



Integrated Resource Plan Action Plan Update

2024



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Introduction

Nova Scotia Power is pleased to provide this update to its IRP Action Plan

On November 30, 2020, Nova Scotia Power submitted **Powering A Green Nova Scotia, Together: 2020 Integrated Resource Plan (IRP)** to the Nova Scotia Utility and Review Board.

The IRP Final Report provided the findings and recommendations in the form of an Action Plan and a Roadmap to support the long-term strategy:

- A commitment to an Evergreen IRP process was included in the Roadmap; if significant changes to the planning environment are observed, the Evergreen IRP process enables further assessment and an update to the Action Plan and Roadmap, if required
- Since the 2020 IRP, changes in environmental policy, load growth and emerging resources triggered further study
- As a result, an Evergreen IRP process was undertaken; the 2022/2023 Evergreen IRP and the resulting update to the Action Plan and Roadmap was completed in August of 2023

This is the third annual Action Plan Update, which provides the following:

- An update on electricity planning environment changes
- An update on the Action Plan and Roadmap items for 2023
- For ongoing items, a description of planned work for 2024



IRP Action Plan Overview

Action Plan Items

Nova Scotia Power's IRP Action Plan consists of 5 Action Plan Items, some of which include multiple elements:



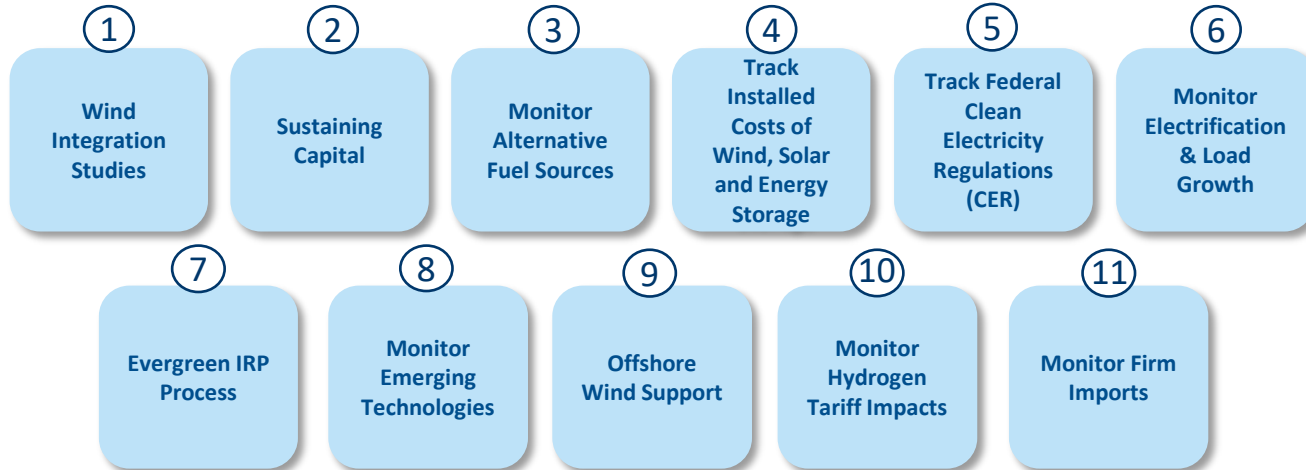
This Annual Report provides an update on each of these Action Plan Items

Descriptions of the Action Plan Items can be found in the updated [2023 Evergreen IRP Action Plan and Roadmap](#)

IRP Action Plan Overview

Roadmap Items

NS Power also monitors the following 11 Roadmap Items for potential impact on Action Plan execution:



In this report, updates on relevant Roadmap item updates have been provided throughout the document.

2020 IRP vs. Evergreen IRP

When comparing the most recent IRP Action Plan and Roadmap released to the 2020 version, updates have been made to the action plan items in alignment with the Evergreen IRP results.

The following two slides highlight those changes, which will be reflected in the subsequent action plan and roadmap updates. The updated Action Plan and Roadmap can be accessed [here](#).

Action Plan Items	2020 IRP	Evergreen IRP
1. Regional Integration Strategy	<ul style="list-style-type: none">a. Near-Term Firm Importsb. Reliability Tiec. Regional Interconnection Development	<ul style="list-style-type: none">a. Reliability Tieb. Regional Integration
2. Electrification	<ul style="list-style-type: none">a. Electrification Strategyb. Data Collectionc. T&D Electrification Impacts	<ul style="list-style-type: none">a. Electrification Strategyb. Data Collectionc. T&D Electrification Impacts

2020 IRP vs. Evergreen IRP

Action Plan Items	2020 IRP	Evergreen IRP
3. Thermal Plant Retirement, Redevelopment, and Replacement Plan	<ul style="list-style-type: none"> a. Thermal Plant Retirement b. Thermal Plant Depreciation Study c. Fast Acting Generation Capacity d. Wind Procurement Strategy 	<ul style="list-style-type: none"> a. Thermal Plant Retirement b. Thermal Plant Depreciation Study c. Fast Acting Generation Capacity d. Procurement Strategy for Variable Renewable Resources e. Thermal Plant Conversions and Fuel Transitions f. Battery Storage Capacity g. Synchronous Condensers
4. Demand Response	<ul style="list-style-type: none"> a. Demand Response Strategy 	<ul style="list-style-type: none"> a. Pilot Programming b. Hybrid Peak Electrification Scenario
5. Avoided Costs of DSM	Provide updated energy/capacity and T&D avoided costs of DSM based on the 2020 IRP.	Provide updated energy/capacity and T&D avoided costs of DSM based on the Evergreen IRP.

2020 IRP vs. Evergreen IRP

To best represent progress of the action plan items, there are some key changes made to the roadmap items shown below.

2020 IRP Roadmap Items	Evergreen IRP Roadmap Items
1. Coal to Gas Conversion	1. Wind Integration Studies
2. Wind Integration Studies	2. Sustaining Capital
3. Sustaining Capital Investments	3. Monitor Alternative Fuel Sources
4. Monitor Alternative Fuel Sources	4. Track Installed Costs of Wind, Solar and Energy Storage
5. Track Installed Costs of Wind, Solar and Energy Storage	5. Track Federal Clean Electricity Regulations (CER)
6. Track NS Cap-and-Trade Program	6. Monitor Electrification & Load Growth
7. Monitor Electrification & Load Growth	7. Evergreen IRP Process
8. Evergreen IRP Process	8. Monitor Emerging Technologies
	9. Offshore Wind Support
	10. Monitor Hydrogen Tariff Impacts
	11. Monitor Firm Imports

The background of the slide is a photograph of a residential area with several houses and trees. Overlaid on this is a semi-transparent blue filter. In the foreground, there are several tall, lattice-structured power transmission towers with power lines stretching across the sky. The overall scene is a mix of natural and man-made elements.

Planning Environment Updates

Planning Environment Updates

NSIESO

The Clean Electricity Task Force was created in April 2023, to advise the provincial government on how to green the grid and transition the province away from coal. Their final report was released on February 23rd, 2024.

Two key recommendations have currently been accepted by the government:

- Create the Nova Scotia Independent Energy System Operator (NSIESO)
- Create a standalone energy regulator, called the Nova Scotia Energy Board (NSEB), responsible for electricity, natural gas, pipelines, enforcement and retail gasoline, separate and distinct from the Utility and Review Board (UARB), to be renamed the Nova Scotia Regulatory and Appeals Board

On February 27, the Nova Scotia Legislature introduced Bill 404 (Energy Reform (2024) Act) establishing a path forward for the NSIESO and NSEB. Formal approval through royal assent of Bill 404 was received on April 5.

