2021

Canadian Energy Outlook

HORIZON 2060

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Modelling by

Financial support

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In this presentation

- The model and main scenarios considered
- Main results and highlights
- Key takeaways from the report

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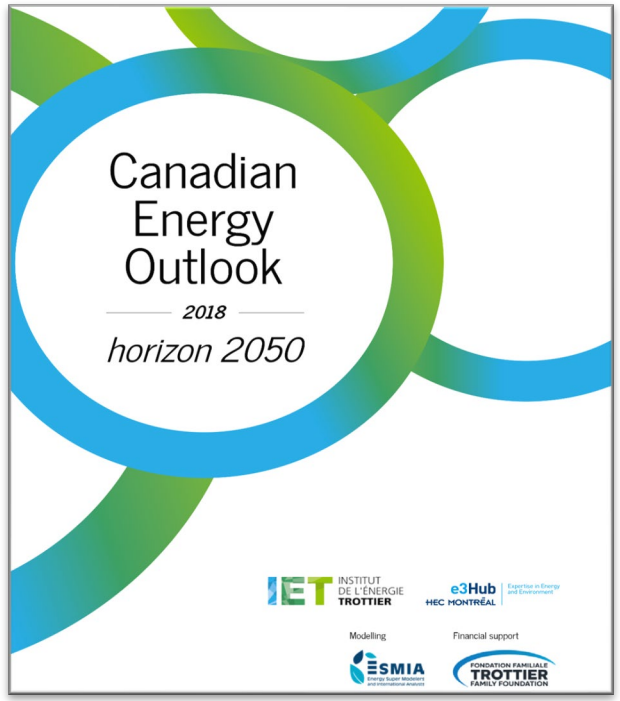
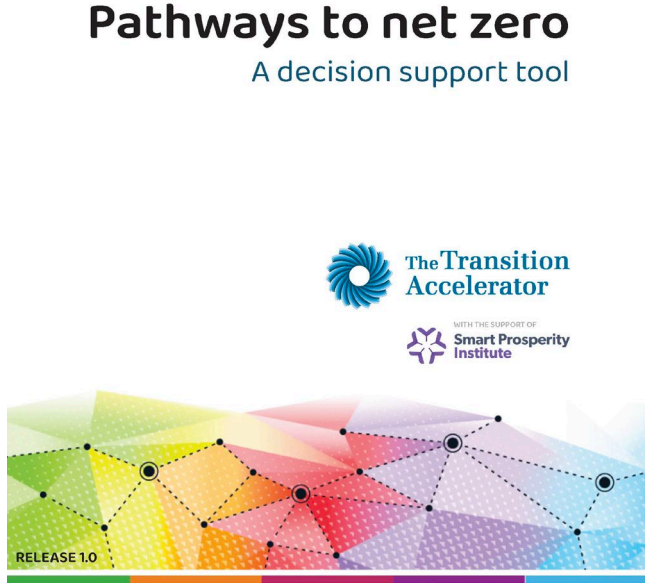
Other contributions





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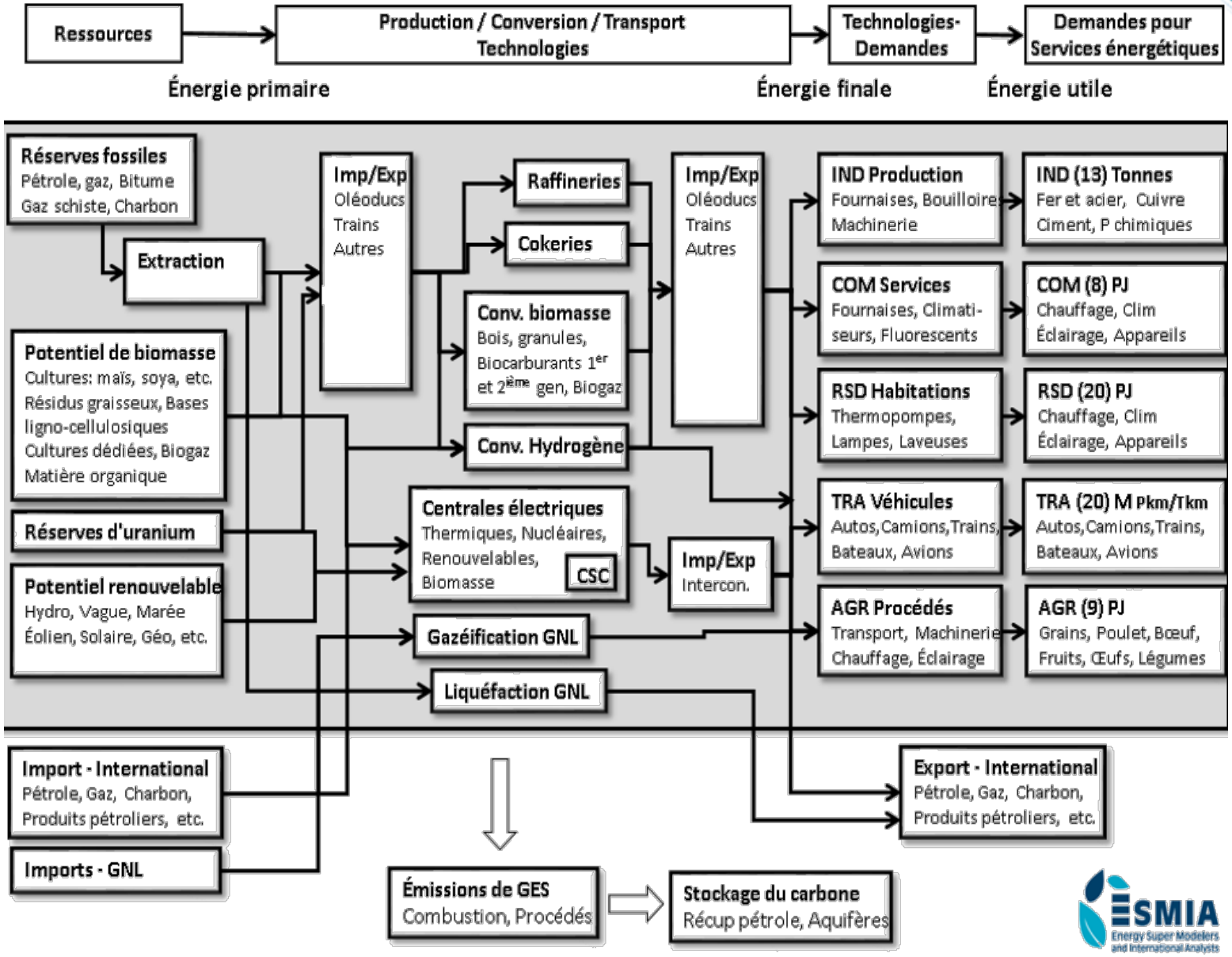
NATEM — A TIMES family model

