Appendix 2

2025 IRP Development Process

Manitoba Hydro
energy for life

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1 | Introduction

The purpose of this appendix is to guide the reader through Manitoba Hydro' s 2025 Integrated Resource Plan (IRP) development process. Each step of the process is summarized to allow the reader to follow how we got to the outcome of the 2025 IRP – the 2025 IRP road map. Where further information on some of these steps is provided in more detailed appendices, it is noted.

Integrated resource plans are repeatable processes that are meant to mature and evolve from one IRP to the next. The 2025 IRP builds on the foundation of the 2023 IRP – Manitoba Hydro's first integrated resource plan. For the 2023 IRP Manitoba Hydro took many steps to ensure alignment with common industry practices, leveraging industry knowledge, and creating processes that reflect the Manitoba context. These steps were continued in the 2025 IRP.

1.1. Actions to Ensure Quality in the 2025 IRP

There is extensive expertise in energy planning within Manitoba Hydro accumulated over decades of planning for supply and delivery of electricity and natural gas. Development of the 2025 IRP included considerable collaboration and coordination across Manitoba Hydro to draw on and build upon these existing planning processes and expertise. Manitoba Hydro also has engagement practitioners with expertise from various projects and programs that support the IRP. To ensure quality in the development of the 2025 IRP and alignment with industry best practices, Manitoba Hydro engaged two consultants to provide technical expertise and independent perspectives.

Energy & Environmental Economics (E3) is a consulting firm with offices in Canada and the United States. They bring experience in reviewing and developing IRPs for both electric and natural gas utilities in the U.S. and Canada. E3 was hired by Manitoba Hydro to review the IRP development process, the results of the modelling and evaluation, and to advise on the development of the road map.

Manitoba Hydro also engaged Urban Systems Ltd. (USL) to support the engagement process. USL is a research firm based in Winnipeg and Ottawa providing client focused research services, including program evaluation. Having an external party to support engagement with customers, interested parties, and Indigenous groups also provided a neutral intermediary to communicate between parties as needed.

IRP processes are established to evolve, mature and to implement continuous improvement. Understanding this, Manitoba Hydro continually monitors and reviews other utilities' IRPs and their development processes in pursuit of best practices, particularly those of Canadian utilities in similarly cold climates. Engaging with peers from across Canada to share and understand best practices has also become a regular part of our business.

1.2. Alignment with Common Industry Practices

Many steps and milestones in our IRP process are common to practices of other IRPs in the energy industry. These fundamental approaches are valuable for ensuring robust technical analysis, as well as repeatable processes so that a diverse range of interested parties can understand and follow the basic process and objectives of an IRP. While not an exhaustive list, here are a selection of common practices used in the 2025 IRP:

- Be informed by engagement. A key aspect of any IRP is that the process is informed by engagement and that it is inclusive to a wide audience. Engagement often includes specific methods for audiences that have a deeper understanding of the IRP development process.
- Establish key inputs. The first step in any IRP is to define key inputs, including key planning assumptions, for the analysis, which are informed through engagement feedback. The context of the 2025 IRP inputs, such as the resource options assumed to be feasible within our 10-year plan, helped frame the analysis.
- Complete complex, technical analysis. The capacity expansion modelling and analysis searches for a portfolio of resources to meet projected demand. Scenarios and sensitivities are used to test various potential futures and their results comply with all modeled constraints and reflects system operations and resulting system costs. The modelling and analysis directly captures key concepts common to other IRPs to assist in evaluation, including:
    - Reliability through the application of Manitoba Hydro's generation planning criteria;
    - GHG emissions reductions through the application of GHG emission constraints and costs; and,
    - Creating outputs that inform net system costs, GHG emissions, and portfolios of resources.

Result in a development plan. The outcome of most IRPs is recommending a development plan that considers both supply and demand side solutions, and requires involvement from more than just the utility (e.g. Efficiency Manitoba) to be successful.

1.3. Additional Enhancements to Manitoba Hydro's 2025 IRP

Additional steps were introduced to the 2025 IRP, beyond those common practices which tend to focus exclusively on reliability, revenue requirement, and GHG emissions. Some of these steps included:

- Integrated natural gas and electric planning. Manitoba Hydro is in a unique position as a utility, needing to understand trade-offs between natural gas and electricity as an integrated system in Manitoba. Balancing the impacts of decisions between the two systems helps to co-optimize decisions, including how to affordably and reliably serve the energy needs of Manitoba.
- Development of more robust analysis based on interim modelling and analysis results. Using preliminary outcomes from the modelling and analysis, a series of combinations of feasible resources were formulated for further testing. The next steps included using the model to quantify the level of regret for a number of potential futures. This process helped identify many of near-term actions included in the road map.
- Enhanced evaluation metrics. Our evaluation of potential development plans included a comprehensive range of metrics to consider trade-offs between our plans that are not directly captured in modeling. Importantly, the evaluation looked at our potential development plans from perspectives beyond the utility, with evaluation criteria informed by engagement.
- Carried analysis across the range of uncertainty based on the 2025 IRP load projections throughout the modelling and analysis. The buildout target was incorporated during evaluations of potential development plans, rather than constraining model observations from the very start, which contrasts with IRPs in many other jurisdictions. Rather than pre-determine how much load our potential development plans should build to under an uncertain future, the buildout target informed the selection of a plan that balances both cost and reliability in uncertain load growth.
- Enterprise risk assessment. The risk analysis examined quantitative and qualitative impacts that cannot be directly modeled or represented by the buildout target. Key exposures and uncertainties such as future changes to regulation (provincial, federal, and international) and resource performance under extreme conditions are important to capture when deciding on a recommended development plan.
- A supplemental energy wallet analysis. An energy wallet analysis was initiated to explore this emerging approach to using estimated customers' total household energy costs to better understand how potential development plans may impact household costs. The analysis is still evolving, so this work is supplemental and was not considered in the recommendation framework or included in the 2025 IRP report. Manitoba Hydro is continuing to work with our consultant to refine the energy wallet analysis, and validate outcomes.

2 | 2025 IRP Development Process

Developing an integrated resource plan (IRP) is a common practice for utilities across North America. Each utility's approach reflects a unique combination of customer needs, service territory, the energy products offered to customers, existing assets, and policy drivers.

The development of Manitoba Hydro's 2025 IRP follows a structured, five-step process designed to support long-term planning for safe, reliable, and cost-effective energy delivery across the province. The IRP development process incorporates input from customers, interested parties, and the Manitoba energy planning community through two rounds of engagement. Feedback heard through engagement informs the development of the 2025 IRP. This process builds on the foundation established by the 2023 IRP and reflects a repeatable process that ensures the IRP remains responsive to changing conditions and stakeholder input, while providing a clear framework for future planning iterations.

This structured process ensures that the IRP is robust, transparent, and informed by diverse perspectives. It provides a foundation for future planning cycles and supports Manitoba Hydro's ability to navigate the energy transition.

Step 1: Setting Direction

This foundational step establishes the overall direction for the 2025 IRP, identifying its purpose, objectives and scope.

Step 2: Develop Key Inputs and Scenarios and Round 1 Engagement

During this step, Manitoba Hydro gathers information and data from a wide variety of sources to outline key inputs and develop scenarios used in the IRP. Evaluation metrics are also established in this phase prior to modelling, analysis, and evaluations. Engagement feedback is sought on these elements before they are implemented in the IRP.

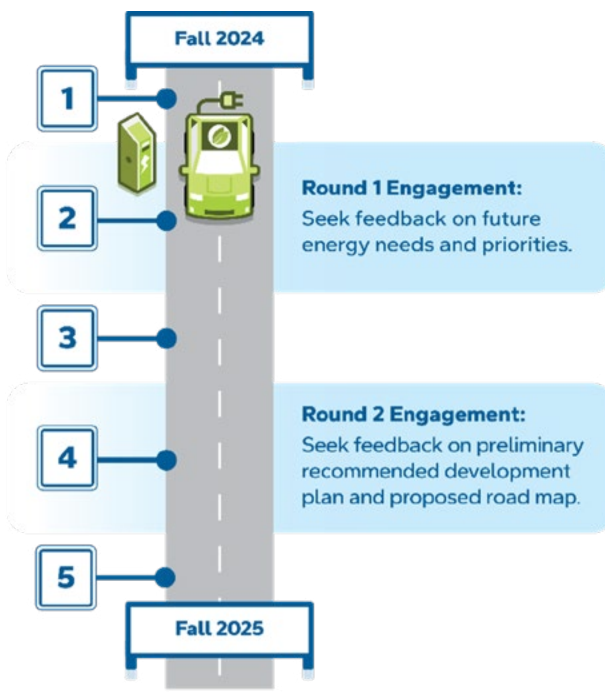

Figure 2.1 - 2025 IRP Development Process

Key inputs include load projections and resource options strategies. These inputs have significant uncertainty and impact on the analysis. Key inputs are underpinned by the planning assumptions.

