2025 Integrated Resource Plan

PUB Information Session
February 2025

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Manitoba Hydro
energy for life

Land acknowledgment

Manitoba Hydro has a presence right across Manitoba – on Treaty 1, Treaty 2, Treaty 3, Treaty 4 and Treaty 5 lands – the original territories of the Anishinaabe, Anishininew, Cree, Dakota, and Dene peoples and the National Homeland of the Red River Métis.

We also acknowledge the ancestral lands of the Inuit in northern Manitoba.

We acknowledge these lands and pay our respects to the ancestors of these territories. The legacy of the past remains a strong influence on Manitoba Hydro's relationships with Indigenous communities today, and we remain committed to establishing and maintaining strong, mutually beneficial relationships with Indigenous communities.

Agenda

Topics:

1. Introduction
2. Engagement
3. Key inputs, scenarios, and evaluation metrics
4. Next steps

1. Introduction

What is an Integrated Resource Plan?

- A utility best practice used across North America to understand and prepare for future energy needs.
- A repeatable process that plans for long-term needs and will be updated as future conditions evolve.
- One output of the ongoing planning cycle at Manitoba Hydro.
- Includes engagement to incorporate feedback from customers and interested parties.

The 2023 Integrated Resource Plan

- Primary objective was to plan for safe, reliable energy that meets the evolving needs of Manitobans at the lowest cost possible.
- Studied how the energy transition could impact our natural gas and electricity systems including generation, transmission and distribution.
- Resulted in a road map that included signposts and near-term actions
- Notable learnings from the 2023 IRP:
  - The energy transition is already underway in Manitoba
  - Investment is required in all scenarios
  - Natural gas will play a role in getting to a low carbon future

Why we need the 2025 IRP now

We need a development plan approved as soon as possible

- We need new resources as early as 2029/30.
- The Manitoba Hydro Act requires Manitoba Hydro to recommend a development plan for approval, prepared as part of an Integrated Resource Plan that is informed by engagement.

What is a development plan?

It outlines the steps Manitoba Hydro will take to meet future energy needs.

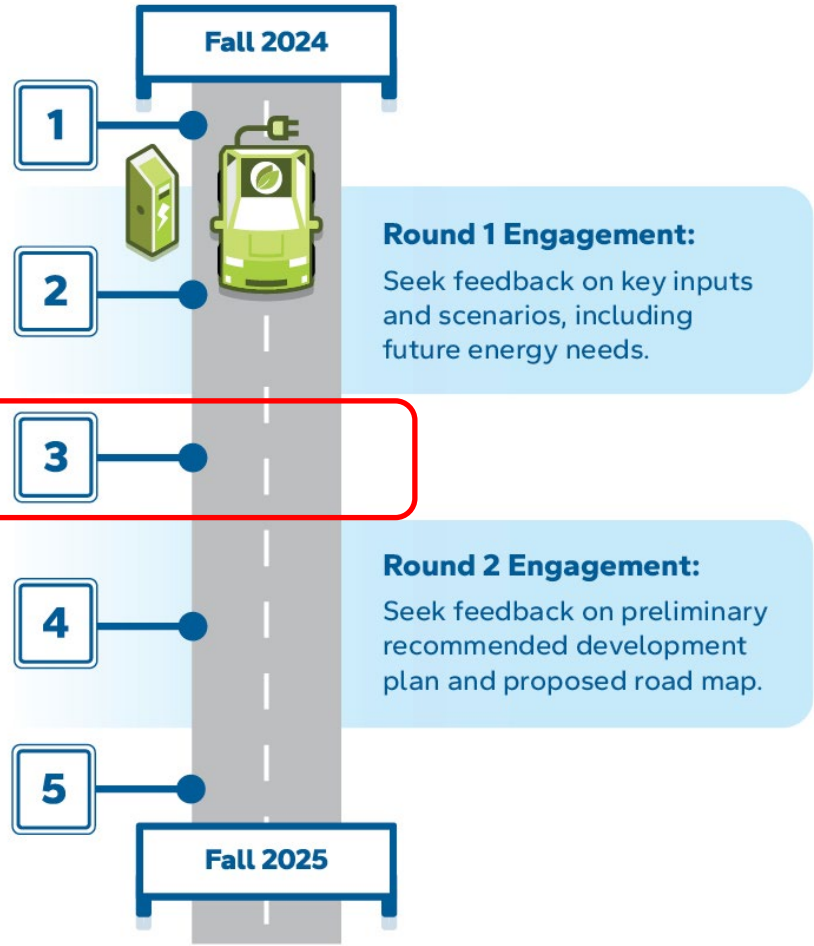
It may include building new energy sources, infrastructure, and programs to manage energy use during peak demand.

The 2025 Integrated Resource Plan will…

- Result in a road map that will include a recommended development plan of ~10 years.
- Include analysis that extends to 2050.
- Include all energy infrastructure, non-MH owned assets, and investments to defer need for new infrastructure.
- Consider policy from all levels of government, such as federal, provincial, and municipal.

2025 IRP process overview

1. Setting direction
2. Develop key inputs and scenarios
3. Modelling, analysis, and evaluations
4. Preliminary recommendation
5. Finalize the Integrated Resource Plan



How we ensure quality in the IRP

In house technical experts

- Decades of experience
- Ensure Manitoba context is considered

Ensure industry best practices

- Share and review best practices and plans
- Maintain industry networks

Third party reviews

- Leveraged for technical, engagement, and communications
- Validate processes and results

Quality in the IRP – Technical Consultant

Who is E3?

Technical & Strategic Consulting specializing in the Energy Transition…

125+ full-time consultants | 30 years of deep expertise | Engineering, Economics, Mathematics, Public Policy…


San Francisco


New York


Boston


Calgary


Denver

E3 Clients

300+ projects per year across our diverse client base

E3 Project Examples

Data center analysis working with utilities, regulators, independent power produces, and data center companies on strategy, siting, rate design, power supply, and grid impacts

Integrated System Planning supporting a wide range of North American utilities with system planning at the distribution and bulk system level across investor-owned and public power utilities

Policy analysis supporting many state regulatory bodies and energy agencies across the U.S.

Market design and expansion analysis working with ISOs/RTOs directly (ERCOT, MISO, AESO, etc.) on design issues including resource adequacy and capacity accreditation as well as analyzing and supporting Western U.S. market expansion between CAISO EDAM and SPP Markets+

Supporting project developers, asset owners, and investors with strategic and market advisory services across all major power asset classes like renewables, energy storage, gas, transmission, etc.

Quality in the IRP – Technical Consultant

E3's experience in resource planning

+ **E3 has worked with a wide range of clients that are increasingly writing the script for the emerging clean energy transition to understand how to plan deeply decarbonized electricity systems**
  - **California PUC:** Assisting the CPUC in administration of IRP program mandated by SB 350 by developing a 'Reference System Plan' that achieves 40% GHG emission reductions by 2030
  - **Pacific Northwest Low Carbon Scenarios Study:** Investigated the costs and emission reductions associated with various policies in the Northwest, including a higher renewable portfolio standard, cap and trade, and a carbon tax
  - **Sacramento Municipal Utilities District:** Assisting with 2018 IRP to evaluate long-term clean energy goals including GHG emission reductions of 90-100% by 2040
  - **Los Angeles Department of Water and Power (LADWP):** Evaluated reliability contributions of clean energy alternatives to natural gas once-through-cooling plant repowerings
  - **Hawaiian Electric Company (HECO):** Developed an affordable, technical feasible Power Supply Improvement Plan (PSIP) consistent with Hawaii's goal of 100 percent renewable energy by 2045
  - **Xcel Energy Upper Midwest IRP:** Provided support to Xcel Minnesota by conducting independent technical analysis to examine how to meet long-term carbon reduction goals along with associated costs as part of their 2019 IRP process
  - **Nova Scotia Power:** Full support for Nova Scotia Power's 2021 IRP considering coal retirements and deep decarbonization in a geographically constrained region

SMUD®

PGP Public Generating Pool

Public Utilities Commission · Eureka · State of California

Hawaiian Electric

LA DWP

Xcel Energy

Nova Scotia POWER An Emera Company

+ **Through these projects, E3 has developed an unparalleled understanding of resource planning within highly decarbonized renewable electricity systems**

Energy + Environmental Economics (E3)

Retained as the 2025 IRP Technical Consultant

Scope of work will include:

- Provide review of the development of the 2025 IRP,
- Share their expertise to ensure the IRP meets industry best practices, and
- Support technical studies.

E3 supported the development of the 2023 IRP in a similar way.

Quality in the IRP – Engagement Consultant

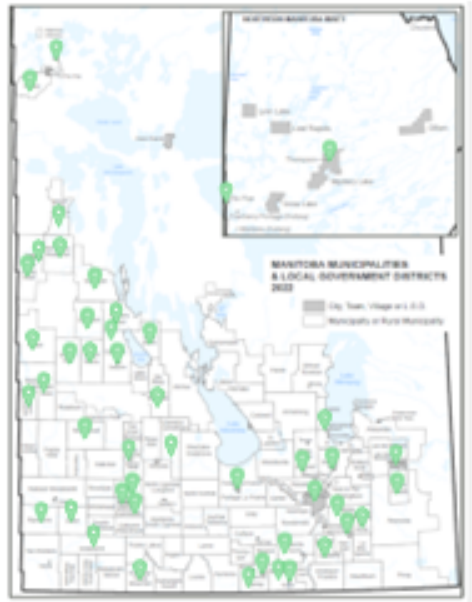
URBAN SYSTEMS

- One of Canada's leading inter-disciplinary consulting firms
- Privately owned and operated by our employees for 50 years
- 18 locations in Western Canada
- 700+ Employees

- Local Winnipeg office with 16 planners, engineers, landscape architects, environmental specialists, designers and communications and engagement professionals

- We support municipalities, provincial governments and agencies, and Indigenous communities everyday through complex issues and the development of new processes, policies and regulations

- Committed to and passionate about supporting the long-term health and well-being of the communities we work with and live in



Manitoba municipalities we've worked with

Quality in the IRP – Engagement Consultant







OUR ENAGEMENT EXPERIENCE AND APPROACH

INTER-DISCIPLINARY - Assembling teams with diverse technical knowledge and expertise.

DEEP UNDERSTANDING OF THE MATERIAL WE ARE ENGAGING ON - Distilling complex technical material into programs, processes and communication materials that generate meaningful conversations and input from a wide range of community members.

INTEGRATED TEAM - Providing all the communications and engagement expertise necessary for the successful delivery.

EXTENSIVE ENGAGEMENT EXPERIENCE - Our engagement processes ensure community members and stakeholders are engaged and able to contribute to projects in meaningful ways.

LONG HISTORY OF WORKING WITH INDIGENOUS COMMUNITIES - We are currently working with more than 400 Indigenous communities and governments throughout Canada.

STRONG RELATIONSHIPS WITH MANITOBA MUNICIPALITIES - We pride ourselves on the many strong working relationships we have with communities across Manitoba, both urban and rural.

WE UNDERSTAND ENERGY PLANNING - Our team has a breadth and depth of expertise in supporting the development and implementation of renewable energy projects, community energy plans, and greenhouse gas emissions management strategies for Indigenous, provincial, and local government clients.

Urban Systems

Retained as the 2025 IRP Engagement Consultant

Will:

- Support development of engagement strategy,
- Facilitate activities, and
- Ensure engagement feedback is incorporated into the project.

CHECK-IN

2. Engagement

Who and How

NGOs
Social and Environmental

Academia

Associations
Sector and Community

Economic Development Organizations

Indigenous Organizations

Government

Municipalities

Customers

General Public

Public Utilities Board

Efficiency Manitoba

Employees

- Surveys
- Multiparty conversations with representative voices
- Individual conversations
- Research
- Direct emails
- Self-serve and accessible information on website
- Informational presentations & workshops
- Technical Advisory Committee

Round 1 Engagement Summary

End October – End December 2024

Customer Survey

6,800

Responses

IRP Webpage

1,750

Unique Views

Project Newsletter Subscribers

7,200 + **1,500**

Previous | New Subscribers

Interested Parties and MH Employees

7

Virtual Workshops

Technical Advisory Committee

3

In-Person Meetings

Customer Insights Interviews & Surveys

15 Large Customers

30 Municipalities

13 First Nations Leadership

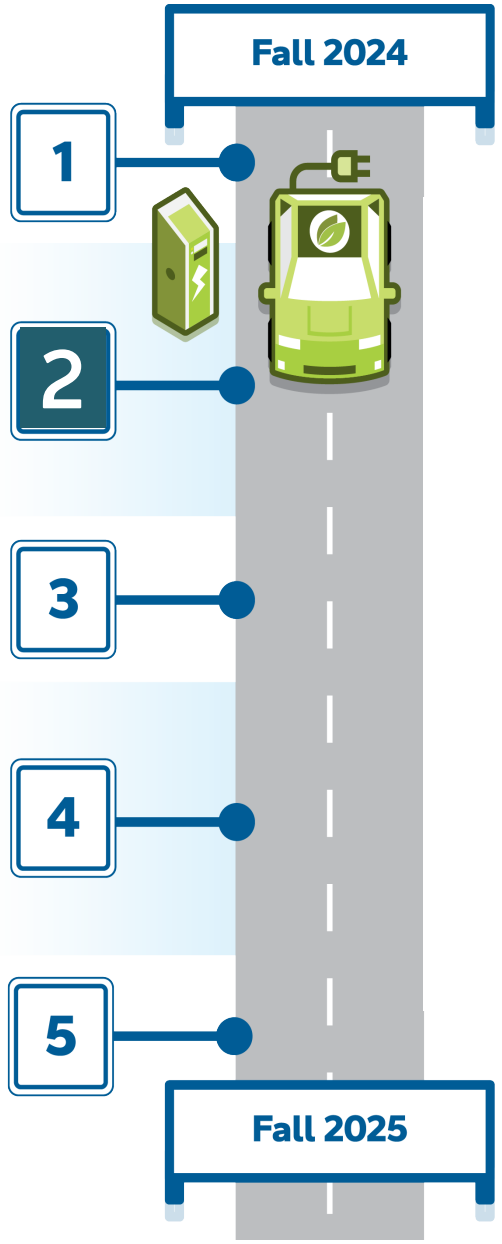
- Round 1 Engagement was broad, and the response rate was excellent.
- Audiences were engaged with varying depth appropriate for each audience

