Bioenergy in Canada's Net-Zero Future

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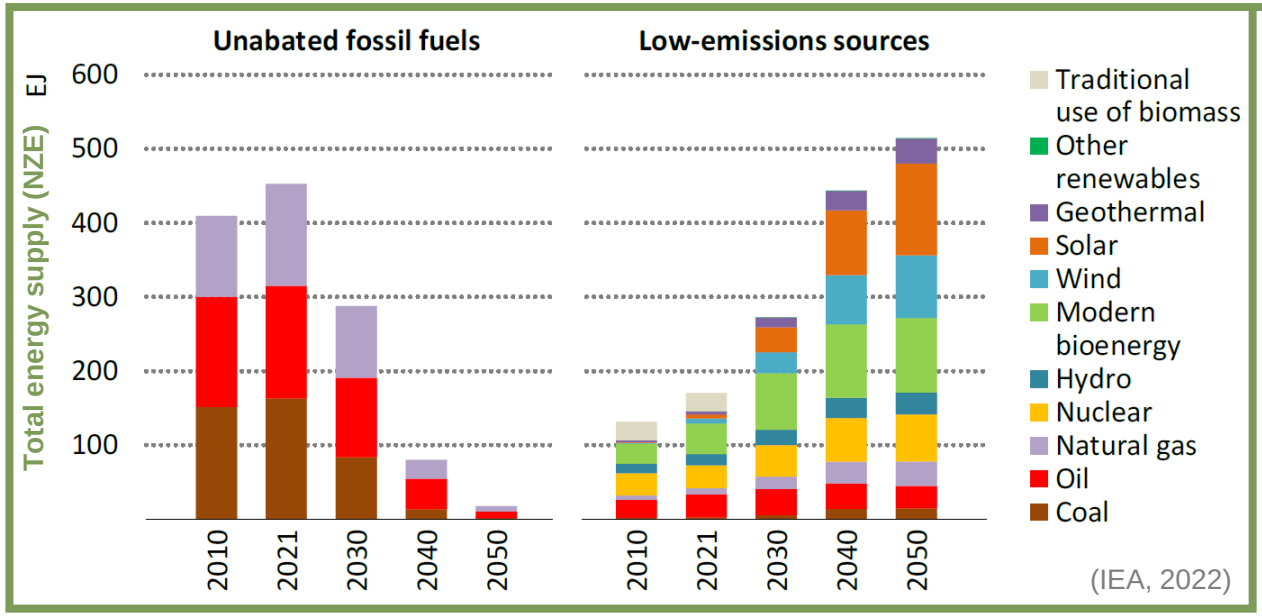
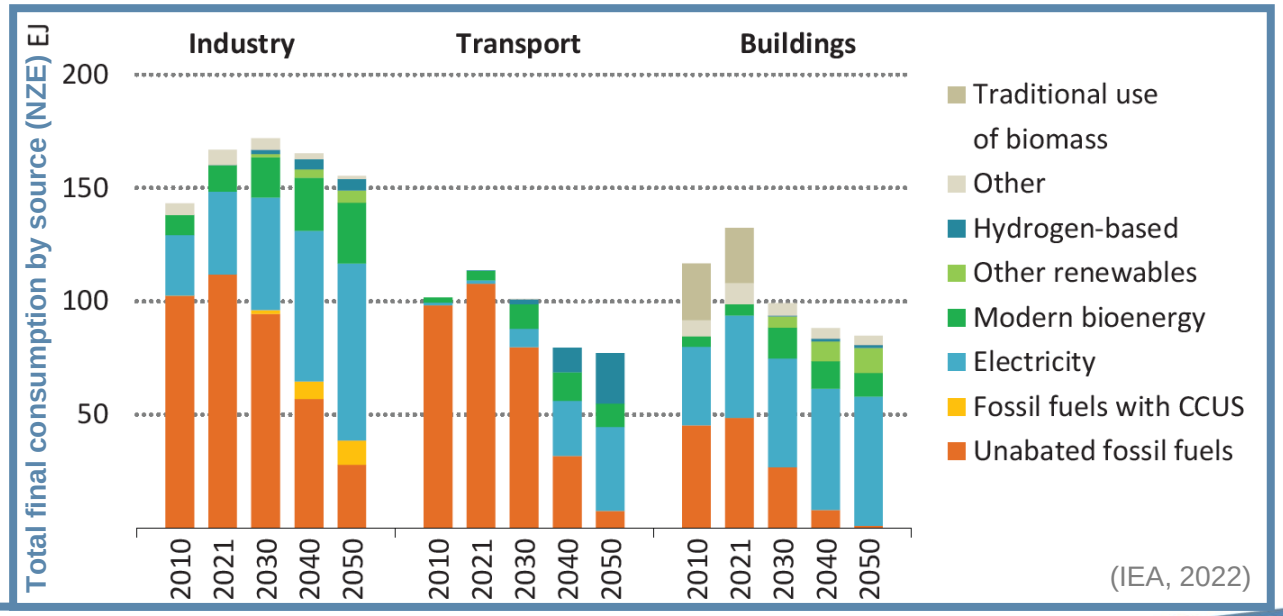
Canada