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

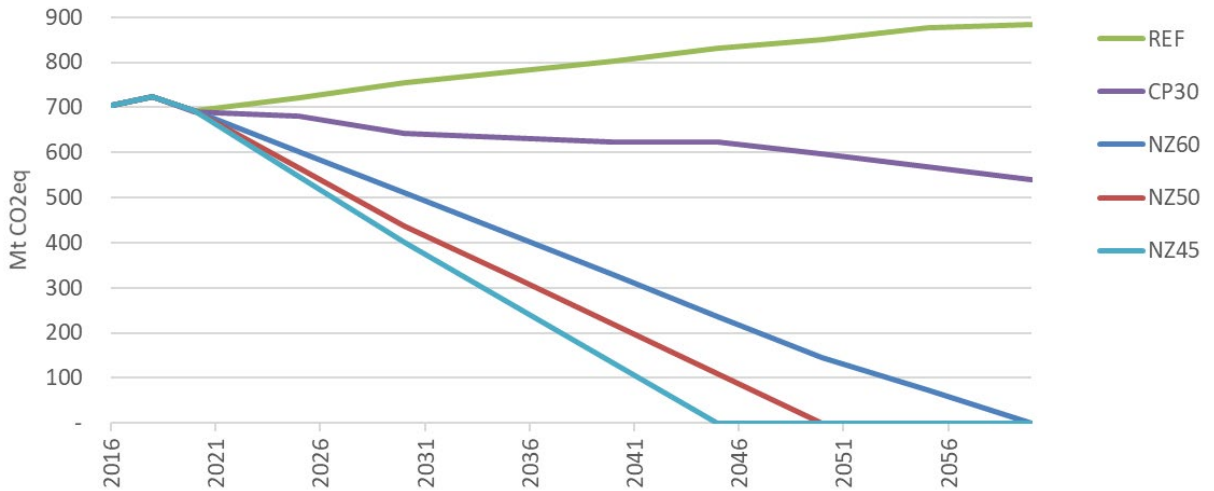


ESMIA Energy Super Modelers and International Analysts
www.esmia.ca

The scenarios

REF	• no GHG reduction targets. • aligned with the Reference scenario used in the CER'S Energy Future 2020 report • Includes **GHG policies already in place**
CP30	• REF + schedule to **$170/tonne of CO_2e in 2030** • also **lowers the hurdle rate**
NZ60	• Imposes **net-zero** emissions on total CO_2e by **2060**. • Aligned with CER'S Evolution Scenario (as all NZs) • 30% target by 2030 (base = 2005).
NZ50	• Imposes **net-zero** emissions on total CO_2e by **2050** • 40% target by 2030 (base = 2005). • **corresponds most closely to the current government's targets**.
NZ45	• **net-zero** emissions target on total CO_2e by **2045** • 45 % by 2030

Figure 1 – GHG trajectories by scenarios



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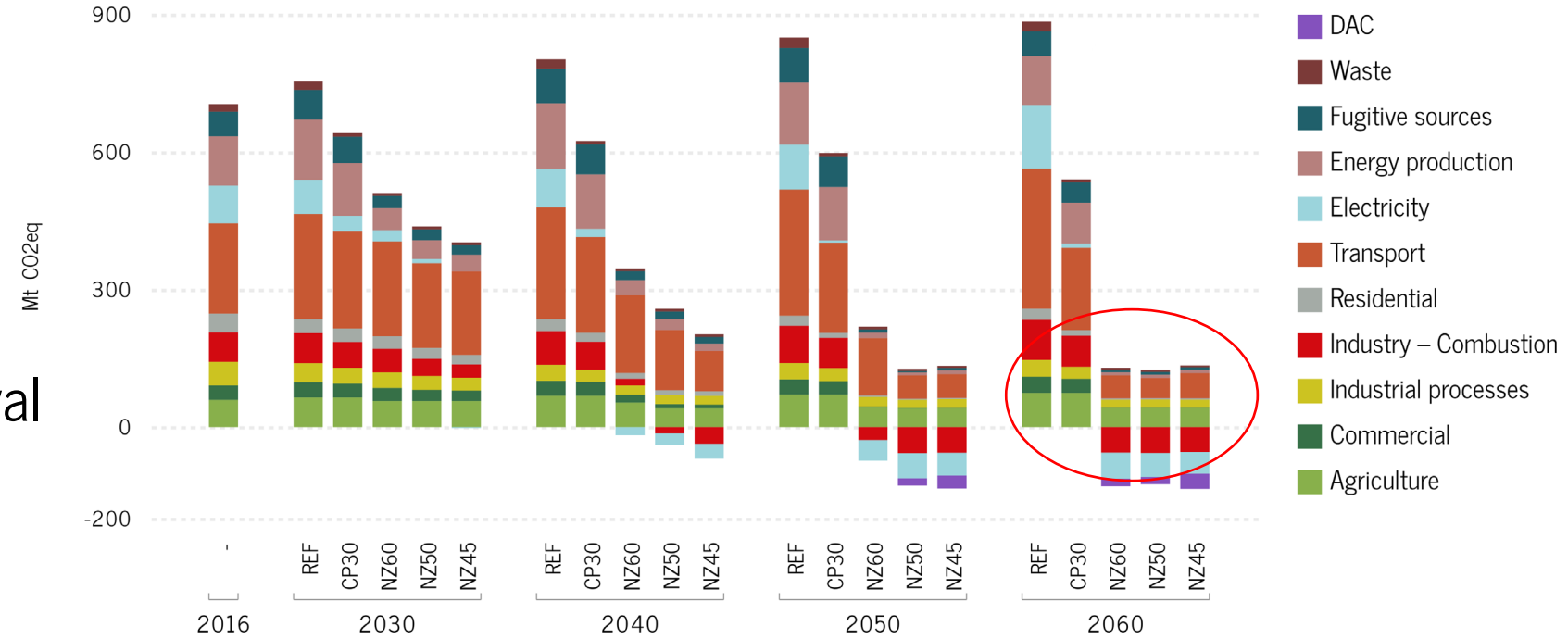
The challenge of reaching net-zero emissions