2025 IRP Technical Advisory Committee

INVITED MEMBERS **(* Invited but did not attend)**	Assembly of Manitoba Chiefs* Association of Manitoba Municipalities Efficiency Manitoba Manitoba Government – Finance & Environment and Climate Change Public Utilities Board City of Winnipeg Climate Change Connection Eco-West/Éco-Ouest Canada Sustainable Building Manitoba Consumers Coalition Manitoba Industrial Power Users Group Manitoba Chamber of Commerce (Green Advantage) Manitoba Keewatinowi Okimakanak Inc. Manitoba Métis Federation Manitoba Sustainable Energy Association Red River College Polytech Southern Chiefs' Organization Inc.* University of Manitoba University of Winnipeg

CHECK-IN

3. Key Inputs, Scenarios, and Evaluation Metrics



Step 2. Develop key inputs and scenarios

What is included in this step of the 2025 IRP development process

Step 1. Setting direction

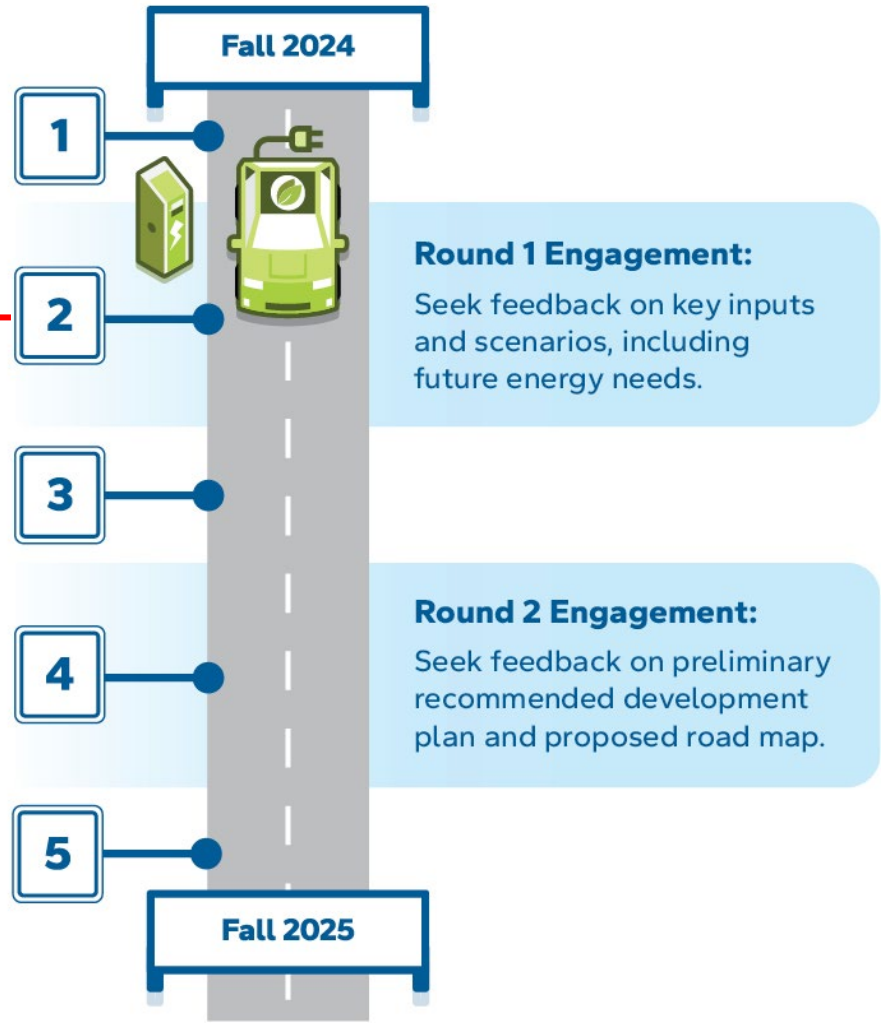
Step 2. Develop key inputs and scenarios

- Planning assumptions
- Key inputs
  - Load projections
  - Resource options strategies
- Scenarios
- Establish evaluation metrics

Step 3. Modelling, analysis and evaluations

Step 4. Recommended development plan

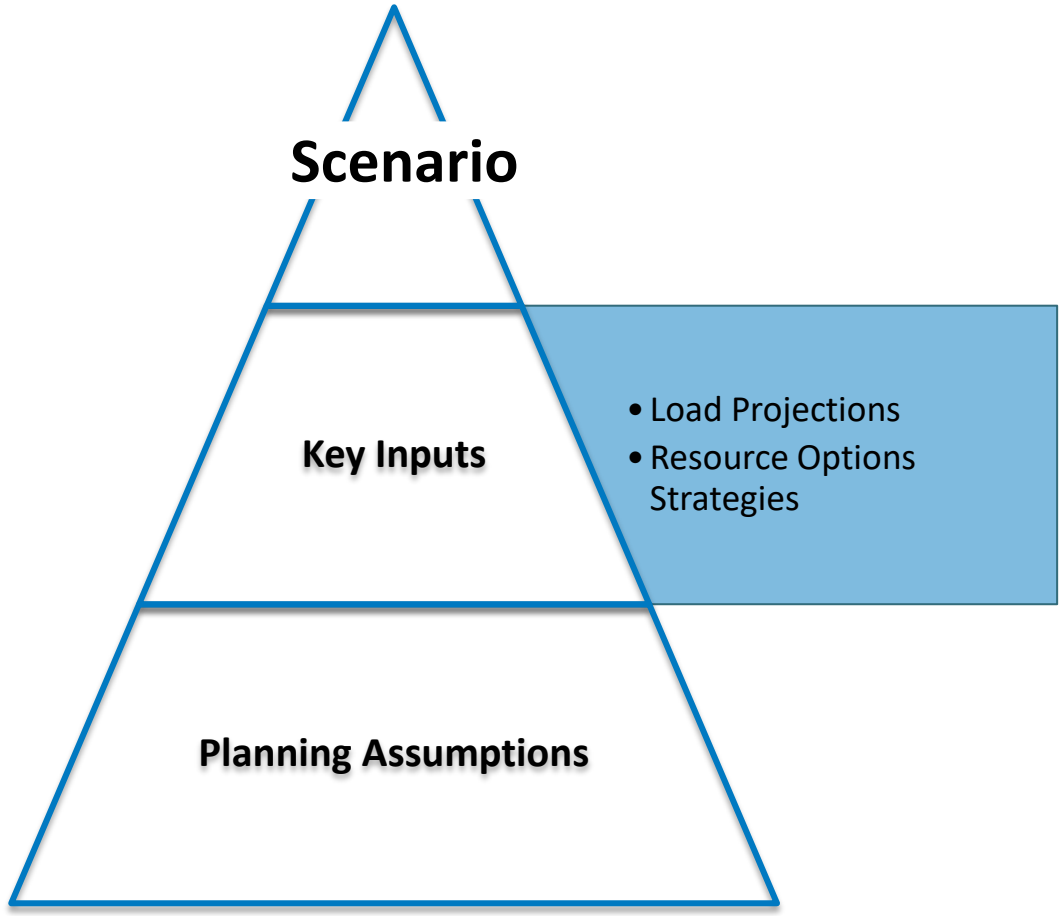
Step 5. Finalize the Integrated Resource Plan



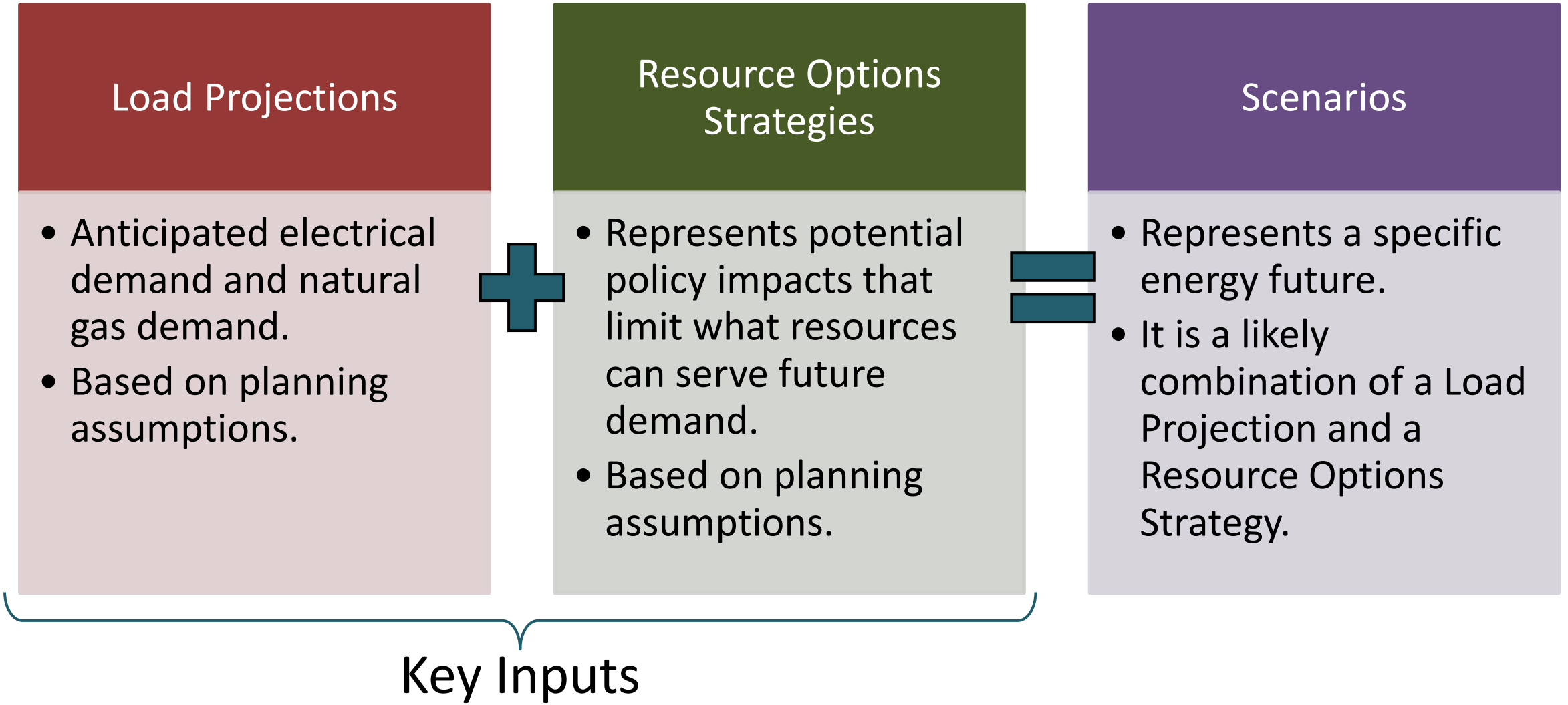
Developing key inputs and scenarios

Underpinned by planning assumptions

- The **planning assumptions** underpin the key inputs.
- **Key inputs** for the 2025 IRP include:
  - **Load projections**
  - **Resource options strategies**
- A **load projection** and a **resource option strategy** are combined to create an energy future **scenario**.



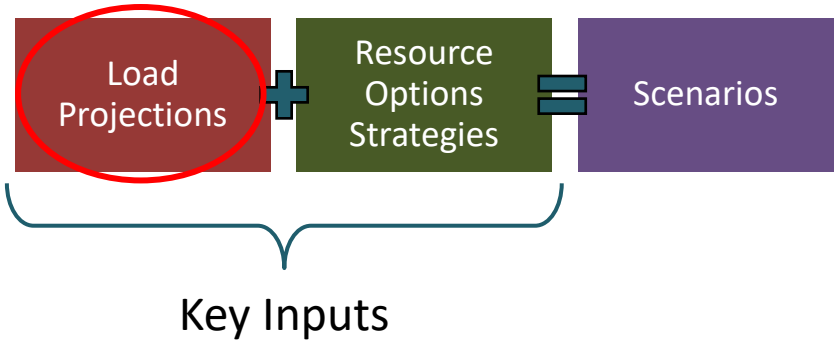
Key inputs and scenarios



CHECK-IN

Load Projections

Key Inputs



Load projections and their planning assumptions

- Load projections show the energy demand Manitoba Hydro might be required to serve.
- Planning assumptions are common between electricity and natural gas.
- The net-zero economy by 2050 future is uncertain and could result in a range of electricity and natural gas demand that needs to be served by Manitoba Hydro.
- Three proposed load projections reflect increased impact to Manitoba's electric and natural gas demand:

Baseline Load Projection
Assumes minimal changes from current policies and customer decisions.

Medium Load Projection
Assumes moderate impact from government actions and customer decisions and achieves economy wide net-zero by 2050.

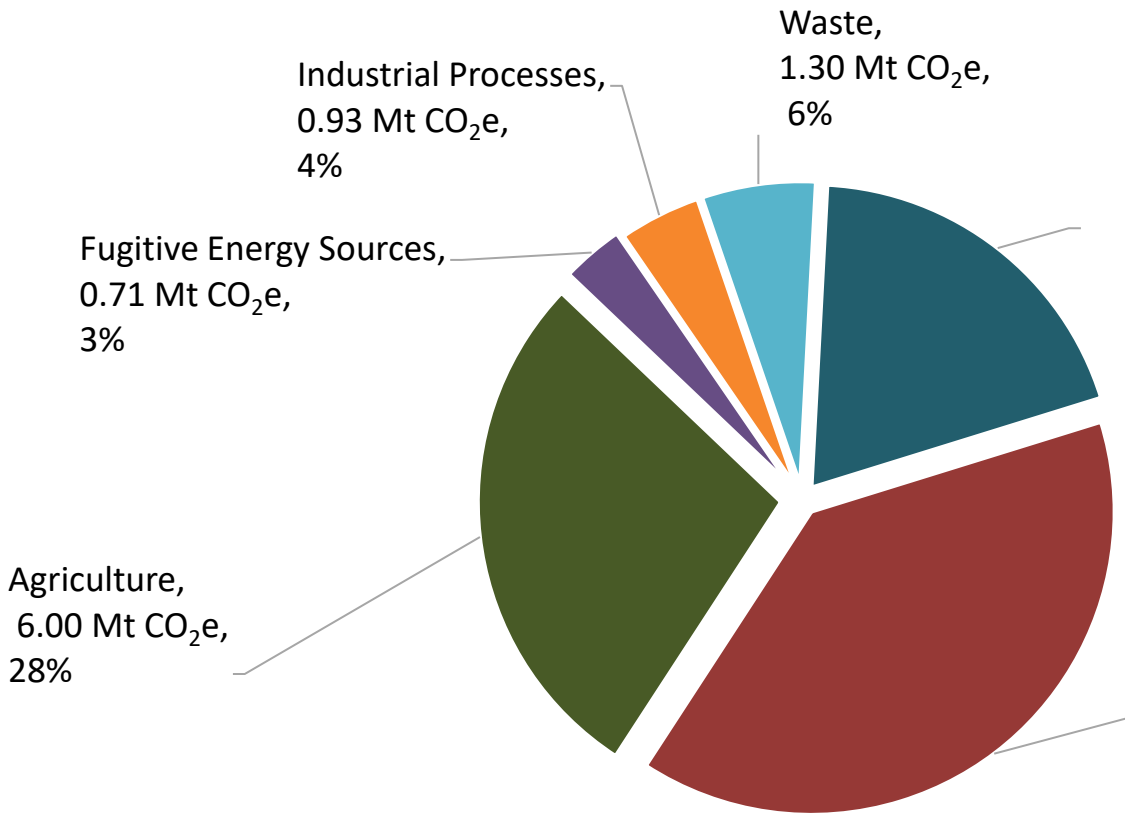
High Load Projection
Assumes significant impact from government actions and customer decisions and achieves economy wide net-zero by 2050.

