IRP Preliminary Outcomes

2023 Integrated Resource Plan (IRP)

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, Cree, Anishininew, Dakota, and Dene peoples and the homeland of the Red River Métis.

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.

Manitoba Hydro
energy for life

Welcome!

- Introductions
- Purpose of today's session
  - Share summary of modelling and analysis results
  - Share IRP Roadmap
  - Group Discussion
- Housekeeping

Manitoba Hydro
energy for life

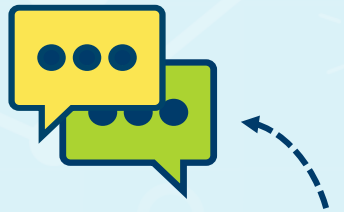
Agenda

- Background
- Modelling and Analysis Results
- Roadmap
- Discussion
- Next Steps

Manitoba Hydro
energy for life

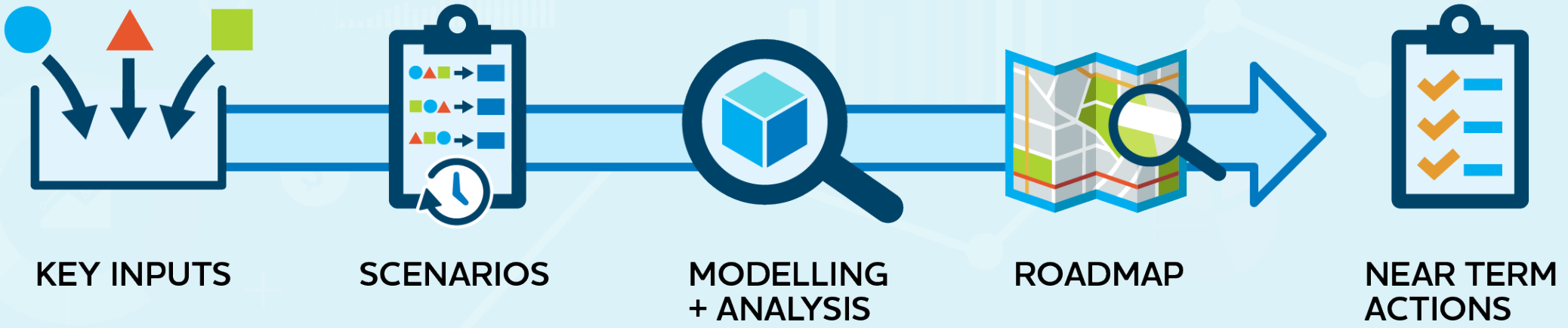
Thank you!

- We appreciate your time and contribution throughout our four rounds of engagement to develop the IRP.
- Engagement was critical to ensuring the IRP:
  - Reflected customer needs and decisions today and into the future
  - Considered unique perspectives and provided opportunities to build shared understanding



Your input informed plan development and analysis for Manitoba Hydro's first IRP.

Steps in the IRP development process



Our IRP conversations

Round 3 Engagement

We asked: What additional IRP analysis would you like to see?

INITIAL MODELLING RESULTS

WHAT WE HEARD

- Customer self-generation, solar
- Ground source heat pump, including use in district heating
- How large customers can help manage peaks
- Hydrogen production increases for transportation decarbonization
- Rate impacts and customer costs

WHAT WE DID

- Additional sensitivity modelling & analysis completed: customer solar generation, ground source heat pumps, demand response
- Some suggested sensitivities deferred to possible future IRP analysis

MODELLING & ANALYSIS RESULTS

TO SUPPORT ROADMAP DISCUSSION

Initial Modelling & Analysis Results Summary
as presented in Round 3 Engagement Conversations

Electrification as a means of decarbonization results in our customers needing significantly more electricity.

All scenarios result in increased winter peak demand, new generation capacity resources, and impacts on transmission and distribution requirements.

There are many options to reliably meet long term needs and future choices will have significant impact on cost.

Strategic use of natural gas can reduce overall greenhouse gas emissions and mitigate cost impacts.

Modelling & Analysis Updates Since Round 3

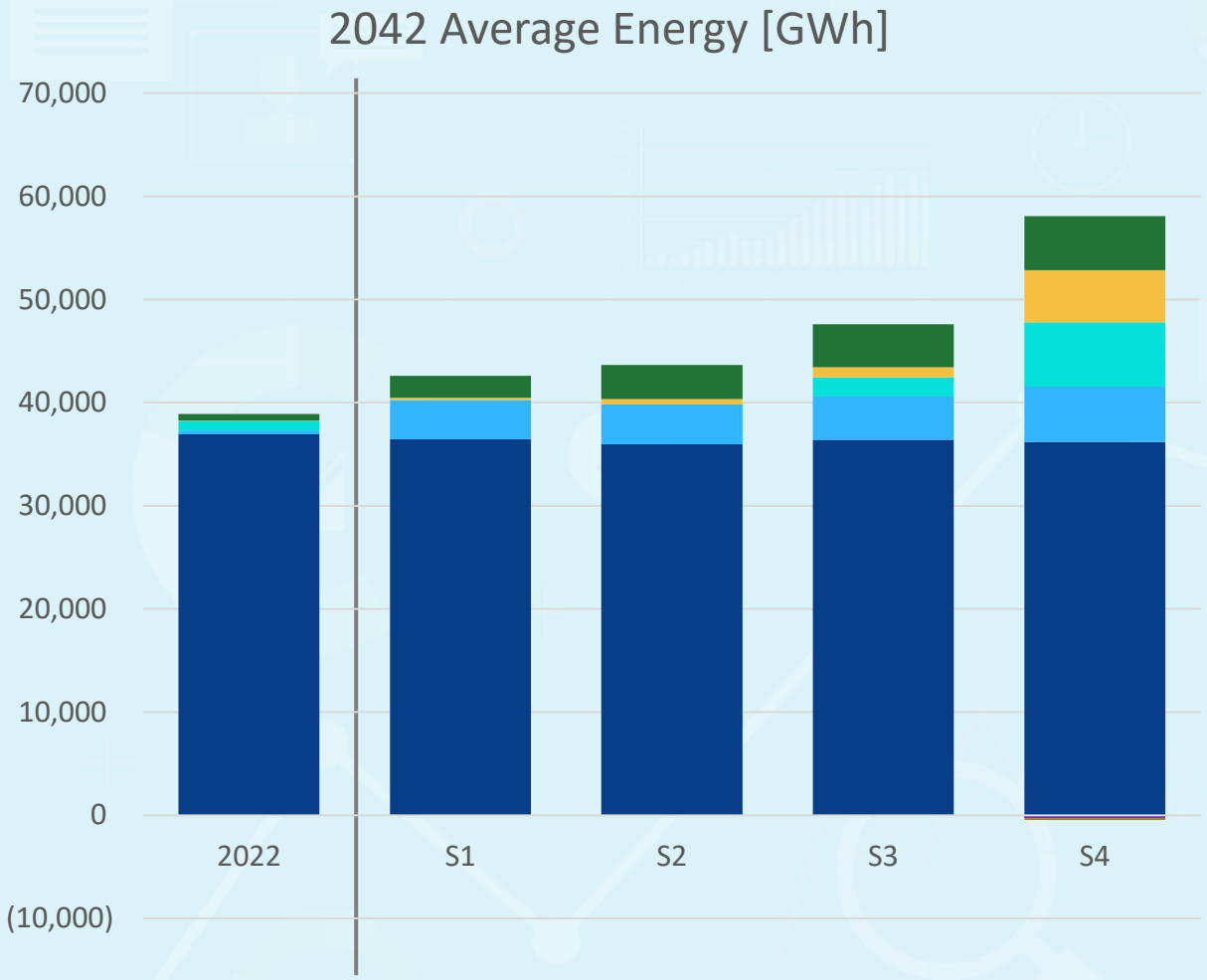
- Adjustments to assumptions and updates to modelling and analysis for IRP scenarios and several sensitivities
- New sensitivity analyses completed
- Modelling and analysis outcomes inform development of roadmap and near-term actions