- 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



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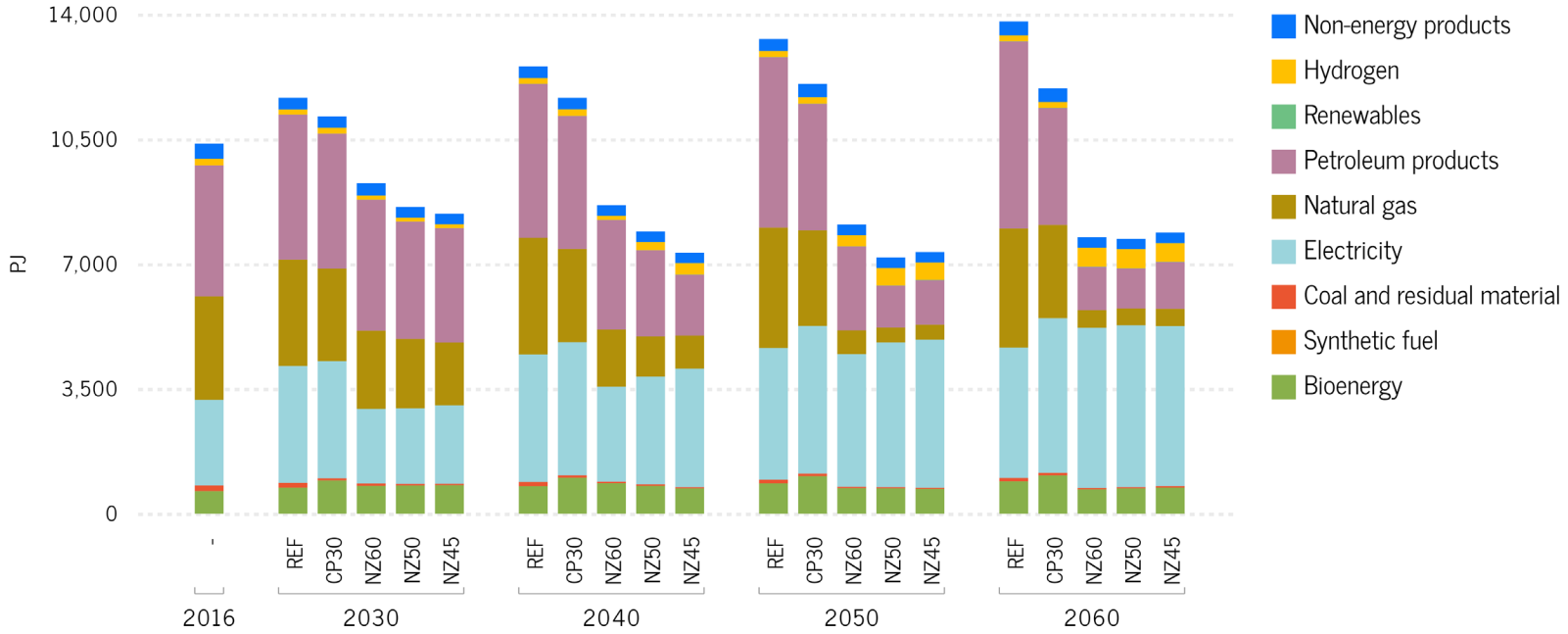
Transformation of energy consumption profiles

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

Figure 3 – Final energy consumption



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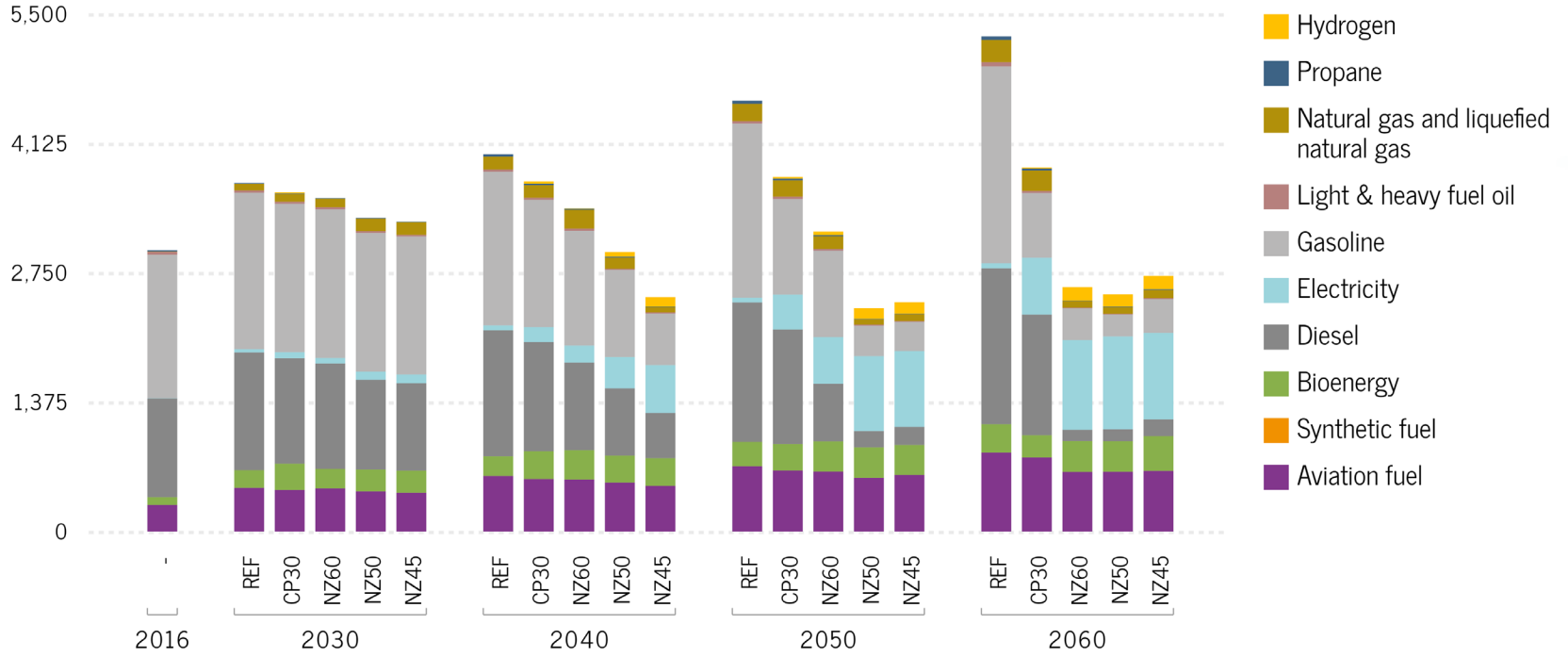
Transport