Scenarios represent an energy future. They are a likely combination of a specific load projection and resource option strategy.

Evaluation metrics are established to be applied to the modelling and analysis outputs and short list the potential development plans later in the development process.

Step 3: Modelling, Analysis, and Evaluations

Specialized computer modelling tools are used to perform capacity expansion planning and to simulate Manitoba Hydro's ability to meet future electrical and natural gas energy needs under each scenario. The analysis considers generation requirements, peak demand management, energy efficiency opportunities, infrastructure needs, and the existing system and future resource options. Transmission, distribution and natural gas infrastructure needs, as well as the existing system, are integrated into the study analysis as inputs and collaborative reviews of the results. Outputs are evaluated using the established metrics to identify trade-offs and inform the recommendation.

Step 4: Preliminary Recommendations and Round 2 Engagement

Based on the modelling and evaluation results, a road map is prepared, which includes the recommended and alternative development plans. Risk and financial analyses are used to arrive at the recommendation. The road map is presented for engagement feedback.

Step 5: Finalize the Integrated Resource Plan

Feedback from Round 2 engagement sessions is summarized in the IRP report and the IRP report is published. Full results from the Round 2 engagement will be published after the IRP report is published.

2.1. Step 1: Setting Direction

The IRP is just one part of Manitoba Hydro's planning cycle. The IRP's scope is shaped by the current conditions, existing knowledge, and needs at the time the IRP development process begins. An IRP should have a defined delivery date to ensure the recommendations are relevant and capable of informing timely decisions.

The 2023 IRP confirmed that the energy transition had started in the Manitoba. Worldwide, the energy sector is experiencing unprecedented change driven by the energy transition. Decarbonization is increasing demand for electricity — and Manitoba Hydro's supply is limited. Building out energy systems and supporting the decarbonization of heating, transportation, and industrial processes will require materials, equipment, and people with the expertise, education, and training to support this work.

The objectives and scope of this IRP were designed to help ensure Manitoba Hydro can successfully navigate the challenges around meeting the future energy needs of Manitoba. Planning for the 2025 IRP started in spring of 2024 to determine the objectives and scope of the 2025 IRP and how engagement would inform the 2025 IRP.

2.1.1. Objectives and Scope

Through ongoing energy planning that happened after the 2023 IRP, it was found that Manitoba would need new generation resources, or additional energy savings, by 2029/30 to meet growing electricity demand. As such, a primary objective of the 2025 IRP was to arrive a recommended development plan that meets the electricity and natural gas needs of the Province of Manitoba.

What is a development plan?

It outlines the steps Manitoba Hydro will take to meet future energy needs. It may include building new energy sources, infrastructure, and programs to manage energy use during peak demand.

The 2025 IRP also needed to meet requirements set by The Manitoba Hydro Act, and align with other government policies and mandates. This resulted in another key objective of the IRP to study how to meet a net-zero grid by 2035 and how Manitoba Hydro could support a net-zero economy by 2050 in Manitoba. Through the 2025 IRP, we sought to understand the many trade-offs to consider in landing on a recommended development plan that best met the electricity and natural gas needs of the evolving energy needs of Manitobans.

For a full summary of energy related policy considered in the 2025 IRP – including energy, climate, economic development, and environmental policy – please see Appendix 4 – Policy Update.

An IRP is founded on broad technical analysis that studies a range of potential energy futures. A study period of 25 years was set for the 2025 IRP, starting in 2025 and ending in 2050. This time period was chosen to meet the objective of studying a net-zero economy by 2050 in Manitoba,. The time period for the recommended development plan was set at 10 years, out to 2035.

Given analysis in an IRP is forward looking, the 2025 IRP does not include analysis of current or past operations, projects, practices, and decisions. Similarly, the 2025 IRP does not include specific community or regional needs and solution, but rather takes a macro view of Manitobans' needs. Building new or aspirational interconnections with neighboring utilities for importing electricity in place of building new resources to serve demand was not part of this IRP's scope. The 2025 IRP assumes that all existing import and export contracts are not renewed once they expire; however, future opportunities to export and import using existing interconnections are considered.

2.1.2. Integrating Existing and New Energy Systems

The 2025 IRP considers all of Manitoba Hydro's energy systems, including electricity and natural gas supply and delivery infrastructure across generation, transmission, and distribution. The existing system plays an important role is meeting future energy needs. Also considered were non-Manitoba Hydro owned assets or any investment that can defer construction or upgrade on the system – also known as customer side solutions – such as Efficiency Manitoba programming and demand response. This integrated approach ensures that planning decisions reflect the interdependencies between these systems and supports coordinated, cost-effective development strategies.

Existing Systems

In integrated resource planning, the existing system serves as the foundation upon which all future decisions are built. Understanding the current infrastructure, operations, and resource mix is critical because it defines the baseline for reliability, cost, and environmental performance.

The 2025 IRP seeks to ensure that new investments complement existing resources. The existing energy systems consist of electricity supply (generation, power purchase agreements, and imports from neighbouring markets), electricity delivery (transmission and distribution), and natural gas supply and delivery. Manitoba Hydro's existing electric system is predominantly hydroelectric, offering both advantages and challenges as we plan to achieve the objectives of the 2025 IRP.

IRP analysis assumes that energy reliability of the existing system is sustained. However, as outlined in the Asset Management Plan, Manitoba Hydro's existing system requires significant new investment and faces future risks that could challenge this assumption.[1] By considering this, it provides Manitoba Hydro with the opportunity to develop an IRP roadmap that positions Manitoba Hydro for continued reliability and sustainability well into the future.

Figure 2.2 - Major Electrical and Natural Gas Facilities

> **For further information on Manitoba Hydro's existing systems, please refer to Appendix 3 – Existing System.**

[1] 2025 AMP - Manitoba Hydro Asset Management Plan

Natural Gas

Natural gas is considered alongside electricity throughout the IRP process, including in planning assumptions, scenario development, and selection of new resources. The IRP evaluates future natural gas demand in the context of decarbonization and evolving customer needs. Resource options strategies reflect potential constraints on fossil fuel use and explore alternatives to conventional natural gas generation, including demand-side measures.

Electric Generation

Electric generation resource options are evaluated for their ability to meet future electric energy needs under a range of scenarios. The IRP considers both existing and emerging generation technologies, including but not limited to hydroelectric, small modular reactors, wind, solar, battery, and combustion turbines powered by a variety of fuels. Resource option strategies define which technologies are available for selection in each scenario, reflecting potential policy constraints and system needs.

> **For further information on the electric generation resource options considered in the 2025 IRP, please refer to Appendix 6 – Resource Options.**

Electric Transmission and Distribution

Electric transmission and distribution infrastructure are integrated into the IRP through analysis of system impacts associated with different development plans. The analysis process captures how resource additions due to load growth affect transmission and distribution requirements, including potential upgrades, expansions, and customer side solutions.

Customer Side Solutions

Customer side solutions are integrated into the IRP through three mechanisms. Firstly, the Efficiency Plan projection is all accounted for in the load projections (See appendix 5 – Load Projections for more details); mandated capacity savings observed through the Efficiency Plan Projections are observed as load modifiers. Secondly, Demand Response and Curtailable Rates programs are assumed to be maximized, meaning that they are reducing the peak demand as much as they can. Lastly, additional opportunities for efficiency savings are constrained to the limits identified by market research. Distributed energy resources and demand-side programs in the IRP result in opportunities for deferring or reducing infrastructure needs.