Guiding principles for developing the 2025 IRP load projections and their assumptions

- Capture a **broad range of potential futures** for both electricity and natural gas.
- **Leverage key learnings from 2023 IRP** in developing planning assumptions for each load projection.
- **Limit the premature removal of existing systems** that have not reached end of life.
- Develop a **baseline projection** with limited changes to how Manitobans use electricity and natural gas.
- Ensure **two load projections support** achieving a **net-zero economy by 2050**, highlighting different pathways to a net-zero economy by 2050.

Manitoba Greenhouse Gas Emissions

Average Manitoban GHG Emissions Between 2018 - 2022 (21.5 Mt per year)



Stationary Combustion (e.g., Boilers, Heaters, Furnaces, Electricity Generation, etc.),
4.16 Mt CO_2e,
20%

Residential natural gas use (space heating, water heating, other uses) produces 1.2 Mt of CO_2e, <6% of Manitoba GHG emissions.

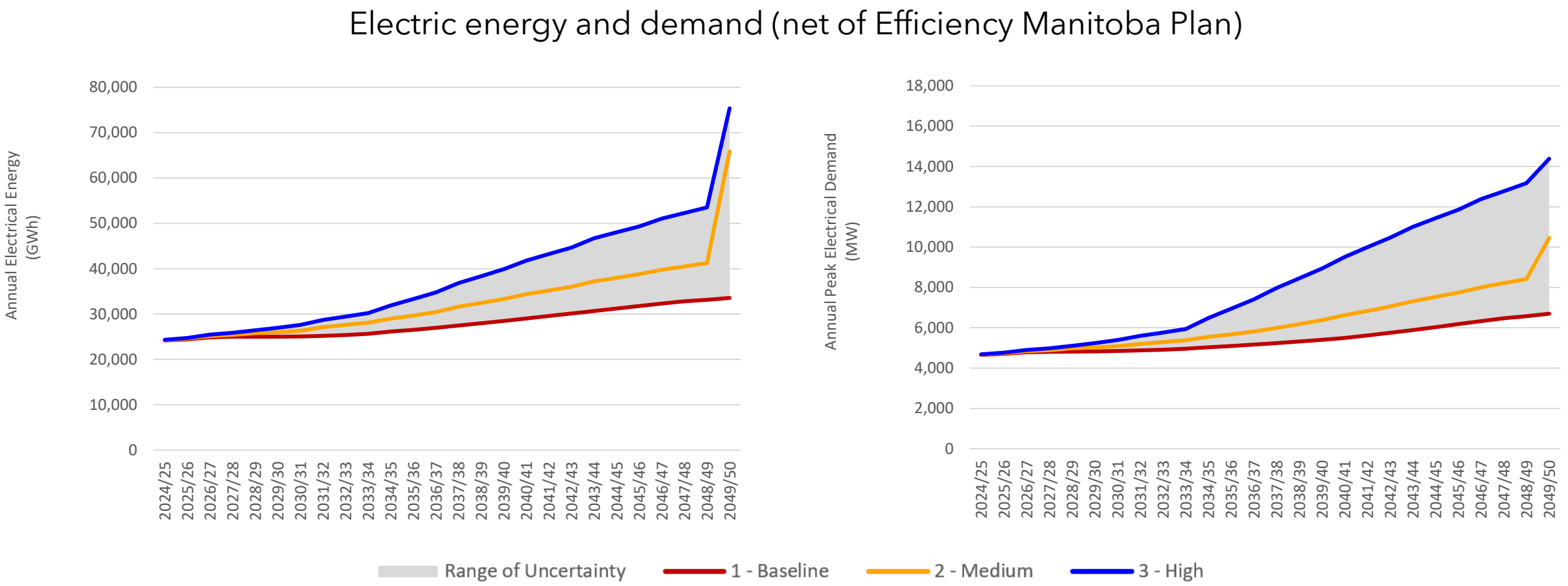
Transport (including on-road, off-road, farm vehicles, aviation, rail),
8.37 Mt CO_2e,
39%

Light-duty road vehicles produce 2.9 Mt of CO_2e, <14% of Manitoba GHG emissions.

Further descriptions of the categories and subcategories found in Table A9-1 in the NIR Part 3
https://publications.gc.ca/collections/collection_2024/eccc/En81-4-2022-3-eng.pdf

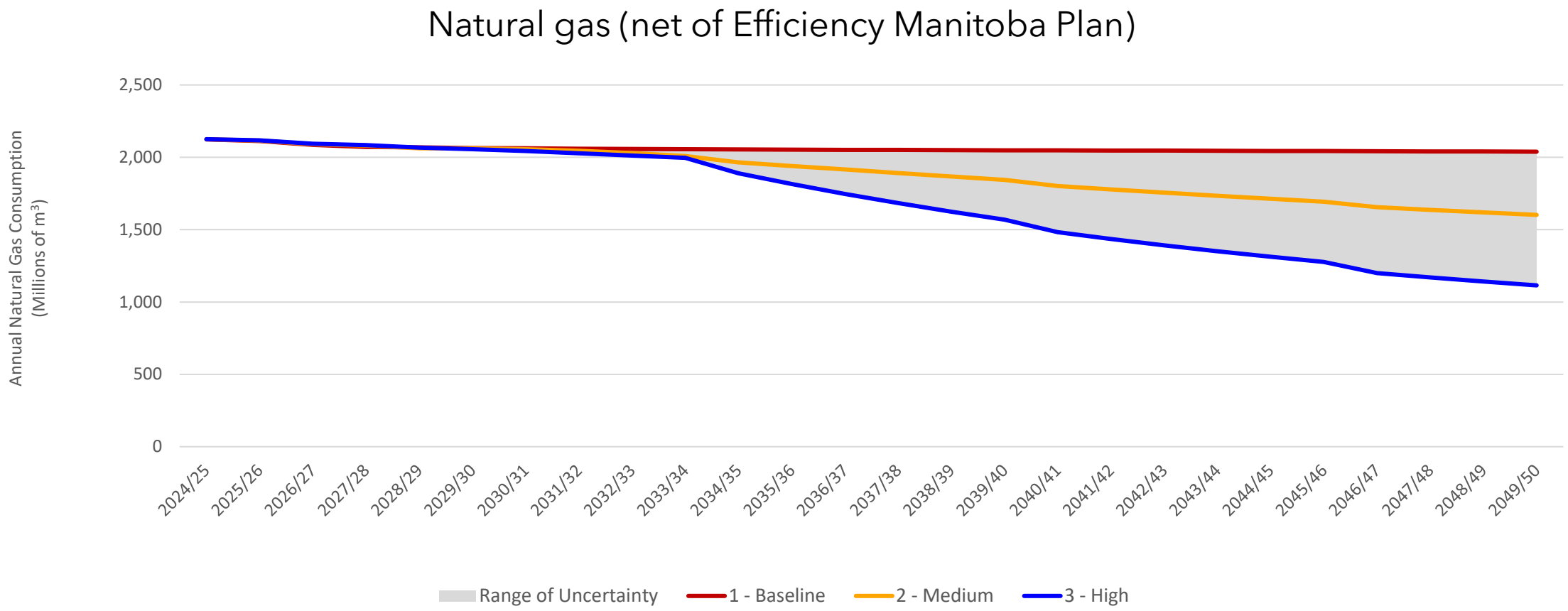
Electric load projections

Three electric load projections reflect a range of uncertainty



Natural gas load projections

Natural gas load projections correspond to electric load projections.



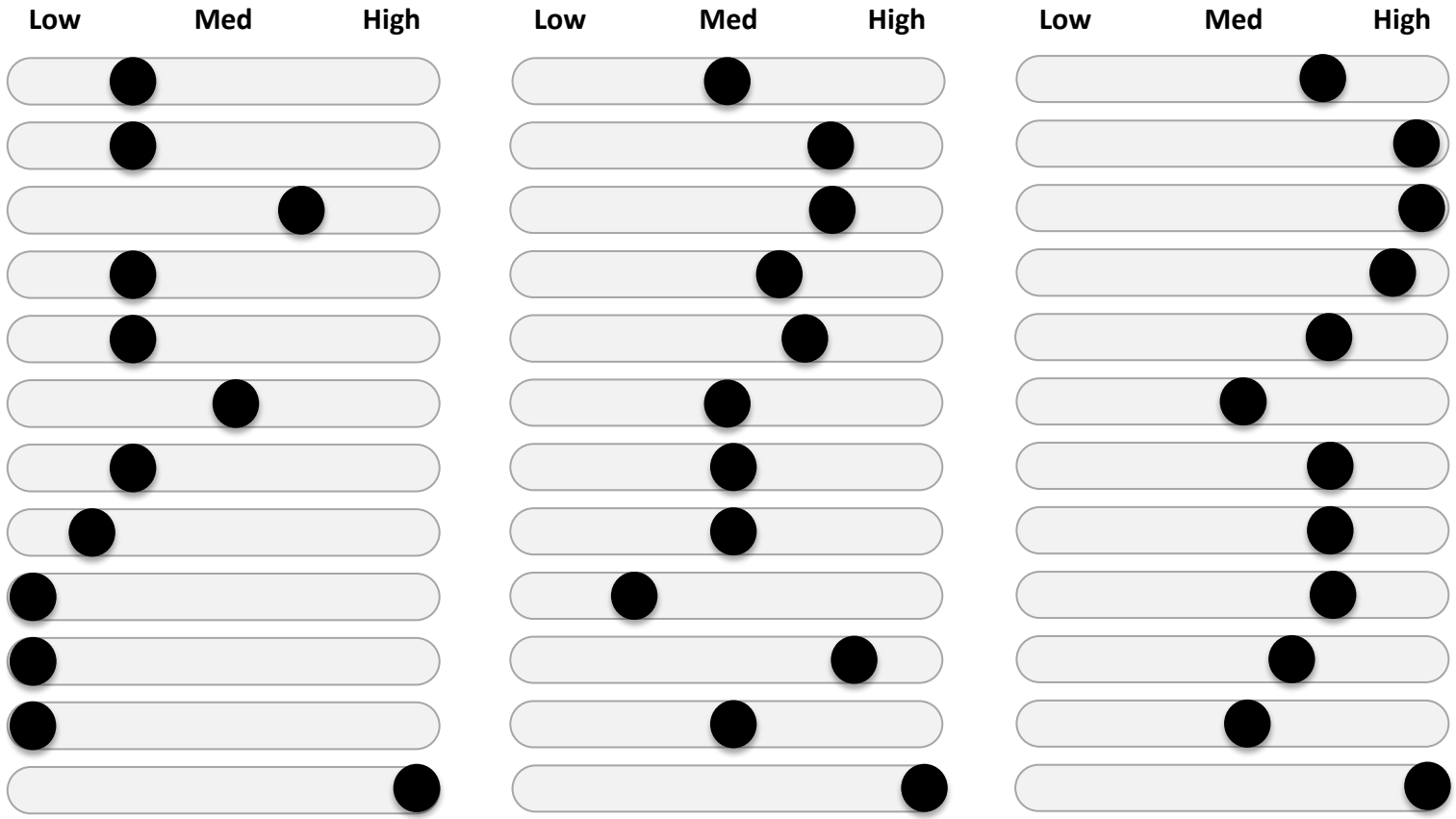
Load projection planning assumptions

Lower anticipated impact — *Higher anticipated impact*

1-Baseline Load Projection
assumes minimal changes from current policies and customer decisions.

2-Medium Load Projection
assumes moderate impact from government actions and customer decisions.

3-High Load Projection
assumes significant impact from government actions and customer decisions.



- **Economic growth**
- **Energy Policy** (incl. GHG policy)
- **Electrification of Transportation**
- **Space Heating** (electrification, ASHP, GSHP, energy efficiency)
- **Customer Self-Generation & Storage** (e.g. solar)
- **Energy Efficiency***
- **Industrial Decarbonization**
- **Industrial Economic Development**
- **Hydrogen Production**
- **CO_2 Capture**
- **Biofuels & Hydrogen**
- **Demand Response**

* Includes an Energy Efficiency Plan from Efficiency Manitoba which is extrapolated from their 3-year plan and was developed in collaboration with Manitoba Hydro.

Electrification of Transportation

Zero-emission vehicle sales assumptions

	Baseline		Medium		High	
Type	**2034/35**	**2049/50**	**2034/35**	**2049/50**	**2034/35**	**2049/50**
Passenger Cars	100%	100%	100%	100%	100%	100%
Light Trucks	100%	100%	100%	100%	100%	100%
Medium	25%	80%	25%	90%	25%	100%
Heavy	10%	50%	18%	75%	25%	100%
Buses	40%	100%	40%	100%	40%	100%

To produce hydrogen through electrolysis, over twice the amount of electricity is required for the same level of km driven

Medium and High Load Projections include the introduction of Hydrogen vehicles starting in 2034/35.