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

Figure 4 – Energy consumption in the transport sector



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Transport subsector variations

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

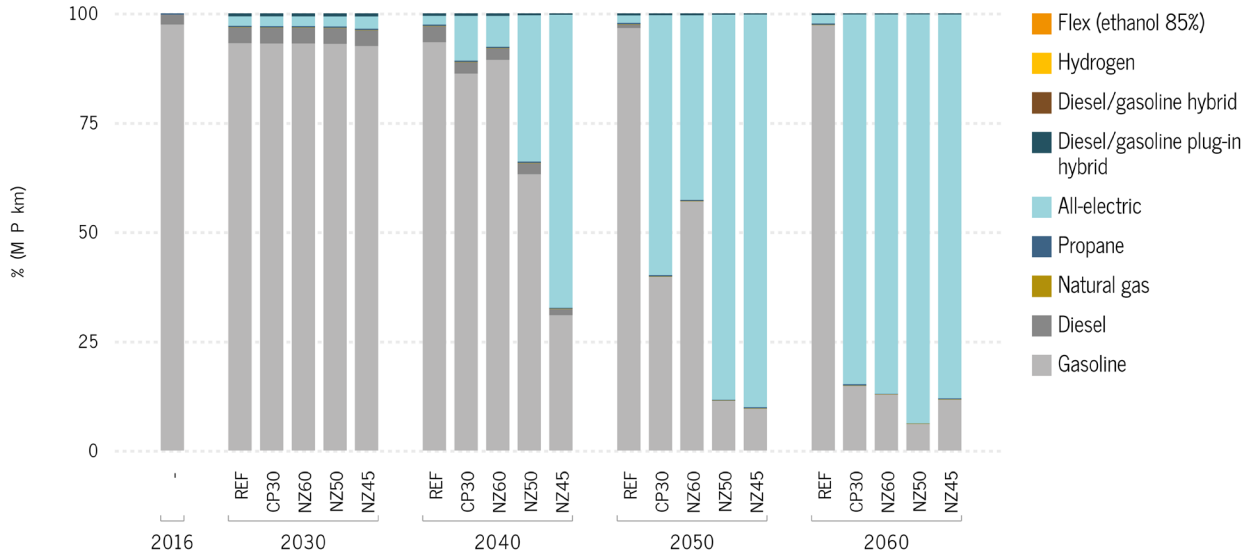
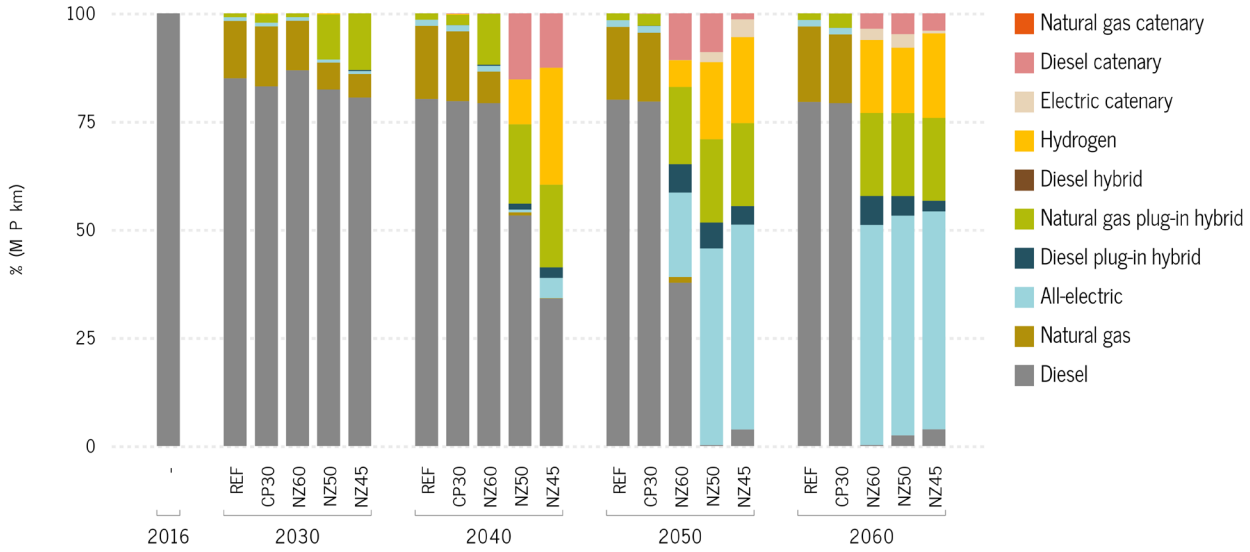


Figure 6 – Heavy-duty merchandise transport vehicles, share of demand by vehicle type



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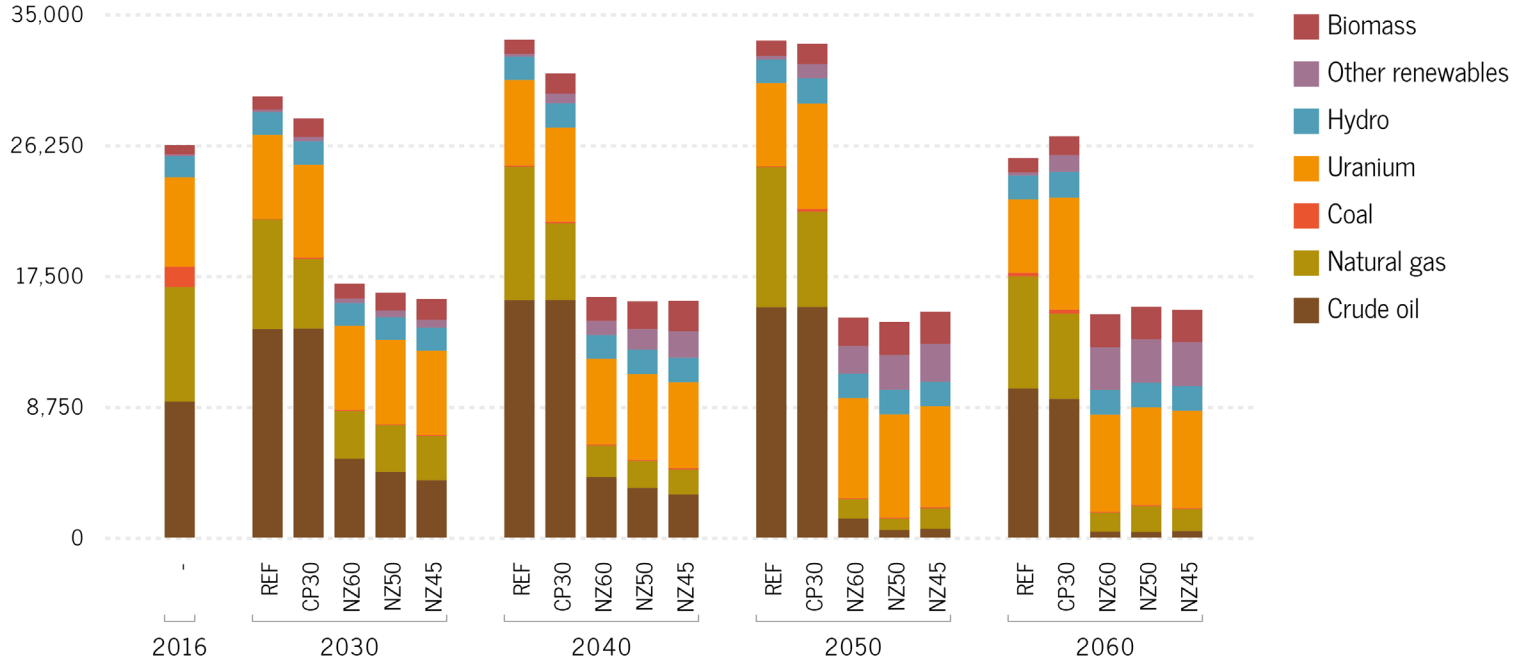
Energy production