2.1.3. Engagement

Engagement was a core part of developing the 2025 IRP. Throughout the process, it supported openness and transparency in energy planning and enabled the consideration of diverse perspectives from a range of audiences, all of which helped improve the 2025 IRP outcomes.

Our engagement approach continues to evolve based on experience, feedback from participants, and insights from other utilities. Each engagement brings feedback that helps us refine our methods to support meaningful dialogue grounded in active participation, inclusive discussion, and mutual respect.

Engagement was designed to gather feedback at key project milestones. For the 2025 IRP, two distinct rounds were planned – at the start of the process with the key inputs and scenarios, and to share the outcomes through the road map. The diverse perspectives shared by participants helped deepen our understanding of the Manitoba context and helped inform the plan.

The engagement objectives for the 2025 IRP include:

- Providing meaningful opportunities for influence within the process and to inform decision making.
- Providing inclusive opportunities to participate, recognizing different types of knowledge and interest.
- Fostering dialogue of diverse points of view to facilitate knowledge sharing and informed decision making.
- Being transparent and providing clarity on the development and outcomes of the IRP and how feedback was considered and incorporated.
- Being responsive and accountable to feedback shared during engagement.
- Setting a foundation for ongoing engagement as Manitoba Hydro progresses towards project-specific decisions.

Engagement methods were chosen to meet audiences where they are and to support participation at their desired level of involvement throughout the process. The goal was to foster responsive, two-way dialogue to help inform the IRP. Different audiences were included in the engagement, include:

- Government of Manitoba
- Indigenous Nations
- Efficiency Manitoba
- The Public Utilities Board
- The Technical Advisory Committee, which included select individuals and groups from the Interested Parties
- Interested Parties, which included individuals and groups with a demonstrated interest in participating in the development of the IRP
- Public participation, including IRP email subscribers and customers

> **For a detailed overview of the engagement objectives, process, and outcomes, please refer to the 2025 IRP Engagement Report.**

2.2. Step 2: Develop Key Inputs and Scenarios and Round 1 Engagement

Key inputs include load projections and resource options strategies, which have significant impact on the outcomes of the IRP. Planning assumptions underpin the development of the key inputs. Scenarios represent specific energy futures. Each scenario is defined by a likely combination of a load projection and a resource options strategy.

It was also important to establish and define evaluation metrics for the 2025 IRP during this stage to ensure any information or data needed from the modelling and analysis would be prepared.

2.2.1. Key Inputs

Load Projections

Load projections represent the future energy demand of natural gas and electricity that Manitoba Hydro might have to supply. To address uncertainty in the amount and pace of change to both electric and natural gas consumption, three distinct load projections were developed, covering the period from the present to 2050. These load projections explore different combinations of potential policy directions and customer decisions. Two load projections were developed to study how Manitoba might transition to a net-zero economy by 2050.

A load projection sensitivity, to understand how energy demands might change if ground transportation and space heating produce no greenhouse gas emissions by 2050 (i.e. they achieve absolute zero), was added based on engagement feedback.

Load projections vary based on assumptions and uncertainty surrounding factors such as:

- economic growth
- space heating options
- decarbonization of transportation
- energy efficiency
- decarbonization of industry

With the exception of transportation, assumptions underpinning the load projections are common to both the electric load projections and natural gas volume projections.

The resulting electric load projections and gas volume projections are shown in Figure 2.3 and Figure 2.4.

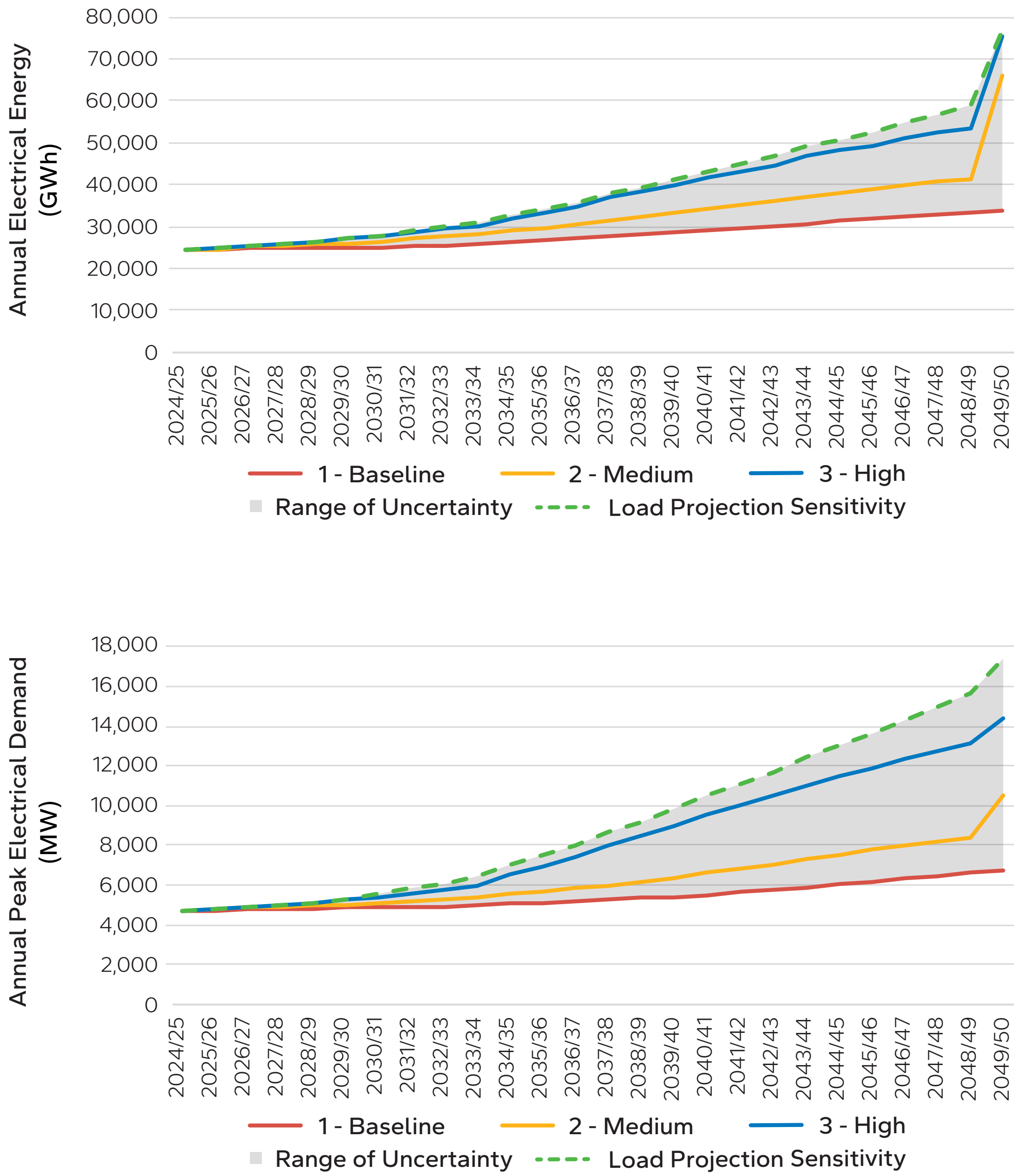

Figure 2.3 - Electric energy and demand (net of Efficiency Plan Projection)

