Manitoba Hydro's Integrated Resource Plan

Round 3 Questions and Answers

The following are responses to questions received throughout the Round 3 conversation in our Integrated Resource Planning process.

Communities – Regional Constraints

Does the Integrated Resource Plan (IRP) consider how energy will be delivered to specific areas in the province, including rural and remote areas that already experience limitations?

The IRP analysis is completed at a provincial level, so no consideration is given to specific regional needs. Future planning for specific investment decisions will work to consider these regional differences to develop area specific solutions.

Customer Self-Generation

How is distributed energy generation considered in the model? Is there any consideration to customer self-generation?

Distributed generation is considered through the inclusion of Efficiency Manitoba's programming for customer solar generation. Full details of how this is included in the model can be found in the Round 3 materials and in the Demand Side Management (DSM) / Efficiency Manitoba questions addressed below.

Would accelerated decentralization of generation help offload some of the demand on the utility to generate electricity?

Meeting capacity at times of winter peak demand is driving the majority of resource needs in the initial modelling results. Decentralization in the IRP scenarios is assumed to be through customer self-generation, which provides little to no capacity for meeting this peak demand, so it does little to offset the need for new electricity generation resources.

Demand Side Management (DSM) / Efficiency Manitoba Programs

Does the analysis include Efficiency Manitoba's Energy Efficiency Plan?

Efficiency Manitoba's plans were included in the analysis. We also used Efficiency Manitoba's market potential study data as input for Manitoba Hydro's IRP modelling.

How are Ground Source Heat Pumps (GSHP) considered within the IRP scenarios? Are they considered a DSM measure?

GSHP are considered in a few different ways in the IRP. Each IRP scenario has different timing and levels of adoptions of GSHP as an alternative to natural gas

space heating. Please refer to the Key Input Assumptions document for further information.

As well, the IRP is investigating sensitivities to understand the full potential and impact of GSHP adoptions. For this analysis, conversion to GSHP is included as a potential DSM measure and the rate of adoption is based on the market potential of Efficiency Manitoba's programming.

How are Efficiency Manitoba's targets and programs built into the model? Are Demand Side Management (DSM) investments an alternative to new generation?

All IRP scenarios include DSM as an alternative to new generation.

Efficiency Manitoba's DSM programming acts to reduce load in calculating future customer demand. Energy savings achieved through Efficiency Manitoba's programming was included in the modelling in two ways.

Efficiency Manitoba provided Manitoba Hydro with a long-term projection of electric and natural gas savings, based on its current Energy Efficiency Plan to achieve their legislated targets. This forecast of electric and natural gas savings was subtracted from the load forecasts of all IRP scenarios.

Efficiency Manitoba also provided Manitoba Hydro with results of a recent market potential study that looked at energy savings that could be achieved through over 100 different energy efficiency measures. This study estimated that more energy efficiency could be achieved than in the long-term projection of savings. This extra energy efficiency potential is included in the model and competes on a level playing field with other resource supply options. In this way, the model is able to select extra energy savings as an option to meet future energy needs as an alternative to new generation.

Does the IRP consider rate structures and their impacts on conservation?

Analysis of different rate structures is outside the scope of this IRP.

Is the loss in revenue from Demand Side Management (DSM) included in the model?

Yes. DSM shown in the initial modelling includes lost revenue in the modelling resource characteristics. However, further adjustments to the modelling assumptions and resource characteristics are planned to change this in the final modelling results. By not including the lost revenue for DSM measures, this allows the model to optimize based on total resource cost, as is done for other resources the model can select.

Electric Vehicles (EVs) / Zero Emission Vehicles (ZEVs)

In the model assumptions for converting from Internal Combustion Engines (ICEs) to EVs, did you consider that EVs require less energy to operate than ICEs?

Increased efficiency was considered and would have been reflected within the load forecast and the impact on emissions.

Does the analysis consider energy required for charging EVs will change by season? Given that EVs can consume as much as 40% more electricity per kilometre on a winter day, this would have a significant impact if all customers recharged their EVs at the same time.