- All NZs see drastic reductions in oil and gas production by 2030
- Doing otherwise shifts the burden of reductions to other sectors

Figure 7 – Primary energy production



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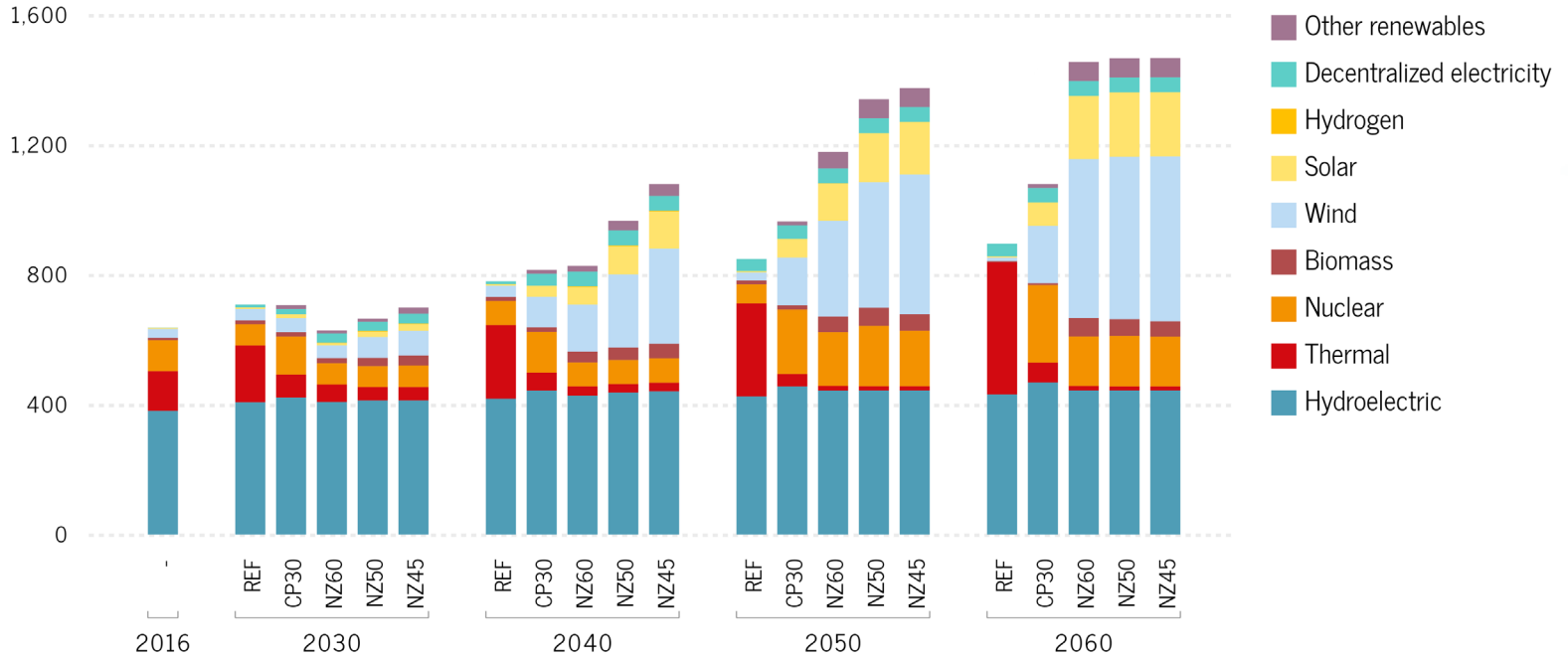
Electricity production

- Electricity demand expands dramatically in all NZs
- The exact form of this expansion may vary depending on technological developments and political choices