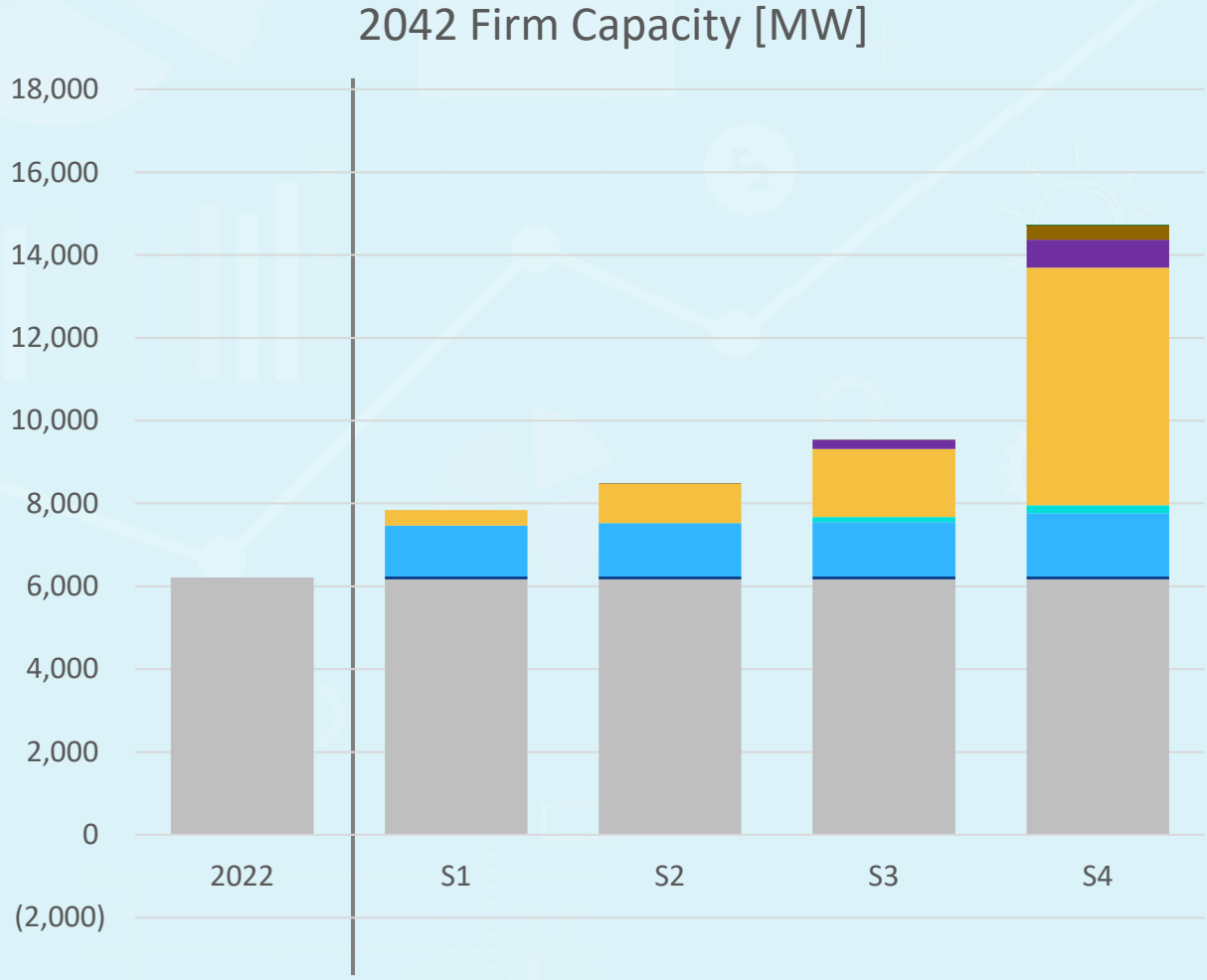
WHAT IS A SENSITIVITY ANALYSIS?

- Changing an assumption in a Scenario to see the impact on model outputs
- Can be used to explore “what-if” situations

Scenario Outputs
Energy and Capacity Supply Mix

Minor changes in proportion of each resource type





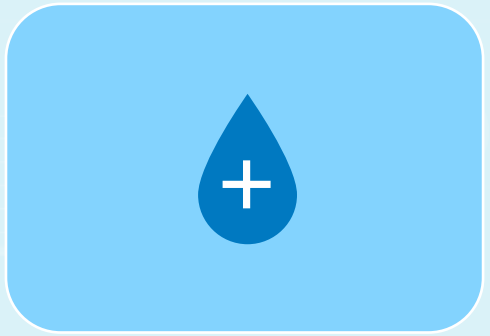
Existing Capacity | Hydro | DSM | Wind | Solar | Thermal | Hydrogen | Battery | Imports

DSM stands for Demand Side Management, which is referred to elsewhere as Energy Efficiency

Resource Observations
Energy and Capacity Supply Mix

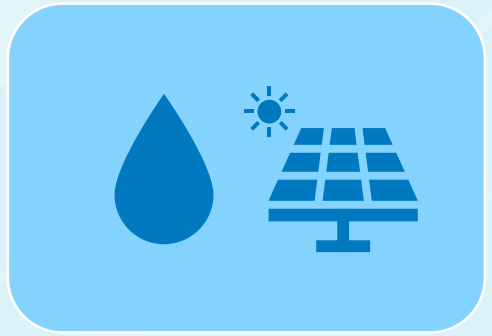
Energy efficiency observation updated

Maintain existing hydropower



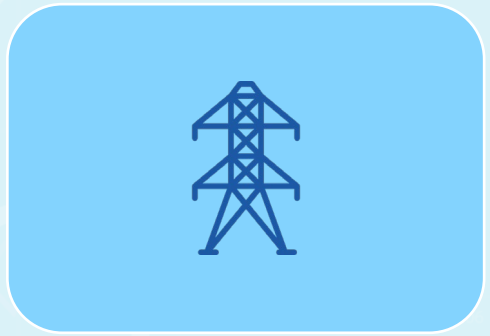
Upgrade existing hydropower

Wind is a low-cost energy resource



New hydropower and solar are not selected

Natural Gas Turbines are a low-cost capacity resource



Imports are an important source of energy

Some energy efficiency measures are cost-effective and require further study

Observations
Cost and GHG Emissions

Additional observation added for renewable fuels

Financial investment is needed in all scenarios

Different levels of electrification result in different net system costs

Need for capacity resources are driving cost

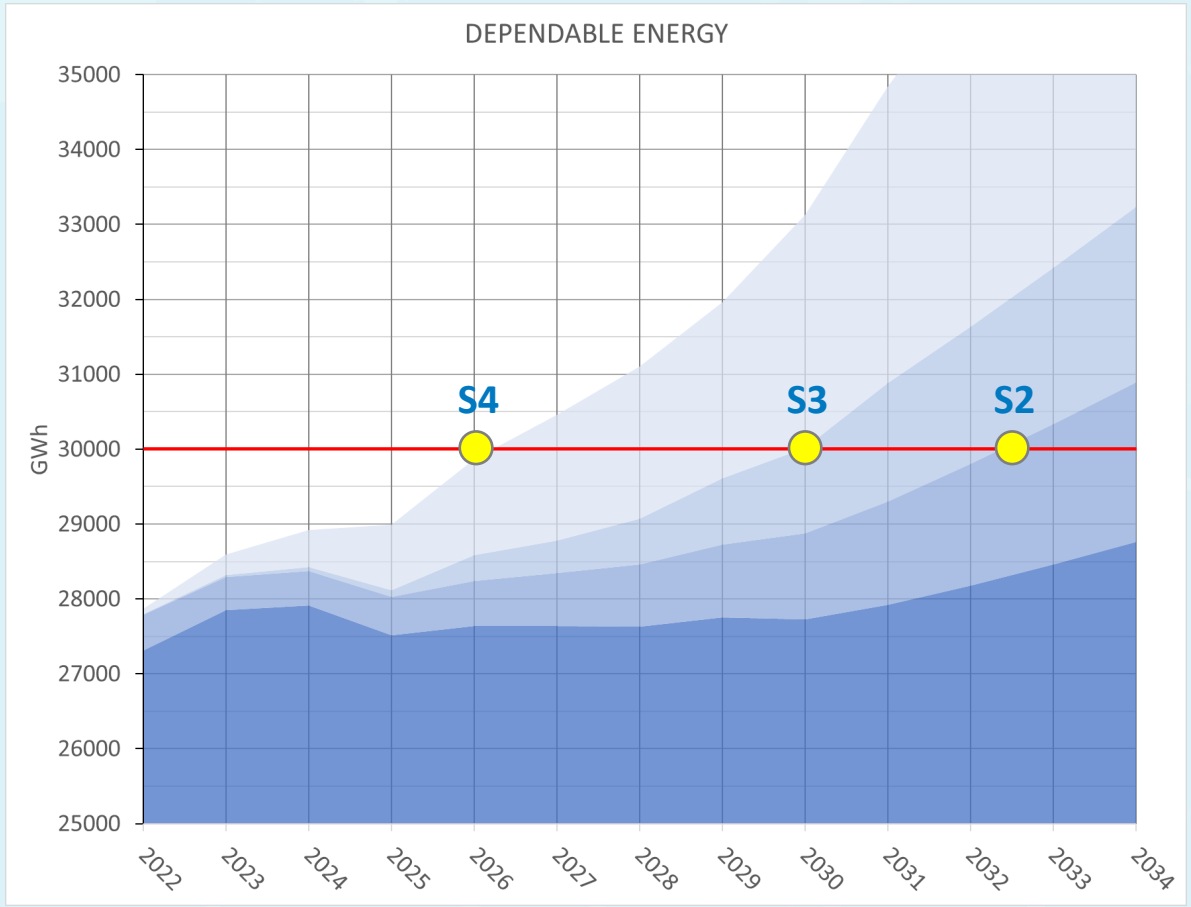
Energy related emissions drop in all scenarios