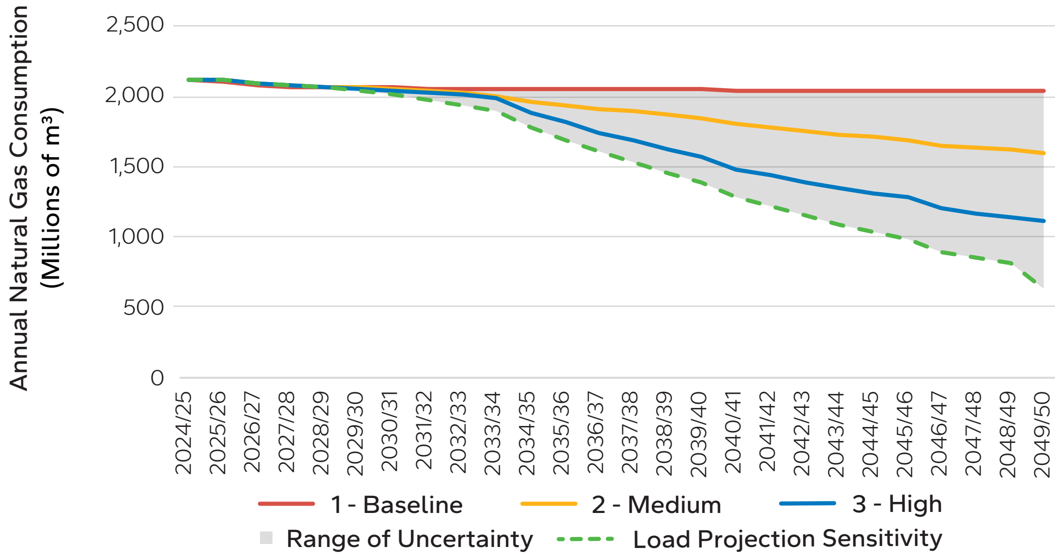

Figure 2.4 - Natural gas (net of Efficiency Plan Projections)

> **For further information on the 2025 IRP load projections and how they were designed, please see Appendix 5 – Load Projections.**

Resource Options Strategies

Resource options strategies reflect the potential resources available to meet future electricity and natural gas demand. Policy is a key driver that influences what resource may be allowed to serve energy needs. Four strategies were developed to reflect varying assumptions about policy and its potential to impact resources available for selection, as shown in Table 2.1, which range from a technology neutral strategy to a more restrictive strategy with no fossil fuel-based resources.

Table 2.1 – Resource option strategies

Resource Options Strategies	Assumptions
A – Technology Neutral	Compliant with federal Clean Electricity Regulations.
B – Net-Zero Grid 2035	Strategy A, plus requirement that electricity grid is net-zero by 2035.
C – Near Term Wind Generation Projects	Strategy B, plus up to 600 MW of Indigenous majority owned wind with dispatchable resources for reliability.
D – No Fossil Fuel-Based Resources	Strategy B, plus requirement of no fossil fuel-based combustion turbines post 2035 (i.e. no natural gas generation).

Strategy A (Technology Neutral) is the starting point and reflects current policy. It is compliant with the federal Clean Electricity Regulations. This means that the operation of any emitting resource will be compliant with the regulated emission limits. The Clean Electricity Regulations will have minimal impact on how Manitoba Hydro operates our system.

Strategy B (net-zero grid 2035) builds on Strategy A to include an additional requirement to ensure the grid is net-zero by 2035. This reflects the Manitoba Hydro mandate letter from 2023. Net-zero grid means that generation emissions are allowed, but these emissions must be balanced by removing the same amount from the air through other means, such as offsets and credits.

Strategy C (near term wind generation projects) builds on Strategy B, to ensure wind generation is in alignment with Manitoba's Affordable Energy Plan. There is also a need to ensure dispatchable resources are in place to ensure the reliability of our current electricity system along with any other resources that are added – the exact dispatchable resource will be identified through the modelling and analysis.

Strategy D (no fuel-based resources) also builds on Strategy B, but increases the influence of the restriction by not allowing any fossil-fuel based combustion.

Strategy D was originally proposed to restrict all fuel-based resources; however, we heard through engagement that the assumptions to eliminate all fuel-based generation resource options (such as hydrogen, biodiesel, and biomass) were not reflective of realistic policy and could over restrict the analysis. Therefore, Strategy D was revised to allow the use of hydrogen, biomass fuels, and biodiesel for electricity generation.

Manitoba Hydro maintains an inventory of resource options to meet future energy needs. These resource options include new generation, such as wind turbines, and customer side solutions, such as energy efficiency programs. Each resource has different characteristics such as costs, emissions, dispatchability, technology maturity, and earliest in-service dates. Details of the resource characteristics can be found in Appendix 6 – Resource Options.

2.2.2. Scenarios

Combining a load projection with a resource options strategy results in a scenario. Eight scenarios were selected for analysis, as shown in Table 2.2, representing a reasonable range of possible energy futures in Manitoba. Scenario 1A and 3D serve as bookends, with Scenario 1A reflecting the least restrictive energy policy environment and Scenario 3D reflecting the most restrictive. Unlikely combinations of load projections and resource options strategies were excluded from the analysis.

A common link between a load projection and a resource options strategy is the underpinning planning assumptions, particularly energy policy. For example, if there is a strong energy policy restriction on a resource option and the operation of Manitoba Hydro's electricity and natural gas systems (e.g., Strategy D), it is assumed that there would be complementary government action associated with the policy impacting energy consumption. Both the resource option strategy and load effects of the policy assumption must be considered together to define a potential scenario.

For the 2025 IRP Manitoba Hydro did not study less likely combinations of load projection and resource options strategies shown by the dashes in Table 2.2. This decision saved significant computing and analysis time and focused analysis on scenarios that had the most influence on Manitoba Hydro's recommended development plan.

Table 2.2 - 2025 IRP Scenarios

Resource Options Strategies	1 – Baseline Load Projection	2 – Medium Load Projection	3 – High Load Projection
A – Technology Neutral	Scenario 1A	-	-
B – Net-Zero Grid 2035	Scenario 1B	Scenario 2B	Scenario 3B
C – Near Term Wind Generation Projects	Scenario 1C	Scenario 2C	Scenario 3C
D – No Fossil Fuel-Based Resources	-	-	Scenario 3D

There was concurrence that only modelling the most likely scenarios was an acceptable strategy for the 2025 IRP

2.2.3. Establishing Evaluation Metrics

Alongside the development of key inputs and scenarios, evaluation metrics were established to provide insight into the trade-offs between potential development plans. These metrics were informed by industry best practices for integrated resource plans, Manitoba Hydro's planning experience, and feedback previously heard from customers. The evaluation metrics were organized into four overarching themes:

- reliability
- environmental
- cost
- socio-economic

The metrics were subsequently refined through feedback gathered during engagement activities, internal workshops, and with input from the IRP development consultant. This process resulted in a structured framework for comparing potential development plans that extended beyond traditional planning criteria and standard modelling outputs. Application of the evaluation metrics occurred in Step 3.

> **Additional details on the 2025 IRP evaluation metrics can be found in Appendix 8 - Evaluation.**

2.2.4. Engagement: Round 1

To start the initial conversation, Round 1 focused on seeking feedback on the drafted key inputs, scenarios, and evaluation metrics that were being considered for use within the 2025 IRP. This included connecting with various audiences and customer segments to understand future energy plans and needs.

Feedback was sought through multiple opportunities, including a public survey, customer conversations and targeted surveys, engagement with Indigenous and municipal leadership, Interested Parties workshops, and multiple meetings with the Technical Advisory Committee.

A summary of feedback heard and how it was used in the 2025 IRP was published to the project website. Please see the Engagement Report for further information.

2.3. Step 3: Modelling, Analysis, and Evaluations

Modeling, analysis, and evaluation followed the first two steps outlined in Figure 2.5. The modelling and analysis include all the work required to arrive at the potential development plans. There are multiple sub-steps for the modelling and analysis, which included preparing the model for the 2025 IRP, modelling activities for capacity expansion optimization, and significant analyses completed outside of the model. Scenarios and sensitivity results identified feasible resource options that could be included in a potential development plan, and provided options on how those resources should be combined into meaningfully different plans for further investigation. Least regrets analysis was used to gain a deep understanding of the impacts of the potential development plans. The potential development plans are then shortlisted against a build-out target and by using evaluation metrics. An information session was held while analysis was ongoing to share key findings.