Overall projections include:
- Electricity required to charge electric vehicles
- Electricity required to produce hydrogen to power H_2 vehicles

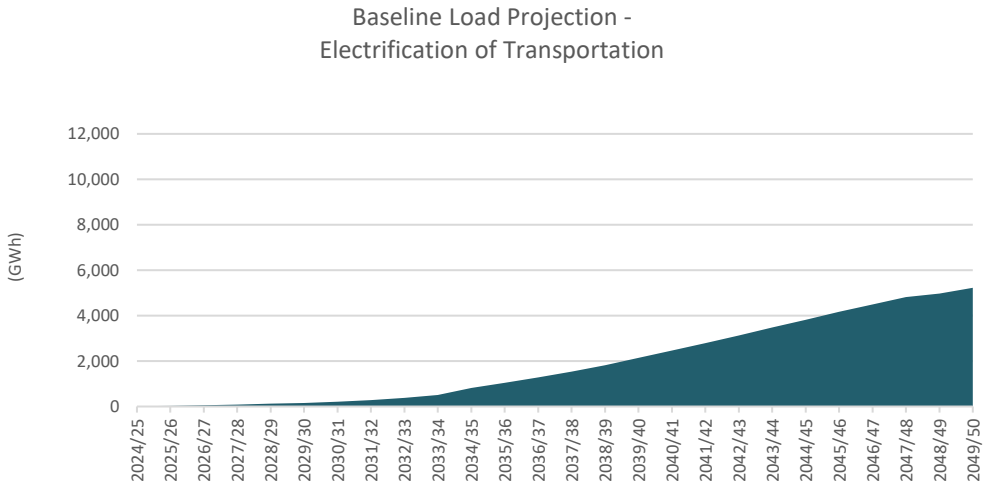
Projections align with known federal mandates for new vehicle sales.

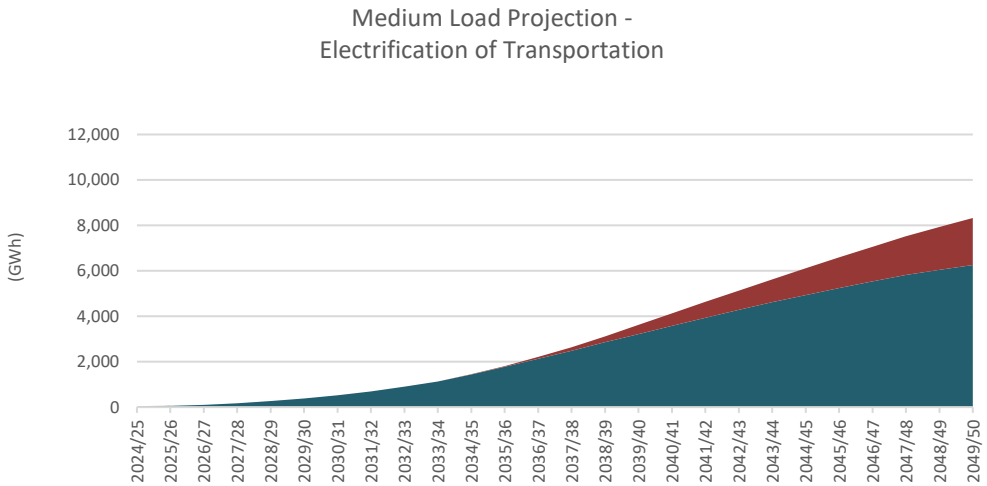
Type	Annual km driven	Annual kWh
Passenger Cars	15,000	3,225
Light Trucks	15,000	4,473
Medium	14,260	7,812
Heavy	88,615	135,612
Buses	55,000	78,160

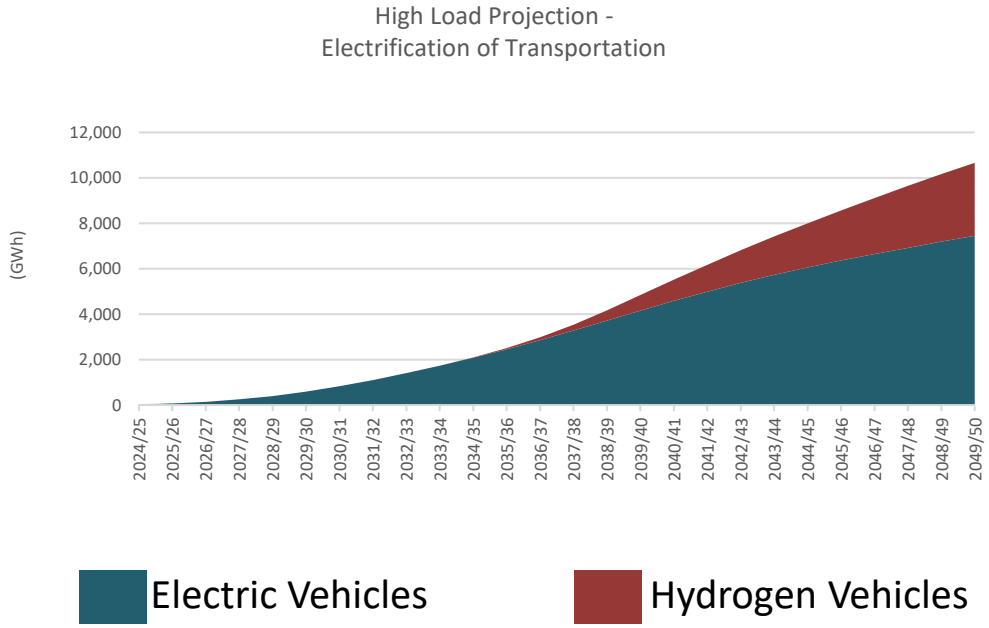
Electrification of Transportation

Projected forecast by 2049/50

	Baseline Load Projection	Medium Load Projection	High Load Projection
MW	+650	+1,040	+1,330
GWh	+5,200	+8,300	+10,650
Millions of m^3	n/a	n/a	n/a





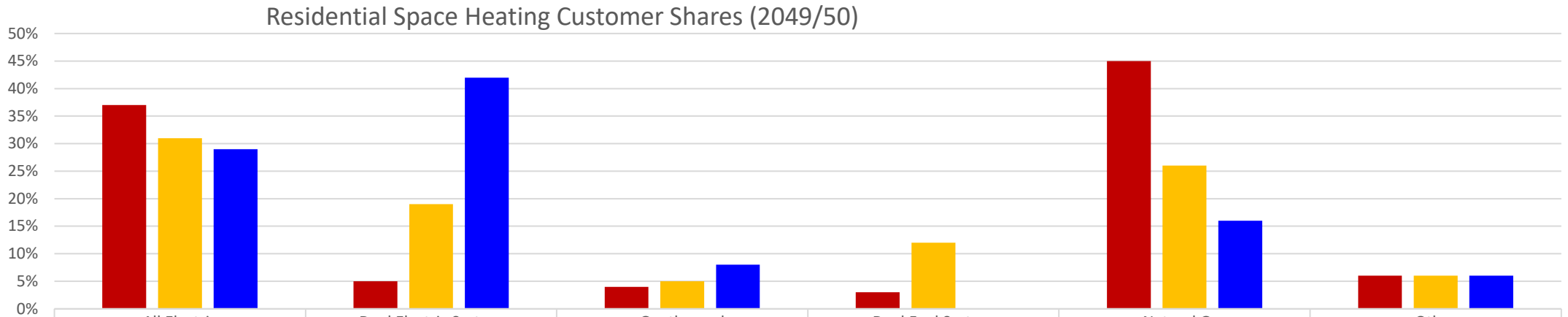


Space Heating

- **Baseline Load Projection** - Customers are still selecting natural gas space heating and reflects an increase in the adoption of alternative technologies such air source heat pumps and cold climate air source heat pumps.
- **Medium Load Projection -** Customers are moving away from traditional gas space heating and reflects an increase in the adoption of alternative technologies such air source heat pumps and cold climate air source heat pumps
- **High Load Projection** - Customers are moving away from traditional gas space heating and reflects a greater increase in the adoption of alternative technologies such air source heat pumps and cold climate air source heat pumps

Projected fuel switching forecast by 2049/50

	Baseline Load Projection	Medium Load Projection	High Load Projection
MW	+150	+1,010	+4,320
GWh	+350	+2,980	+8,240
Millions of m^3	-40	-460	-1,080



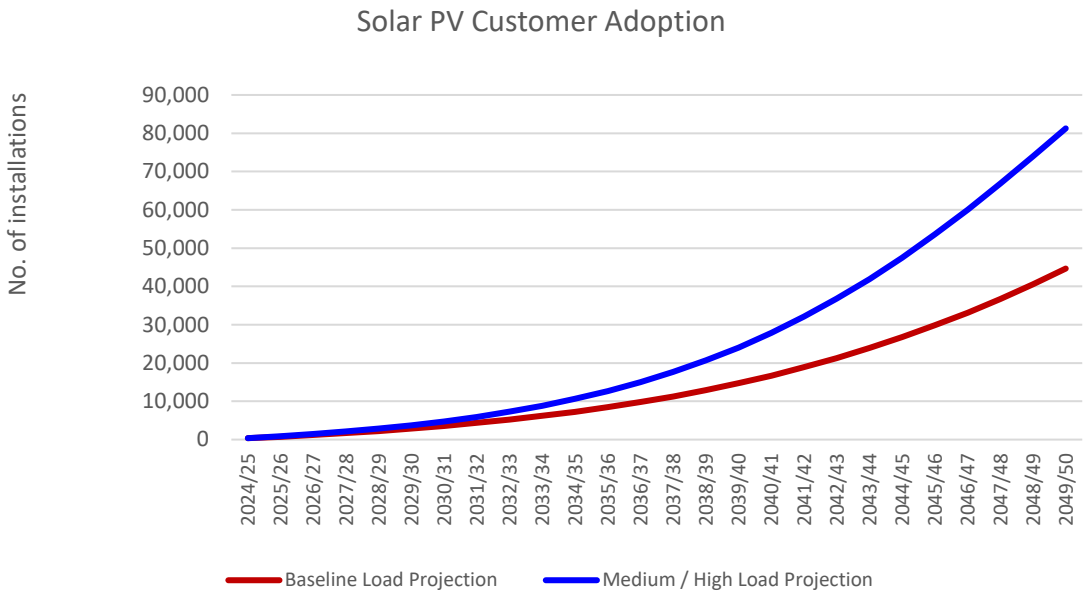
	All Electric	Dual Electric System	Geothermal	Dual Fuel System	Natural Gas	Other
Baseline Load Projection	37%	5%	4%	3%	45%	6%
Medium Load Projection	31%	19%	5%	12%	26%	6%
High Load Projection	29%	42%	8%	0%	16%	6%

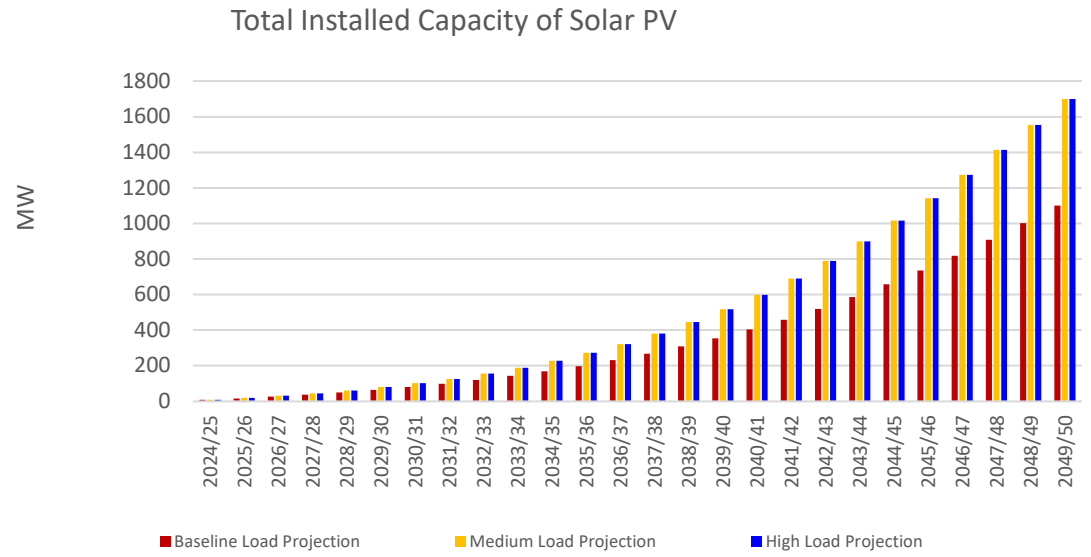
Customer Self-Generation & Storage

- **Baseline Load Projection -** Assumes all customer self-generation is through solar generation (i.e., Solar PV) with a low rate in customer adoption of Solar PV technology
- **Medium Load Projection -** Assumes all customer self-generation is through solar generation (i.e., Solar PV) and reflects moderate rate in customer adoption of Solar PV technology
- **High Load Projection –** Assumes all customer self-generation is through solar generation (i.e., Solar PV) and consistent with the adoption rates assumed in the medium load projection.