The impact of seasons on the charging of EVs was considered in the model.

How quickly do these EVs get adopted in your model?

Each of the four IRP scenarios consider different levels of EV uptake timing. Please refer to the Key Input Assumptions document for further information.

Does the IRP consider policy and regulatory changes such as electric vehicle sales mandates the Federal government is currently discussing for medium and heavy-duty vehicles.

Policy decisions, from all levels of government, including some potential future policies, are included in the IRP scenarios.

When we talk about the electrification of transportation, does that include the City of Winnipeg's transit buses? What about medium and heavy duty vehicles that are making money during the day?

Assumptions for electrification of transportation include several vehicle classes, like medium and heavy duty vehicles and transit buses. These details are included in the Key Input Assumptions document.

Does the model include assumptions about how many vehicles might be purchased that use hydrogen as a combustion fuel?

Hydrogen was not assumed as a combustion fuel for transportation in the IRP. All decarbonization of transportation is assumed to be electric. While the future may use hydrogen in place of some electrification, it is likely that this hydrogen would be produced using electricity.

Greenhouse Gas (GHG) Emissions

The volume of emissions generated by other sources compared to transportation was interesting. I would like to have more information on the non-energy dependent GHGs.

The government of Canada publishes a detailed GHG Inventory annually with the information provided on their website here: https://publications.gc.ca/site/eng/9.506002/publication.html .

To find information on non-energy dependent GHGs for Manitoba, navigate to Table A11-14 "GHG Emission Summary For Manitoba, Selected Years" (Page 28) from the Part 3 of the most recent report, found here: https://publications.gc.ca/collections/collection_2022/eccc/En81-4-2020-3-eng.pdf

Do the emissions presented in the IRP include emissions produced by generation, not just emissions produced by end use?

Yes, the emissions presented on do include both generation and end use emissions.

Are there any estimations for $/ton of GHG reduction?

No analysis has been completed for the estimate of $/ton of GHG reduction. The IRP will investigate the possibility of characterizing these values.

Does the model consider carbon taxes?

Yes, the model assumes carbon taxes. The model assumes an increasing level of carbon tax per the Minimum National Carbon Pollution Price Schedule (2023-2030).

What definition was used for net-zero greenhouse gas emissions? Does the IRP consider net-zero for the province overall?

The IRP analysis is looking at how changes in future energy use can impact energy dependent GHG emissions. The IRP analysis does not consider net-zero for all emissions within the province. Scenario 4 provides for a path to net-zero that is specific to energy dependent GHG emissions.

Hydrogen & Other Gaseous Fuels

Does the IRP consider renewable gases such as hydrogen, renewable natural gas, etc.? Does it consider injecting hydrogen into the natural gas pipeline as part of decarbonization.

This IRP does not consider blending of renewable gases into the existing natural gas system as a means

of decarbonization as further development work is required to properly complete this analysis. It is recognized that there is significant potential for this technology, so future planning will look to include this analysis.

What kind of hydrogen is considered in the IRP? Does it look at low carbon hydrogen, green hydrogen, and blue hydrogen (i.e., derived from natural gas with carbon capture and sequestration)?

In this IRP, hydrogen is considered to be green hydrogen, produced through electrolysis using surplus electricity generation. No consideration was given to blue hydrogen within this IRP analysis.

Was hydrogen considered as an additional demand in the model in transportation and other areas? Or was it integrated into the model in terms of generating and using it for heating?

No, hydrogen demand was not considered as an additional demand in the model. This includes producing hydrogen for the purposes of blending into the natural gas system, direct use for space heating, or for commercial use. When the optimization model selects a hydrogen fueled thermal plant as a resource, there is no impact to the system because of this additional demand. Hydrogen to fuel this thermal generation is produced using surplus electricity when other electrical demand is lower (such as in summer). All transportation is assumed to switch to electric energy.

How would a "hydrogen-fueled combustion turbine" work?