NS Power is supporting the transition to the NSIESO.

Planning Environment Updates

Clean Electricity Regulations

Roadmap Item 5

On August 19, 2023, the Federal Government released the draft Clean Electricity Regulations (CER) in Canada Gazette 1 (CG1)

- The CER is the Federal Environment and Climate Change Canada (ECCC) approach to achieve Canada wide economy net zero targets by 2050 by reducing emissions from emitting generation starting in 2035
- The CER is enforced under the Canadian Environmental Protection Act (CEPA); violations under CEPA can result in criminal prosecution

Although the draft CER included provisions for emitting generation, as currently proposed, the conditions did not allow for the use of these resources to enable the integration of wind and solar required to reduce overall system emissions

NS Power engaged with ECCC (policy and modeling) as part of the formal engagement process under CG1 and in November of 2023, provided the following feedback to ECCC:

- Additional flexibility is required to operate our emitting fleet to maintain system reliability and ensure we can meet customer demand during peak periods and support the integration of wind resources
- Our modeling demonstrates that operating our emitting fleet in a peaking capacity (low capacity factors) supports system reliability while still reducing overall system emissions

Planning Environment Updates

Clean Electricity Regulations

Roadmap Item 5

On February 16th, 2024, ECCC provided an update to stakeholders reflecting the feedback received and proposed changes to the CER

- The proposed changes acknowledged the importance of emitting generation in supporting the integration of variable renewable generation (wind, solar) to support the safe and reliable operation of the grid while reducing overall system emissions
- The proposed changes included the following, which are the most impactful to NS Power:
 - Increased flexibility to efficiently operate (reduce emissions and system cost) the generating fleet through emissions caps by facility, of which the allowable emissions can be pooled
 - Adjustment of the performance standard that informs unit emission limits
 - The use of offsets for utilities who have operated in good faith but have exceeded the limits
 - Changes to the “first generation” date for new units and the applicable requirements
 - Enabling emergency provisions that reflects the need (urgency of the requirement for emergency provisions)
- On March 16, 2024, NS Power submitted a feedback summary response to ECCC
- NSP will continue to work with ECCC on a path forward that is sensitive to reliability and affordability for customers
- The release of the updated CER as part of Canada Gazette 2 (CG2) is anticipated for 2024. At such time, NS Power will undertake an assessment to understand the impacts of the CER on the long term strategy and action plan, which is reflected by the **Evergreen IRP Roadmap Item 5**.

The background of the slide features a light blue overlay on a photograph. The photograph shows several high-voltage power transmission towers (pylons) stretching across a landscape. In the foreground, there are residential houses and a line of trees. The overall scene is hazy, suggesting a misty or overcast day.

Action Plan Item 1: Regional Integration Strategy

Regional Integration Strategy

Action Plan Item 1

This strategy will identify methods of gaining access to firm capacity and low-carbon energy while increasing the reliability of Nova Scotia's interconnection with North America.

The key components of this strategy include monitoring the potential for firm capacity imports and the progression of the reliability tie project.

Reliability Tie

Action Plan Item 1a

The Reliability Tie is a second 345kV AC transmission line from Onslow, NS to Salisbury, NB. For internal planning purposes, the Nova Scotia portion of this new transmission line has been designated as L-8006.

This enhanced transmission interconnection is anticipated to provide the following system benefits:

- Increased integration opportunity / reduced curtailment of domestic wind (or other variable inverter-based) generation
- Reductions to minimum online generation constraints in order to meet system synchronous inertia requirements
- Allow for expansion to access additional energy and capacity markets via additional transmission infrastructure beyond Salisbury, NB

The Reliability Tie work plan for 2023 focused on progressing the permitting, environmental assessment, funding and design aspects required to advance this project.



Reliability Tie

Action Plan Item 1a

The Reliability Tie continues to be developed with significant progress made in the past year in progressing the overall scope of work, including the following:

- NBP-NSP Intertie Development agreement is in progress
- Detailed Engineering design contract has been awarded and work is advancing
- First Nations Collaboration Agreement has been completed with continued engagement with the Millbrook and Sipekne'katik Indigenous communities
- The Environment Assessment for the project was approved on December 15th, 2023. NSP will address the conditions outlined in the approval in our work plan going forward.
- Survey work for the right of way (ROW) and watercourse crossings is in progress
- A ROW access study has been completed for future construction planning and building
- Funding for a portion of the pre-development costs has been provided through Natural Resource Canada's Strategic Interties Predevelopment Program (SIPP)
- Stakeholder engagement and open houses have occurred throughout the year and will continue as the project progresses

The target-in-service date is currently 2028, subject to regulatory approval, in alignment with the Nova Scotia Path to 2030.

Reliability Tie

NSP and NB Power Development Agreement

- NSPI has continued discussions with NB Power on the project development agreement
 - The development agreement will identify the scope of work for each organization and how project work will be coordinated.
 - This includes details on the structure and the role of each organization in the procurement process.
 - It is anticipated the agreement will be complete prior to submitting the UARB application for the Reliability Tie.
- As part of the Clean Power Plan presented by the Province of Nova Scotia, Stage 2 of the Reliability Tie was presented, which reflects an extension from Salisbury to Point Lepreau.
 - This Stage 2 work has the potential to provide firm imports to Nova Scotia. As part of this Stage 2 work, an upgrade of Onslow – Brushy Hill line L7018 from 230 kV to 345 kV may also be required.
 - NSPI is in discussions with NB Power on the Stage 2 option and will continue discussions through 2024.

Reliability Tie

Detailed Engineering Design

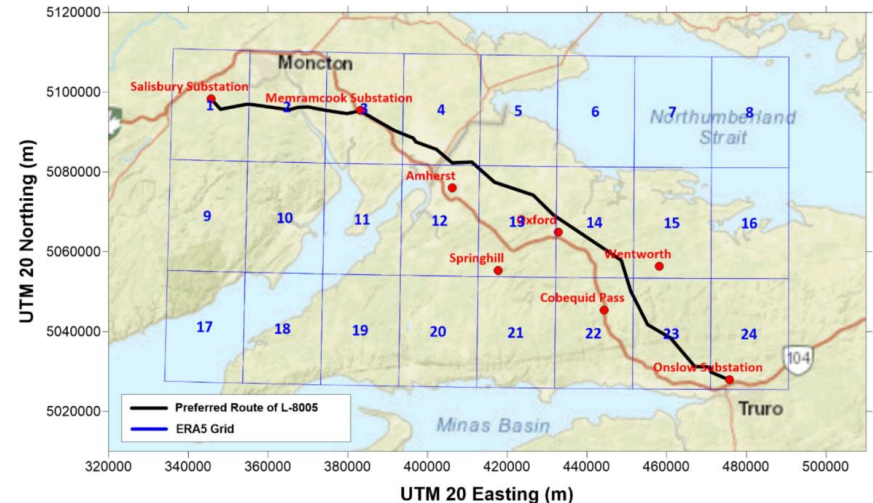
- Detailed engineering commenced in October 2023 for L8006 Reliability Intertie Line and 67N Onslow Expansion
- The following was completed for the L8006 Reliability Intertie:
 - Climate Study – completed in December of 2023
 - Review of the Preliminary Study Class 3 Design – started in December of 2023
 - Electrical Studies (e.g. EMF, Corona, Induction, Grounding, Insulation) – started in December of 2023
 - Line Material Specification – started in December of 2023
- The following was completed for the 67N Onslow Expansion
 - Review of the Transmission Facility Study and Cost Estimates – completed in December of 2023
 - Review of Class 5 Design for the transmission infrastructure – completed in December of 2023
 - Establish primary material specifications and order materials – started in December of 2023