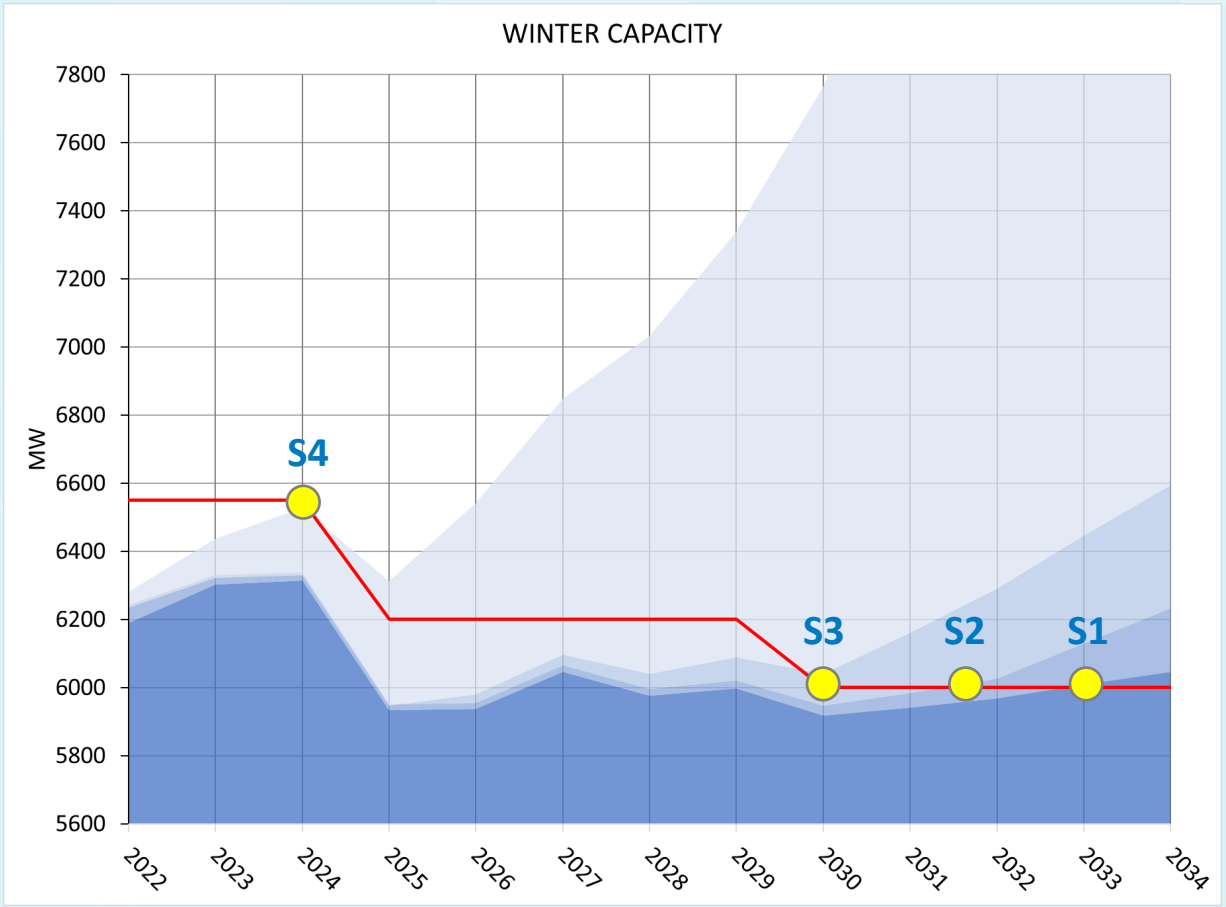
Increases in emissions from electric generation enable overall emission decreases

Use of renewable fuels to decarbonize by leveraging existing gas infrastructure needs further investigation

Observations
Pace of Change – Early Years

Existing supply has a limited ability to meet future needs





Scenario Specific Demand

S1	S2	S3	S4

Existing Supply

Point in time when demand exceeds supply

Observations
Pace of Change

Observations updated since initial modelling results

Investment is needed in all scenarios to support growth, and to maintain and modernize existing assets.

Existing system meets early demand in scenario 1, 2, and 3

Meeting early demand in scenario 4 will be challenging

Final Modelling Results
Select Sensitivities

Gas Generation Grouping
Restricted gas generation usage
Carbon capture required for gas generation
No new natural gas generation*

Customer Grouping
Demand Response*
Energy Efficiency*
Dual fuel for heating*
Ground source heat pump*
Solar*

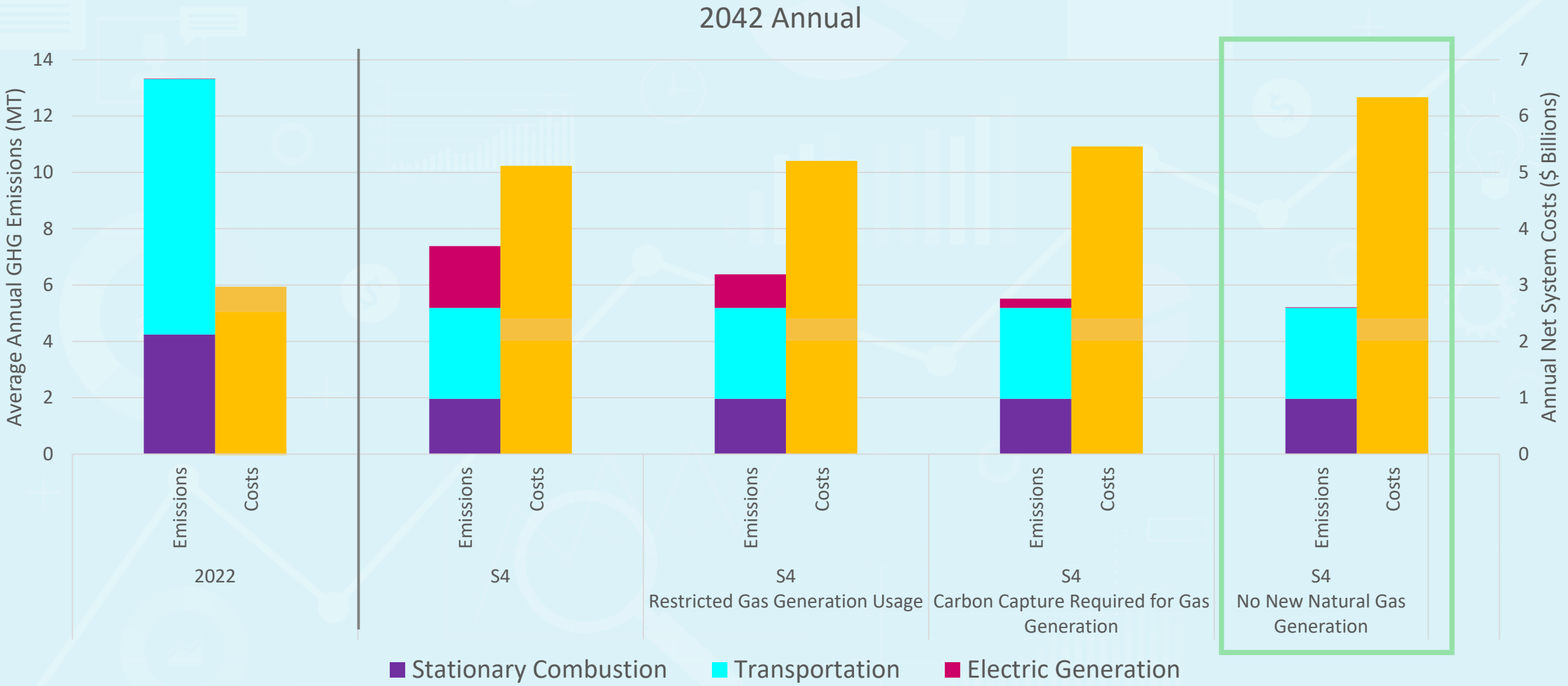
Other Grouping
Energy Price & Market Interactions*
Climate Change*
New hydropower*

Over 70 different model runs were completed.
Highlighted sensitivities will be discussed here.