Projected forecast by 2049/50

	Baseline Load Projection	Medium / High Load Projection
No. of installations	44,655	81,319
Total installed capacity (MW)	1,100	1,700
Annual electrical energy (GWh)	1,280	1,980
Total consumed by the customer (GWh)	510	790
Total sold back to the grid (GWh)	770	1,190





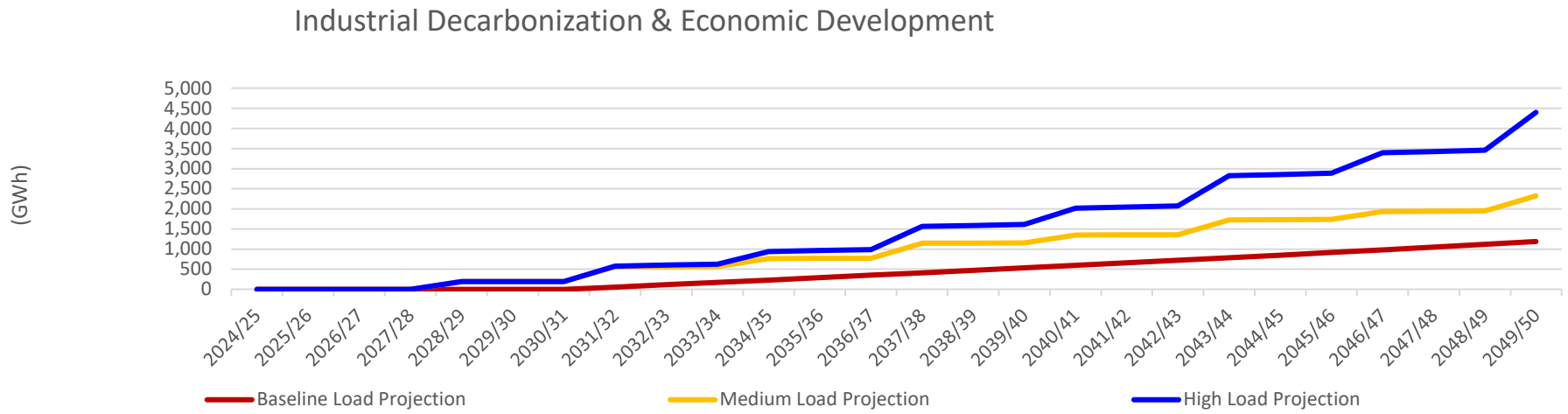
Industrial Decarbonization & Economic Development

- **Baseline Load Projection**
  - Long-term assumes existing Potential Large Industrial Load modeling approach
- **Medium Load Projection**
  - Decarbonization efforts by way of electrification every 6 years (50MW, 50MW, 50MW, 50MW) starting in 2028/29
  - Economic development efforts by way of electrification every 6 years (50MW, 50MW, 50MW, 50MW) starting in 2031/32
- **High Load Projection –**
  - Decarbonization efforts by way of electrification every 6 years (50MW, 75MW, 100MW, 125MW) starting in 2028/29
  - Economic development efforts by way of electrification every 6 years (50MW, 75MW, 100MW, 125MW) starting in 2031/32

Projected forecast by 2049/50

	Baseline Load Projection	Medium Load Projection	High Load Projection
MW	+160	+370	+690
GWh	+1,190	+2,320	+4,400
Millions of m^3 *	0	-70	-130

* Note: Reflects reduction in natural gas consumption as customers decarbonize through electrification of processes

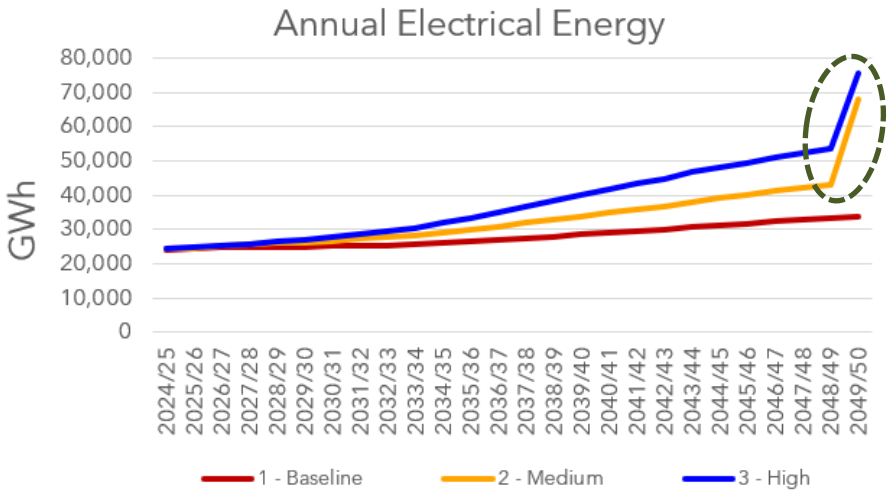


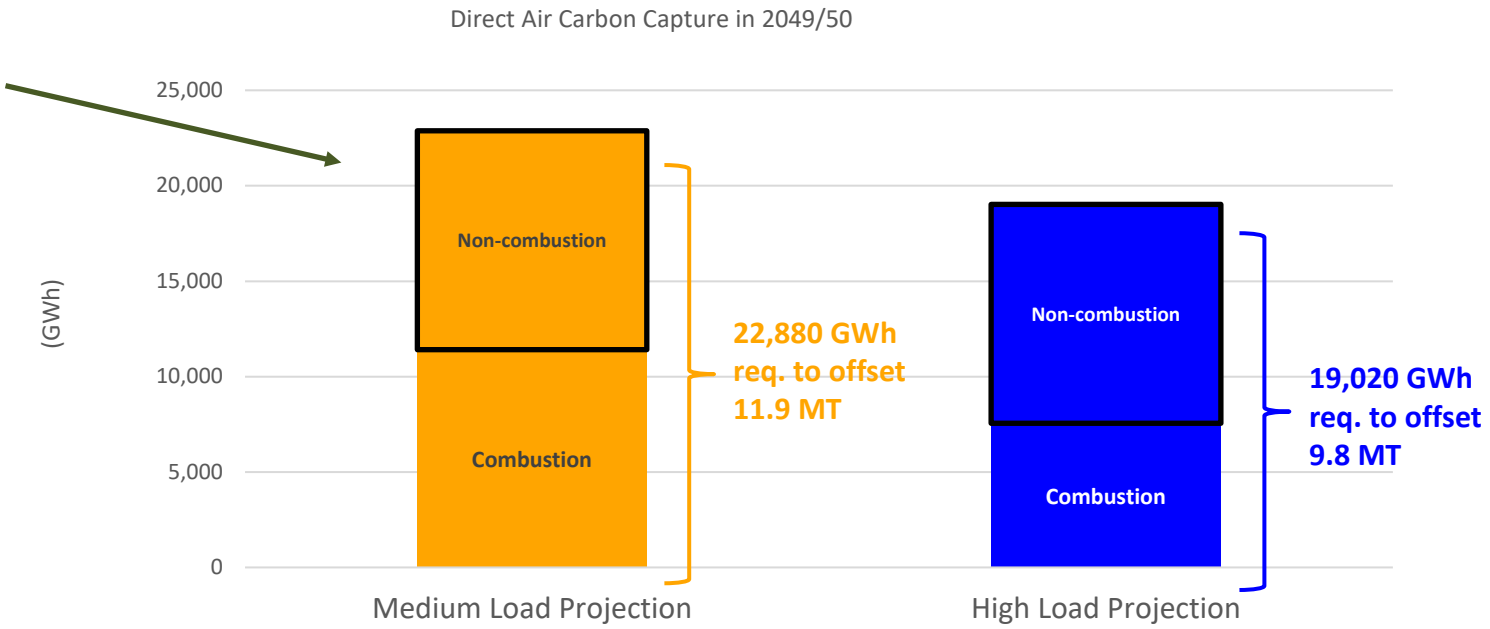
Direct Air CO2 Capture

The Medium and High load projections achieve net-zero economy by 2050 through negative emission technologies that are optimized to Manitoba's energy consumption patterns and impact to peak demand.

Projected forecast by 2049/50

	Baseline Load Projection	Medium Load Projection	High Load Projection
GWh	0	+22,880	+19,020
Installed Capacity (MW)	0	+3,900	+3,250
Peak Demand (MW)	0	+780	+730





Load Projection Sensitivity

Planning Assumptions

Moved away from the guiding principles used to develop the three load projections

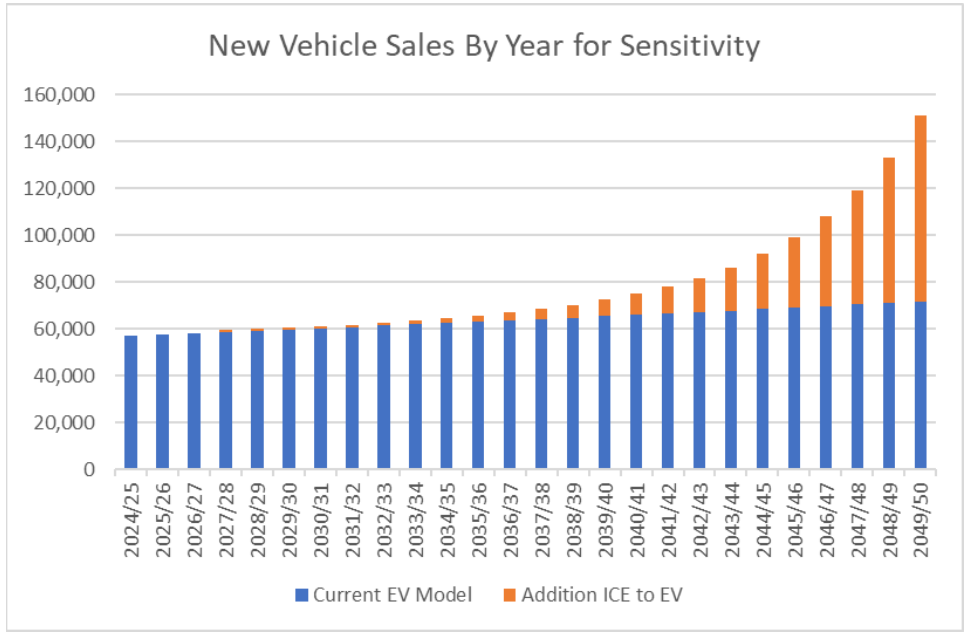
- Replace heating systems and vehicles before they reach end of life.
- Remove all natural gas equipment for customers when they replace space heating systems.
  - Extend this to include smaller industrial and commercial natural gas applications
- Significantly increase market demand for products (i.e. heating systems & vehicles) which ends abruptly in 2049/50.

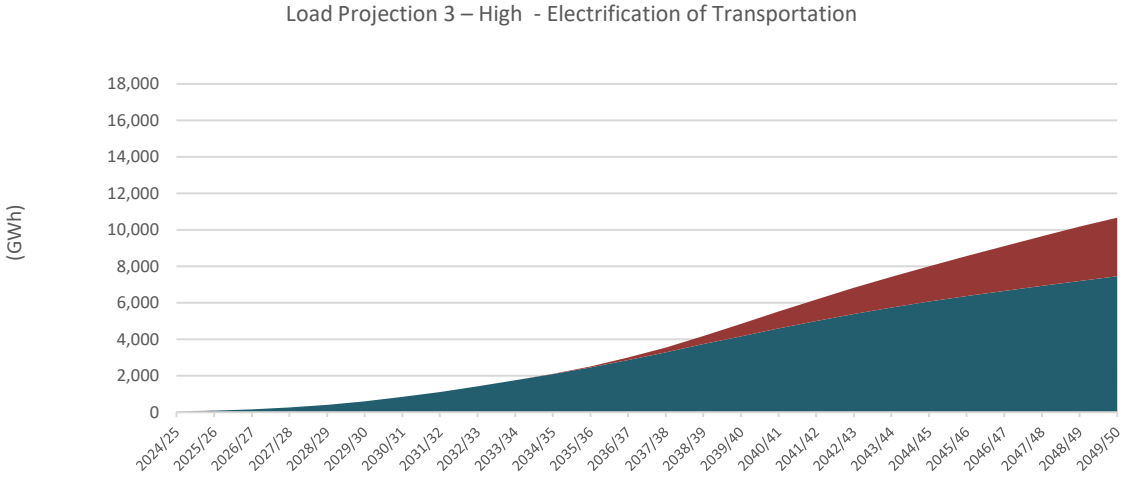
Load projection sensitivity

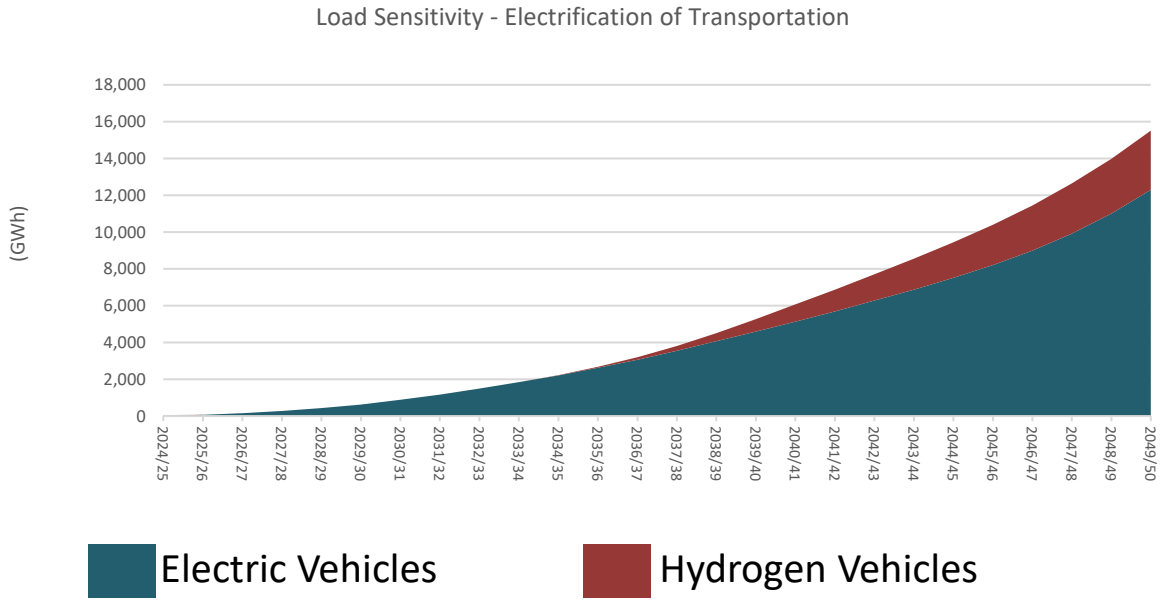
Ground transportation assumptions

- **Manitoba market demand for vehicles may exceed supply** – The load sensitivity requires over 360,000 vehicles to be replaced which otherwise would not have retired by 2049/50 in load projection 3.

- **Absolute zero will be a challenge for medium & heavy duty –** The load sensitivity assumes all vehicle classes (Light Duty, Medium Duty, Heavy Duty & Buses) are fully replaced with zero emitting technologies where limited options are currently available for the larger vehicles.