Reliability Tie

Detailed Engineering Design – Climate Study

- Climate Consultant was retained to do Climate Study for the 345kV Corridor
- ERA5 model uses European Center for Medium Range Weather Forecast using Integrated Forecast System.
- This model considers physical characteristics of the environment such as terrain, ground water and proximity to water bodies.
- ERA5 Dynamic Model data was used from 1979 to 2019 on a 30km grid resolution
 - Contains Hourly Climate data
 - Wind Speed & Direction, wind gust
 - Precipitation
 - Temperature



Geomorphology & Geotech Study



- **Surficial Geology**

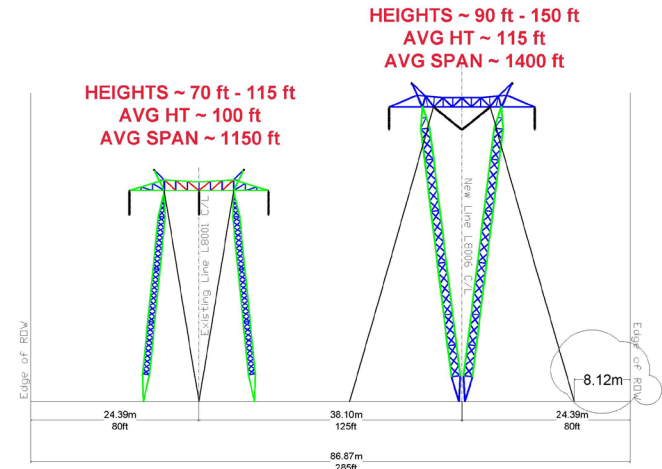
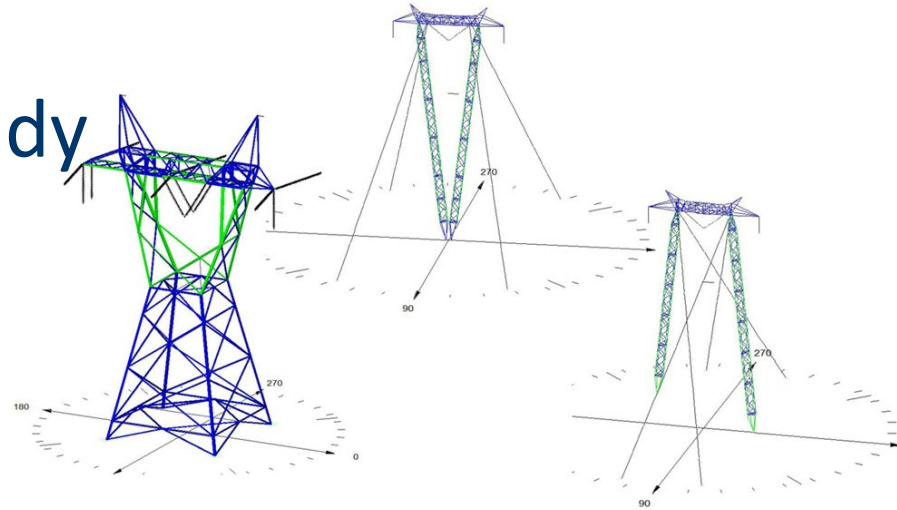
- Corridor Assessment was completed based on 3D Aerial Photos taken during LiDAR along with Hi-Res digital elevation model
- Summit Evolution and ArcGIS Software (Photogrametric Workstation)
- Allowed us to distinguish the area for different categories of surface material
- Bedrock, granular material, Fine Sediments and organic Soils
 - Wetland and Sensitive zones such as erosions, landslide-prone areas, flood-risk areas...etc.



Tower and Conductor Study

• Tower Study

- Pros and Cons of each configuration such as:
 - Operational Records
 - ROW constraints
 - Weight of towers
 - Conductor blow-out conditions
 - Foundation designs
 - Constructability
 - Cost efficiency



Reliability Tie

Mi'kmaq Relations

- A Mi'kmaq Ecological Knowledge Study (MEKS) was completed in 2023 to support the EA filing
- A Collaboration Agreement was reached in August of 2023 and Implementation Committee meetings commenced discussions in November of the same year
- An early consultation meeting was held with the Province and KMNKO on September 21, 2023 to discuss project details and engagement with Mi'kmaq.
- Community Information Sessions were held in Spring 2024 in three First Nations Communities, Millbrook, Pictou Landing and Paqtnkek.
- The KMKNO's "Mi'kmaq First Program" language has been adopted in project procurement initiatives to promote local benefits for Mi'kmaq Communities

Reliability Tie

Stakeholder Engagement

- Four community open houses held in the fall of 2023 in Oxford, Amherst, Wentworth and Onslow
- NSPI engaged with over 80 stakeholders including government, environmental, interest groups and public groups along the proposed route over 2023-24
- Met with at Fire Service Assoc of NS, Nova Scotia Ground Search & Rescue in spring 2024
- Socializing project at industry events and energy forums
- Proactive engagement where there are opportunities, overall no major concerns have been raised
- Engagement is ongoing and planned to to keep folks informed:
 - Landowners
 - Trail users
 - Agricultural sector
 - Blueberry Growers Association

Mi'kmaw Community Information Sessions & Open House Presentations

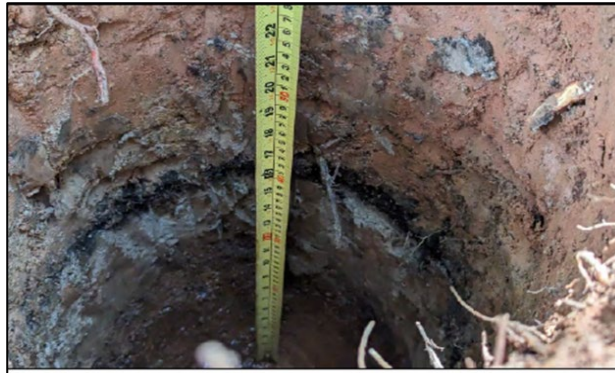
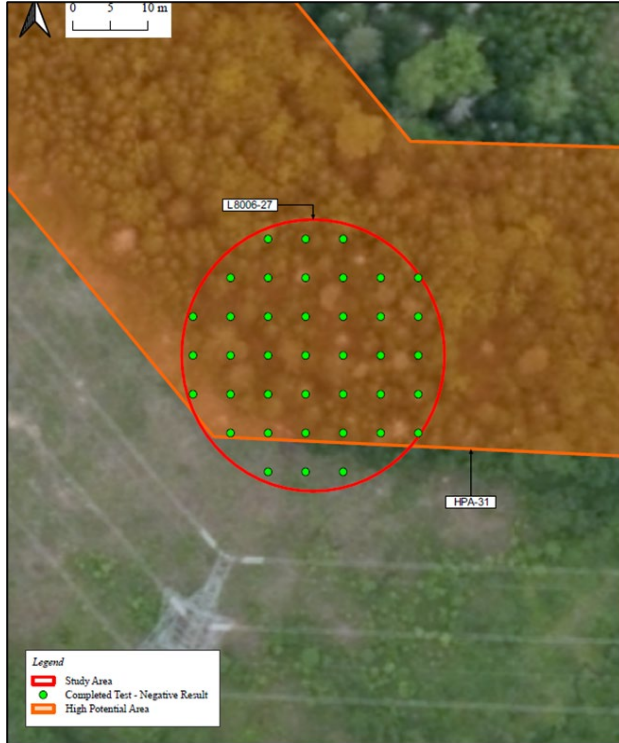