Global Bioenergy Forecasts to 2050



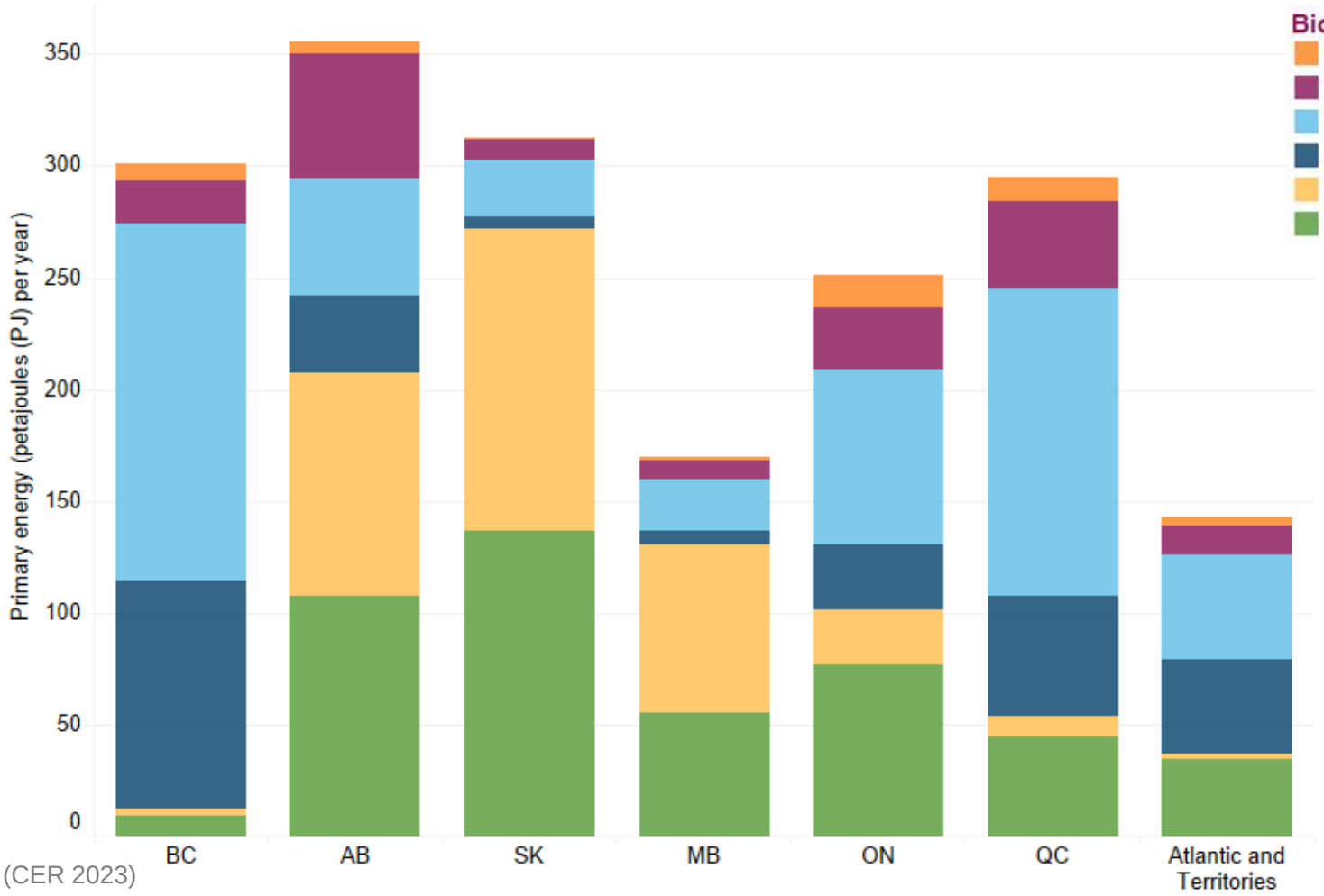
- The traditional use of biomass is phased out as energy access goals are achieved.
- Among low-emissions sources, modern bioenergy increases the most to 2030.