*New sensitivities completed since initial modelling results shared in Round 3 Engagement

Gas Generation Sensitivities
Cost and Emissions

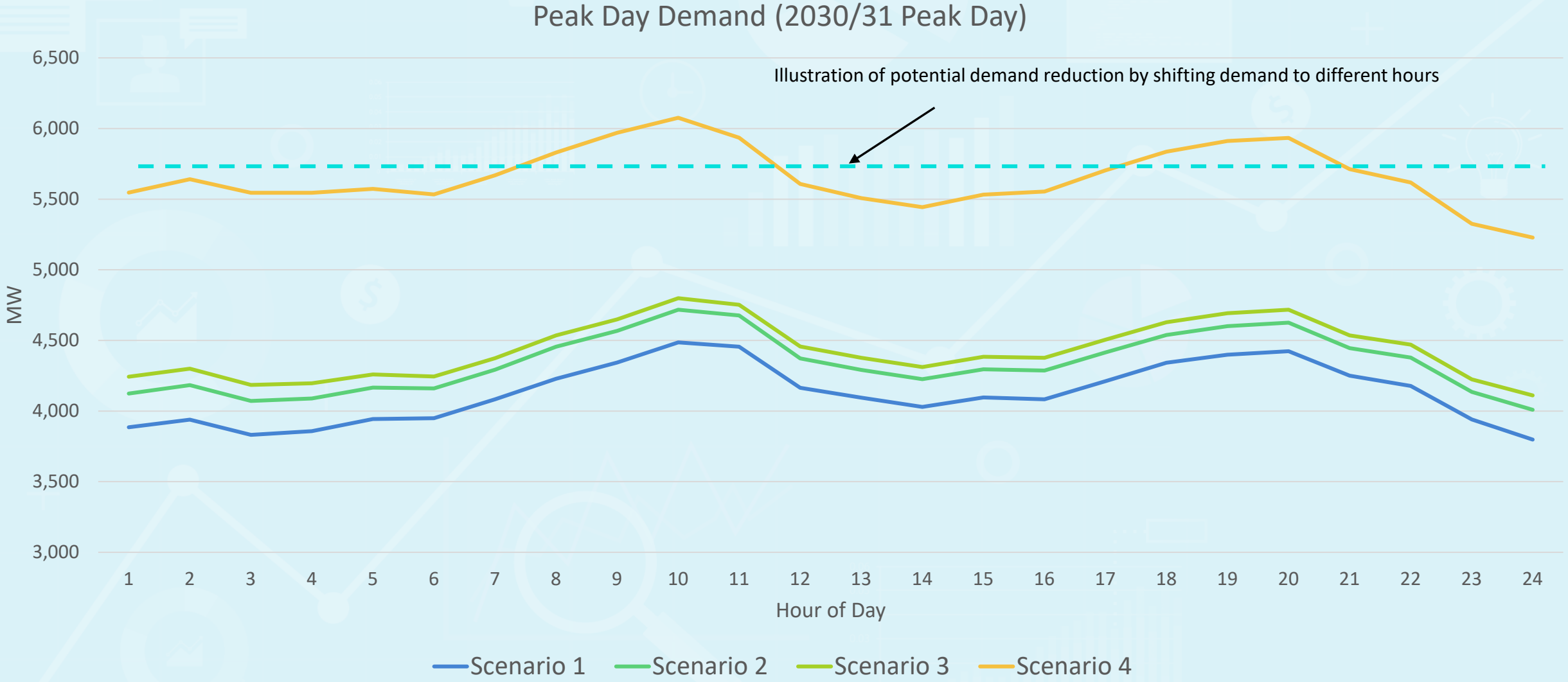
No new gas generation can reduce emissions at increased cost



* Manitoba GHG emissions shown do not include non-energy dependent sources, like agricultural based emissions

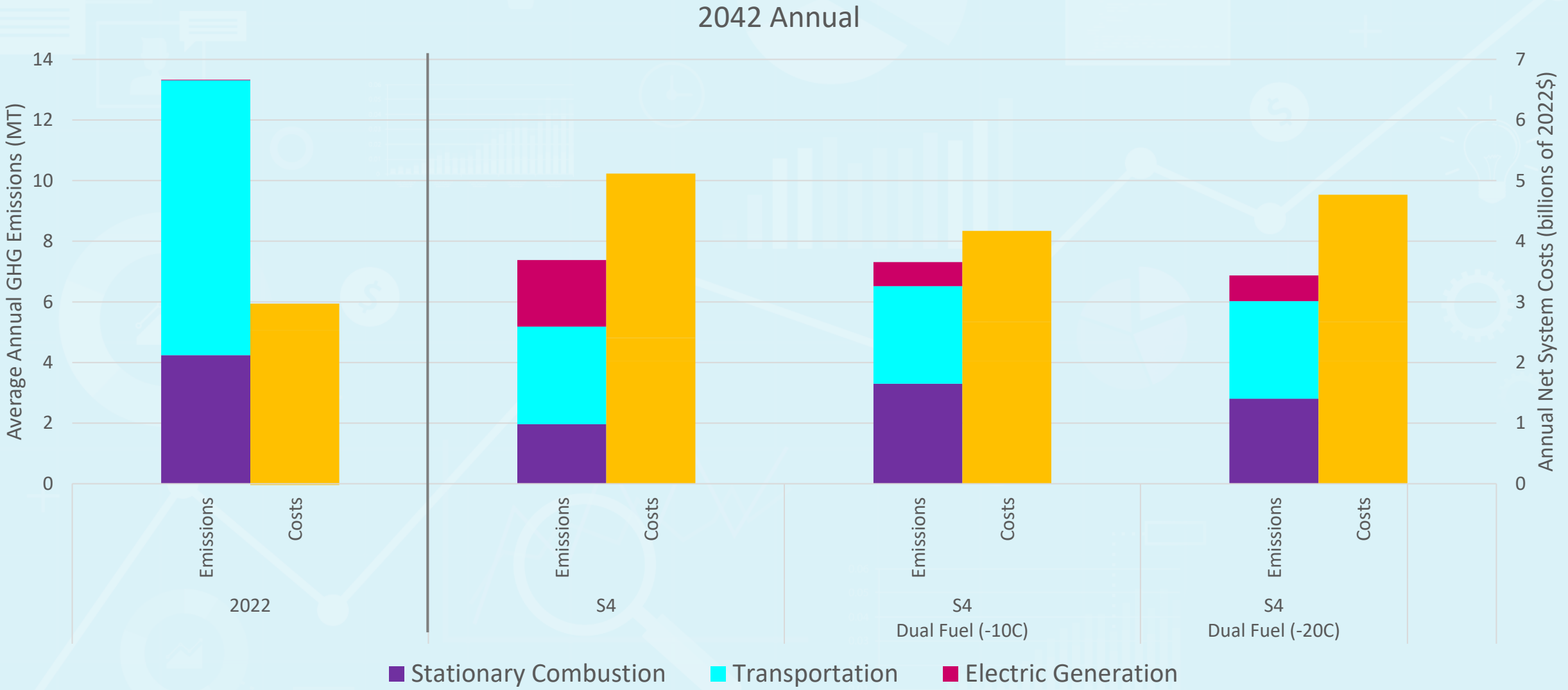
Customer Sensitivities
Demand Response

Demand response cost effective alternative for capacity



Dual Fuel for Heating
Cost and Emissions

Dual fuel has potential to reduce overall emissions at lower cost than electric resistance heating



* Manitoba GHG emissions shown do not include non-energy dependent sources, like agricultural based emissions

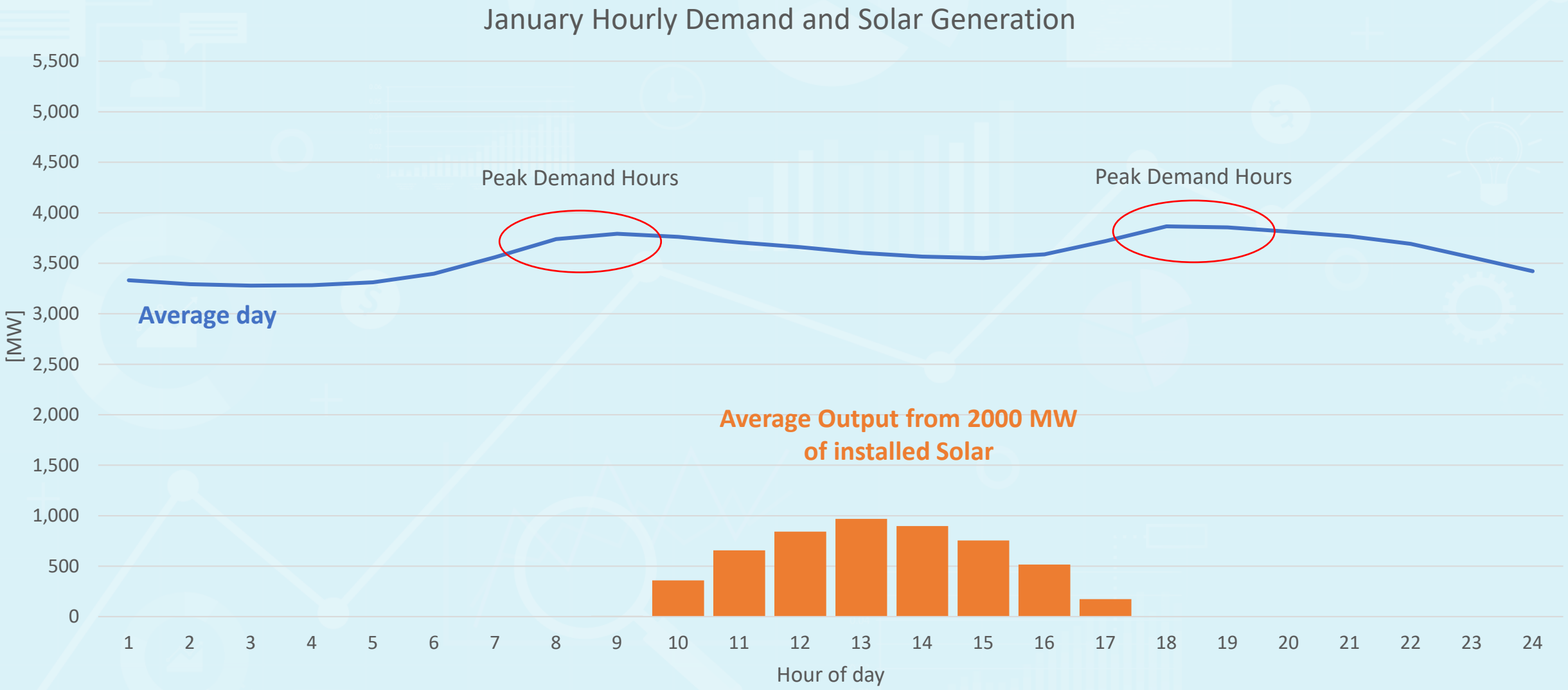
Customer Sensitivities
Ground Source Heat Pump