Reliability Tie

Environmental Assessment

- On December 15, 2023, the NS-NB Reliability Tie Environmental Assessment was approved with conditions by the Nova Scotia Department of Environment and Climate Change (NSECC)
- In support of the EA, the following work has been completed for the proposed transmission corridor:
 - Archaeological shovel testing was completed for seven high potential areas in 2023, with follow-up testing planned for this summer (2024)
 - Environmental studies were done for mainland moose, avifauna, old-growth forest, wetlands, watercourses and rare species 2020-2024
- Processes have been developed to identify environmental constraints for project planning and permit/EA conditions tracking

Intertie Archaeological Shovel Testing



Intertie Environmental Surveys



Reliability Tie

Wind Integration Support

- In 2023, NS Power completed the Large Scale Integration of Inverter Based Resources (IBR) in Nova Scotia study to better understand the impacts on the grid and corresponding requirements with a future increase in IBRs on the system as coal generation is phased out
- In the report, the contributions provided by the Reliability Tie to support IBR integration on the system was discussed:
 - *The addition of a second 345kV transmission line to New Brunswick would improve System Strength available from New Brunswick in the Onslow area and reduce the impact of the most critical contingency of the present system. In particular, the NSPI system can experience high RoCoF for the loss of the existing 345kV line under high imports. As IBR increases in Nova Scotia, keeping the RoCoF down may involve significant additional grid support and a second tie is a viable grid support option*

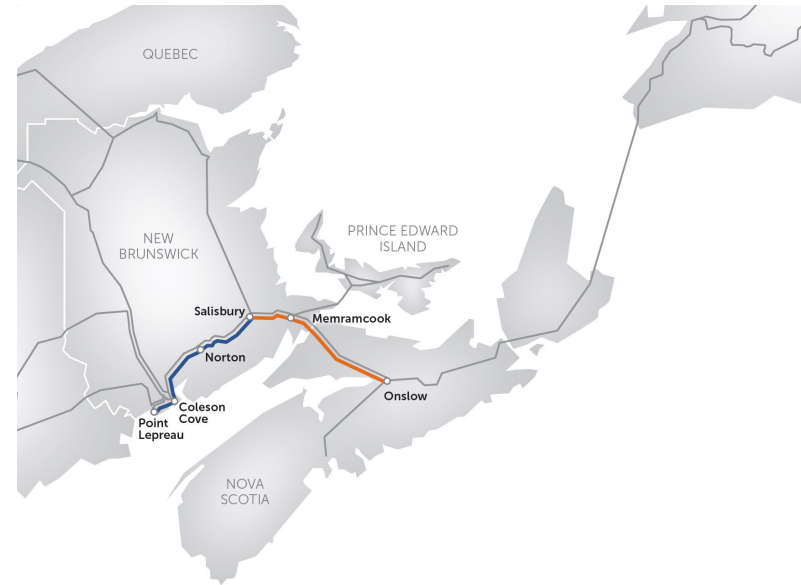
Regional Integration

Action Plan Item 1b & Roadmap Item 10

The 2030 Provincial Clean Power Plan notes the potential for the Reliability Tie to incorporate an extension from Salisbury, NB to Point Lepreau, NB:

- This would enable greater access to New Brunswick, New England and Quebec energy exports and imports
- Studies (detailed engineering, economic) will continue through 2024 and 2025 in parallel with the development of the Reliability Tie
- This approach was also identified in the Province of New Brunswick's recently released report, *Powering our Economy and the world with Clean Energy – Our Path Forward to 2035*

NS Power will continue to monitor opportunities for near-term firm imports over existing transmission infrastructure through working with neighboring jurisdictions.



— **Stage 1** Salisbury, NB, to Onslow, NS, 2027/28 in service

— **Stage 2** Salisbury, NB to Point Lepreau, NB, 2028/29 in service

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Action Plan Item 2: Electrification Strategy

Electrification Strategy

Action Plan Item 2a

The focus in 2023 for the Electrification Strategy involved finalizing the Electrification Strategy work with E3, which evaluates and identifies the impacts of, and strategies to enable beneficial electrification in Nova Scotia.

The completion of the report achieves the final task (5) of the electrification strategy, the components of which are as follows:

- Task 1: Objectives and Analysis Plan
- Task 2: Jurisdictional Scan and Electrification Load Shapes
- Task 3: Revenue Requirement Model and Customer Affordability Calculator
- Task 4: Beneficial Electrification Modeling Tool and Program Option Modeling Results
- Task 5: Electrification Roadmap

Key components of this work completed in 2023 included the following:

- Assessing impact on peak load requirements through developed loads shapes based on heat pump adoption/building shell improvement scenarios as well as EV managed charging scenarios.
- Focusing on building heating electrification and EV charging, through load shapes to assess the most likely electrification scenarios:
 - Current Policy and Trends: peak load profile impact based on heat pump adoption and usage reflective of current policy and heat pump adoption/building code trends
 - Hybrid Peak/Dual-Fuel: peak load profile based on a dual-fuel approach - heat pump adoption combined with retaining fossil fuel back up heat sources for use during peak load periods (coldest nights of the year), resulting in reduced peak load requirements
- Additional details from the study can be found in the 2023 update [here](#)

Electrification Strategy Roadmap

Action Plan Item 2a

E3 and NS Power developed an Electrification Strategy Roadmap to summarize key findings and recommendations on programming to support beneficial electrification in both the transportation and building sectors.

Based on the results of both the jurisdictional scan, the report identifies the following key findings:

- Electrification of building and transportation reduces total, economy-wide emissions in Nova Scotia
- Most transportation electrification investments produce benefits that exceed costs for drivers, ratepayers and society
- Policy changes may be required to encourage adoption of the most efficient equipment to support building electrification and avoid potential adverse impacts to ratepayers
- Utility actions through time of use rates and programs to avoid “rebound peaks” at the beginning of off-peak hours to manage transportation loads will be crucial to minimizing costs and achieving ratepayer benefits
- Encouraging adoption of advanced building technology (high performance heat pumps and hybrid heat pumps as well as building shell energy efficiency measures) will be essential to mitigate peak load impacts

The electrification strategy report was published on the Evergreen IRP website on [December 8th, 2023](#).