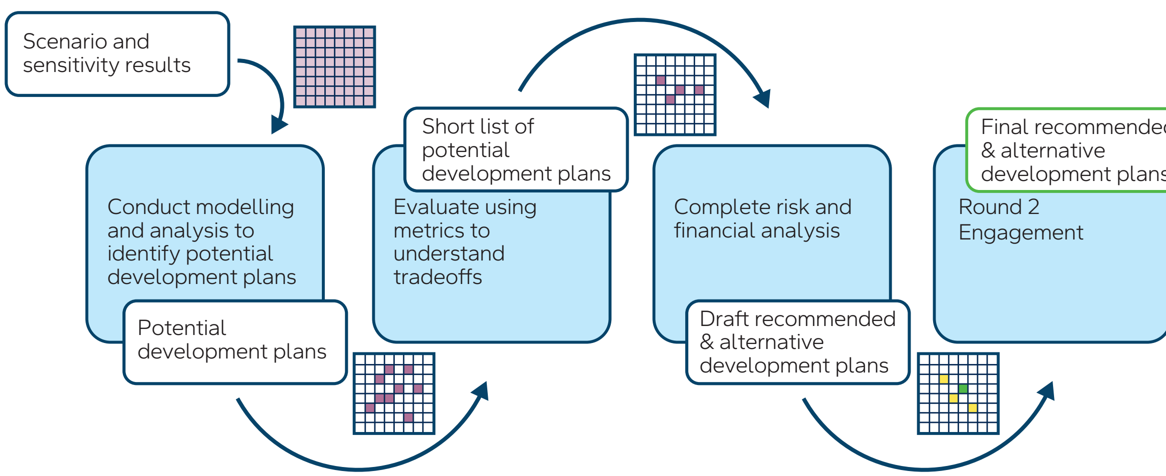

Figure 2.5 - Modelling, analysis and evaluation progression

Further details on the model used can be found in Appendix 7.1 - Modelling and Analysis Approach, and the results of the modelling and analysis can be found in Appendix 7.2 - Modelling and Analysis Results. Further details on evaluation metrics can be found in Appendix 8 - Evaluations.

2.3.1. Modelling and Analysis

The object of modelling and analysis is study what combination, timing, and quantity of resources can serve future demand. The outcome of this step is establishing the potential development plans that are advanced to the next stage to be shortlisted.

Scenario Analysis

By undertaking scenario analysis, Manitoba Hydro establishes a foundational understanding about how the load projections and resource options strategies jointly influence the modelling results. This includes:

- Identifying how resources can potentially meet electrical demand requirements, in both the near-term and the long-term.
- Gaining insight into which resource options are robust choices for meeting future demand, regardless of the scenario, and the timeframes and magnitudes for which this holds true.
- Ensuring that the full range of scenarios are understood, and that book-end results can be used appropriately to inform further analysis.
- Confirming that planned sensitivities are sufficient to understand model behaviour and the outcomes observed during scenario modelling and analysis.
- Providing baseline results for sensitivity analyses and least regrets analysis calculations.

Sensitivity Analysis

Sensitivity analysis, or “what-if” analysis, tests how changes to individual planning assumptions affect the results. Sensitivities may include adjustments to:

- Energy market prices
- Capital costs
- Resource option lead times (i.e., in-service dates)
- Additional resource option restrictions

Sensitivity analyses provides a deeper understanding of the potential impacts of uncertainty in the 2025 IRP inputs and assumptions. Information derived from sensitivity analysis complemented scenario analysis results and set the ground work for further study during the least regrets analysis where the potential development plans were identified.

Sensitivities studied in the 2025 IRP were strategically selected to focus on assumptions most likely to meaningfully influence development plan results and/or to answer questions raised during engagement. The choice of which sensitivities to study leveraged Manitoba Hydro's knowledge of uncertainties, while also creating an opportunity to investigate questions specific to the scenarios defined for this IRP. Some sensitivities were strategically not selected as they have already been sufficiently explored in previous Manitoba Hydro analysis, such as the 2023 IRP.

Outcomes of the Scenario and Sensitivity Analysis

Timeframe for the recommended development plan

The ten-year development plan timeframe was selected to ensure confidence in data and analysis and align with legislated requirements regarding Manitoba Hydro's IRP. The modelling and analysis results showed common sizing and types of resource selections within the 10 year time frame. Past the 10-year timeframe, resources selections started to have more variability, as the load projections grew to serve a net-zero economy by 2050 in Manitoba. While some resources showed more consistent selection than others, achieving potential target in-service dates after the 10-year timeframe does not require project commitments in the 2025 IRP, although decisions around longer lead time resource may be required in the next IRP planning cycle Given these findings, the capacity need date of 2029/30, and the Manitoba Hydro Act requirement that the IRP include a planning period of at least 10-years,[2] it was determined that the timeframe for the recommended development plan be no more than 10-years, covering a period from 2025 to 2035.

Feasible Resource Options

Six resources were found to be feasible options to meet firm demand in the 10-year development plan timeframe. These six resources formed the building blocks of our potential development plans and all of them have the following characteristics:

- Can be implemented within the 10-year development plan timeframe.
- Provide the necessary reliability to meet energy and capacity needs.
- Are proven technologies with reliable fuel sources.

[2] Section 38.1(1) of the Manitoba Hydro Act; https://web2.gov.mb.ca/laws/statutes/ccsm/h190.php

The six feasible resource options include:

- Efficiency Plan Projection;
- Additional energy efficiency programs, demand response, and the curtailable rate program;
- Wind;
- Batteries (short-term);
- Enhancements to existing hydropower;
- Combustion turbines that can be fuelled by natural gas, synthetic natural gas, and/or biomethane.

Other resources options are available, but only after the 10-year development plan time frame. These resources include longer leader time resources and emerging technology, such as new hydropower, nuclear small modular reactors (SMRs), long term battery storage, and combustion turbines fuelled by alternative fuels.

Least Regrets Analysis

Least regrets analysis (LRA) was used to further study the timing and combinations of the six feasible resource options, within the significant uncertainty of the 2025 IRP analysis. By identifying the boundaries of risk based on load uncertainty, the results of the least regrets analysis further informed the potential development plans and ensured there was a suitable range for further analysis. The LRA was not about recommending a development plan or shortlisting the potential development plans, rather it informed the decision-making process.

There are risks that the capacity expansions planning model cannot account for, as they are constrained by the inputs built into the models. These risks are real-life limitations that do not allow for resources to be added perfectly in anticipation of uncertain need. These include:

- Load projections: these include significant uncertainty in the planning assumptions and this uncertainty grows in scale further into the planning horizon.
- Resource options lead time: Most, if not all, resource options considered in the 2025 IRP have minimum lead time of 5-7 years. These lead times require decision and commitments well before need dates.

Lead time for a resource option is the time it takes from committing to investment to the time that resource can serve demand. The lead time includes all the steps needed to plan for the resource, obtain the needed approvals, and to design, procure, and construct the resource.

To test this uncertainty, the least regrets analysis had a locked-in period, to simulate commitment to resources, where the model could not adjust the plan based on the load projection. Then, the model was allowed to reoptimize for the remaining period to 2050. This method helped to understand robust decisions that would minimize regret of overbuilding or underbuilding based on uncertainty in the analysis.

Outcomes of the Modelling and Analysis – Potential Development Plans

The outcomes of the modelling and analysis process are the development of potential development plans to advance for further analysis. Modeling and analysis of the scenarios, sensitivities, and least regrets analysis resulted in ten potential development plans for the 2025 IRP. These potential development plans were formulated to:

- Include different combinations and sequencing of the six feasible resource options;
- Align with the Government of Manitoba's Affordable Energy Plan;
- Comply with net-zero grid by 2035 requirements;
- Provide a pathway to a net-zero economy by 2050;
- Include 600 MW of Indigenous majority-owned wind;
- Reflect feedback from public engagement; and
- Consider all 2025 IRP load projections.

The ten potential development plans fell into three groups, which reflect various observations and results of the modelling and analysis:

- **Lower Cost Plans:** This group tested various quantities of combustion turbines fuelled by natural gas, along with the use of alternative resources. This reflects that combustion turbines, fuelled by natural gas, were consistently selected as part of the portfolio of resources through all of the modelling and analysis. Four potential development plans are included in the Lower Cost Plans grouping.
- **Diversified Capacity Plans:** This group tested plans with potentially more balance between combustion turbines fuelled by natural gas and alternative resource options. Three potential development plans are included in the Diversified Capacity Plans grouping.
- **Maximized Alternatives Plans:** This group tested alternative resources to minimized the quantity of combustion turbines. This grouping reflects that it is important to explore these alternatives and it reflects the feedback heard through engagement. Three potential development plans are included in the Maximized Alternatives Plans grouping.