GSHP not cost effective on average; needs further study

Ground Source Heat Pumps (GSHP) have a wide range of performance, up front and maintenance costs.
Making general conclusions about their economics is difficult.

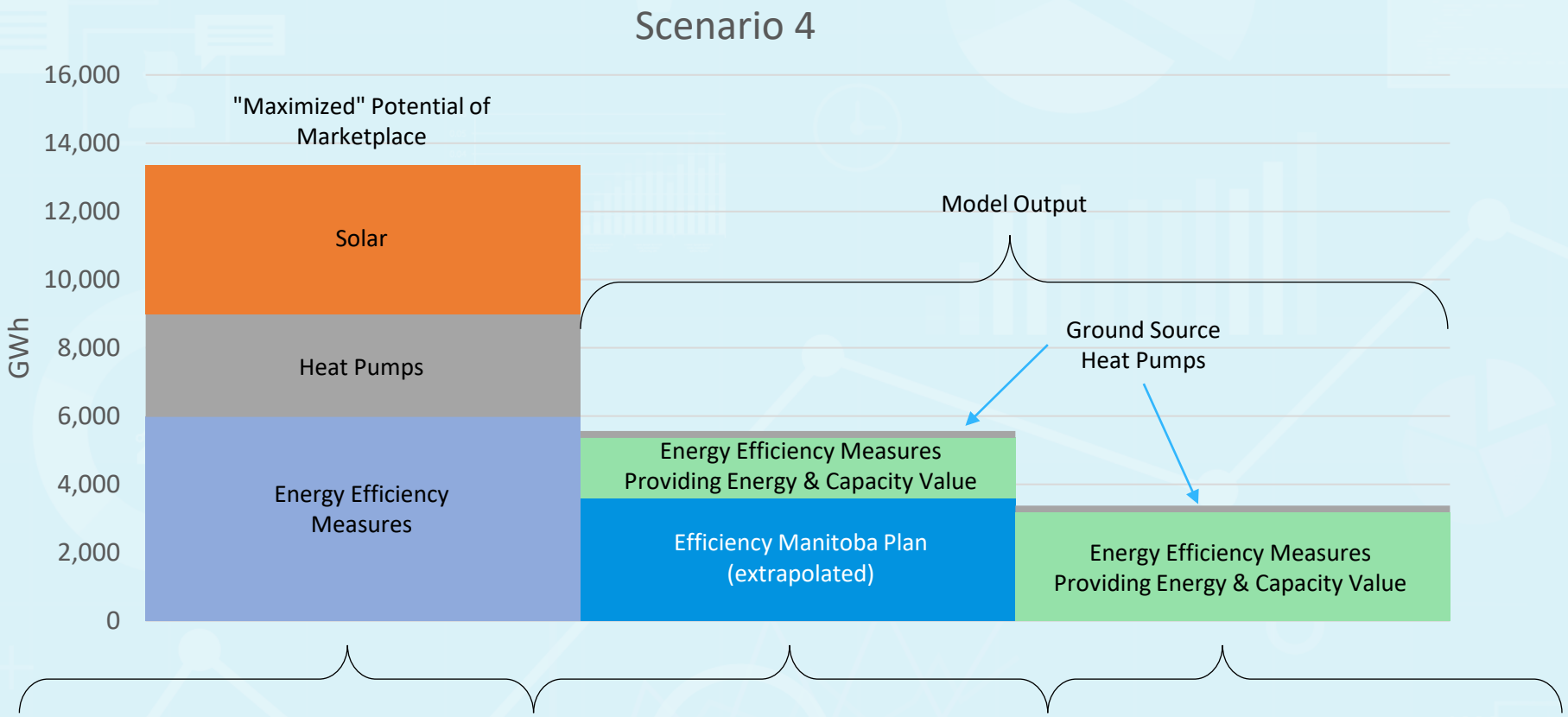
Customer Sensitivities
Solar Power

Solar profile not aligned with need; more expensive than alternatives



Customer Sensitivities
Energy Efficiency

Energy efficiency requires further analysis



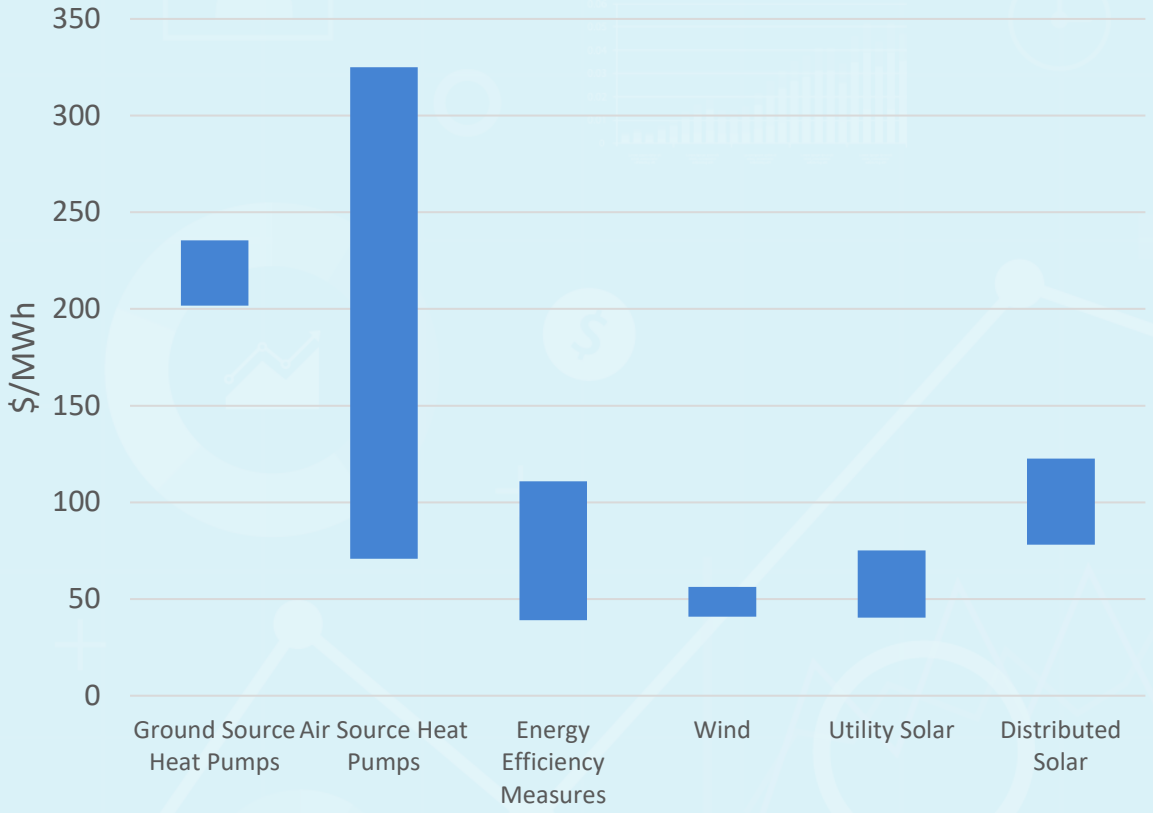
Notes:

- *Charts exclude energy savings associated with codes and standards*
- *Heat pumps were only found to be cost effective in scenario 4, before other more cost-effective resources could be implemented*