Electrification Strategy Roadmap

Action Plan Item 2a

NS Power conducted a stakeholder engagement session on February 2nd, 2024, to work towards developing programming to support the outcomes of the electrification strategy report in 2024. The key outcomes that are being prioritized are listed below;

- Engaging with various levels of government to implement EV charging stations across the province, and encourage EV adoption through infrastructure readiness
- Establishing TVP (Time-Varying Pricing) rates for customers based on TOU (Time of Use) or CPP (Critical Peak Pricing) tariffs. More information can be found on Slides 51-53
- Focusing on electrification of residential buildings
- Enabling heat-pump installations through preferred contract networks, community events, and easy conversion from fossil fuel heating systems
- Engaging commercial contractor network by growing their focus on building electrification efforts
- Promoting the Efficiency Nova Scotia Small Business Energy Solution Program to incentivize commercial customers with fuel conversions
- Establishing regular cadence with key accounts focusing on producing insights on the electricity needs and trends. This activity is to ensure we have awareness to provide accuracy on customer load increases or decreases
- Continue to support key account large project expansions and to ensure adequate energy supply to meet their evolving needs and timelines

Electrification Impacts – T&D System

Action Plan Item 2b & Roadmap Item 6

As outlined in **Roadmap Item 6**, NS Power continues to monitor electrification and load growth, to reflect these impacts in developed load forecasts for Nova Scotia.

Electrification Impacts to the NS Power Transmission & Distribution system continue to be studied, with more accurate information becoming available due to system modelling improvements.

- SCADA data continues to be utilized to monitor the annual transmission system peak load and to set up transmission system generation dispatch in system models.
- Further integration of AMI data into distribution modelling software is planned to consider multiple timeframes to capture any feeders that are morning, afternoon, and summer peaking (versus a typical evening winter system peak). It will also be used to identify overloaded downline equipment by feeder, including reclosers, voltage regulators, and stepdown transformers.

Electrification Impacts – T&D System

Action Plan Item 2b & Roadmap Item 6


Addition of electrification loads in the 2023 load forecast and the submission to the Board of the Path to 2030 in December 2023 have provided a clear picture of the generation resources required to serve load over the next five to ten years.

- The increase in load growth reflected in the 2023 load forecast exceeds assumptions used in earlier regional reliability studies. NERC TPL assessment of the Long-Term (10 year) Planning Horizon was revised in 2023, revealing no thermal or voltage violations for the NS BES with anticipated load and generation changes.

The 2023 Feeder Assessment and 2023 System Load Snapshot reports have identified feeders and substation transformers that are overloaded or expected to become overloaded within the next 5-10 years. No issues have been identified so far that would not be able to be mitigated within that time.

More detailed studies to meet NERC TPL and NPCC Area Transmission Review requirements will be completed in 2024.

Planning studies for the areas identified in the 2023 annual reports are being prioritized for completion in 2024 by the Distribution Planning team.

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Action Plan Item 3: Thermal Retirement Plan

Thermal Plant Retirement

Action Plan Item 3a

- As discussed in the 2023 10-Year System Outlook, the updated Evergreen IRP projections outline a target retirement date for Trenton 5 in 2028, based on updates to near-term firm imports and fast acting generation availability.
- NS Power has completed a transmission planning study to determine the impacts of retiring Trenton 5
 - This study provided recommendations for system reinforcements to mitigate impacts to the system.
 - The key findings of this study were outlined in the [2023 IRP Action Plan Update](#).
 - The findings of this study will continue to guide NS Power in planning the retirement of Trenton 5.
- The development of the overall coal retirement plan is still in progress for remaining units including consideration of cold reserve operating modes to enable the integration of new resources and reduced utilization over time.

Thermal Plant Depreciation Study

Action Plan Item 3b

- The GRA Settlement Agreement submitted to the UARB recommends a Decarbonization Deferral Account (DDA) to recover undepreciated thermal asset net book values (NBV) and unrecovered decommissioning costs.
- With the approval of the GRA Settlement agreement by the UARB, the intent is to prepare a depreciation study before the next GRA, outlining the creation of the DDA, which has been approved by the board.
- The study will determine depreciation rates and recovery strategies to better align depreciation with updated lifetimes of generation assets.
- NS Power will be progressing the plan for this depreciation study in 2024.

Fast Acting Generating Capacity

Action Plan Item 3c

The 2030 Clean Power Plan outlines the need for fast acting dispatchable generation to support the anticipated load demand as well as the increased concentration of renewables forecast. When the wind isn't blowing, and the sun isn't shining this generation is required for grid stability.

Forecast models show the need for 300MW of generation in the 2027 – 2028 period followed by an additional 300MW in 2030, for a total of 600MW.

These facilities will be known as RIPS – Renewable Integration Power Sites as they will primarily be operated as synchronous condensers which is key to provide system inertia to support the planned large wind penetration into the grid. While operating in synchronous condensing mode, which is anticipated to be 50-75% of the time, the power generation itself is turned off. The power generation is only anticipated to be dispatched approximately 15% of the year in times when it's needed most.

These facilities will primarily operate on natural gas however they will be hydrogen capable once the market supply is available. They will be dual fuel, being able to run on liquid fuel with the future potential for biofuel if available.

Fast Acting Generating Capacity

Action Plan Item 3c

Timelines for the proposed RIPS project are forecasted to deliver a total of 300MW, constructed as two separate 150MW Renewable Integration Power Sites operational in the 2027 – 2028 period.

Details of the RIPS project progress planned for 2024 are as follows:

- Conceptual Engineering market insight on OEM technology
- Site selection studies
- Environmental desktop and field studies to support permitting applications
- Discussions ongoing in relation to funding support for the project.



Procurement Strategy for Variable Renewable Resources

ECEI Wind

Action Plan Item 3d

In September of 2023, Everwind Fuels (EWF), one of the prospective Hydrogen developers in Nova Scotia, purchased the NS Power ECEI Wind Projects.

Additional wind/solar based projects required as part of the Path to 2030 will be supported by provincial programs, specifically the Rate Based Procurement and Green Choice Programs.

Procurement Strategy for Variable Renewable Resources

NS Rate Based Procurement (RBP) Program

Action Plan Item 3d

The Nova Scotia Rate Base Procurement (RBP) program is a Provincially-led program that has enabled the procurement of renewable generation in Nova Scotia, with support from NS Power on completing studies a part of the Generator Interconnection Process (GIP). This program is managed by the procurement administrator, Coho Climate Advisors (Coho).

The goal of the RBP program is to acquire low-cost renewable electricity for Nova Scotia. Some key details are as follows:

- Procure 1100 MWh of renewable energy
- The RBP portfolio involves 5 projects¹, totaling 373 MW of renewable electricity generation from wind. This RFP portfolio process concluded in August 2022 and was updated in July 2023.

NS Power has completed facilities studies for 3 of the 5 project locations as part of the GIP and continues to progress the additional study work for the remaining projects.

¹Benjamins Mill Wind near Falmouth in Hants County, Higgins Mountain Wind Farm near Wentworth in Colchester and Cumberland counties, WEB Weavers Mountain Wind near Marshy Hope in Pictou and Antigonish counties, Wedgeport Wind Farm in Yarmouth County, Clydesdale Ridge Wind Energy Project near Dalhousie Settlement in Pictou County.

Procurement Strategy for Variable Renewable Resources

Provincial Green Choice Program

Action Plan Item 3d

The provincial Green Choice Program (GCP) focuses on acquiring renewable generation to serve participating NS Power customers with 100% renewable energy to meet their load requirements.

The goal of this program is to build up to 350 MW of low-impact renewable generation capacity, which large scale energy customers (with >10,000 MWh of annual load) can contract to achieve greenhouse gas emissions reduction targets, while supporting NS Power's 2030 decarbonization goals.