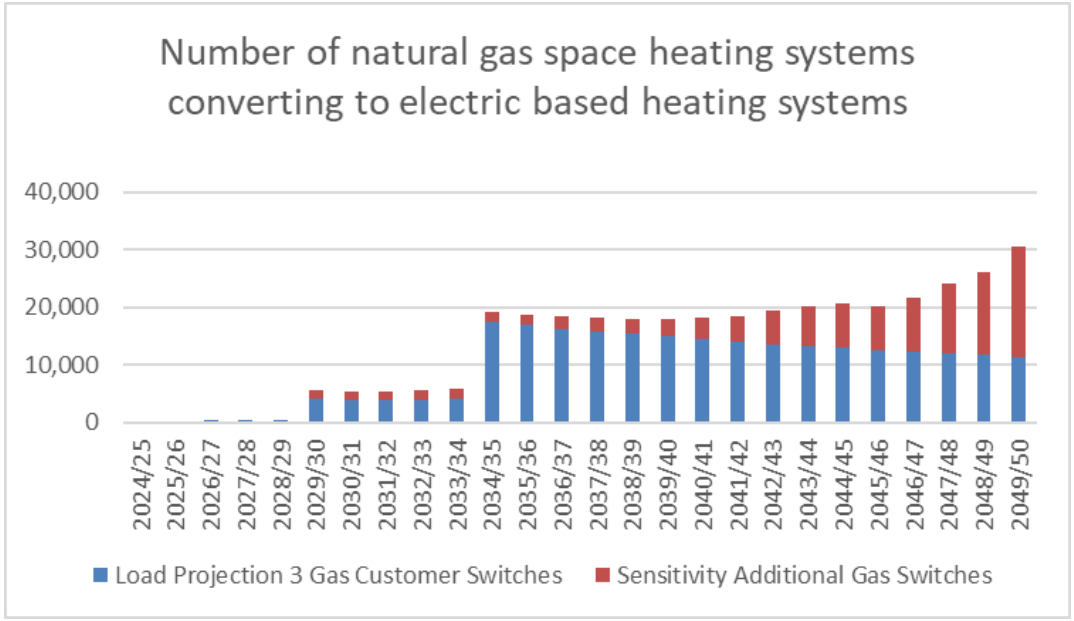


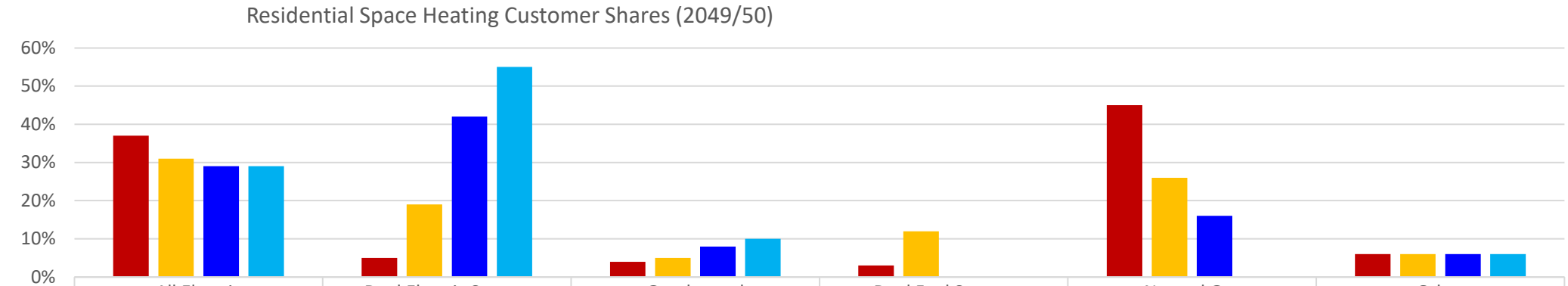
Load projection sensitivity

Space heating assumptions

- **Replacing space heating systems -** Customers are replacing over 110,000 gas space heating systems before they reach end of life and the sensitivity assumes all replacements use alternative technologies such air source heat pumps, cold climate air source heat pumps or ground source heat pump.

- **Market demand could lead to price increases**, and the heating and cooling industry required to ramp up and meet market demand will see an abrupt reduction in demand by over 50% after 2050.

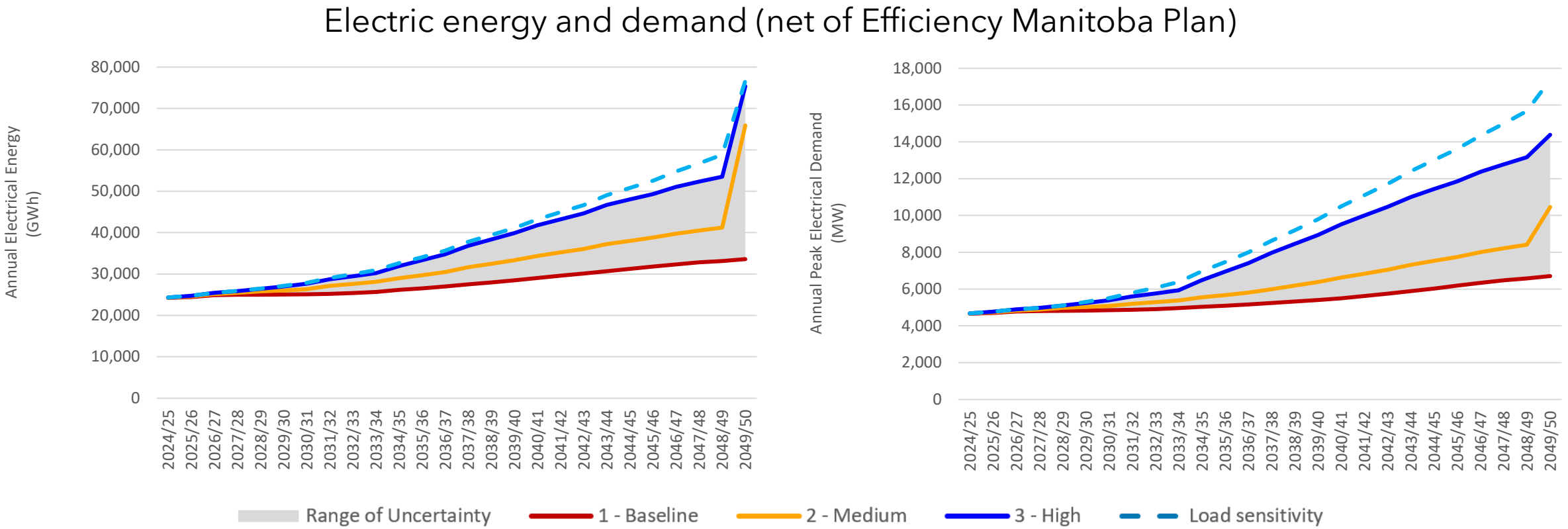




	All Electric	Dual Electric System	Geothermal	Dual Fuel System	Natural Gas	Other
1-Baseline Load Projection	37%	5%	4%	3%	45%	6%
2-Medium Load Projection	31%	19%	5%	12%	26%	6%
3-High Load Projection	29%	42%	8%	0%	16%	6%
Load Sensitivity	29%	55%	10%	0%	0%	6%

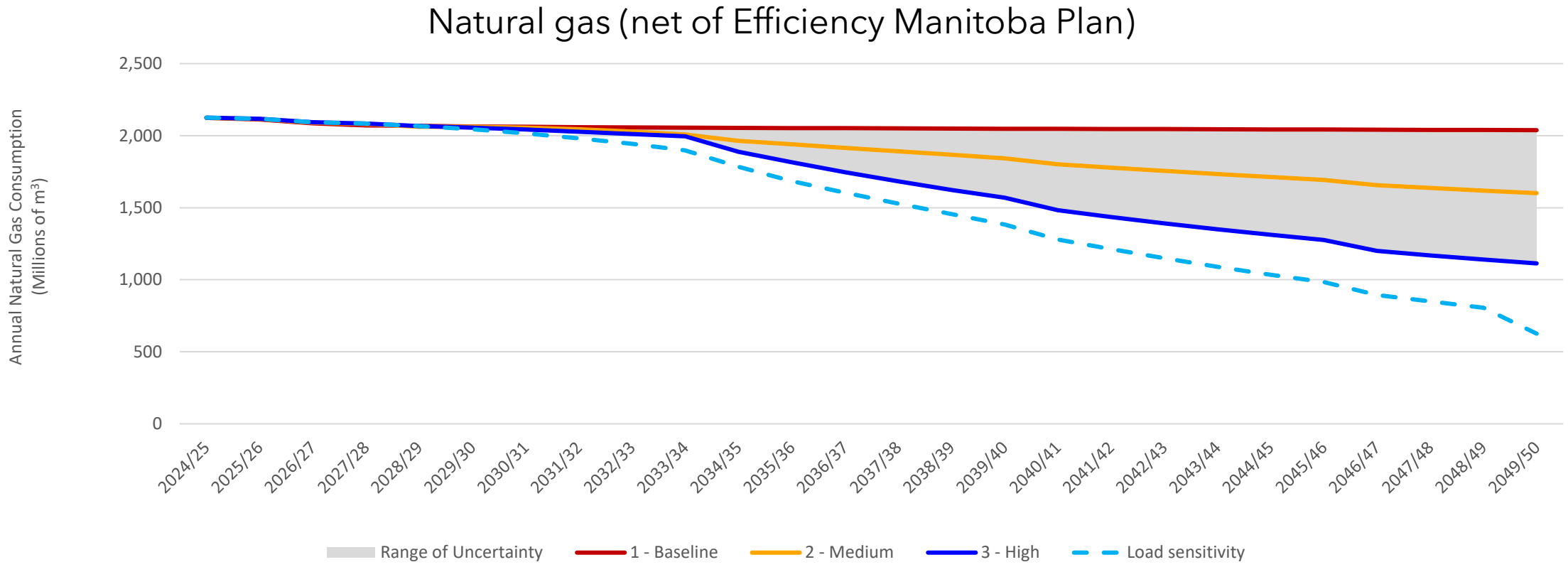
Load Sensitivity increases peak demand

The load sensitivity reflecting absolute zero assumptions for space heating and ground transportation significantly increases peak demand, requiring an additional 3,000 MW of capacity compared to Load Projection 3.



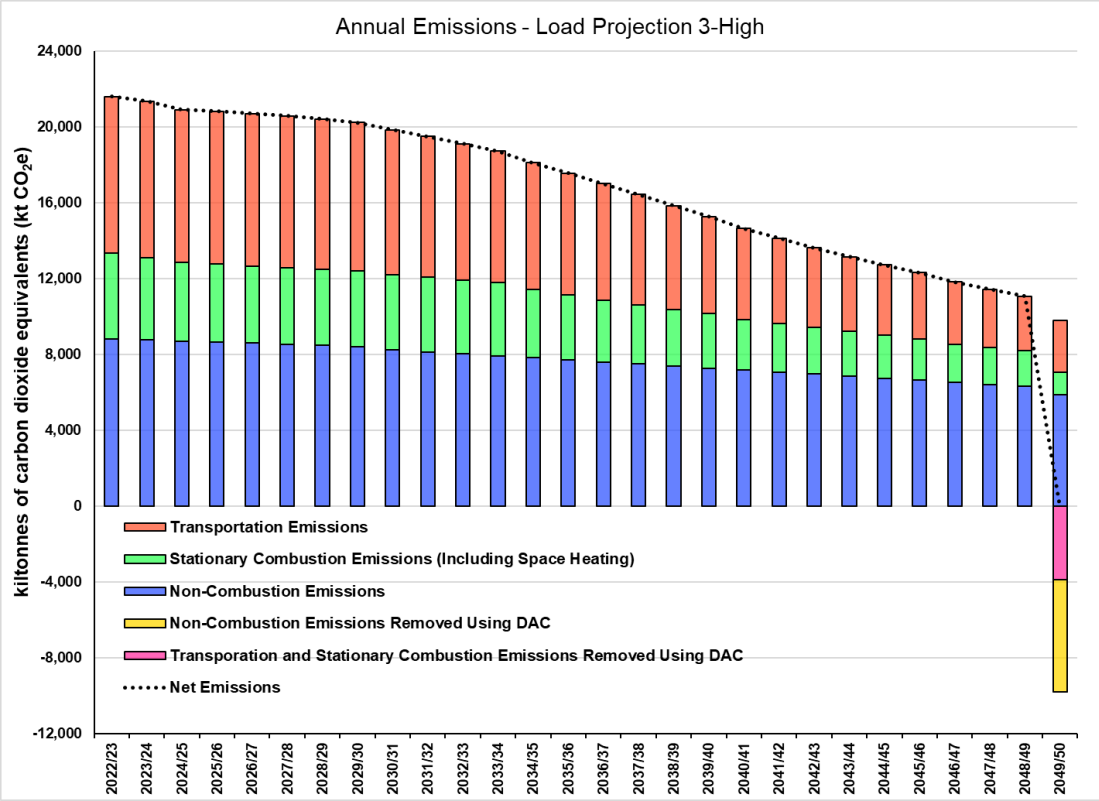
Load Sensitivity cuts natural gas consumption in half by 2049/50

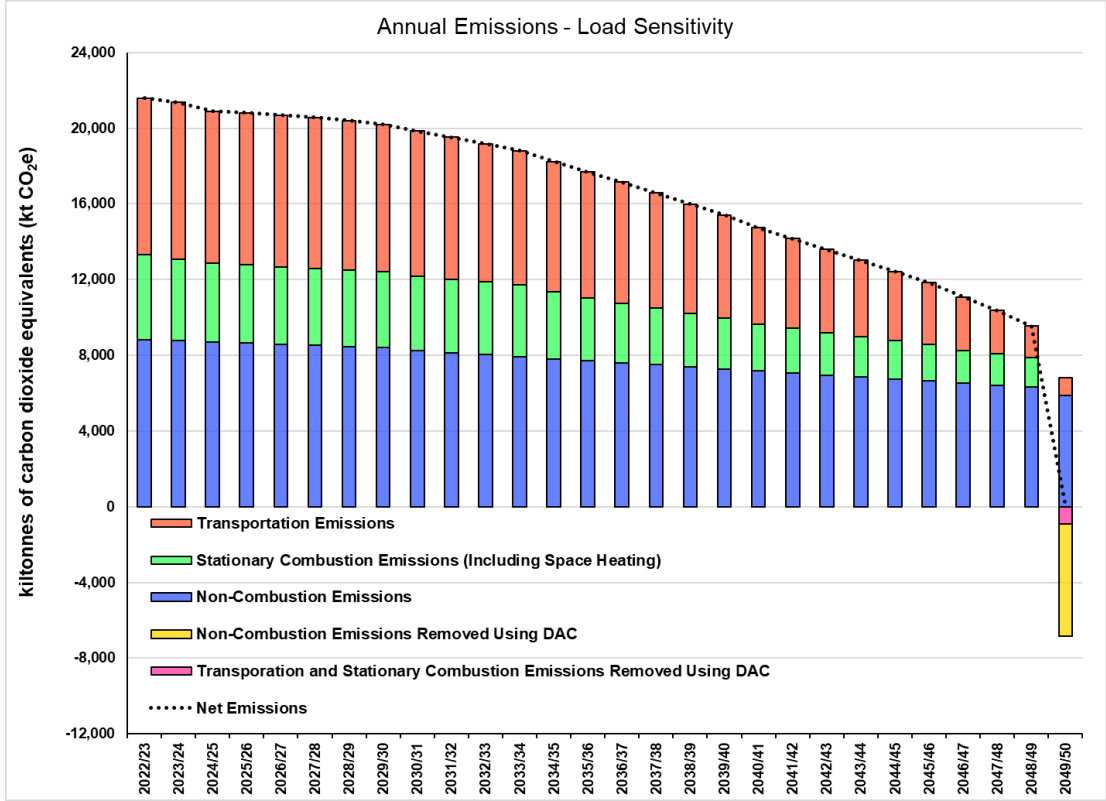
Recognizing the difficulty in replacing some industrial processes, leveraging renewable natural gas and industrial carbon capture and storage technology is assumed beyond 2050



GHG Emissions of Load Sensitivity compared to Load Projection 3

Non-combustion emissions (Agriculture, Waste & Industrial Processes) still require significant negative emission technologies to offset





Additional potential risks within the Load Sensitivity

Moving away from the guiding principles used to develop the load projections, by aiming for absolute zero emissions in ground transportation and space heating, creates significant execution risks that need to be addressed.

