PEMBINA institute

Modelling a Path to 2050 using the Energy Policy Simulator

Method and limitations

by Jason Lam | November 2023

Policy scenario design method

The Path to 2030 and Path to 2050 illustrative policy scenarios were designed in the Energy Policy Simulator (EPS) using an iterative process. First, the policies outlined in Canada's Emissions Reduction Plan 2030 that could be directly translated to the EPS model's policy levers were applied. From there, additional policies were approximated that were already announced or developing in Canada. After that, feedback was collected internally from Pembina Institute experts on the policy levers to revise the policy ambition levels and to revise the policy timelines as needed. The modelled data for emissions, GDP, jobs, and electricity generation were checked to ensure that the policies were having the intended affect and were not having adverse effects on economic factors such as jobs and energy costs. The scenario at this point was named the Path to 2030 in the EPS model.

When designing a net-zero scenario, the Path to 2030 was used as a starting point and a combination of increasing the policy ambition levels of several policy levers and revising the implementation schedules were implemented. In addition, some policies that were implemented in the U.S. EPS model's "NDC Pathway" scenario were added to the scenario, with the rationale being that Canada could implement similar style policies in the future to remain in sync with U.S. environmental and energy policies.

Model limitations

The Canada EPS model is a national model and is unable to model the specific outputs at a provincial or territorial level; province- or territory-specific business-as-usual data would need to be imported into the model to achieve this objective.

The electricity module does not calculate an hourly or seasonal peak electricity demand forecast. It calculates the electricity demand by using a combination of the annual demand forecast, and calculates the electricity needed based on the annual peak demand estimate.

Energy storage and demand-management strategies are incorporated in the annual demand but are not explicit outputs of the model.

The EPS model is not well suited for solving a net-zero end goal, as you are not able to set end targets and work backwards to determine the pathways to achieving the target. In addition, it does not model the global trends impacting prices/trade between countries.

Policy levers

The policy levers that the EPS model has at its disposal may not directly correlate to proposed or developing policies in government. For example, there is no explicit "electrification" policy in development for industrial fuel use in Canada. Along with that aspect, the impacts shown in the wedge diagram can be the result of more than one specific policy. An example of this is how the electrification + hydrogen wedge slice is made up primarily of the Electrification (low temperature) and Electrification + Hydrogen (medium and high temperature) policy levers, though other combinations of policies may also influence this wedge. This makes it challenging to use EPS to model specific government policies, and may require a combination of policy levers in order to approximate the impacts of a single policy such as a cap on oil and gas emissions.

As a systems dynamic model, EPS is able to model how policy combinations interact with each other. The effect of one specific policy may change with different combinations of policy levers (i.e., electrification of industry will need clean electricity generation for the full emission reductions to be realized). An incremental approach, where the impact of one policy change is made and observed, will need to be employed in order to determine the approximate effects of an individual policy lever in a given policy scenario. There can still be variability in the effects of an individual policy lever as different combinations of policy levers can produce different results.

Carbon pricing

The model is not able to accurately model the different carbon pricing systems that are found across Canada. This price does not represent the output-based-pricing system (OBPS), nor cap-and-trade as it is implemented in specific Canadian provinces.

The model's carbon pricing system applies an additional carbon price nationally to all fuels from the selected sector on top of the business-as-usual (BAU) scenario, which already applies the existing carbon pricing to two sectors, buildings and transportation.

Thus, for buildings and transportation, the value applied with the "Simplified carbon price" will be additional to the legislated carbon price for these sectors (e.g., $170/tonne CO_2eq in 2030),.

For example, setting this policy to have a value of $30/tonne in year 2030 will model a price of $200/tonne ($170+$30).

For all other sectors, the BAU did not include the full legislated carbon price. Adding a carbon price in the model will apply the full price to the entire sector selected, but the user has to also consider free allocations. For example, if the nominal price is $100/tonne but the free allocation is 80%, then the correct price to assume is $20/tonne.