Hydrogen fueled thermal generation is modelled as follows: Hydrogen is produced through electrolysis using excess energy during seasonal non peak times (summer). The hydrogen is then stored underground before being used as fuel in a thermal combustion turbine to produce electricity for the high peak season (winter).

Initial Results – Cost

In the financial analysis, do the net system costs include new additional resources and the current existing resources?

The costs shown are the net system costs, which include the costs of new additional resources and what is required to maintain the existing system in its current condition. These include all costs to provide electricity and natural gas service over the 20-year IRP study period. The net system costs include:

- Capital
- Maintenance and operation
- Natural gas
- Transmission and distribution infrastructure
- Fuel
- Import costs and export revenue

Note that the costs in the initial results are generated from very high-level estimates for the purposes of comparing model outputs between the scenarios. The costs help to inform decisions as part of developing the IRP. These costs are not intended to be relied upon to support specific project decisions.

In the presentation you shared the costs to the utility. Will there be consideration of customer costs? For example, the cost to purchase an EV or investing in DSM.

The costs shown are the net system costs, and do not include costs the customer will be required to cover. Determining customer costs is a complex process, in part due to the different rate structures between the gas and electric systems. We are still investigating how best to represent customer costs.

In the IRP scenarios, what is the net present value to maintain the existing system?

Costs to maintain the existing system in its current condition are estimated to be a present value of $30 billion. This does not change between IRP scenarios.

Thermal plants don't operate at 100% efficiency. Would the energy that's lost through inefficiencies in generation be represented in the cost curve?

Efficiencies of all resource options are carefully considered and integrated into the model, including any associated costs. Impacts of these assumptions would be reflected in the cost output of the initial modelling results. Please review Round 3 modelling results for more detail.

Initial Results – Resource Options

In the presentation (Slide 19) you mentioned the conversion of natural gas usage to electric usage. Did this include any efficiency savings or does the conversion just consider energy usage? Was a transition to other energy sources considered? For example, if we did all that heating with geothermal, the electrical demand would be significantly less than the gas demand.

Slide 19 is an illustration of what would happen if all natural gas usage were to be converted to electric usage on an equivalent energy basis. This illustrative example does not account for differences in efficiency or transition from natural gas to other energy sources, such as geothermal, etc.

While most of the end user data (i.e., residential, commercial, industrial, and farm) is aggregated, the solutions for those energy users can vary significantly. Will this data be available at some point to better develop energy efficiency solutions for each group?

Currently, it is not possible to breakdown the data by the different types/classes of customers. Future planning could consider this analysis.

Was new hydro eliminated from consideration? It does not appear to be an optimized supply option under any of the IRP scenarios. Can you share the key factors that make new hydro uncompetitive?

New hydro generation was not eliminated from consideration. Rather, the model did not choose new hydro generation as an economic resource choice to meet the projected customer demand, as compared to the other available resources.

There are several factors influencing this result. First, it is getting more costly to plan, design, and construct hydro generation resources. Secondly, the marketplace is changing and where there was once an opportunity to sell excess energy at a premium, this is no longer a certainty. Third, the long cycle of planning and receiving the necessary approvals for hydro generation mean this resource cannot be put into service in time to meet the demand in the IRP scenarios anticipating aggressive load growth.

What is the maximum percent hydropower can be increased, given hydro power does not come in as a resource in the initial results? Can the existing resources not be made more efficient?

A small amount of capacity enhancements to existing hydro generation stations are included in the model as a selectable resource. These enhancements are selected early and in every single scenario. Further work will be required to understand the full potential across all the existing hydro generating resources.

Recognizing the intermittent nature of wind, what assumptions are made about the contribution of new wind supply to capacity?

The firm capacity rating for wind is assumed to be 20%. However, this capacity rating does decrease when large amounts are selected by the model.

Why was solar not included in the model?

Solar is included in the model as a resource that can be selected. Additional solar beyond that included in

Efficiency Manitoba's Plan is not selected by the model as other resources are more economic to meet future needs. Solar cannot meet winter peak demand because it does not provide the capacity needed in Manitoba's winters when we need it the most. Please see the Round 3 initial modelling results for more information.