- Modern bioenergy can be used in many applications; including to decarbonize the three most energy intensive sectors.

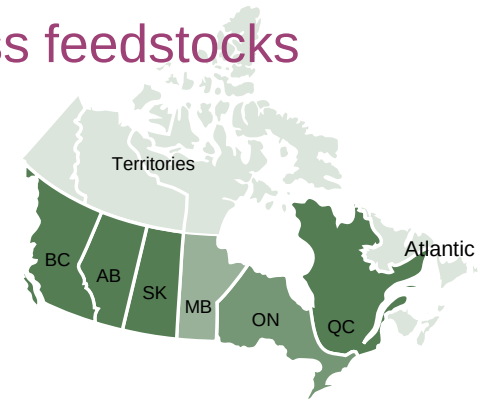


Canadian Biomass Profile by Province

Estimated annual maximum energy potential from currently available biomass feedstocks



(CER 2023)



- Large potential for Canada to leverage bioenergy to achieve climate change goals.
- Canada ranks as the country with the third-largest forest area in the world
- Canada has 6 principal types of biomass feedstocks (note animal fats, animal oils, and waste cooking oil not included).

Expanding Knowledge to Advance Bioenergy

Techno-economic & environmental assessments

Market assessment & utilization in regional contexts

Feedstock availability & delivered cost

Artificial Intelligence

Review modern bioenergy pathways

Modelling & simulation of production pathways

(CEV, 2023)

Multi-Criteria Approach – Weight Factors

Analysis objective: Optimize GHG reductions in industrial facilities, considering technical and economic constraints

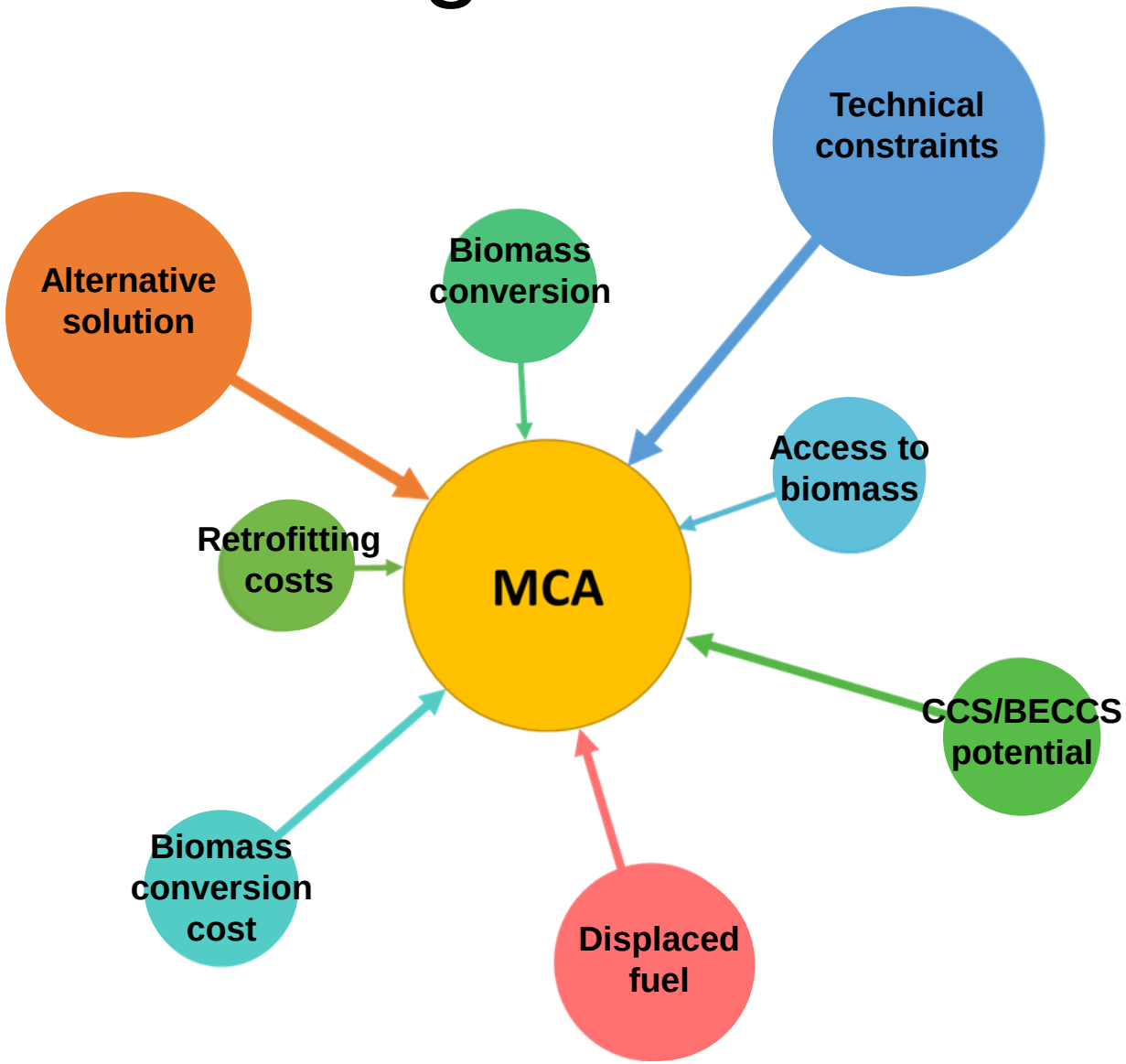
Sensitivity analysis easily completed with different weight factors.