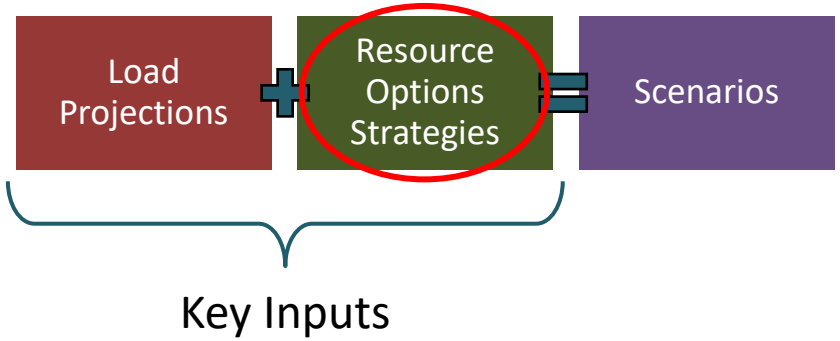
Some risks include:

- Willingness and affordability of Manitobans to pre-maturely switch out products before end of life.
- Creating accelerated market demand for specific products poses risk of price increases.
- Ability for supply chain to respond to increased market demand.
- Industries heavily involved in the transition (i.e. Heating, Ventilation and Air Condition) face significant reduction of market demand post 2050.
- Challenge and affordability for industrial & commercial customers to find clean alternatives for natural gas appliances currently being used.

CHECK-IN

Resource Options Strategies

Key Inputs



Resource options strategies

Overview

- Resource options strategies reflect the potential ways Manitoba Hydro may be required to meet electricity and natural gas demand.
- Policy is a key driver that influences what resources may be allowed to serve energy needs.
- The strategies are based on the full inventory of resource options available to meet future energy needs in Manitoba.
- The different strategies reflect a range of potential policies that could influence the resource options.

Resource options strategies

Four resource options strategies and their assumptions

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).

Resource options strategies

Examples common planning assumptions

Electricity and natural gas system characteristics

- System hydrologic inflows
- Current power generation supply mix
- Interconnections with neighbouring markets

Modelling and analysis parameters

- Transmission planning criteria
- Generation planning criteria for dependable energy and capacity
- Fuel availability and cost (e.g. natural gas, biomethane)
- Demand driven natural gas and electric delivery system costs
- Firm export contracts are not renewed
- Demand side resources (e.g. Efficiency Manitoba plan, demand response)

Resource options inventory

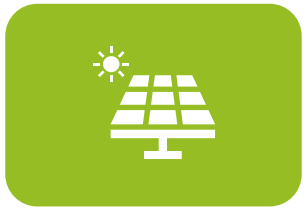
Resource options inventory

A common planning assumption


New Hydropower


Upgrade Existing Hydropower


Wind


Solar


Energy Efficiency

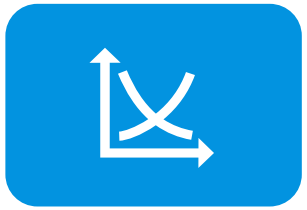
Batteries

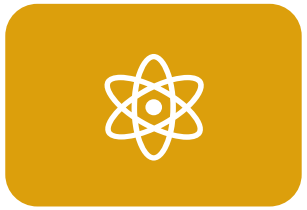

Natural Gas Fueled Combustion Turbine


Natural Gas Fueled Combustion Turbine With Carbon Capture


Biomass Fueled Steam Turbine

Hydrogen Fueled Combustion Turbine


Market Purchases (Imports)


Small Modular Nuclear Reactors

Dispatchable & Mature | Intermittent & Mature | Dispatchable & Emerging

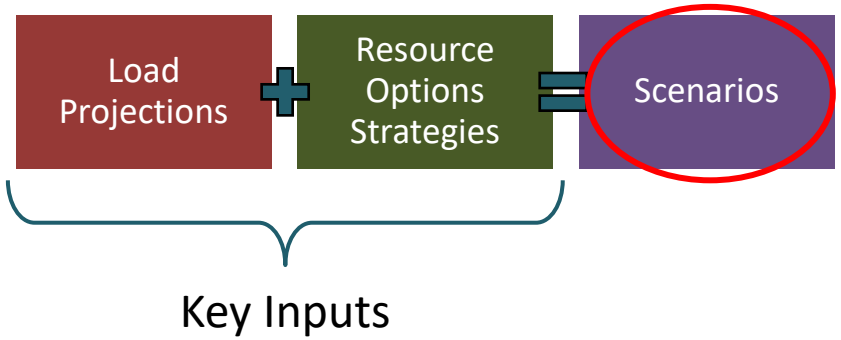
All **resources have different** characteristics such as **cost, emissions, dispatchability, maturity, and time to in service.**

This list shows all potential resource options available, however, some may not be available under specific Resource Options Strategies.

CHECK-IN

Scenarios

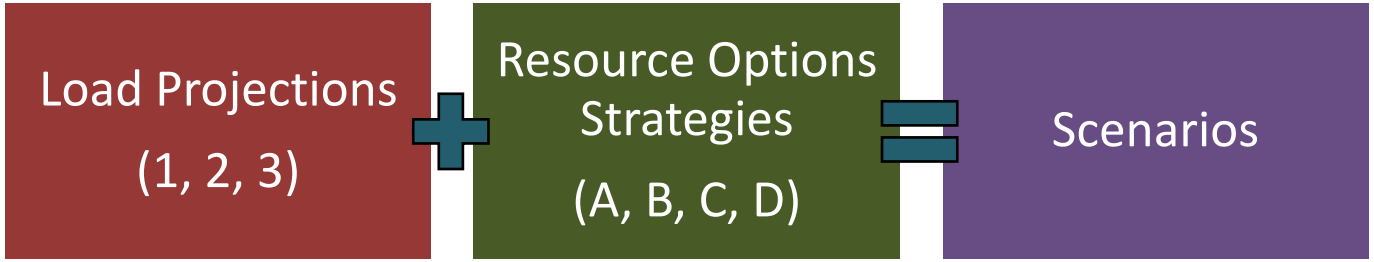
Including Sensitivities



Scenarios

Overview

- Scenarios are a likely combination of a Load Projection and Resource Options Strategy.
- Scenarios represent the energy futures.
- Aiming to have a group of scenarios that together, represent a reasonable range of what the energy future might look like in Manitoba.



Scenarios

Eight scenarios represent different energy futures

Resource Options Strategies	Load Projections		
	1 - Baseline	2 - Medium	3 - High
A - Technology Neutral	S1A	-	-
B - Net-Zero Grid 2035	S1B	S2B	S3B
C - Near Term Wind Generation Projects	S1C	S2C	S3C
D - No Fossil Fuel-Based Resources	-	-	S3D

S = Scenario
Scenarios range from **1A to 3D**, where the number represents a **Load Projection** and the letter represents the **Resource Options Strategy**.

Only likely combinations of load projections and resource options strategies will be studied.

- Those not to be studied are noted by (-).

Modelling and analysis approach

Potential development plans

- In the modelling and analysis, scenarios produce potential development plans.
- A development plan outlines the required steps to meet future energy needs.
  - It may include building new energy sources, infrastructure or programs to manage energy use during peak demand.
- Sensitivity analysis will test the robustness of the potential development plans against different risks.

Sensitivity analysis

Test key planning assumptions that have a high potential to impact results

Sensitivities:

- Higher or lower market prices
- Increased capital costs for new resources
- Delays in new resource construction
- Lower or higher water inflow conditions (climate change)
- New hydrogeneration and capacity enhancements at existing hydro stations

Not all sensitivities will be run on every scenario.

Sensitivity analysis, or what-if analysis, helps us to understand how individual inputs or constraints change a development plan.

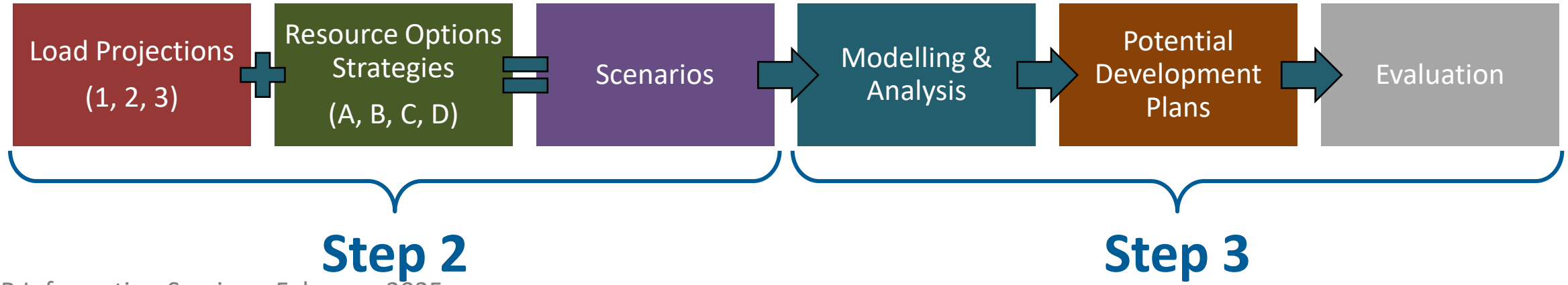
This means we can test the robustness of the outcomes against different risks and understand if that will change the outcomes.

Next steps towards evaluation

In Step 3 – Modelling, analysis and evaluations:

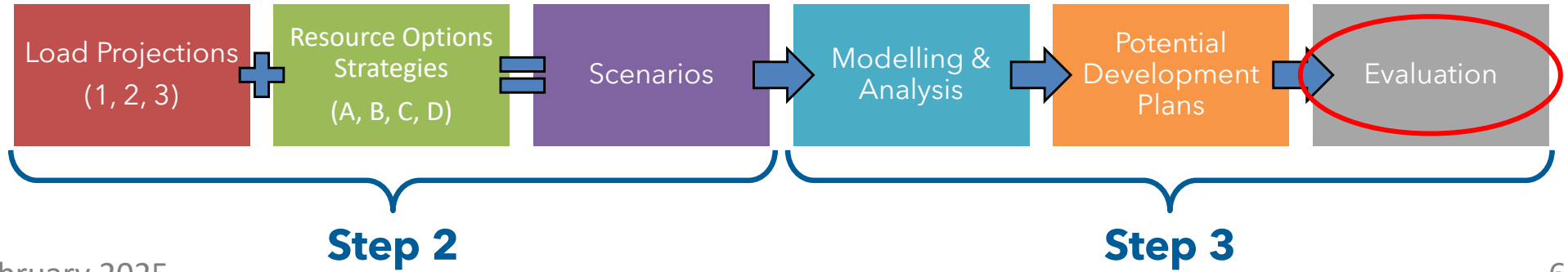
- Approximately 50+ scenarios and sensitivities will be analyzed.
- Result will be a series of potential development plans for evaluation.
- Evaluation includes applying evaluation metrics to these potential development plans.

In Step 2 – develop key inputs and scenarios, we establish the evaluation metrics to prepare for Step 3.



CHECK-IN

Evaluation Metrics



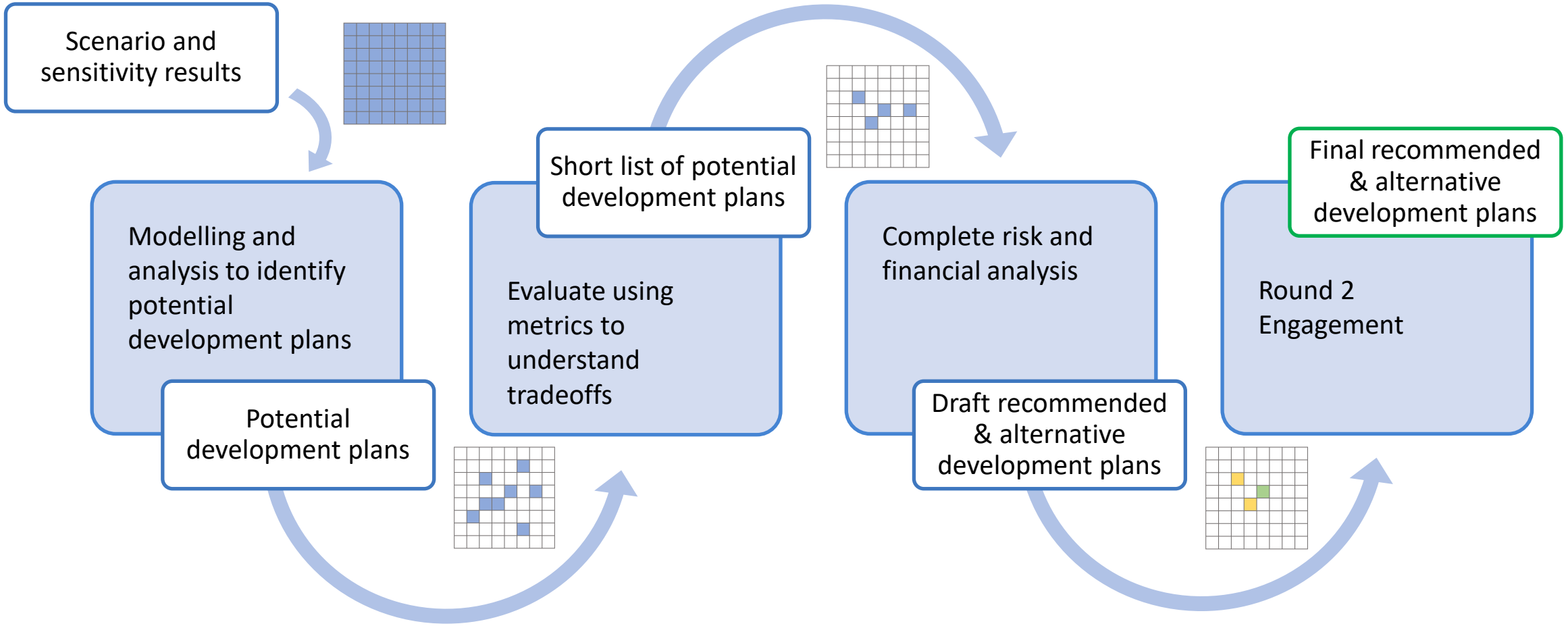
Evaluation metrics

What are evaluation metrics and how will they be used?

