Canadian Energy Outlook
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HORIZON 2060

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Available online
iet.polymtl.ca/en/energy-outlook
In this presentation

• The model and main scenarios considered

• Main results and highlights

• Key takeaways from the report
Other contributions

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NATEM — A TIMES family model

Strengths

• System representation
• Technology explicit: capital stock turnover, effect of techno regulation
• Capital, operating and fuel cost allowing least cost analysis
• Results at the provincial level
# The scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
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<tbody>
<tr>
<td>REF</td>
<td>no GHG reduction targets.</td>
</tr>
<tr>
<td></td>
<td>aligned with the Reference scenario used in the CER’S Energy Future 2020 report</td>
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<td></td>
<td>Includes <strong>GHG policies already in place</strong></td>
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<tr>
<td>CP30</td>
<td>REF + schedule to $170/tonne of CO₂e in 2030 also <strong>lowers the hurdle rate</strong></td>
</tr>
<tr>
<td>NZ60</td>
<td>Imposes <strong>net-zero</strong> emissions on total CO₂e by <strong>2060</strong>.</td>
</tr>
<tr>
<td></td>
<td>Aligned with CER’S Evolution Scenario (as all NZs) 30% target by 2030 (base = 2005).</td>
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<tr>
<td>NZ50</td>
<td>Imposes <strong>net-zero</strong> emissions on total CO₂e by <strong>2050</strong> 40% target by 2030 (base = 2005).</td>
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<tr>
<td></td>
<td><strong>corresponds most closely to the current government’s targets.</strong></td>
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<tr>
<td>NZ45</td>
<td><strong>net-zero</strong> emissions target on total CO₂e by <strong>2045</strong> 45 % by 2030</td>
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Figure 1 – GHG trajectories by scenarios

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The challenge of reaching net-zero emissions

- NZs requires a rapid divergence away from current pathways
- NZs implies a significant amount of emission removal

Figure 2 – Evolution of total GHGs across scenarios
Transformation of energy consumption profiles

- Demand goes down rapidly in NZs, even without loss in energy services
- Efficiency gains in the delivery of services, including from electrification
Transport

- Does not decarbonize as quickly as might be expected
- Many technologies compete in some sub-sectors, several of which require significant new infrastructure
Transport subsector variations

Figure 5 – Passenger light trucks, share of demand by vehicle type

Figure 6 – Heavy-duty merchandise transport vehicles, share of demand by vehicle type
All NZs see drastic reductions in oil and gas production by 2030.

Doing otherwise shifts the burden of reductions to other sectors.
• Electricity demand expands dramatically in all NZs

• The exact form of this expansion may vary depending on technological developments and political choices
• An already diversified energy mix in industry evolves slowly in NZs, highlighting barriers

• Important challenges result from the varied needs profile across sub-sectors and the importance of process emissions
• Decarbonizing buildings through electrification represents a low-hanging fruit, but barriers remain.

• The commercial sector takes longer to reduce emissions in NZ scenarios.
• At least 150 MtCO2e of remaining emissions (21% of today’s) must be captured annually to reach net-zero.

• Negative-emission technologies are essential, with very important uncertainties.

Figure 11 – Captured emissions

- DAC
- Energy production + CCU
- Energy production + CCS
- Industrial processes + CCU
- Industrial processes + CCS
- Industry combustion + CCU
- Industry combustion + CCS
- Electricity + CCS
Sensitivity analysis: hydrogen

- Developments in hydrogen technologies and infrastructure choices may change its importance.

- Its GHG profile will depend on the availability of biomass and the cost evolution of electrolysis.
Sensitivity analysis: biomass availability

• The need for negative emissions makes biomass key and limited by the availability of feedstocks

• Careful management of this resource should be prioritized if it is to be tapped into

### Alternative scenarios (wrt NZ50)

<table>
<thead>
<tr>
<th>Scenario</th>
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</tr>
</thead>
<tbody>
<tr>
<td>BioMin</td>
<td>Biomass availability is reduced by 50%</td>
</tr>
<tr>
<td>BioMax</td>
<td>Biomass availability is increased by 50%</td>
</tr>
</tbody>
</table>

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Main takeaways from the report (1/4)

Net-zero changes everything, including for the short term

• targeting partial reductions of GHG emissions is neither sufficient nor in most cases appropriate
• reaching net-zero means giving priority to preventing emissions rather than compensating them
• energy efficiency and productivity must be designed to be compatible with a net-zero objective
Main takeaways from the report (2/4)

Reaching net-zero by 2050 will be cheaper than projected a few years back

Figure 14 – Marginal cost of reduction, NZ50 compared with REF

Figure 15 – Net annual costs from electrification
Main takeaways from the report (3/4)

Especially on the short term, sectors are not all facing the same type of challenge

• for buildings, technological uncertainties are not an issue: scale is
• for the electricity sector, grid resilience may be the biggest difficulty
• most cost optimal way to reach 2030 targets: significantly reduce emissions from oil and gas sector
• in addition: industrial, commercial and electricity sectors must bear the largest efforts early on.
• transport does not transform as quickly as might be expected.
Main takeaways from the report (4/4)

Canada’s approach is getting stronger but still lacks in key dimensions:

• achieving net-zero requires strong leadership and making immediate difficult choices
• policies should aggressively target sectors where pace is the only variation across scenarios and where technological uncertainties are the fewest
• given jurisdictional issues in Canada, a large share of action necessary for GHG reduction ambitions resides with provinces, which need to move in the same direction
Thank you