To calculate weight factors:

Conducted survey of experts and determined average weight factors.

Facilitated consensus meeting with leading experts to discuss and refine.

Note: Non-energy applications are excluded from analysis.



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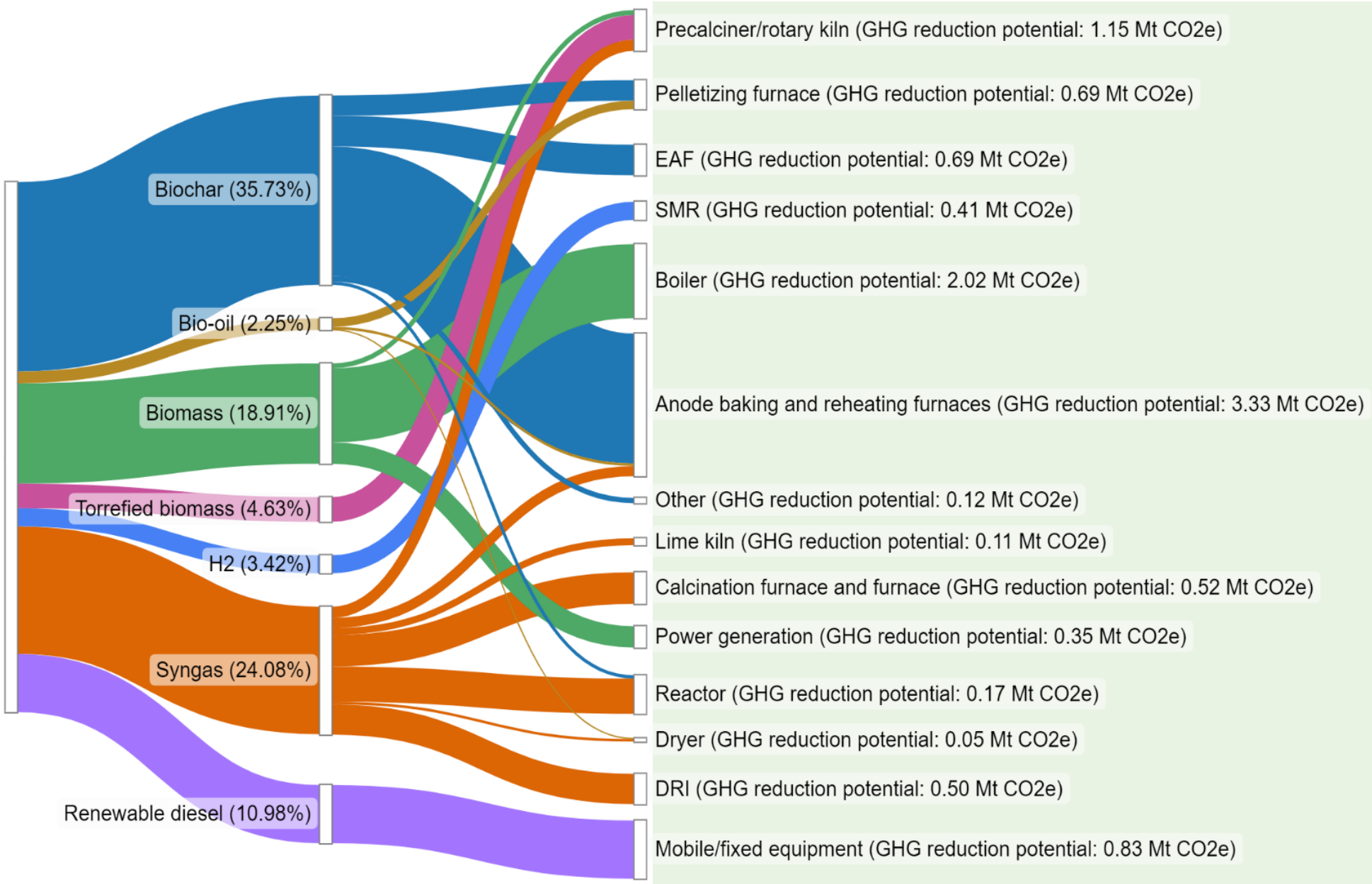
Quebec Case Study: High Impact Uses for Bioenergy