Figure 2.6 shows the installed capacity (MW) in 2035 of the ten potential development plans, based on the 2-Medium load projection, with the accredited capacity (MW) in 2035 shown in Table 2.3.

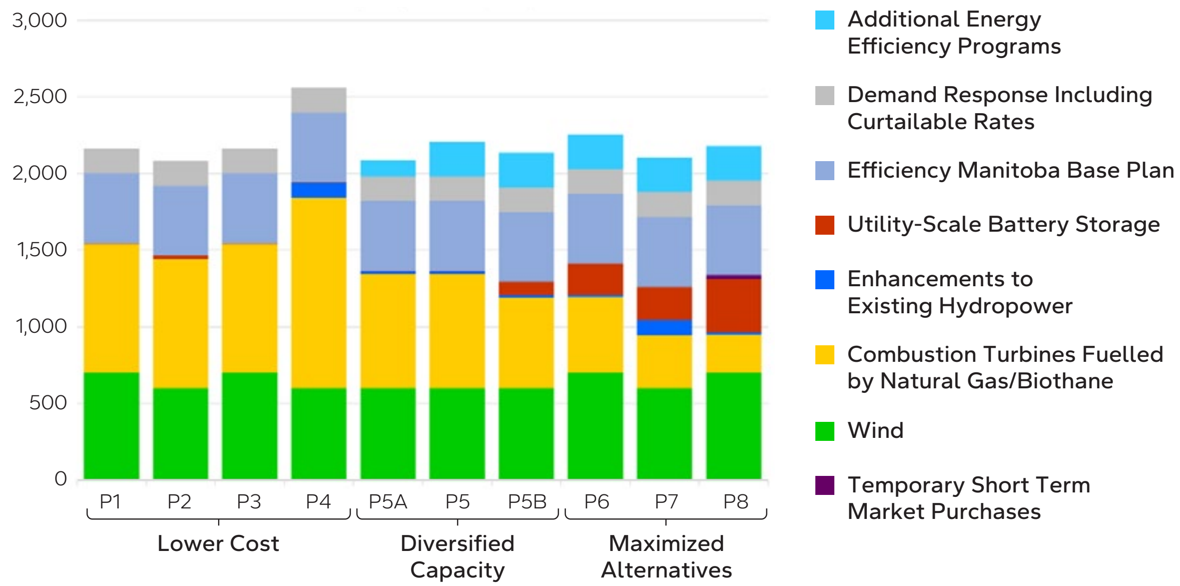

Figure 2.6 - Installed Capacity (MW) of 10 Potential Development Plans in 2035 at 2-Medium Load Projection

Table 2.3 - Accredited Capacity (MW) of 10 Potential Development Plans in 2035 at 2-Medium Load Projection

Legend:

Potential Development Plans (P)

Lower Cost	Diversified Capacity	Maximized Alternatives	Total Customer Side Solutions

Feasible Resource Options	P1	P2	P3	P4	P5A	P5	P5B	P6	P7	P8
Efficiency Plan Projection	456	456	456	456	456	456	456	456	456	456
Demand Response including Curtailable Rate Program	312	312	312	312	312	312	312	312	312	312
Additional Energy Efficiency Programs	0	0	0	0	95	196	196	196	196	196
Wind	140	120	140	120	120	120	120	140	120	140
Battery Storage	5	25	5	0	5	5	85	200	215	350
Enhancements to Existing Hydropower	0	0	0	100	25	25	25	25	100	25
Combustion Turbine fuelled by Natural Gas	850	850	850	1,250	750	750	600	500	350	250
Total	**1,763**	**1,763**	**1,763**	**2,238**	**1,763**	**1,864**	**1,794**	**1,829**	**1,749**	**1,754**

*120 MW of accredited capacity of wind is equivalent to 600 MW of installed wind

For further information on the modelling and analysis process and its outcomes, please see Appendix 7.1 - Modelling and Analysis Approach and Appendix 7.2 - Modelling and Analysis Results.

2.3.2. Evaluations

Evaluation of the potential development plans is to create a short list of the ten potential development plans that would be advanced for further analysis. This was done by applying the evaluation metrics, which reflect considerations important to Manitoba Hydro and our customers, as well as by establishing a build-out target any potential development plan would need to meet.

Build-out target

To help narrow the range of uncertainty in the 2025 IRP analysis, a build-out target was set to establish a minimum amount of resources to allow flexibility to meet future needs. It helps to narrow the range of underbuilding or overbuilding for potential future based on observations up to this point.

Through modelling and analysis it was observed that the risks of underbuilding are far greater than overbuilding – this means that it is much easier to slow down or scale-back a development plan than to accelerate or add to it. A build-out target, helps us identify potential development plans that proactively protect in-service dates to avoid needing to accelerate the plan. In this way, we are better placed to support higher load growth in Manitoba and manage other key risks, while also being flexible should identified risks do not materialize (e.g., if load does not grow as fast as projected).

As shown in Figure 2.7, the 2025 IRP included a range of uncertainty of ~2,000 MW of electric peak demand between the 1-Baseline load projection (red line) and the load sensitivity (blue dashed line). The 2024 Electric Load Forecast (green dashed line) is included in the chart as it is Manitoba Hydro's most recent approved load forecast used in ongoing planning.

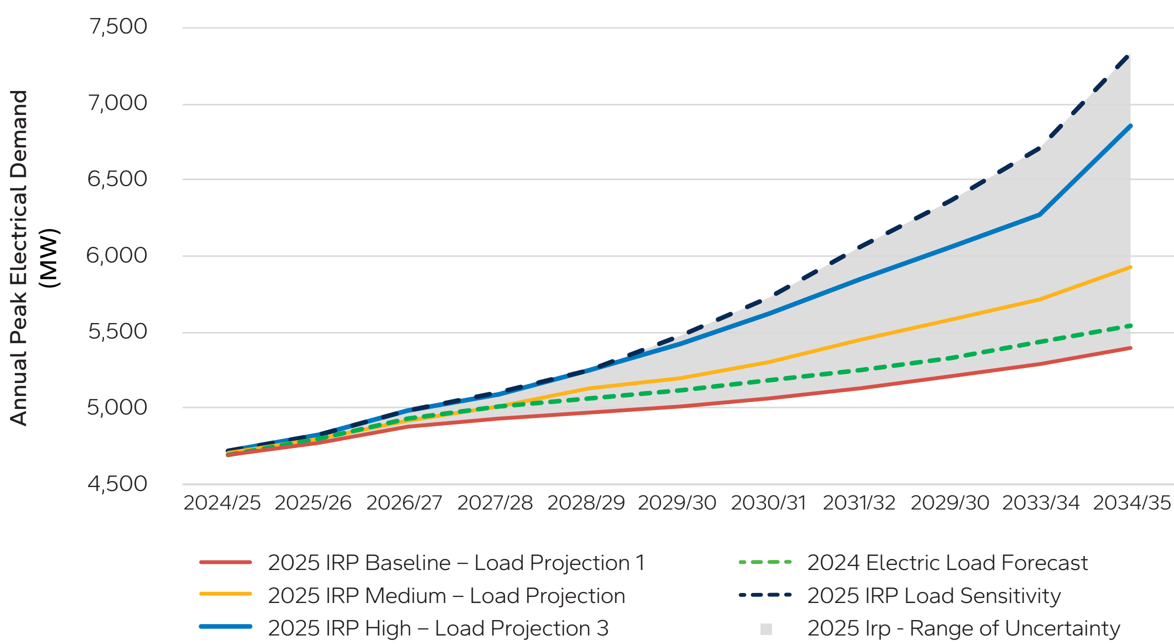

Figure 2.7 - 2025 IRP Load Projections to 2035, including the 2024 Electric Load Forecast

For the 2025 IRP, the build-out target in Figure 11 was based on the 2024 Electric Load Forecast (2024 ELF) from 2025 to 2029., for the following reasons:

- 1-Baseline load projection is below the approved 2024 Electric Load Forecast, is unlikely to occur and, if used as the minimum build-out target, would introduce high probabilities for supply deficits.
- 3-High load projection is not recommended as the minimum build-out target as it would require aggressive policy, that is not currently in place, to drive such accelerated load growth. Furthermore, modelling and analysis results found that growth at this pace would almost certainly lead to supply deficits as Manitoba Hydro would not be able to develop that quickly.
- The Load Sensitivity load projection is also not recommended as the minimum build-out target for reasons similar to 3-High load projection.
- For the short term to 2029, there are no policy instruments in place that would result in a load projection higher than the 2024 Electric Load Forecast.
- From 2030 to 2035, the build-out target is equal to the 2025 IRP 2-medium load projection to support a net-zero economy by 2050 and ensure that resources are in place to support this level of demand.