Figure 8 – Electricity generation



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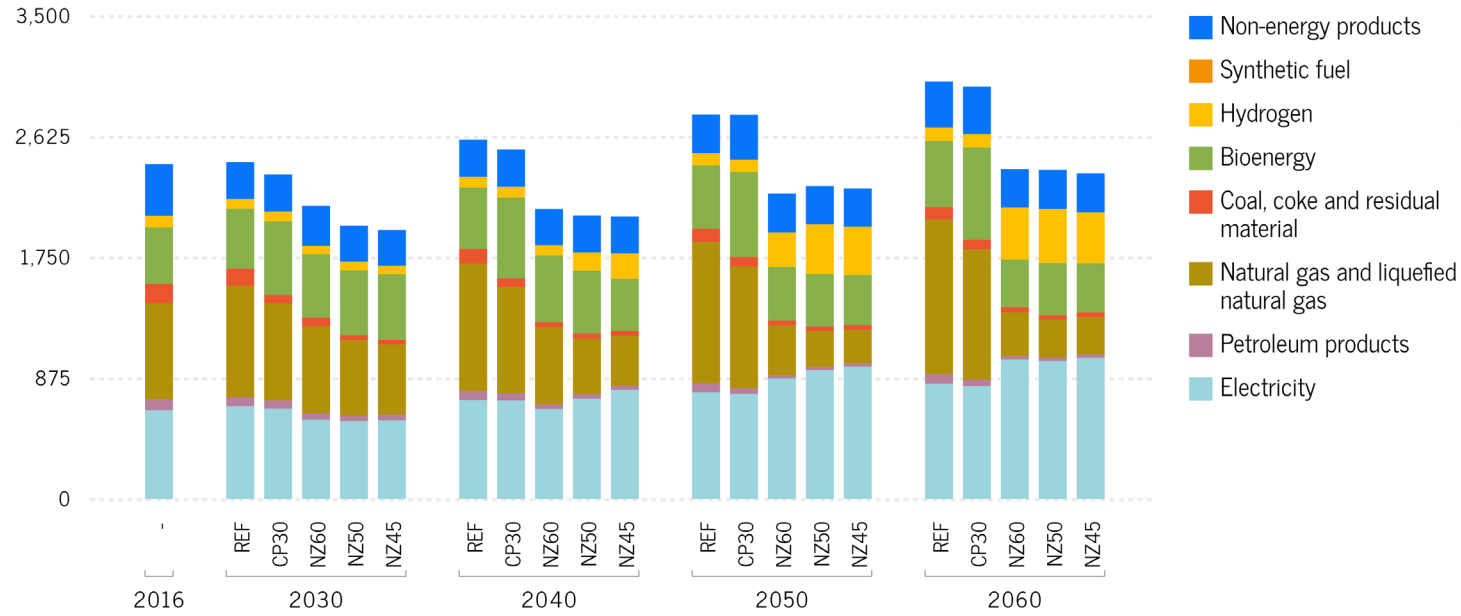
Industry

- 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

Figure 9 – Energy consumption in industry (outside of energy production)



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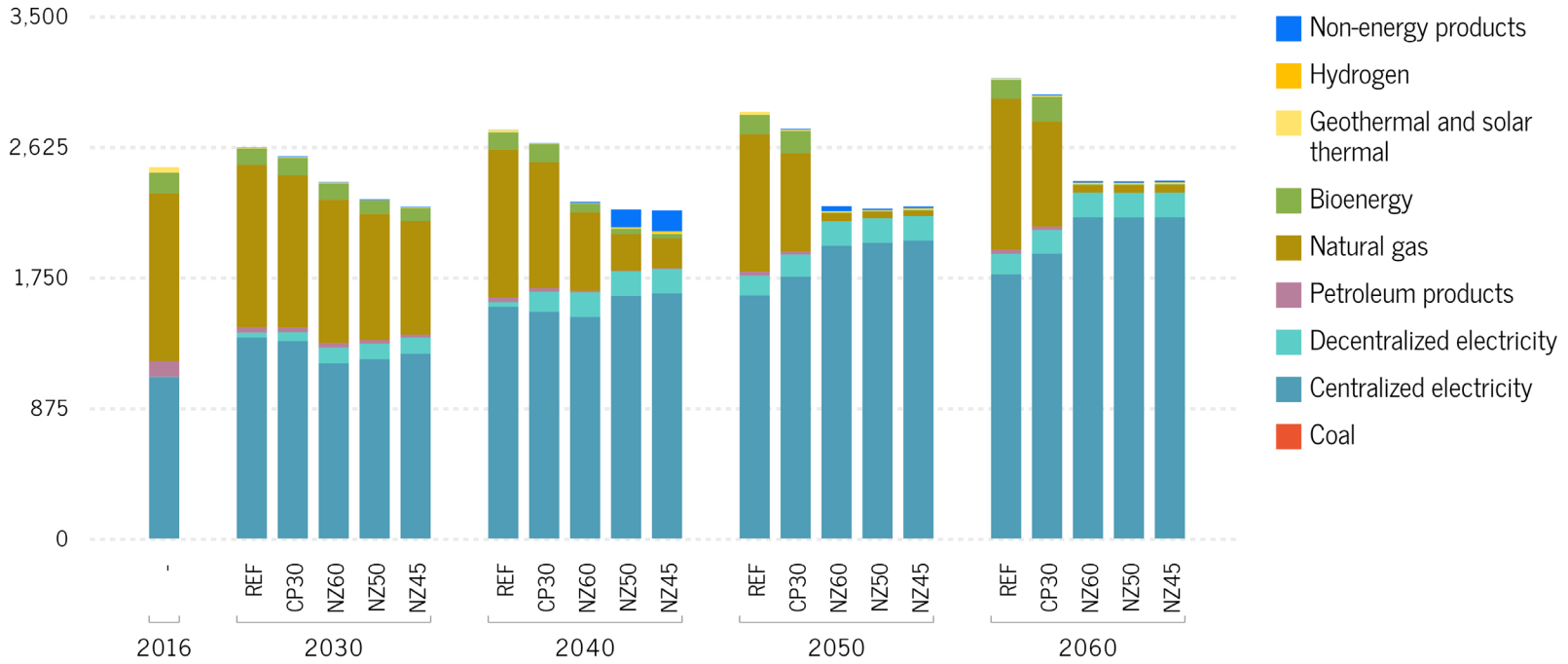
Buildings

- Decarbonizing buildings through electrification represents a low-hanging fruit, but barriers remain
- The commercial sector takes longer to reduce emissions in NZ scenarios