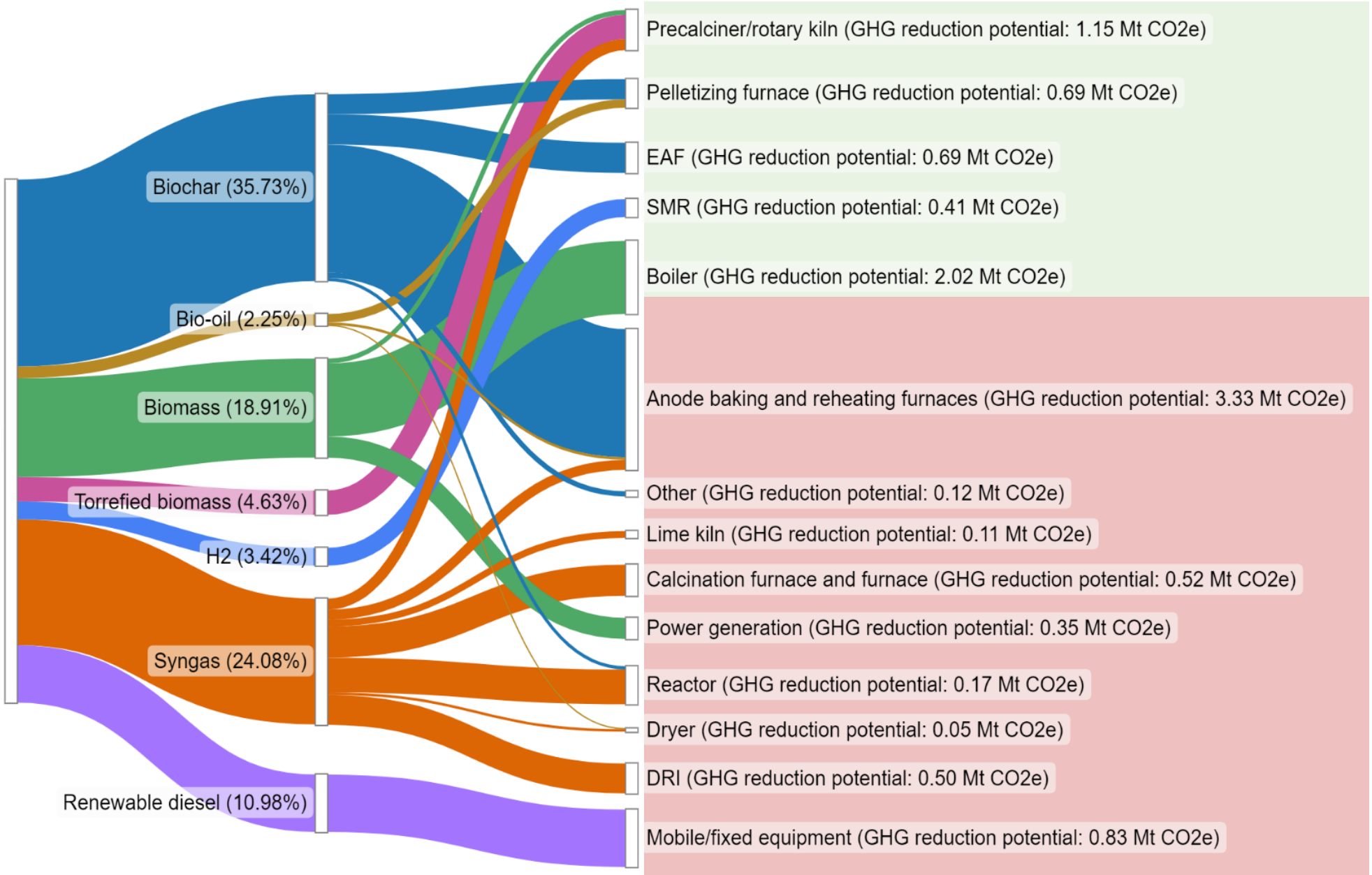


Total biomass demanded per year = 16.11 MODT

Total GHG reduction potential per year = 10.77 Mt CO_2e

(CEV, 2023)

Quebec Case Study: Model Outputs



*Estimated available biomass
= 4.67 MODT (29%)

GHG reduction potential with available biomass
= 3.82 Mt CO_2e (35%)

Summary:

- There is not enough biomass to cover all identified fuel switching projects.