Modelling and analysis demonstrated that plans were the most robust to changes in the energy landscape at the 2-Medium load projection over this near-term period. This meant that there was still a reasonable path to build resources to support greater capacity, and there was not significant regret for building too early should the increase in load not materialize as projected 2-Medium load projection. The build-out target does not fully eliminate exposure to residual impacts should certain high-consequence risks materialize but provides effective mitigation for a range of identified risks. The build-out target was further tested and validated through risk analysis.

The 2025 IRP build-out target was set to be the 2024 Electric Load Forecast in the short term (present to 2029) and to mirror the 2-Medium load projection in the near-term (2030 to 2035) as shown in Figure 2.8.

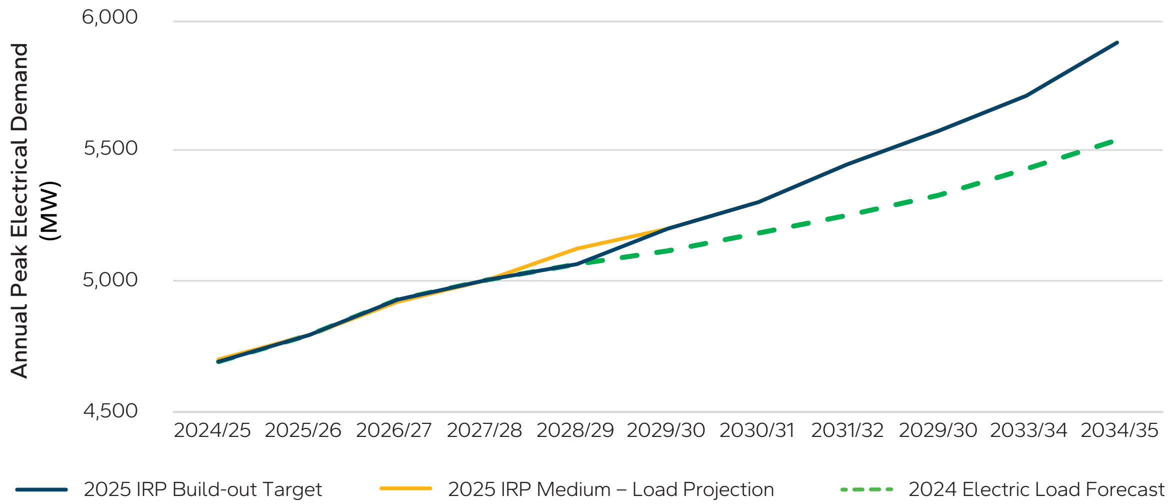

Figure 2.8 - 2025 IRP Minimum Build-out Target to 2035

Evaluating the potential development plans

Applying the evaluation metrics and themes takes into account modelling and analysis observations, as well as plan characteristics that cannot be captured within the model. While each potential development plan is valid and viable, they exhibit distinct characteristics that result in different outcomes across evaluation metrics and themes. As noted previously, the evaluation metrics and themes were established in Step 2, where feedback was sought through Round 1 Engagement.

The evaluation of a potential development plan does not constitute a comprehensive assessment of each individual resource within that plan. Each project identified in a development plan will be subject to further detailed analysis, including justification and business case development, at the time of specific project review. These assessments will be informed by the results of the IRP as well as project-specific data and context.

All ten potential development plans were evaluated over the full study period (2025 to 2050) as well as across all load projections considered in the 2025 IRP. Evaluation results across the range of load projections inform which potential development plans are more robust and favourable overall. The results of the evaluation are compared within the potential development plan groupings – the Lower Cost, Maximized Alternatives, and Diversified Capacity Plans – to identify those that have more favourable results relative to their peers.

Each evaluation theme was evaluated to be one of "more favourable", "neutral", or "less favourable". The evaluation results highlight how each potential development plan's unique combination of assumptions and resources lead to distinct impacts across the four evaluation themes and help to understand the trade-offs of each potential development plan. For example, one potential development plan may perform more favourably under the cost and socio-economic themes, but less favourably under the reliability theme.

This approach supports a comparative assessment of potential development plans seeking balance, recognizing that different potential development plans may align with different priorities or planning objectives.

> **For further details on the evaluation metrics and themes, please see Appendix 8 - Evaluation.**

Shortlisting of Potential Development Plans

In addition to using the evaluation metrics and build-out target to short list the ten potential development plans, a goal of the short list was also ensuring that meaningfully different potential development plans were included.

Lower Cost Plans

The evaluation results of the Lower Cost Plans are shown in Table 2.4. P1 and P2 did not meet the build-out target. P4 was more costly so did not move forward to the short list of potential development plans. The result is that P3 is advanced to the short list of potential development plans for the Lower Cost Plans.

Table 2.4 - Lower Cost Plans Evaluation Results

Potential Development Plan	Reliability	Costs	Environmental	Socio-Economic
~~P1~~	~~Less Favourable~~	~~More Favourable~~	~~Neutral~~	~~Neutral~~
~~P2~~	~~Less Favourable~~	~~More Favourable~~	~~Neutral~~	~~More Favourable~~
P3	Neutral	More Favourable	Neutral	More Favourable
~~P4~~	~~Neutral~~	~~Neutral~~	~~Neutral~~	~~Neutral~~

Maximized Alternative Plans

The evaluation results for the Diversified Capacity Plans, as shown in Table 2.5, had no material difference between them. Given the similarity, all three of P5A, P5, and P5B advanced to the short list of potential development plans.

Table 2.5 - Diversified Capacity Plans Evaluation Results

Potential Development Plan	Reliability	Costs	Environmental	Socio-Economic
P5A	Neutral	Neutral	Neutral	More Favourable
P5	Neutral	Neutral	Neutral	More Favourable
P5B	Neutral	Neutral	Neutral	More Favourable

Maximized Alternatives Plans

The evaluation results for the Maximized Alternative Plans are shown in Table 2.6. Of this set, P7 demonstrated more value and is the potential development plan advanced to the short list of potential development plans. P6 and P8 did not meet the minimum build-out target. Furthermore, P6 has less favourable costs.

Table 2.6 - Maximized Alternatives Plans Evaluation Results

Potential Development Plan	Reliability	Costs	Environmental	Socio-Economic
~~P6~~	~~Neutral~~	~~Less Favourable~~	~~Neutral~~	~~Neutral~~
P7	Neutral	Neutral	Neutral	More Favourable
~~P8~~	~~Less Favourable~~	~~Less Favourable~~	~~Neutral~~	~~Neutral~~

The resultant short list of potential development plans includes plans P3, P5A, P5, P5B, and P7, as shown in Figure 2.9. These plans, which represent a meaningful range of feasible resource options, were advanced to the next stage of the IRP where they underwent risk analysis and financial analysis. The remaining plans were no longer considered.

Lower Cost Build-Outs

P3	Prioritizes cost and reliability by employing combustion turbines in near-term. More wind provides additional social-economic benefits.

Diversified Capacity Build-Outs

P5	Includes alternative dispatchable capacity resources and enhances reliability through additional combustion turbines. Maximizes energy efficiency, providing additional socio-economic benefits.
P5A	Maintains reliability of P5 by employing combustion turbines, while building closer to the build-out target through reduced reliance on additional energy efficiency programs.
P5B	Maintains the socio-economic benefits of P5 through maximizing additional energy efficiency programs, while building closer to the build-out target through smaller combustion turbine selections.

