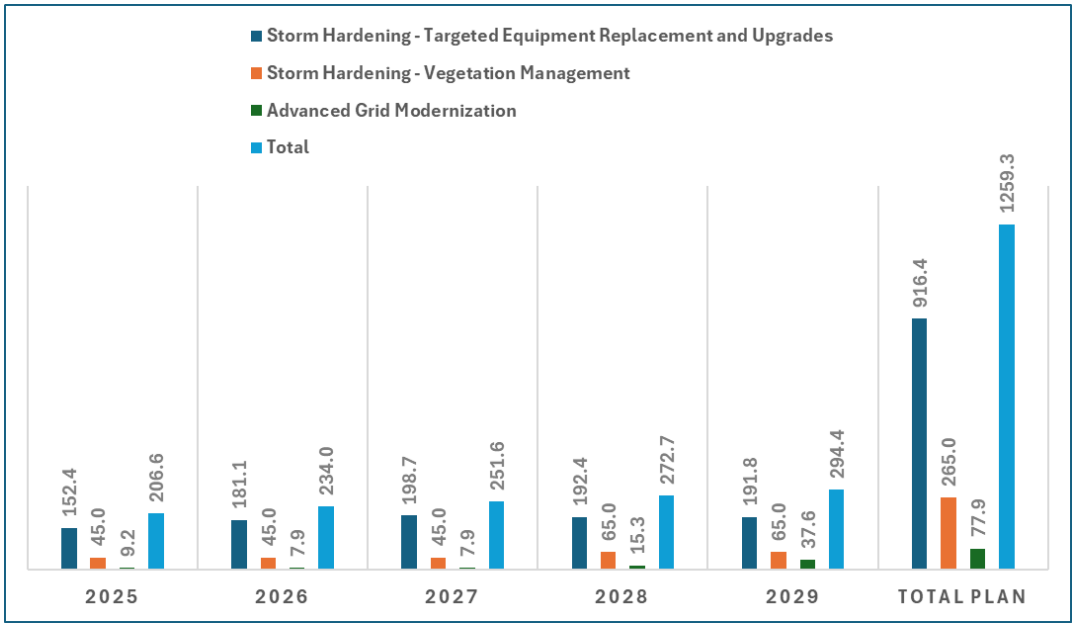
Following on the successes of the Intelligent Feeder and Smart Grid Nova Scotia projects, NS Power is evaluating its approach to best integrate DER into the Nova Scotia grid, including deployment of a DERMS platform with capabilities to manage DER within system constraints to maintain system stability and reliability by orchestrating DER-related use cases, where control capabilities exist.

## 7.0 CONCLUSION

This Plan demonstrates NS Power's commitment to delivering reliable and resilient electrical service to customers. By investing in infrastructure hardening, grid modernization, vegetation management, and leveraging innovative technologies, the Company is addressing both immediate needs and long-term challenges to enhance system performance and recovery capabilities. While this plan aims to provide the Board and stakeholders with specific actions, related timing, and quantification of the improvement to reliability and resilience, evolving circumstances, some of which are beyond NS Power's control, may impact NS Power's ability to complete specific actions outlined in this Plan. As a result, the Plan must be flexible and will be reassessed routinely to update strategies to stay aligned with changing conditions.

NS Power commits to identifying all updates to this Plan in subsequent ACE Plans as directed by the Board in M11692. These updates will demonstrate the evolving nature of the Plan, reflecting any emerging risks, information about evolving weather patterns, stakeholder data and feedback, new opportunities for further collaboration, potential new technologies, and updated investment forecasts to the benchmark forecast included in this Plan and summarized in **Figure 15** below:

**Figure 15: Benchmark Investment Forecast by Reliability Program (2025-2029):**



NS Power is committed to proactively communicating progress on reliability improvements and any adjustments to our strategies in a transparent manner. Moving forward, NS Power continues to explore partnerships to advance significant resilience investments, including the potential for capital-intensive projects like undergrounding.

As stated previously, it is NS Power's hope that this Plan and the regulatory process related to it will provide the opportunity to engage with stakeholders not only on the importance of making the grid more reliable and resilient to the impacts of climate change, but also the appropriate balance between desired performance and costs.

## APPENDIX A – DEFINITIONS

**DERs (Distributed Energy Resources):**
Small-scale, decentralized power sources such as solar panels, wind turbines, and battery storage systems that are connected to the distribution grid.

**DERMS (Distributed Energy Resource Management System):**
Software platforms designed to integrate, monitor, and manage distributed energy resources to optimize grid performance and reliability.

**Extreme Event Day (EED):** A day when the daily cumulative hours of interruption exceeds the Extreme Event Threshold, calculated annually using the 3.5 beta method.

**Feeder:** A distribution circuit that delivers electricity from substations to end-use customers. Feeders often consist of overhead and underground lines, serving specific geographic areas.

**Advanced Grid Modernization:** Refers to the integration of advanced technologies, capabilities and data into utility systems and practices to enhance efficiency, customer experience, reliability, resilience and sustainability of the electrical grid. It encompasses upgrades to infrastructure, the adoption of digital tools, and the implementation of innovative operational strategies.

**IEEE:** Institute of Electrical and Electronics Engineers

**Major Event Day (MED):** As defined by the IEEE Standard 1366, is a day when the daily cumulative hours of interruption exceeds the Major Event Threshold, calculated annually using the 2.5 beta method.

**Major Event:** a significant weather-related or other disruptive event that results in at least one Major Event Day (MED).

**Performance Standards SAIDI:** Calculated in a similar manner to SAIDI, but excluding EEDs, MEDs and planned outages as detailed in the Board's directive related to Performance Standards[7].

**Performance Standards SAIFI:** Calculated in a similar manner to SAIFI, but excluding MEDs and SEDs.

**Recloser:** An automated electrical switch that can interrupt and reclose a circuit to isolate faults temporarily, allowing power restoration, often, without manual intervention.

**Reliability:** The ability of the electric grid to deliver uninterrupted power to customers under normal operating conditions.

**Resilience:** The ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions.

**SAIDI (System Average Interruption Duration Index)**: SAIDI is a measure of the duration of electric system outages. It is calculated by dividing the total duration of customer outages by the total number of customers served.

$$\text{SAIDI} = \frac{\text{The sum of the total customer hours of Interruption}}{\text{Total Customers served}}$$

**SAIFI (System Average Interruption Frequency Index)**: SAIFI is a measure of the frequency of electric system outages. It is calculated by dividing the total number of customer interruptions by the total number of customers served.

$$\text{SAIFI} = \frac{\text{The sum of the total number of customers interrupted}}{\text{Total Customers served}}$$

[7]M10279 – Order, April 7, 2022 approving 2022-2026 Performance Standards Compliance Filing Attachment 2, section 1.0.

**Significant Event Day (SED):** A day when the daily cumulative hours of interruption exceed the Significant Event Threshold. The Significant Event Threshold is calculated annually using the 2.0 beta method.