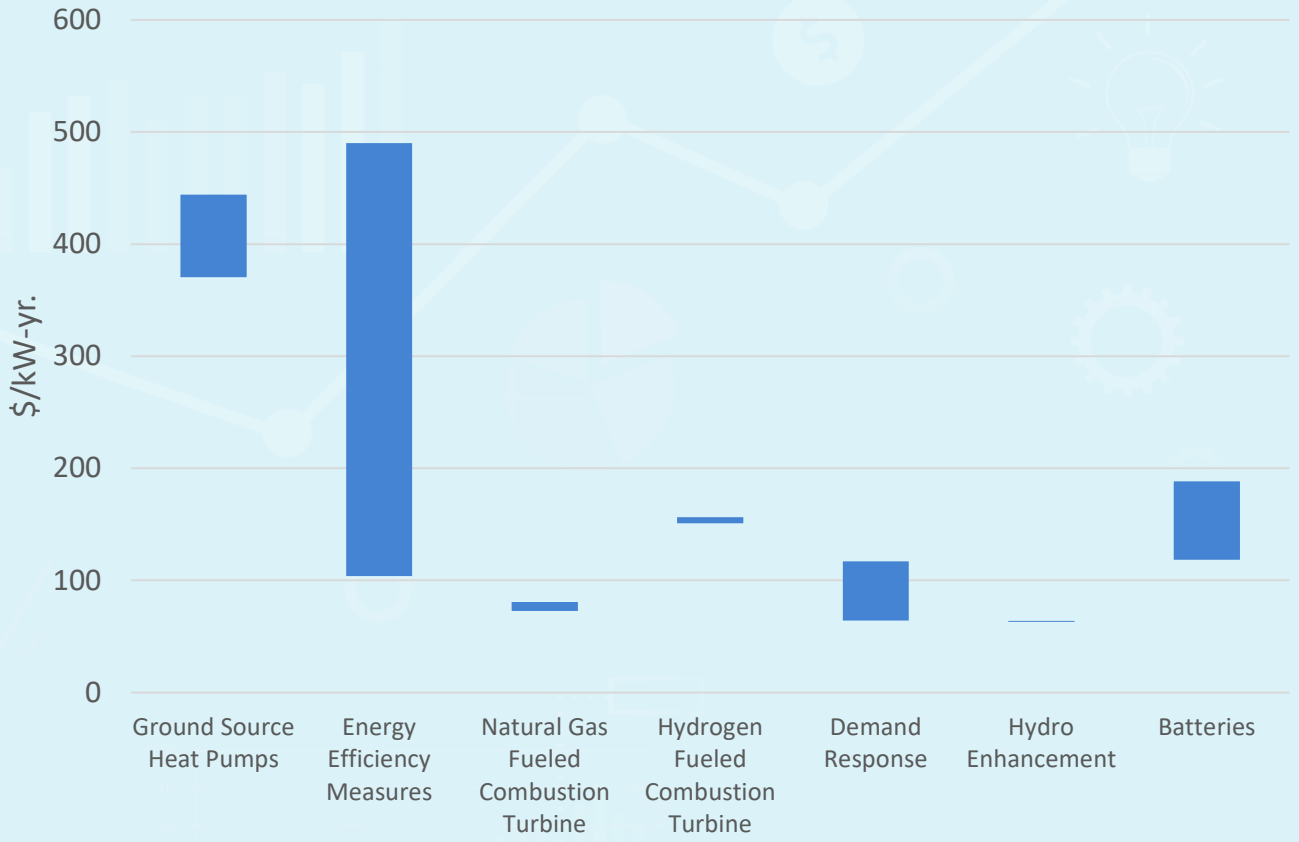
Resource Option Costs

There is a range of cost for each technology

Levelized Cost of Energy
Select technologies (Total Resource Cost)



Levelized Cost of Winter Firm Capacity
Select technologies* (Total Resource Cost)



* Solar and Air Source Heat Pumps are not included in the capacity chart because they do not provide winter firm capacity

Observations Summary
Sensitivities

No New Natural Gas Generation

- significantly increases cost and reliance on technologies that are less mature

Dual Fuel

- programs have the potential to reduce GHG emissions at a lower overall cost

Demand Response

- cost-effective for delaying or reducing the need for new capacity resources

Ground Source Heat Pumps

- performance varies widely, not found to be cost-effective on average

Energy Efficiency

- cost-effectiveness dependent upon program and requires closer analysis

Solar

- not as cost-effective as other resources available in Manitoba

IRP ROADMAP

AN INTRODUCTION

Roadmap

A collection of learnings, signposts and near-term actions that together allow us to manage the energy transition.

LEARNINGS
Knowledge gained from the process.

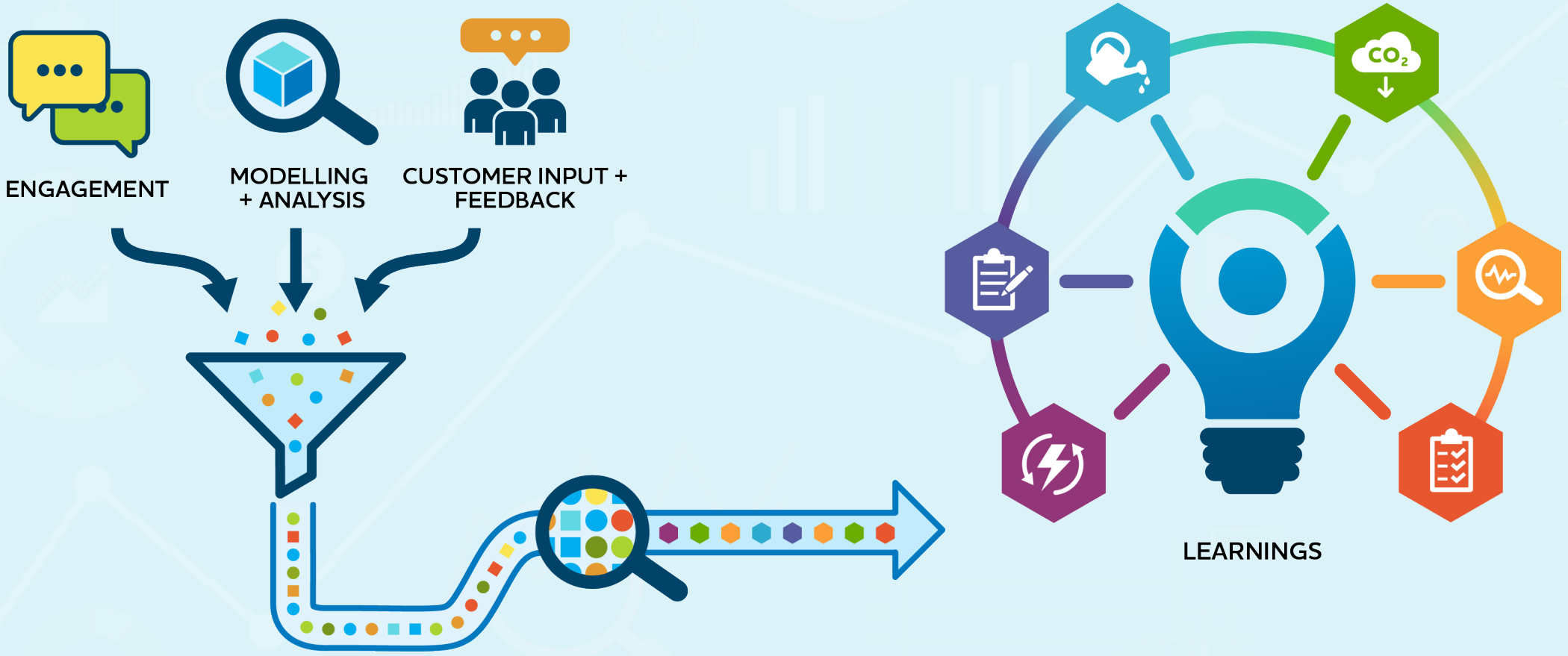
NEAR-TERM ACTIONS
Actions over the next 2–5 years.

SIGNPOSTS
Policy, market, technology or customer trends and events.

IRP ROADMAP

LEARNINGS

What are learnings?



2023 IRP Learnings

1. The energy transition is underway in Manitoba.
2. Managing the energy transition will be critical to continue ensuring safe, reliable, and low-cost energy.
3. Investment is required in all scenarios.
4. Strategic use of natural gas assets and gaseous fuels are an integral part of the energy transition in Manitoba.
5. Analysis findings common to all scenarios can inform responses to an accelerated energy transition.
6. Future energy-related decisions will require complex considerations.

Learnings

1. The energy transition is underway in Manitoba.

A. Some large energy users are beginning to transition to achieve environmental, social, and governance goals.

B. Changes are expected on how energy is produced, delivered, and used. The pace of change is uncertain.

C. Meeting the pace of accelerated decarbonization would be a challenge in early years.

Learnings

2. Managing the energy transition will be critical to continue ensuring safe, reliable, and low-cost energy.

A. Energy policy will be a major influence on the pace of decarbonization and is a needed tool to manage the energy transition.