Figure 10 – Energy consumption by source in commercial and residential buildings



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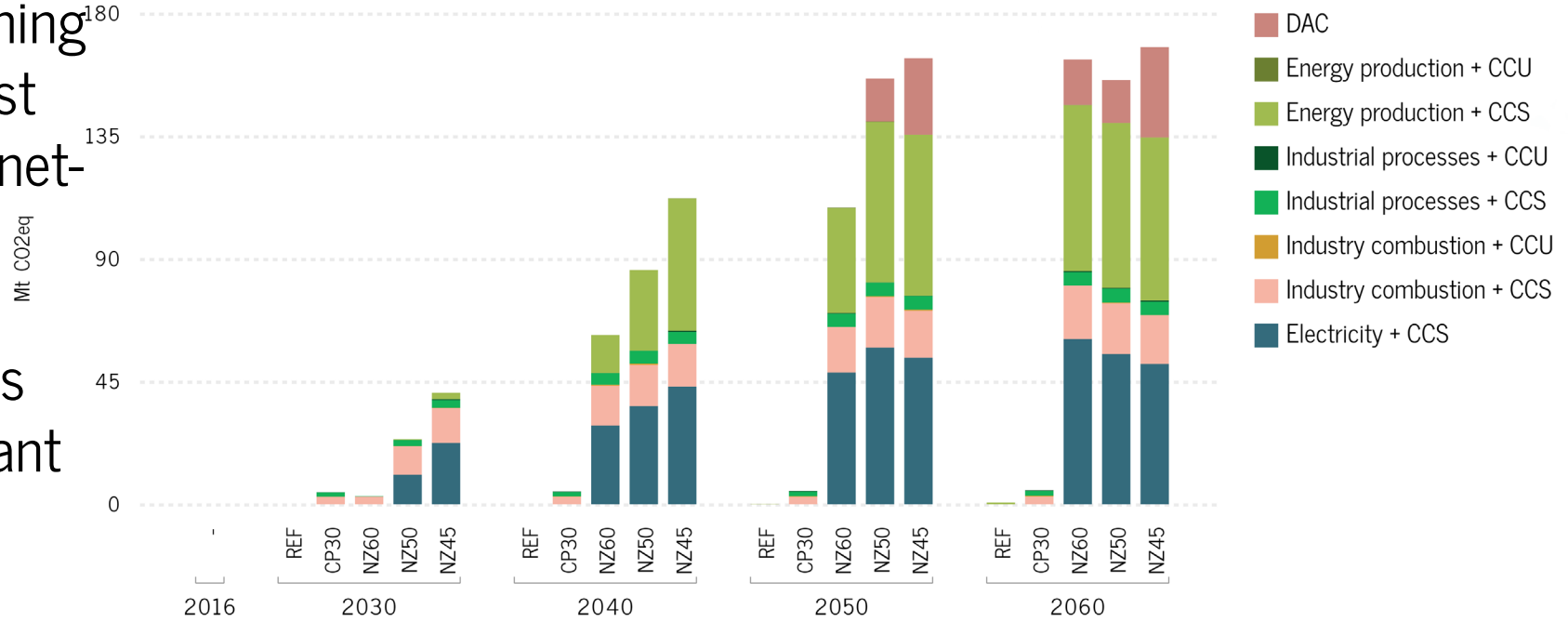
Capturing remaining emissions

- 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



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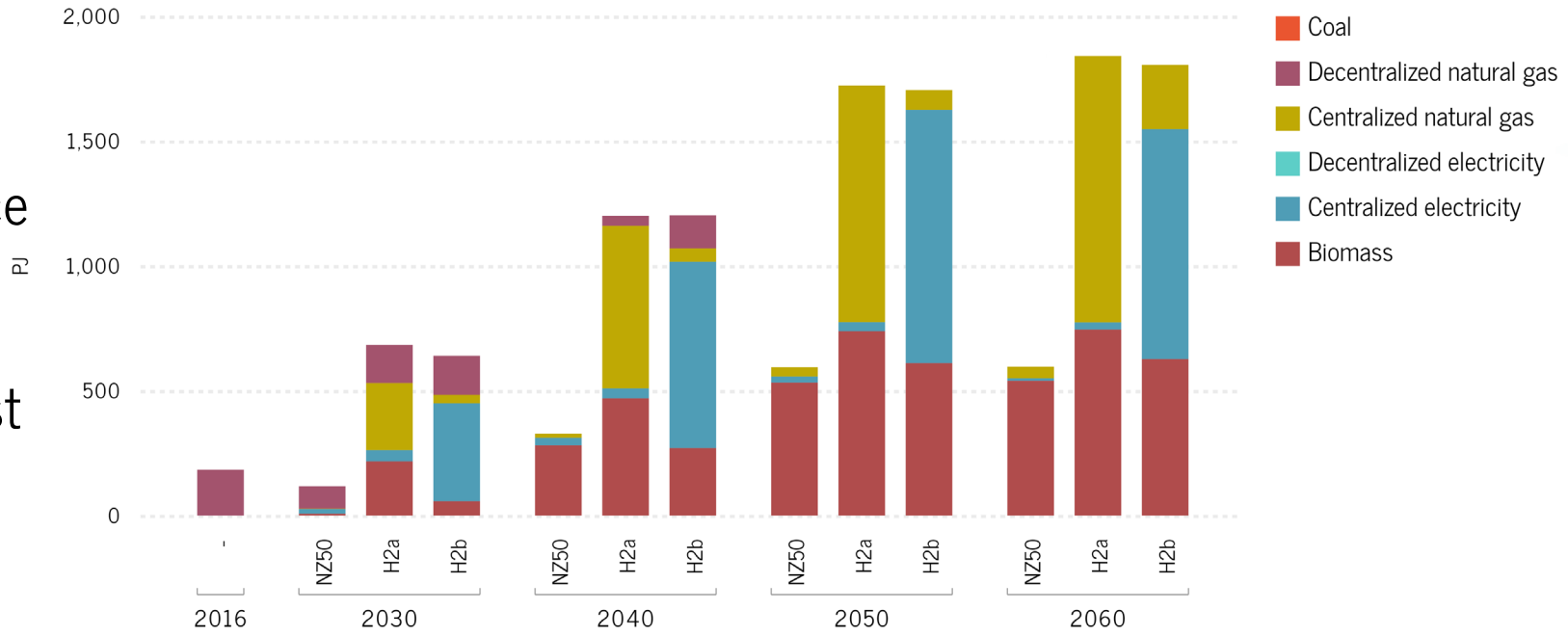
Alternative scenarios (wrt NZ50)	
H2a	Higher penetration of hydrogen in some sectors
H2b	Higher penetration + minimum of H_2 from electrolysis