Maximized Alternative Build-Outs

P7	Prioritizes alternative dispatchable capacity resources to minimize reliance on combustion turbines in the near-term. Maximizes energy efficiency, providing additional socio-economic benefits

Figure 2.9 - Summary of the short list of five potential development plans

2.3.3. Engagement: Information Session

During the modelling and analysis process, Manitoba Hydro made a decision to host a mid-project information session, which was held in July 2025. The information session was held in the middle of the modelling and analysis step, prior to the least regrets analysis and the evaluation sub-step being completed. While this step of engagement was not originally planned, it was added because it provided an opportunity to share feedback received to date from engaged audiences, how it was informing the process, and to communicate two key findings from modelling and analysis as follows:.

1) There are only six feasible resources to meet demand in the 10-year timeframe, but there are more options available after 2035.

2) While the scenarios were broad and important to inform analysis, narrowing focus to make decisions on a development plan resulted in establishing the build-out target,

The information session did not seek any feedback from participants, and was designed to inform on project progress to date. The presentation, transcript, and Question & Answer document were shared with all interested parties.

2.4. Step 4: Preliminary Recommendations and Round 2 Engagement

Arriving at a road map involved a structured, multi-step process. To arrive at the recommended development plan Manitoba Hydro applied a framework that incorporated financial analysis, risk analysis, and policy alignment to assess the five shortlisted development plans. Learnings were documented, near-term actions were developed and signposts were identified. Round 2 engagement sought feedback and hear perspectives on the road map, including the recommended development plan.

2.4.1. Recommendation Framework

To guide decision-making towards the recommended development plan, Manitoba Hydro established a framework that was applied for each shortlisted potential development plan. The framework was a pass/fail-based threshold and included the financial and risk analyses results. These thresholds helped identify plans with acceptable levels of financial impact and enterprise risk. Importantly, not meeting a threshold did not automatically exclude a plan from further analysis. Rather, the impacts and the drivers of a fail in combination were considered. The framework thresholds were defined as follows:

- Risk: Maximum of one risk classified as very high risk for any of the key risks identified.
- Capital Investment: Within $600M of the lowest-cost option.

2.4.2. Risk Analysis

Risk analysis provided insight into how each shortlisted potential development plan may perform under uncertainty. Manitoba Hydro used its Enterprise Risk Management (ERM) Framework to assess exposure to key enterprise risks within a 10-year horizon (to 2035). A very high risk level results from combinations of likely to almost certain likelihoods and major to severe impact. Plans with multiple very high risk levels require more complex risk management, which can hinder successful implementation. Therefore, the threshold of no more than one very high risk supports a more manageable and resilient development plan.

The outcomes of the risk analysis are summarized in Figure 2.10. Four risks are constant across plans and do not influence the recommendation: resource effective capacity; long-term generation and distribution reliability; performance of energy efficiency; and, transmission & distribution execution and capital expenditures (capex). From the remaining risks, plans P3, P5A, and P5 pass the risk threshold (maximum of one very high risk level for any of the key risks identified), while P5B and P7 do not pass.

	Potential Development Plan (PDP)				
Risk	PDP - P3	PDP - P5a	PDP - P5	PDP - P5b	PDP - P7
Execution	20	20	20	20	20
HVDC Failure	16	16	16	20	20
Economic	16	16	16	16	20
Demand	12	12	12	12	15
Regulation	12	12	12	16	16
Resource Effective Capacity	3	3	3	3	3
Long-term Gen. and Distribution Reliability	9	9	9	9	9
Sovereignty	1	1	1	2	2
Performance of Energy Efficiency	8	8	8	8	8
Extreme Weather	4	4	4	3	3
Reputation	12	12	12	12	9
T&D Execution and Capex	20	20	20	20	20

Figure 2.10 - Summary of Risk Assessment

For further details on the risk analysis, please see Appendix 9.2 - Risk Analysis.

2.4.3. Financial Analysis

The financial analysis ensured the recommendation was grounded in metrics familiar to regulators and interested parties. It focused on capital investment requirements which are regularly communicated and influence perceptions of Manitoba Hydro's financial health. The capital investment threshold reflects enterprise risk categorizations and financial performance expectations. Figure 2.11 summarizes the financial analysis and demonstrates that, plans P3 and P5A pass the threshold (within $600M of the lowest-cost option), while the remaining plans do not pass.

Potential Development Plans	Capital Investments to 2035 (Nominal $s)
Lower Cost, P3	$3.1 B
Diversified Capacity, P5A	$3.4 B
Diversified Capacity, P5	$3.9 B
Diversified Capacity, P5B	$3.9 B
Maximized Alternatives, P7	$4.0 B

Figure 2.11 - Summary of Capital Investment

For further details on the financial analysis, please see Appendix 9.1 - Financial Analysis.

2.4.4. Energy Wallet

An energy wallet analysis was also initiated as part of the 2025 IRP to explore this emerging approach to estimating customers' total household energy costs – including utility bills, transportation fuel, and appliance purchases – to better understand how potential development plans may impact household costs. Because the methodology is still evolving, this work was intended as supplemental and not considered in the recommendation framework or included in the 2025 IRP report. Manitoba Hydro is continuing to work with our consultant to refine the energy wallet analysis and validate outcomes.

2.4.5. Recommended Development Plan and Alternative

Through financial and risk analysis, P3 and P5A were the best-performing plans, passing all thresholds, as shown in Figure 2.12.

Potential Development Plans	Investment	Risk	Summary
P3	✓	✓	✓
P5A	✓	✓	✓
P5	✗	✓	✗
P5B	✗	✗	✗
P7	✗	✗	✗

Figure 2.12 - Summary of Recommendation Framework results

Policy Alignment

To determine which plan to recommend, Manitoba Hydro assessed alignment with the Government of Manitoba's Affordable Energy Plan (AEP) and other government mandates for Manitoba Hydro. Figure 2.13 summarizes the alignment of the two remaining shortlisted potential development plans.

Directives/Objectives	P3	P5A
Maintain Affordability	✓ Lower projected investment.	✓ Higher projected investments.
Expand Energy Efficiency	✗ Only includes efficiency plan projection.	✓ Includes 600 MW of wind.
Support Indigenous Ownership	✓ Includes up to 700 MW of wind.	✓ Includes 600 MW of wind.
Hydro Station Refurbishments	✗ No enhancements to existing hydropower.	✓ Includes enhancements to existing.
Net-zero Grid by 2035	✓ Meets net-zero grid by 2035.	✓ Meets net-zero grid by 2035.
Path to Net-Zero Economy by 2025	✓ Enables a path to net-zero economy by 2050.	✓ Enables a path to net-zero economy by 2050.

Figure 2.13 - Summary of Policy and Mandate Alignment for P3 and P5A

Plan P5A was selected as the basis for the recommended development plan due to its stronger alignment with Manitoba's Affordable Energy Plan objectives and other mandates. Notably:

- Plan P5A includes enhanced energy efficiency measures beyond the base plan, directly supporting goals of expanding energy efficiency programs.
- Plan P5A incorporates hydropower station enhancements, addressing emphasis on refurbishment and long-term asset sustainability.
- While Plan P5A has higher projected investment requirements than Plan P3, it passed the investment threshold, keeping costs relatively low.

Common practice in an integrated resource plan is to include an alternative and what could be done if the recommended development plan does not materialize. Plan P3, is the alternative development plan as it offers a viable path forward.

2.4.6. Engagement: Round 2

Round 2 engagement for the 2025 IRP focused on sharing the road map, including the recommended development plan. Information sessions were held with interested parties and customers were invited to share their views through an online survey. Feedback and insights from the sessions were summarized in the IRP report. Full reporting of the engagement results will be published in a supplementary document after the IRP report is published.

2.5. Step 5: Finalize the Integrated Resource Plan

Finalizing the integrated resource plan involves doing the quality assurance checks required to ensure the document is ready for publishing and submitting to the Manitoba Government.

Ready to publish

Preparing the document for publish includes reviews and editing of the content, consistency and language checks, finalizing glossaries and table of contents, formatting of text blocks and graphics and accessibility checks. Once all the reviews are complete then the copy must still undergo design layout, translation and final drafting.

Submit to Government

Once the IRP is ready to publish, it is submitted to the Government of Manitoba, as outlined in the Manitoba Hydro Act.