B. Energy planning needs to consider a broad range of scenarios, including pathways toward net-zero GHG emissions.

C. There's an opportunity for the energy planning community (including Manitoba Hydro, governments, regulators, and interested parties including customers and Indigenous peoples and communities) to work together in the best interests of Manitobans.

Learnings

3. Investment is required in all scenarios.

A. All scenarios result in increased winter peak demand (up to 2.5 times current demand) requiring new generation, transmission, and distribution infrastructure.

B. There are many potential ways to reliably meet long term needs. Some ways are better understood than others and are at different stages of maturity.

Learnings

4. Strategic use of natural gas assets and gaseous fuels are an integral part of the energy transition in Manitoba.

A. Electrification of energy use as a means of decarbonization results in customers needing significantly more electricity.

B. Integrated use of electricity and natural gas systems enables strategies that can reduce Manitoba's greenhouse emissions while mitigating cost impacts.

C. Leveraging existing natural gas assets can be a cost-effective way of decarbonizing space heating and enables the potential future use of renewable fuels.

Learnings

5. Analysis findings common to all scenarios can inform responses to an accelerated energy transition.

A. Most energy comes from existing electricity and natural gas assets in the foreseeable future, making continued investment in these assets necessary.

B. Wind generation is a cost-effective future choice for energy.

C. Dispatchable capacity resources are needed to complement future variable renewable energy resources like wind.

D. Energy efficiency measures that reduce peak electricity demand are most valuable to the electricity system.

E. Enhancements to existing hydropower assets are cost-effective, but not major new hydropower.

F. Solar resources are not identified as a solution in the analysis.

Learnings

6. Future energy-related decisions will require complex considerations

A. Future decisions should continue to consider (but not be limited to) cost, reliability, affordability, environmental, climate, economic, and social considerations.

B. Further work to understand potential trade-offs beyond Manitoba Hydro's current electricity and natural gas mandates is required.

IRP ROADMAP

DRAFT NEAR-TERM ACTIONS

What are near-term actions?

- Comprehensive
- Reflect integrated approach and future uncertainty
- Informed by IRP learnings
- Completed in the next 2-5 years

Steps to implement near-term actions

- Draft actions presented today require detailed planning, prioritization, and assessment for feasibility.
- Collaboration with Manitoba Government, Efficiency Manitoba, Public Utilities Board, and others.
- Exact scope and ability to complete actions will be communicated in future engagement conversations.

2023 IRP Near-Term Actions

1. Actively manage increasing winter peak load
2. Pursue near-term options to be ready for potential rapid demand growth
3. Develop options to reduce carbon content in natural gas
4. Enhance integrated resource planning to address evolving needs
5. Continue planning to meet the challenges of deep decarbonization

2023 IRP Near-Term Actions

1. Actively manage increasing winter peak load

1.1 Explore the potential for dual fuel space heating, including development of a pilot project.

1.2 Pursue high-value energy efficiency measures in collaboration with Efficiency Manitoba.

1.3 Develop demand response product options.

1.4 Develop rate design options.

Near-Term Actions

2. Pursue near-term options to be ready for potential rapid demand growth

2.1 Pursue cost-effective enhancements to existing hydropower plants.

2.2 Increase readiness for new resources including minimizing lead times to initiate, plan and construct.

2.3 Prepare detailed plans for high potential near-term new resources, such as wind and dispatchable capacity.

2.4 Establish a range of potential resource development plans that meet Manitoba's future capacity and energy needs.

2.5 Develop grid modernization and expansion strategies to enable future peak demand growth and enhance operations.

Near-Term Actions

3. Develop options to reduce carbon content in natural gas

3.1 Develop renewable natural gas market participation structure.

3.2 Continue investigation of renewable natural gas market and supply potential.

3.3 Investigate hydrogen blending feasibility and market potential.

Near-Term Actions

4. Enhance Integrated Resource Planning to address evolving needs

4.1 Continue building the energy planning community and evolve engagement with interested parties, including Indigenous and community leadership, as well as representation from a variety of customer segments.

4.2 Develop a framework to evaluate total energy-related costs to help Manitobans understand the implications of future energy choices.

4.3 Study the evolving role of energy markets and interconnections.

4.4 Advance detailed planning to reflect regional variations across Manitoba.

Near-Term Actions

5. Continue planning to meet the challenges of deep decarbonization

5.1 Determine impacts of integrating variable renewable resources like wind, including transmission requirements.

5.2 Identify and assess the potential of hydrogen supply, direct-use, storage and other infrastructure.

5.3 Explore the potential long-term role for technologies such as energy storage, carbon capture and storage, hydrogen fueled combustion turbines, biomass, small modular reactors.

Near-Term Actions
Summary

MANAGE WINTER PEAK

1.1 Explore the potential for dual fuel space heating, including the development of a pilot project.
1.2 Pursue high-value energy efficiency measures in collaboration with Efficiency Manitoba and others.
1.3 Develop demand response product options.
1.4 Develop rate design options.

PREPARE FOR RAPID DEMAND GROWTH

2.1 Pursue cost-effective enhancements to existing hydropower plants.
2.2 Increase readiness for new resources including minimizing lead times to initiate, plan and construct.
2.3 Prepare detailed plans for high potential near-term new resources, such as wind and dispatchable capacity.
2.4 Establish a range of potential resource development plans to meet future energy needs.
2.5 Develop grid modernization and expansion strategies to enable future peak demand growth and enhance operations.

DEVELOP OPTIONS TO REDUCE CARBON IN GAS

3.1 Develop renewable natural gas market participation structure.
3.2 Continue investigation of renewable natural gas market and supply potential.
3.3 Investigate hydrogen blending feasibility and market potential.

ENHANCE PLANNING

4.1 Continue building the energy planning community and evolve engagement with interested parties including Indigenous and community leadership, and representation from various customer segments.
4.2 Develop a framework to evaluate total energy-related costs to help Manitobans understand the implications of future energy choices.
4.3 Study the evolving role of energy markets and interconnections.
4.4 Advance detailed planning to reflect regional variations across Manitoba.

PREPARE FOR DEEP DECARBONISATION

5.1 Determine impacts of integrating variable renewable resources like wind, including transmission requirements.

5.2 Identify and assess the potential of hydrogen supply, direct-use, storage and other infrastructure

5.3 Explore the potential long-term role for technologies such as energy storage, carbon capture and storage, hydrogen fueled combustion turbines, biomass, small modular reactors.

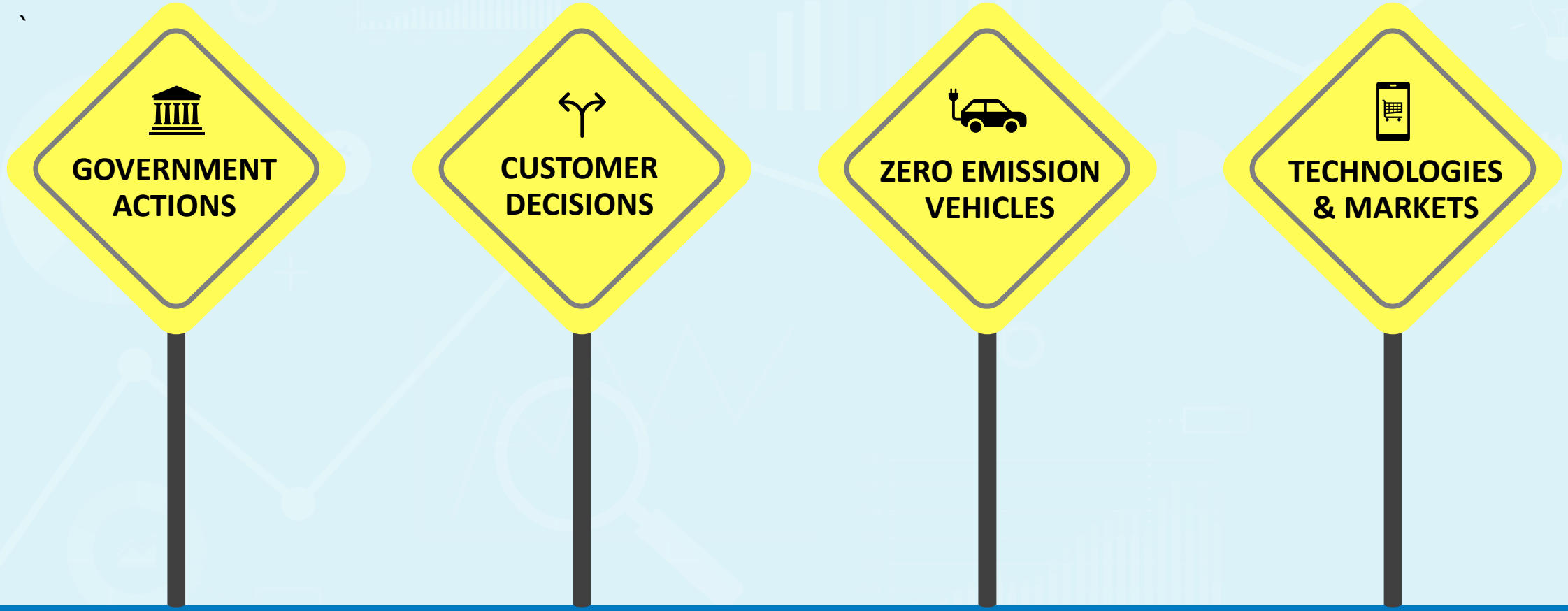
IRP ROADMAP

PROPOSED SIGNPOSTS

What are signposts?