Details of this program are as follows:

- The program is managed by an independent Procurement Administrator (PA) Coho
- The participant application closed on March 25th, 2024, applicants will be notified of participation status in May 2024
- In June 2024, NS Power and participants will execute participant agreements
- In September 2024, the final GCP portfolio announcement will be released, projects selected as part of the GCP portfolio are expected to commit to a commercial operation date (COD) on or before December 31st, 2027
- The PA will conduct RFPs and issue Power Purchase Agreements (PPAs) for renewable electricity generation for large energy customers, NS Power shall procure all electricity under a contract awarded by the PA

Procurement Strategy for Variable Renewable Resources

Provincial Green Choice Program

Action Plan Item 3d

Successful proponents will become the renewable energy suppliers for the participants subscribed electricity requirement. Large energy customers or aggregated partnerships (with >1,000 MWh of annual load, individually, and with an annual minimum subscribed energy of 10,000 MWh) are enabled to subscribe 120% of annual load to the renewable energy generation projects selected through the RFP process.

NS Power continues to support GCP development through:

- Collaborating with NRR and Coho regarding details of the program administration and customer support processes
- Verification of applicant consumption data and account status
- Completing Interconnection Feasibility studies via the Generation Interconnection Procedure (GIP) process for RFP process
- Completion of System Impact Studies and Facilities Studies, development of Transmission Provider Interconnection Facilities and Network Upgrades associated with each project

The focus of 2024 will be the completion of the feasibility studies in support of the prospective GCP IPP proponents

- NS Power has completed 19 feasibility studies in support of the program in alignment with the Coho timelines

Wind Integration Studies

Roadmap Item 1

In parallel with the Wind Procurement Strategy, a series of comprehensive transmission planning studies are ongoing to determine required changes to system or operational support in order to maximize levels of wind integration.

With the support of a consultant with global expertise, a study on the [Integration of Inverter Based Resources \(IBRs\) in Nova Scotia](#) was posted on the IRP website in December of 2023. The following scope of work was advanced in 2023:

- Simulation Model Development:
 - Development of robust PSCAD models for the existing NSPI generation fleet to ensure accurate study of the future grid with increased IBR
- Detailed System Studies:
 - System Inertia in PSCAD
 - System Strength in PSCAD
 - Maximum Wind studies in PSSE and PSCAD



Wind Integration Studies – Initial Results

Roadmap Item 1

System Inertia

Studies to date find that the loss of inertia from the retirement of thermal generating units can be replaced with a mix of Synchronous Inertial Response from remaining thermal plants and synchronous condensers as well as Fast Frequency Response from the Maritime Link, grid scale batteries, Reliability tie and technology-enabled response from new Inverter Based Resources (IBRs). Studies are ongoing to evaluate new technologies such as grid forming static synchronous compensators (STATCOMs) as potential alternatives to the use of synchronous condensers.

System Strength

Analysis and study of the reduction in system strength following the retirement of thermal generating units has highlighted the potential for adverse impact to the grid and the solutions are not as straightforward as for the reduction in inertia. Study and analysis to date indicate:

- Short Circuit Ratio (SCR) for generating units will need to be maintained locally to specified short circuit MVA (SCMVA) to ensure ride through during a disturbance.
- Fault current for the grid protection devices to operate properly following a disturbance in a high IBR landscape needs further investigation.
- System strength sufficient to deliver support over all areas of the province and avoid large step changes when switching reactive devices will need to be dispersed and near IBR generating facilities and flexible AC transmission system (FACTS) devices such as the SVC at Brushy Hill.

Simulations show that high IBR in a weak NS grid can result in low frequency oscillations, or a failure of voltage to recover following a grid event. There is an increased potential for harmonics, transients, IBR control system interactions and sub-synchronous interactions with remaining online synchronous units.

Wind Integration Studies – 2024 Work Plan

Action Plan Item 3g & Roadmap Item 1

NS Power conducted an Engagement Session on the Large Integration of IBR in Nova Scotia report on February 2nd, 2024, with the purpose to engage IRP Stakeholders and discuss study results.

The 2024 work plan will incorporate findings from the Inertia and System Strength studies to refine wind study scenarios:

- Work with customers and IBR OEMs to develop accurate working model for proposed IBR projects in NS
- Continue to develop simulation models for study of additional scenarios and new technologies
- Continue to study the operating scenarios and transmission system requirements to enable the highest possible wind in NS
- Inform **Action Plan Item 3g** by supporting the scope of the synchronous condenser projects

Continue the revision and development of documentation and guidelines:

- Publish PSSE and PSCAD model requirements for load and generation facilities
- Publish NSPI model quality test processes for Power System Simulation for Engineering (PSSE) and Power Systems Computer Aided Design (PSCAD) models
- Continue to review and update Transmission System Interconnection Requirements to enable new resources to better support a grid with high penetration of Inverter Based Resources

Offshore Wind

Roadmap Item 9

In September of 2022, the provincial government announced a goal of leasing 5 GW of offshore wind by 2030, with specific emphasis on supporting the green hydrogen industry. Seabed lease rights for commercial scale projects are expected to be made available via a competitive commercial process in 2025.

NS Power is working with Dalhousie University and the Provincial government to research and assess the value of offshore wind generation. The NS Power System Planning team will be focused on adding this value to the overall resource plan, to aid in reaching renewable energy targets.

Thermal Plant Conversions and Fuel Transitions

Coal to Gas Conversion

Action Plan Item 3e

The Evergreen IRP modeling selected coal to gas conversion of Point Tupper Generating Station Unit 2 (150 MW), in all scenarios modelled. This indicates that a converted unit is a cost-effective source of dispatchable firm capacity at relatively low-capacity factors (generally <10%).

NS Power will be progressing the completion of conversion by 2028, in alignment with phase out of coal for Point Tupper unit.

This unit conversion is included as an ECEI project and Class III engineering design/economic assessment was completed to further evaluate the project scope and value. NSP continues to evaluate options for natural gas supply to the site.

NS Power continues work on developing milestones and project timelines for engagement, regulatory application and design/commissioning in 2024, to enable coal to gas conversion by 2028.

Thermal Plant Conversions and Fuel Transitions

HFO Operation

Action Plan Item 3e

The Evergreen IRP demonstrated the value of converting Langan Units 1, 3 and 4 to peaking usage of Heavy Fuel Oil (HFO). A new finding when compared to the 2020 IRP, the value of which is supported by the low capital cost and ability for these units to operate in peak capacity during net peak demand periods.

- This conversion will maintain 459 MW of firm capacity on the system
- Transition to HFO will be complete in 2029, which is in alignment with phase out of coal operation for these units (2028-2030)

To enable conversion of these units and support the phase out of coal, NSP continues to develop milestones and project timelines for engagement, regulatory application and design/commissioning.

Due to the timing of this project, no significant activity is foreseen for 2024 at this time.

Thermal and CT Investment

Roadmap Item 2

Updated sustaining capital profiles are included as an assumption in the ongoing Evergreen IRP update and corresponding modeling work (please refer to the evergreen IRP assumptions material).

Thermal investment:

The sustaining capital profiles for the thermal units have been updated based on the Evergreen IRP utilization factor approach and the 2030 coal phase out requirements.

To maintain resource adequacy while minimizing capital investment into thermal units, operating restrictions were put in place at Trenton 5 that limit the number of operating hours, while still meeting system firm capacity requirements.