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

Figure 12 – Hydrogen production by source



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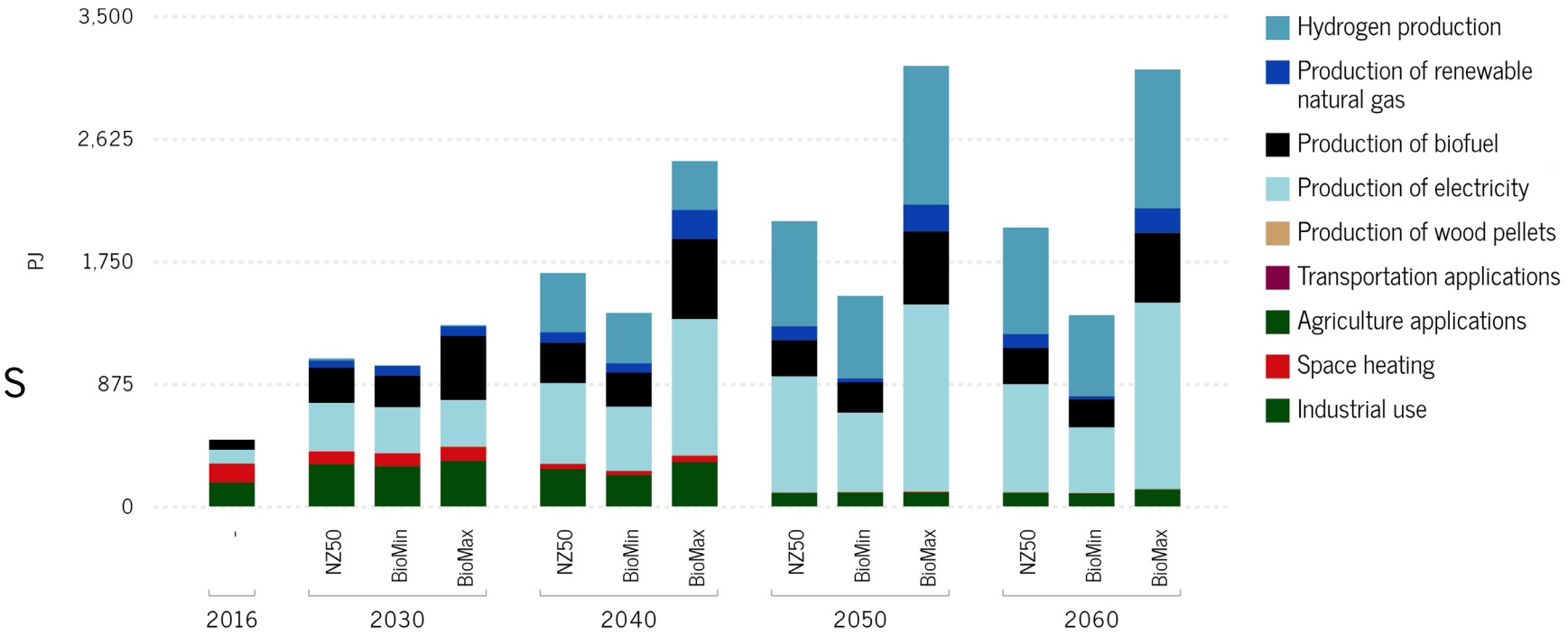
Alternative scenarios (wrt NZ50)	
BioMin	Biomass availability is reduced by 50%
BioMax	Biomass availability is increased by 50%

Sensitivity analysis: biomass availability

- The need for negative emissions makes biomass is key and limited by the availability of feedstocks
- Careful management of this resource should be prioritized if it is to be tapped into

Figure 13 – Biomass consumption by application (NZ50 and alternative scenarios)



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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

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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

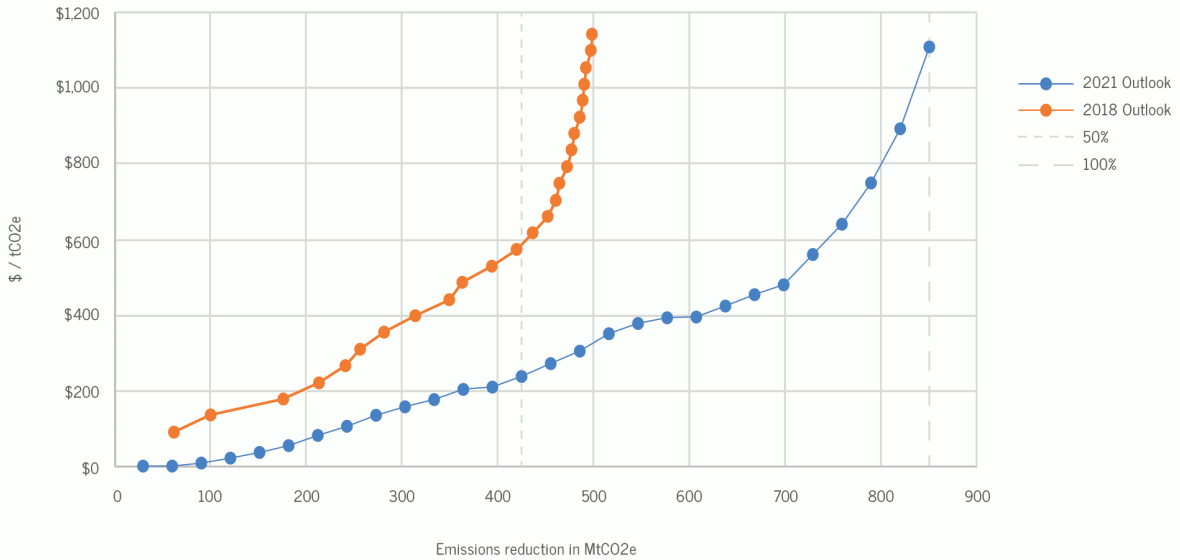
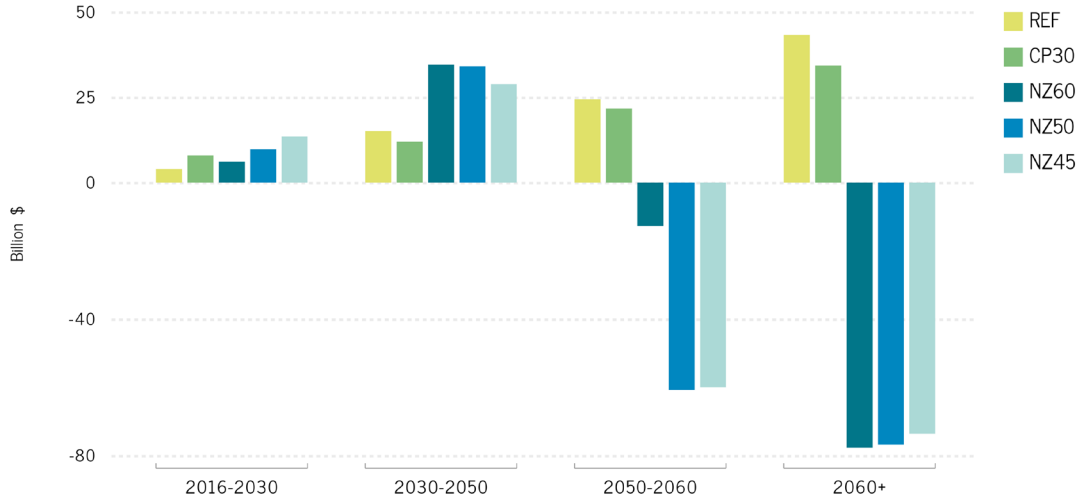


Figure 15 – Net annual costs from electrification



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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.

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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

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Thank you

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