- Will be monitored and reported on
- Indicate timing, pace, and magnitude of change in the evolving energy landscape
- May advance, delay, add, modify, or remove a near-term action

`



Signposts
Government Actions

INCLUDES

- Federal, provincial, municipal
- Regulators
- Canada, United States, International

POTENTIAL GOVERNMENT PRIORITIES

- Climate
- Environment
- Reconciliation
- Economic development
- Energy efficiency

WHAT TO MONITOR: TYPES OF ACTIONS

- Incentives, programs, funding
- Legislation, policy, regulations, codes and standards

Signposts
Customer Decisions

INCLUDES

- Residential, commercial, industrial, institutional
- Current and potential new customers
- Pace, profile and location of load changes and growth

PREFERENCES & ATTITUDES

- Increasing focus on reaching net zero
- Environmental, social, governance (ESG) targets
- Energy sources
- Increasing focus on enhancing resilience
- Energy affordability

WHAT TO MONITOR:

TYPES OF CUSTOMER DECISIONS

- Fuel switching choices (e.g. heating, industrial)
- Changing energy usage (e.g. more transit)
- Self-generation adoption
- Use of battery storage
- Potential new customer loads

Signposts
Zero Emission Vehicles

INCLUDES

- Light duty, medium duty, heavy duty (personal and fleet)
- Pace, profile and location of load changes and growth

PREFERENCES & ATTITUDES

- Forecasts for adoption
- Fleet customers setting ZEV targets

WHAT TO MONITOR:

TYPES OF ZEV CHANGES

- Charging/fueling availability
- Range
- Upfront costs and payback period
- Vehicle type availability
- Electric, hydrogen, other new technologies

Signposts
Technologies & Markets

INCLUDES

- Supply, load and storage technologies
- Wholesale markets

PREFERENCES & ATTITUDES

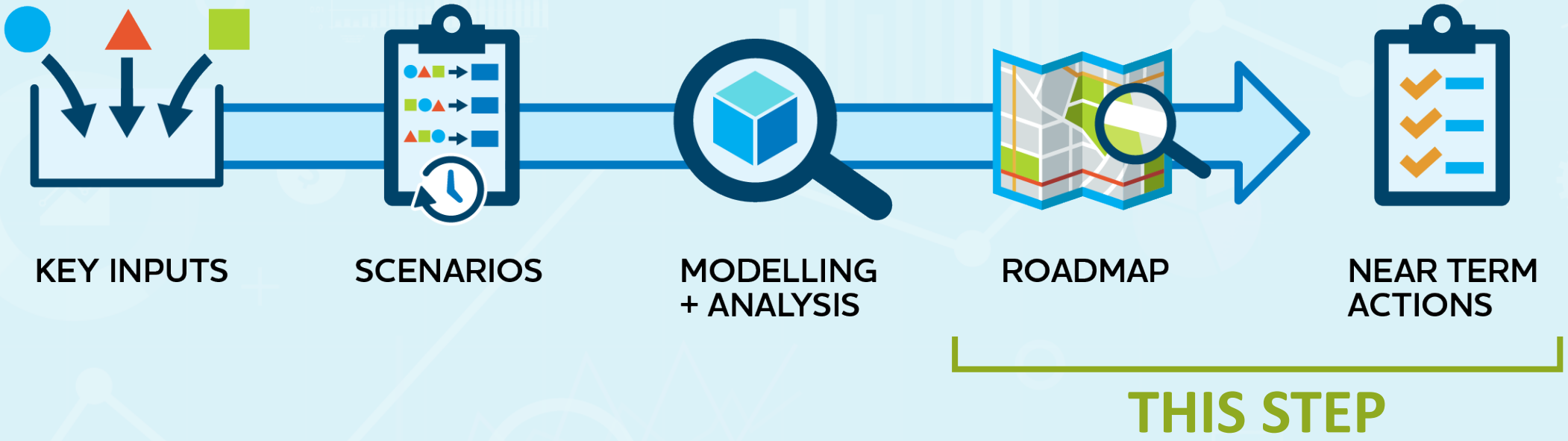
- Technology forecast including cost & commercial availability
- Competition for project resources including labour and materials
- Energy price forecasts

WHAT TO MONITOR: DEVELOPMENTS

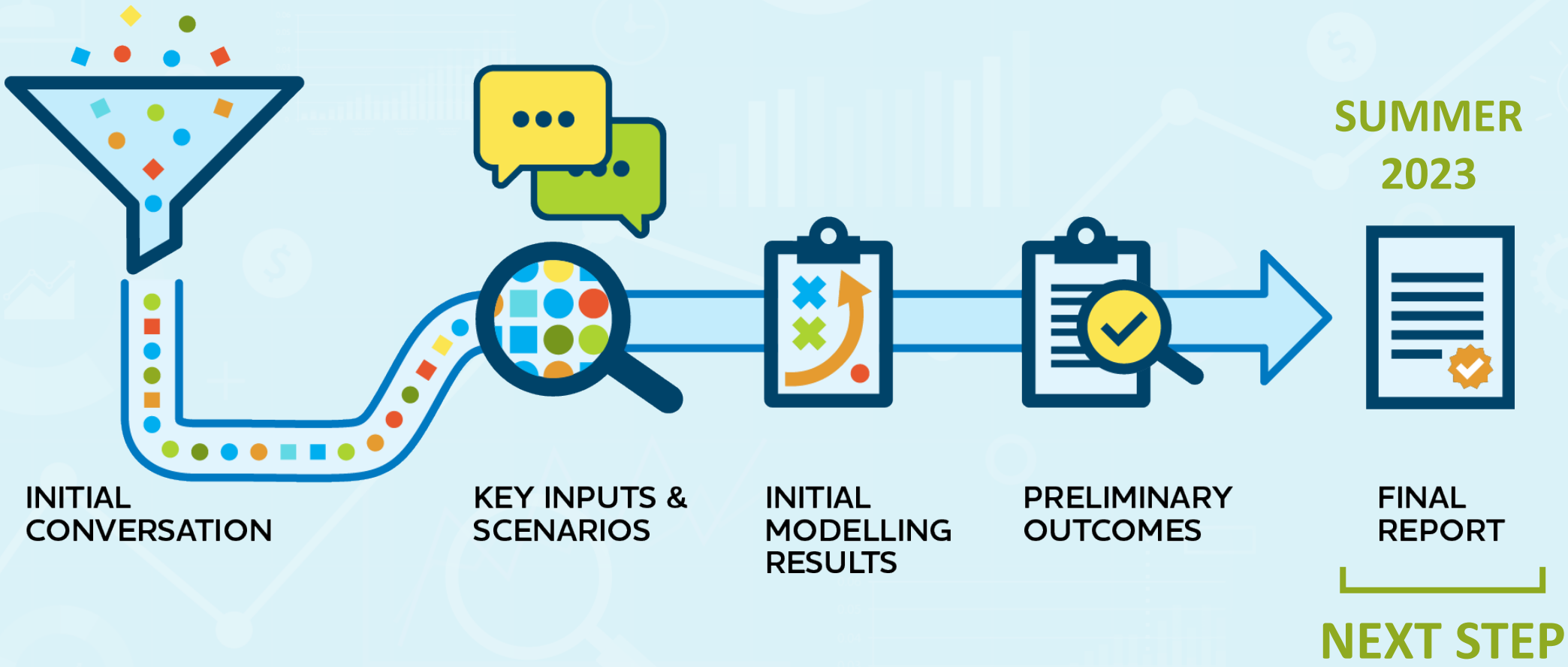
- Utility generation options
- Alternative fuels
- Self-generation technology
- 2-way energy flow (e.g. batteries, vehicle to grid)
- Market construct

NEXT STEPS

Next steps
in the IRP Development process



Next steps
in our IRP conversation



Beyond the 2023 IRP

- Continue the conversation
- Implement the roadmap
  - Scope and plan
  - Carry out near-term actions
  - Monitor signposts
  - Refresh as required
- Prepare for the next IRP

QUESTIONS

www.hydro.mb.ca/corporate/planning

Email us at IRP@hydro.mb.ca

Manitoba Hydro
energy for life