CT investment:

The sustaining capital values for the diesel CTs has decreased as compared to the 2020 IRP assumptions for 2023, with 2023 values being lower than 2022 sustaining capital. This confirms the evergreen modeling approach to assume ongoing operation of the diesel CT fleet.

CT Financial Reporting – 2021/2022/2023

Roadmap Item 2

Description	2021	2022	2023
OM&G fixed - CT (diesel units)	\$689,996	\$693,186	\$923,945

Sustaining Capital	2021	2022	2023
Burnside-1	\$2,165,499	\$565,241	\$207,790
Burnside-2	\$248,105	\$182,846	\$133,310
Burnside-3	\$248,011	\$146,739	\$205,940
Burnside-4	\$248,731	\$407,266	\$1,595,224
Victoria Junction-1	\$2,209,427	\$7,263,449	\$0
Victoria Junction-2	\$155,639	\$32,295	\$438,243
Tusket-1	\$1,724,185	\$1,552,561	\$541,178
Total	\$6,999,597	\$10,150,397	\$2,746,101

CT Financial Reporting – 2021

Roadmap Item 2

Unit	Net Generation (MWh)	Net Capacity Factor (%)	DAFOR (%)	Availability Factor (%)	Failed Starts	Maintenance Outage Hours	Operating Hours
Burnside-1	505	0.2%	98.2%	65.8%	2	2	46
Burnside-2	1,691	0.6%	15.9%	96.0%	2	40	111
Burnside-3	1,768	0.7%	95.0%	73.9%	11	5	105
Burnside-4	1,990	0.8%	15.7%	92.3%	0	386	123
Victoria Junction-1	510	0.2%	75.6%	93.7%	2	35	32
Victoria Junction-2	383	0.1%	74.7%	95.0%	1	6	26
Tusket-1	65	0.0%	6.1%	84.8%	2	1015	31
Total (avg for %)	6,913	0.38%	54%	86%	20	1,489	474

CT Financial Reporting – 2022

Roadmap Item 2

Unit	Net Generation (MWh)	Net Capacity Factor (%)	DAFOR (%)	Availability Factor (%)	Failed Starts	Maintenance Outage Hours	Operating Hours
Burnside-1	3,792	1.4%	96.2%	41.3%	6	21	202
Burnside-2	6,698	2.5%	74.4%	84.9%	1	15	317
Burnside-3	6,303	2.4%	9.2%	94.7%	8	2	316
Burnside-4	1,924	0.7%	46.7%	59.1%	2	7	119
Victoria Junction-1	1,400	0.5%	60.1%	72.8%	4	10	68
Victoria Junction-2	984	0.4%	37.4%	97.0%	2	2	68
Tusket-1	831	0.3%	71.6%	93.5%	6	18	73
Total (avg for %)	21,931	1.19%	57%	78%	29	75	1,163

CT Financial Reporting – 2023

Roadmap Item 2

Unit	Net Generation (MWh)	Net Capacity Factor (%)	DAFOR (%)	Availability Factor (%)	Failed Starts	Maintenance Outage Hours	Operating Hours
Burnside-1	3,182	1.2%	19.6%	94.2%	5	31	177
Burnside-2	2,900	1.1%	12.1%	94.2%	3	42	157
Burnside-3	2,295	0.9%	21.5%	91.6%	7	311	128
Burnside-4	1,006	0.4%	34.4%	85.8%	2	309	64
Victoria Junction-1	922	0.4%	17.7%	93.1%	2	2	331
Victoria Junction-2	961	0.4%	41.8%	87.6%	2	9	68
Tusket-1	657	0.3%	42.9%	93.6%	2	17	178
Total (avg for %)	11,923	0.65%	27%	91%	23	720	1,102

Battery Storage Capacity

Action Plan Item 3f

The 2030 Clean Power Plan calls for significant deployments of grid scale storage in Nova Scotia, reaching an installed capacity of 300-400MW by 2030

On December 21, 2023, the province enacted regulations under section 4D of the Electricity Act which directs NS Power to construct a lithium-ion battery energy storage system (BESS) project consisting of three 50 MW 4-hour duration lithium-ion grid-scale batteries with an electricity storage energy rating of 200 MWh each.

Timelines for proposed BESS project are forecasted to deliver a total of 150 MW installed by 2030, including two 50 MW BESS operational in 2025, and a third 50 MW BESS operational in 2026.

Details of the NS Power ECEI BESS project progress is as follows:

- Open houses were held in October 2023 in the three communities where the BESS are proposed.
- NS Power has negotiated access to low-cost debt financing from the Canada Infrastructure Bank (CIB).
- In association with the commitment from CIB, the Wskijnu’k Mtmo’taquinow Agency Limited (WMA), which represents the 13 Mi’kmaq First Nations, has committed to equity participation with NS Power.
- Capital work order application filed with the UARB January 25, 2024.

NS Power anticipates that up to an additional 150 MW may be designated by the Province in the near term (in-service date in 2026). In addition, another 100 MW of energy storage capacity may be procured by the Province under Section 4B of the Electricity Act with a procurement anticipated in 2025 and project in-service targets in 2027-2028.

Hydrogen

Roadmap Items 3 & 11

The current focus of NS Power's engagement with the prospective H2 developers is to assess both the impacts of future development on the power system and assess for future opportunities for the use of H2 as a green fuel source.

- H2 Tariff:
 - Hydrogen tariff developments continue to be monitored as the hydrogen industry develops in Nova Scotia, as per **Roadmap Item 11**.
 - As a product of this engagement, the development of a hydrogen tariff to identify H2 developer specific utility services and the cost structure is currently under development.
 - The tariff will be subject to UARB approval and will be assessed within the context of the 2030 Clean Power Plan
- Domestic Hydrogen Fuel Source:
 - The value of a future domestic source of hydrogen from these developers was studied in the Evergreen IRP, based on Evergreen IRP modelling results, hydrogen enabled fast acting generation was not selected as a resource
 - Updated information on hydrogen fuel pricing and availability can be assessed in the future through the Evergreen IRP process as a part of **Roadmap Item 3**.

The background of the slide is a photograph of a residential area with houses and trees, overlaid with a semi-transparent blue filter. Two large, lattice-structured power transmission towers are prominent on the right side of the image, with power lines stretching across the sky. The overall scene is bright and clear.

Action Plan Item 4: Demand Response

Demand Response Pilot Programming

Action Item 4a

The Demand Response (DR) Strategy is targeting 75 MW of nameplate capacity for deployment by 2025.

E1's Demand Side Management (DSM) Plan has a target of 17.9 MW of DR capacity by 2025.