- **Modelling & Analysis** identifies cost-effective potential development plans that meet reliability planning criteria, mandates and regulations.
- **Evaluation** narrows the list of potential development plans towards a recommended development plan using evaluation metrics.
- **Evaluation Metrics:**
  - reflect what Manitobans have shared are important factors for them.
  - are used to compare and assess trade-offs between potential development plans.
  - can be numbers-based (quantitative) or descriptions (qualitative).
  - need to be established early in the process ahead of evaluation taking place.

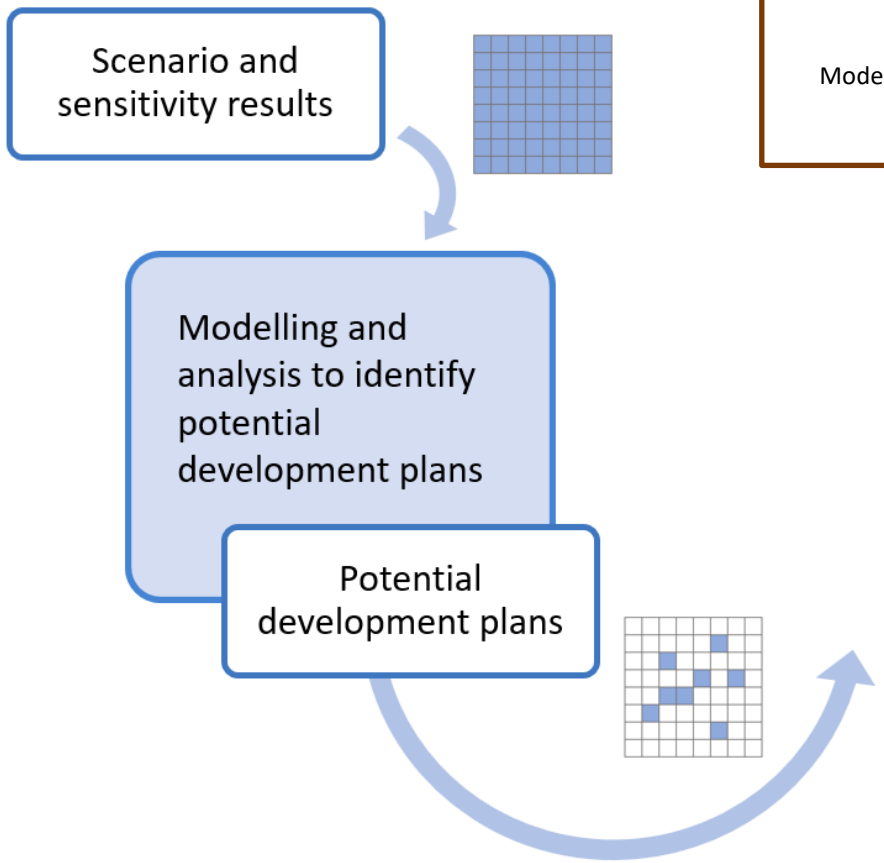
Evaluation methodology

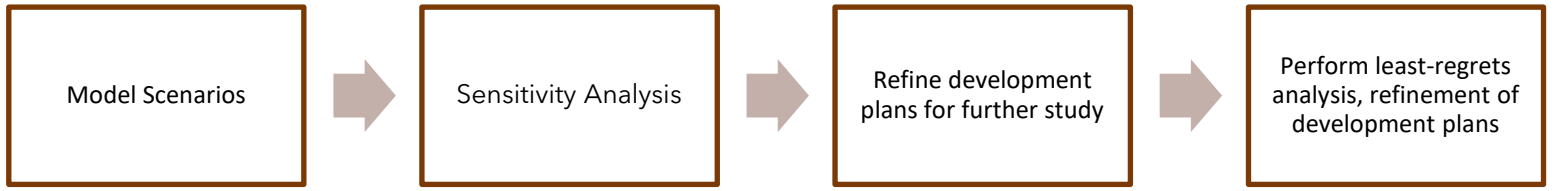
This is how we move towards a recommended development plan



Evaluation methodology

Moving from scenario and sensitivity results to potential development plans

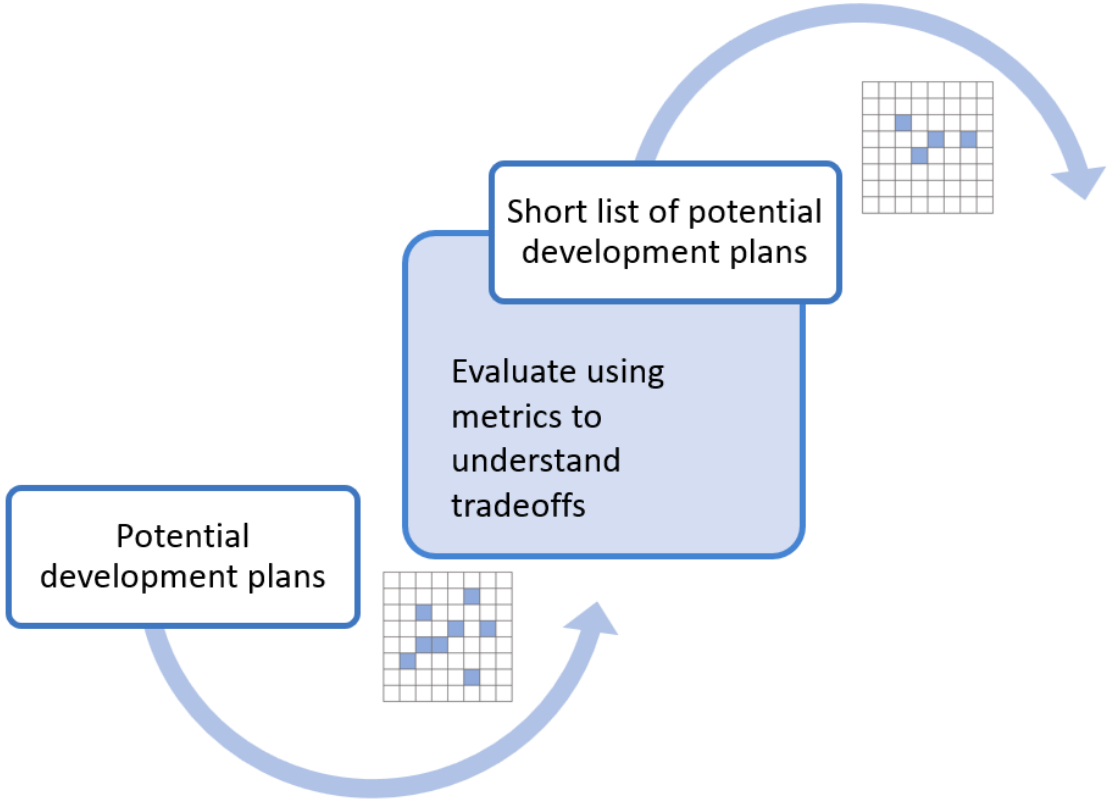




- ~50+ scenario and sensitivity results
- Must meet minimum thresholds
- May adjust potential development plan based on results to reduce its sensitivity
- Least regrets analysis tests potential risks in a development plan once there is a commitment to the first resource(s)
- Reduce potential development plans to those that are meaningfully different (~12)

Evaluation methodology

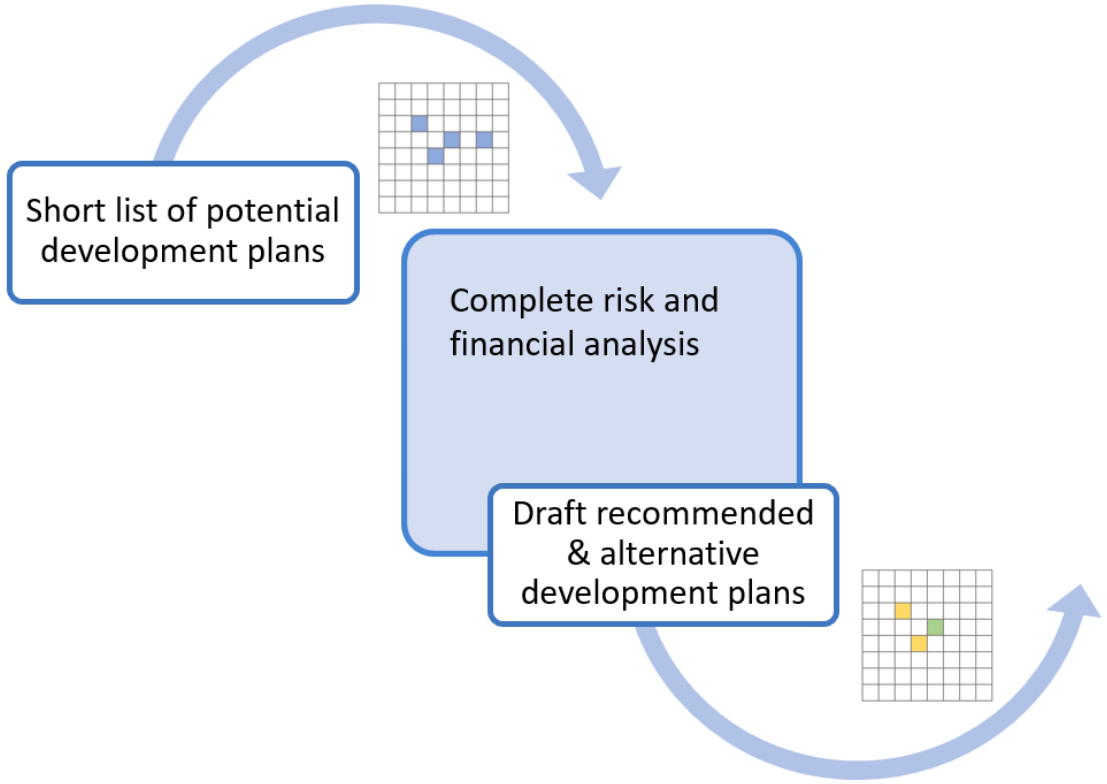
Moving from potential development plans to a short list of potential development plans



- Apply evaluation metrics to create a short list of potential development plans for further evaluation (~4)
- It is a broad assessment of strengths and weaknesses of a potential development plan
- Feedback heard through engagement will help define the relative importance of each evaluation theme in this step

Evaluation methodology

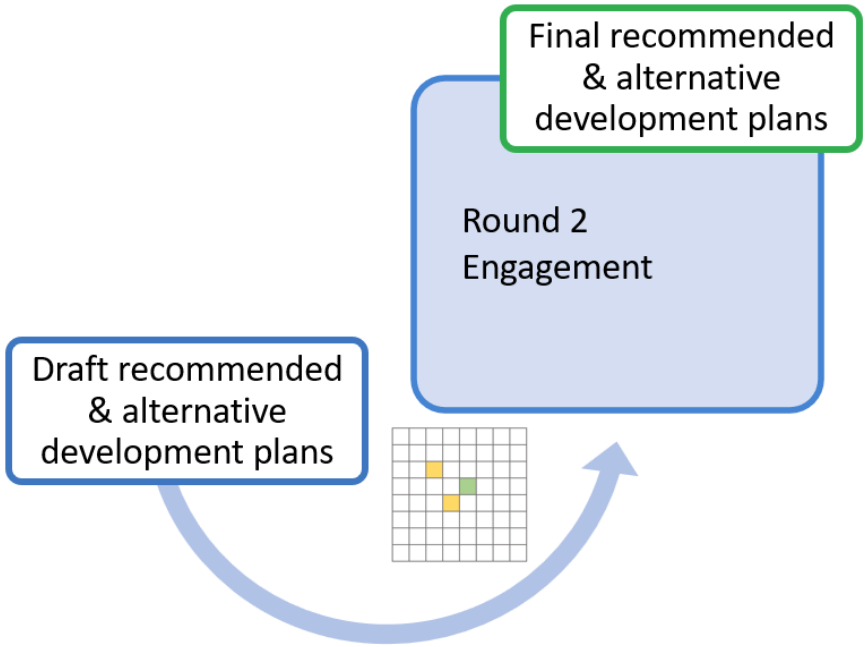
Moving from a short list of potential development plans to draft recommended & alternative development plans



- Complete risk analysis within the Enterprise Risk Framework
- Complete financial analysis which will also support developing an estimate of potential rate impact
- Identify which of the short list of potential development plans have the most potential
- Draft a recommended development plan

Evaluation methodology

Moving from draft to final recommended & alternative development plans



- Round 2 Engagement will seek feedback on the draft recommended development plan
- Feedback heard will inform the final recommended development plan

Evaluation metrics

Four themes confirmed through engagement; 9 metrics confirmed with refinement required; actively seeking feedback on Economic Reconciliation

Reliability

Adequate Supply

Resource Diversity

Technology Maturity

Costs

Net System Costs

Customer Direct Costs

Environmental

GHG Emissions

Environmental Considerations

Social Economic

Economic Reconciliation

Socio-Economic Benefits

CHECK-IN

4. Next Steps

Next Steps: shaping our energy future together

What's next?

We have started our modelling, analysis, and will start evaluation soon.

Round 2 Engagement is planned to start in Spring 2025, where we'll seek feedback on the preliminary recommended development plan.

Questions or comments? Email us at: IRP@hydro.mb.ca

Thank you!

Hydro.mb.ca/future

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