- High-impact GHG reduction applications make best use of low-cost biomass and investment capital.
- Priority order is dependent on specific analysis criteria/objectives.

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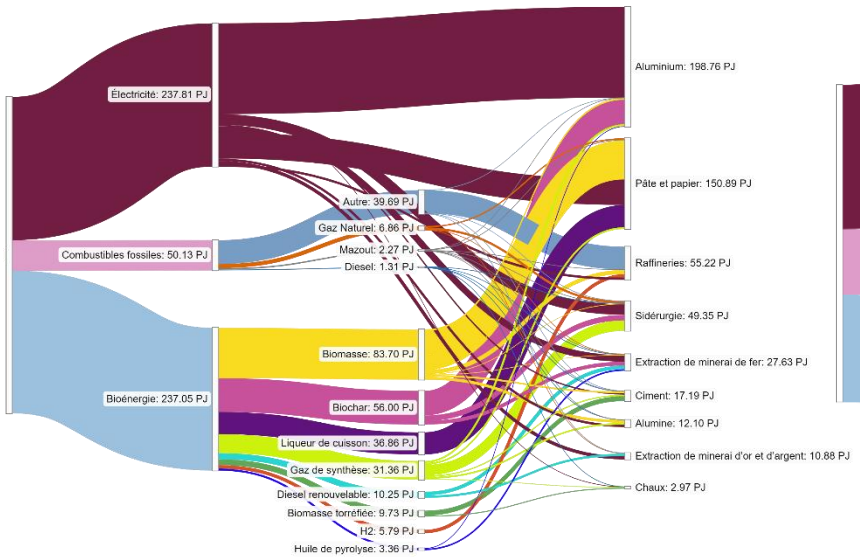
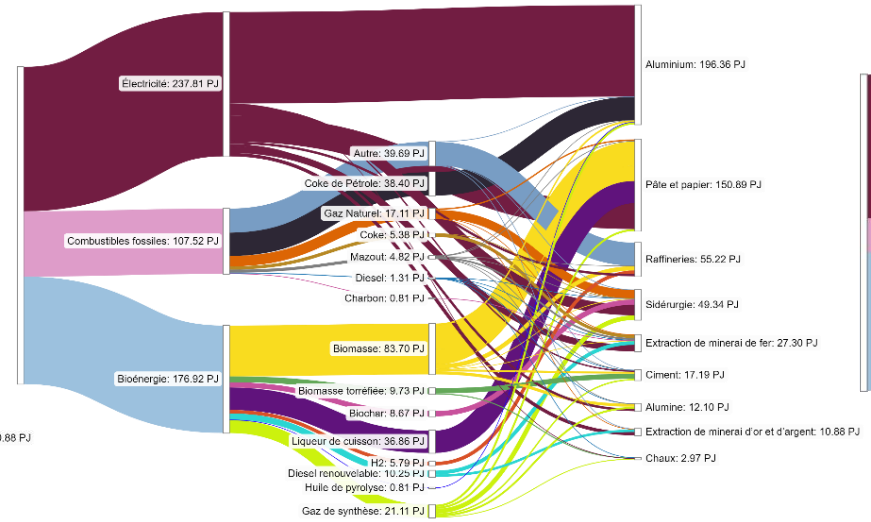
Example Scenario Analysis