The work completed in support of the DR Strategy includes the following:

- Progressed the Water Residential Water Heater Control Program with E1
- Progressed the Commercial & Industrial (C&I) DR Pilot with E1
- Progressed the Eco Shift (BYOD Thermostat, EV Charging & Battery Control) Pilot with E1
- Evaluated the Time-Varying Pricing (TVP) Tariff Pilot for year 1 of the pilot for both the Time of Use (TOU) and the Critical Peak Pricing (CPP) tariffs

Residential Water Heater Control Program

Action Item 4a

- Achieved 0.05 MW of available DR capacity during the 22/23 winter peak period
- Recruitment for the "Shift and Save" Program offering began in April 2023
- Targeted recruitment of CPP and TOU customers was completed in June 2023
- The program was paused in July 2023 and the decision was made to remove all controllers, therefore no DR capacity was available during the 23/24 winter peak period
- E1 continued to work with their supplier to evaluate, acquire and test new controller options, and towards resuming the program

C&I DR Pilot

Action Item 4a

Phase 1 – as part of NSP's SGNS project

- DR events were scheduled by NSP until the pilot testing period ended on June 30, 2023.
- SGNS Final Report was submitted to the UARB in March 2024

Phase 2 – E1 procurement of DR Aggregator

- 12 DR events were scheduled by NSP with Season 1 participants during the 22/23 winter peak period
- Scaled recruitment for Season 2 (winter 22/23)
 - All Phase 2 Season 1 participants re-enrolled and one Phase 1 participant enrolled
- 10 DR events were scheduled by NSP with Season 2 participants during the 23/24 winter peak period, event analysis is ongoing

Achieved 2.1 MW of available DR capacity for Winter 22/23, with a target of 10 MW for Winter 23/24

Eco Shift - BYOD Thermostat, EV Charging & Battery Control Pilot

Action Item 4a

Request for Proposal (RFP) was completed to select a DRMS and program delivery service provider(s) for the implementation of a 2-yr pilot including three Distributed Energy Resource (DER) types:

- Smart thermostats
- Electric Vehicles (EVs) and Electric Vehicle Supply Equipment (EVSEs); and
- Behind-the-meter batteries

E1 has contracted one service provider to act as a DR aggregator and provide software control for all three DERs.

Launched pilot recruitment in December 2023;

- Recruited residential customers that own smart thermostats and EVs/EVSEs

10 DR events were scheduled by NSP during the 23/24 winter peak period, event analysis is ongoing

TVP Pilot – Framework

Action Item 4a

NS Power launched the TVP Tariff Pilot on November 1, 2021 with the goal of incentivizing customers to use electricity during off-peak periods to help reduce operation costs and defer the capital costs of future infrastructure while providing lower cost electricity to customers.

Customers who opted to be a part of the pilot were offered the choice of either Time of Use (TOU) or Critical Peak Pricing (CPP) . The pilot was extended for a third year starting on November 1, 2023.

- TOU: customers pay a higher price for electricity consumed between 7am and 11am and 5pm and 9pm on all non-holiday weekdays, November through March; customers then pay a lower price for electricity during winter off-peak hours and the remainder of the year, April through October
- CPP: customers pay a lower price for electricity at all times except during critical peak pricing events from November through March; participating customers pay a substantially higher price for electricity consumed during CPP events.
 - During Years 1 and 2 of the pilot, NS Power could call CPP events between 7am to 11am or 5pm and 9pm on non-holiday weekdays up to a maximum of 22 times per winter.
 - For Year 3 of the pilot, NS Power was approved to modify the ability to call CPP events during any 4-hour sliding block throughout the day up to 18 times a winter with the inclusion of up to three weekends. Holidays remain excluded.
 - NS Power called eight CPP events in Year 1 of the pilot between November 1, 2021 and March 31, 2022, and twelve CPP events in Year 2 between November 1, 2022 and March 31, 2023.

To determine the longer-term plan for broader TVP expansion after the pilot, NS Power proposed that a stakeholder engagement process take place to develop the plan. Stakeholder sessions commenced in Q1 2024.

TVP Pilot – Evaluation Findings

Action Item 4a

The evaluation of the TVP Pilot for Year 2 included a detailed load impact evaluation for participants of both the CPP and TOU tariffs, which produced the following findings:

- 1315 households and 47 businesses participated in the TVP pilot in Year 2
- Participants in both tariffs consistently reduced their electricity demand during peak periods:
 - TOU residential participants reduced their electricity demand by 10.1% and 8.8% (morning and evening peaks, respectively)
 - CPP residential participants saw a reduction of 27% and 29% (morning and evening peak events, respectively)
- Participants in both tariffs saw annual bill savings on average:
 - TOU residential participants saved on average \$92 annually (4.2%)
 - CPP residential saved on average \$384 annually (14.3%)

TVP Pilot – Evaluation Findings

Action Item 4a

The following was observed for pilot participants:

- Reduction in electricity demand during the highest Adjusted Net Load (ANL) hours
- There was no statistically significant snapback effect observed after peak periods
- Nearly all reported taking one or more actions (deferring timing for electricity needs such as laundry, dishwasher, heating) to reduce electricity demand during peak periods
- Participant satisfaction with the TVP pilot is high overall
- A "structural winners" analysis was completed on most of the customer population (n = 445,236) to determine natural beneficiaries of these tariffs. The TOU rate yielded a balance between structural winners and losers in the domestic (66% winners), small general (43% winners) and general (55% winners) rate classes. For CPP, structural winners comprised a majority of all three rate classes (96 – 99%).

NS Power will continue to collect data and complete an evaluation of the third year of the pilot in 2024 with approximately 3000 households and 70 business participants.

Hybrid Peak Electrification Scenario

Action Item 4b

- As part of the electrification study, a hybrid heating electrification profile was assessed:
 - Represents the peak load reduction associated with retaining back up heating sources (natural gas, oil, wood, etc) to be utilized during the coldest periods of the year when the peak load is the highest and when heat pumps are less efficient (below -15 degrees Celsius)
- This hybrid peak electrification approach was assessed as part of the Evergreen IRP and demonstrated value to the system by reducing resource capacity requirements and system costs.
- As there would be costs associated with the hybrid peak mitigation approach, further assessment is required to determine program cost estimates and validation of savings potential.
- NSP is committed to participated in future work to provide a balanced assessment of the cost impacts and provide necessary information to conduct a more refined assessment of the program from an electricity system cost perspective.

The background of the slide is a photograph of a residential area with houses and trees, overlaid with a semi-transparent blue filter. Two large, lattice-structured power transmission towers are prominent on the right side of the image, with power lines stretching across the sky. The overall scene is a typical suburban or rural landscape.

5. Demand Side Management

DSM Avoided Costs

Action Item 5

NSP is progressing work with the E1 DSMAG to calculate avoided costs related to energy and capacity, and transmission & distribution (T&D).

- T&D avoided DSM costs are based on peak demand and are the savings associated with deferring transmission and distribution investments by not having to deliver additional units of electricity, while still meeting demand requirements of customers.
- Energy and capacity avoided DSM costs are based on the differences in NPV revenue requirement of system in with DSM and without DSM scenarios and utilizes an Evergreen IRP No Atlantic Loop scenario (CE1-E1-R2).

Demand reduction-based DSM can positively impact NS Power capital spending by enabling both project deferral for new transmission lines, substations and feeders, or extensions due to overload, as well as avoiding resource capacity additions.

In alignment with E1's timeline for their 2026-2030 Demand Side Management Resource Plan, NS Power will aim to complete all avoided costs in Q2 2024.

Evergreen IRP

Roadmap Item 7

- NS Power initiated an Evergreen IRP update in 2022, which is now complete. An update on Evergreen IRP process, schedule, and final modeling results were released on May 29th, 2023. Following this update, NS Power released responses to stakeholder comments/feedback on the final modelling results on November 10th, 2023.
- The updated Evergreen IRP Action Plan and Roadmap was released on August 8th, 2023.
- The Evergreen IRP process will continue to monitor for significant changes in the planning environment. If these changes warrant an assessment, NS Power will undertake further study work as part of a future Evergreen IRP update.