Is the dual fuel sensitivity assumed to be only for natural gas customers, or could it include oil or propane?

The assumptions within the dual fuel sensitivity are for natural gas and electricity customers.

Why is nuclear not part of any of your IRP scenarios?

Nuclear is included in the model as a resource that can be selected. It is not being selected by the model as other resources are more economic to meet future needs.

Since your planning window is so long -- twenty years into the future -- there's the possibility that new technologies may be developed or become dominant. Is there flexibility in the model and in the planning process that if a new technology emerges (better, cleaner, cheaper, or more resilient) it can be incorporated into the process?

Yes. The IRP development process is cyclical to ensure there is agility in our future decision making. We anticipate new technologies, developments, policy decisions, etc. in the future will influence the IRP modelling and analysis results. Continuously updating the IRP will allow these changes to be incorporated.

In Scenario 4, the accelerated decarbonization pathway, the impacts of displacing natural gas with electricity significantly increases demand. What increases the demand for electricity more - decarbonization of the transportation sector or the building sector?

Decarbonization of space heating is expected to increase the demand for electricity more than electrification of vehicles.

Is heating our homes and buildings the most significant contributor to increased capacity needs?

Alternatives to natural gas space heating and the electrification of transportation are the most significant drivers of the increased capacity need observed in each of the initial IRP scenario results. In all scenarios it is anticipated that our customers will use more electricity in the future as they adopt electric vehicles and start to use more electricity to heat their homes and businesses. While this demand does increase in Scenarios 1, 2, and 3 - this is most pronounced in Scenario 4, which represents accelerated decarbonization and a pathway to net-zero through electrification. This includes the conversion of natural gas space heating to electricity.

As described in our Round 3 modelling results, Scenario 4 results in our customers needing double the electricity they use today, as well as a peak demand in 2042 that is two and half times the current demand. This has significant impacts on our systems capacity requirements. Note that the potential for dual-fuel heating as examined in our sensitivity analysis has the potential to reduce this peak.

Scenario 4 suggests some very aggressive load growth. Is that at all related to long-term export contracts? How do those two things interact?

Where the IRP scenarios result in early and aggressive load growth, long-term export contracts are not a contributor to this growth; however, any remaining existing export contracts must be met by the model.

In Scenario 4, why are imports increasing as compared to Scenario 1, even with increased use of thermal generation?

Assumptions in the model are that imported energy is a less expensive source of energy than thermal. Thermal also is a beneficial resource during periods of low water or during peak demand.

Imports/Exports

Is there any consideration of a Canada east/west grid in the assumptions of imports and exports?

Consideration of a Canada east/west grid was not included in scope of this IRP. That does not preclude this concept from future iterations of the IRP.

Are energy imports considered in the model as both an energy resource and capacity resource (i.e., the energy resources are what is made and used over a period of time and measured as megawatt-hours, while capacity is the maximum amount of energy that can be made at a specific time and measured as megawatts)?

Imports are assumed to provide energy based upon the capability of the transmission system. A limited amount of capacity is assumed to be available (up to 50 MW). In practice, capacity availability is subject to negotiation of bilateral agreements, and therefore may be lower or higher.

The model notes a role for imports. Does this imply a reduction in exports as existing export contracts expire, or are exports stable and imports are only for peak?

Exports will continue to play a role in the future. Current contracts were assumed to expire per their contractual end date, without being renewed. Opportunity market exports are still assumed within the model.

Could imports be coal based and if so, how is that addressed in the model?

The source of energy to supply imported electricity continually changes but generally is a function of the resource mix in the originating region of the electricity. It is possible that imported electricity will continue to contain a portion of coal-based generation. The IRP analysis does not account for emissions from imported electricity.

Is the Manitoba-Minnesota line considered as part of capacity to import?