Energy consumption after substitution of fossil fuel by bioenergy

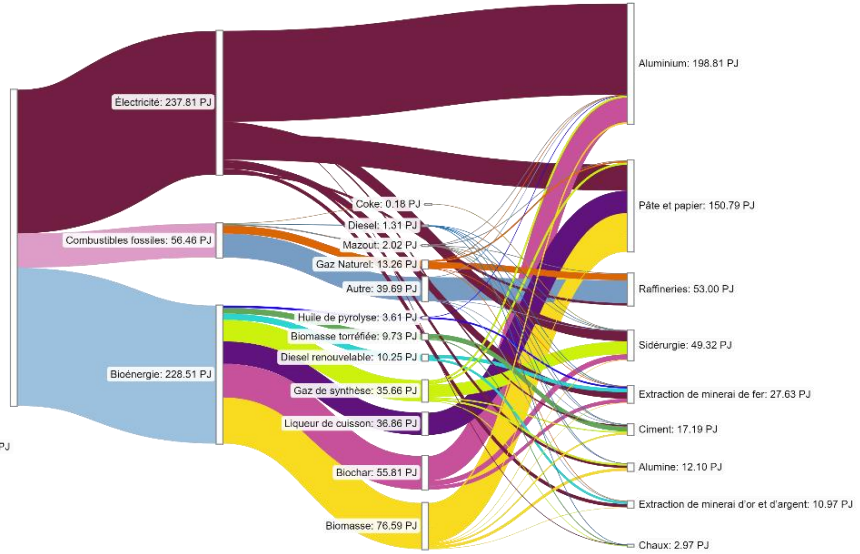
1- Maximizing GHG Reductions



2- Compatibility with BECCS



3- Optimistic Technology View



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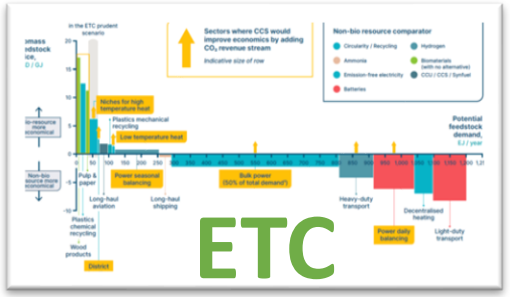
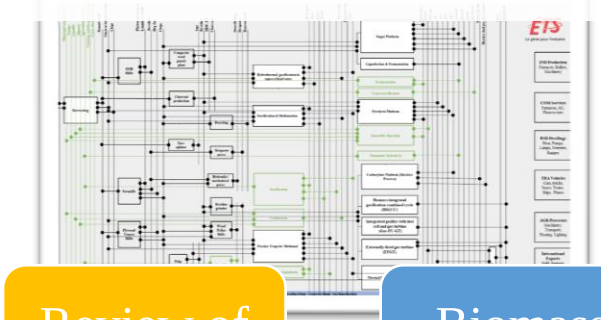
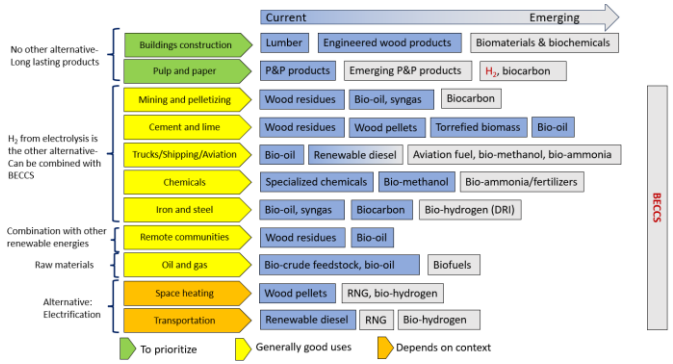
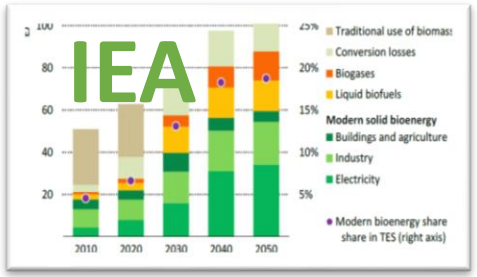
CEV Approach: Order of Merit/Ladder