Yes, the Manitoba-Minnesota Transmission Project (MMTP) is considered as part of Manitoba Hydro's ability to import. In the model, the potential to import is limited by the planning criteria.

The planning criteria are included in the model to determine when and how much new supply resources are needed to meet the demand in each scenario. Two planning criteria were included for the IRP: dependable energy, and capacity. Please see Round 3 modelling information for more information on the planning criteria.

Modelling Process

What are your considerations around growth and how that impacts demand for energy? Can you share assumptions around growth of the population, key demographics, and the economy that have been included in the IRP analysis?

Different assumptions around growth, such as for economic growth and population growth, were made in each of the four IRP scenarios. Please refer to the Key Input Assumptions document.

In the Modelling Process presentation, slide twenty shows a graphic that depicts the summary of the modelling process. Consumer gas demand has an arrow pointing to outputs rather than an arrow pointing to common inputs and optimization. Is that indeed how the model is constructed?

The graphic illustrates that inputs specific to each scenario, are used within the optimization model, but also brought back into the outputs for further analysis.

As part of the financial analysis, are the energy prices held constant through until 2042?

Energy prices are based on market price projections. These projections vary over time based on different assumptions by independent third-party forecasters.

Does the model consider the efficiencies from conversion of natural gas to electric forced air furnaces or equivalent?

Different efficiencies of natural gas and electric furnaces are built into the model.

Does the model consider industrial use of natural gas an in input to their processes?

Yes, natural gas used in industrial applications is included in the model.

Is demand response included in the model?

Demand response is included in the IRP analysis as a sensitivity.

Would solar be at both the utility level and the customer level?

Solar is included in the model both at the customer level through Efficiency Manitoba programming and at a utility scale level.

How many customers are assumed to have dual fuel heating and cooling in the analysis?

Adoption of dual fuel systems was included in the assumptions of IRP scenarios 2 and 3, as well as in a dual fuel heating sensitivity on scenario 4.

Scenario 2 assumed existing customers with natural gas furnaces continue to use this technology. New buildings, that would normally have natural gas space heating, would instead use a dual fuel system. A total of approximately 26,000 customers would use a dual fuel system for space heating and cooling by 2044/45 in scenario 2.

Scenario 3 assumed that in the near-term new buildings that would normally have natural gas space heating would use a dual fuel system. Existing customers with natural gas furnaces would convert to a dual fuel system when air conditioners reach end of life in the near term and use all electric space heating in the long-term. A total of approximately 200,000 customers would use a dual fuel system for space heating and cooling by 2044/45 in scenario 3.

A dual fuel heating sensitivity analysis was also conducted for IRP Scenario 4. Assumptions for this sensitivity analysis are that all new buildings, that would normally have natural gas space heating, would use a dual fuel system. Existing customers with natural gas furnaces would convert to a dual fuel system when air conditioners reach end of life. A total of approximately 232,000 customers would use a dual fuel system for space heating and cooling by 2044/45 in this sensitivity.

Have you made any assumptions about aviation in your projections?

The IRP does not consider the potential of future changes in fuel for aviation use, including through electrification. This consideration will be revisited in future iterations of the IRP.

How are electric furnaces considered in IRP scenarios with accelerated decarbonization?

Each IRP scenario assumes different types and rates of uptake of various space heating technologies. Please refer to the Key Input Assumptions document for further information.

When does the assumption of the electrification of space heating kick in?

Each IRP scenario assumes different types and rates of uptake of various space heating technologies. Please refer to the Key Input Assumptions document for further information.

What assumptions are made about the ability of the grid infrastructure to support potential future growth?

Assumptions are made for both the transmission and distribution systems on the cost to connect additional resources to the grid and deliver energy to customers.

Policy

To what degree does the IRP consider potential recommendations regarding the provincial energy strategy? For example, could we see scenario 4 as reflective of these recommendations?

The IRP scenarios were designed to be broad bookends of the potential changes to the energy landscape. It is anticipated that these bookends adequately reflect the potential recommendations related to the provincial energy strategy.