Review of Net Zero Studies

Biomass Conversion Tool

E3 + LCA Models

Multi-Criteria Analysis

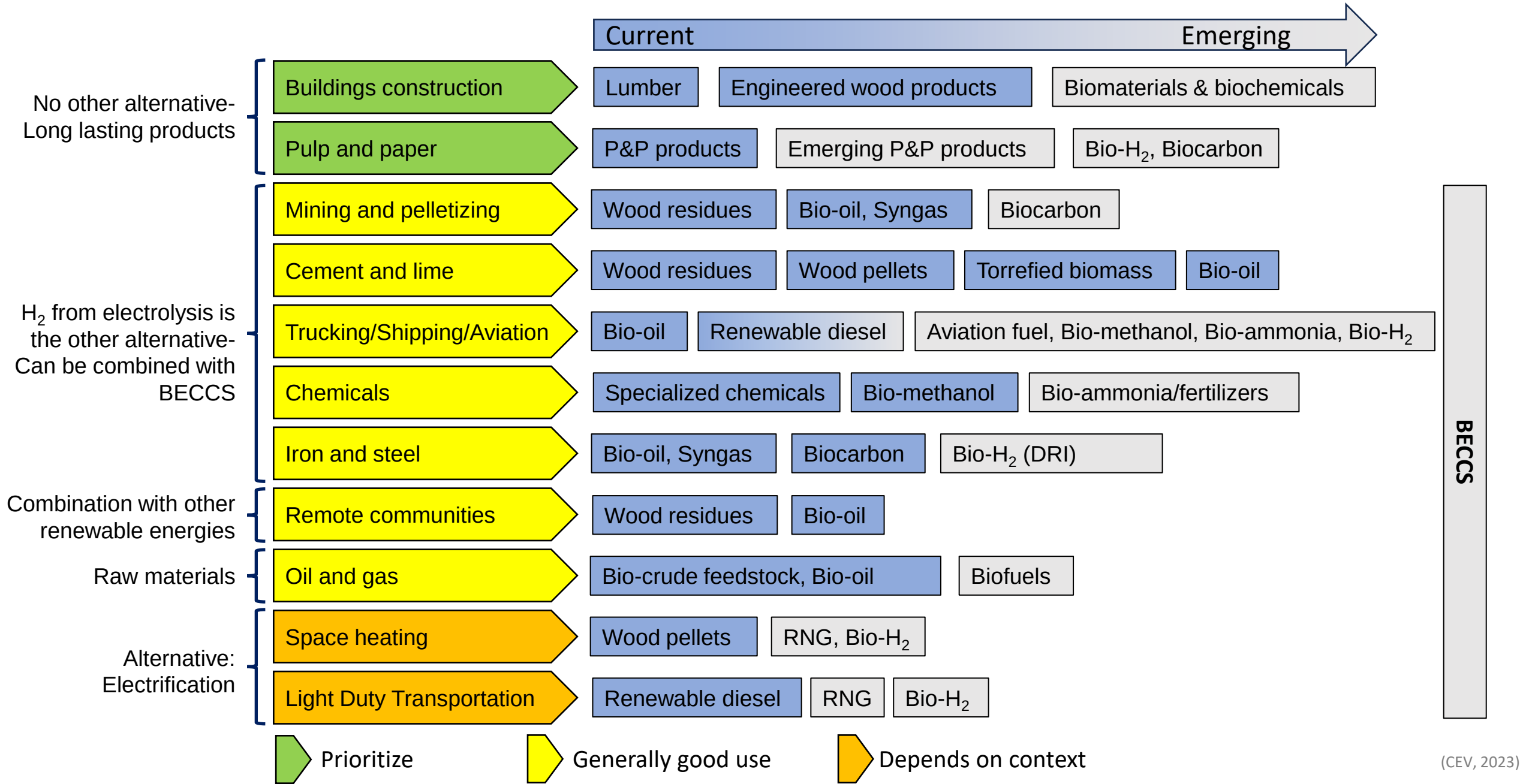
Industrial Case Studies

Order of Merit

CADSIM and ASPEN Simulations

(CEV, 2023)

Order of Merit: Industrial Decarbonization



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Works Cited

- Canada Energy Regulator (CER). (2023). Market Snapshot: Canada's Bioenergy Diversity and Potential. Retrieved from https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2023/market-snapshot-canada-bioenergy-diversity-potential.html
- CanmetÉNERGIE Varennes (CEV). (2023). Industrial Decarbonization Strategic Plan.
- IEA. (2022). World Energy Outlook 2022. Retrieved from https://www.iea.org/reports/world-energy-outlook-2022