BioEnergy with CCS (BECCS)

Canada's Greatest Climate ~~Opportunity~~ Imperative

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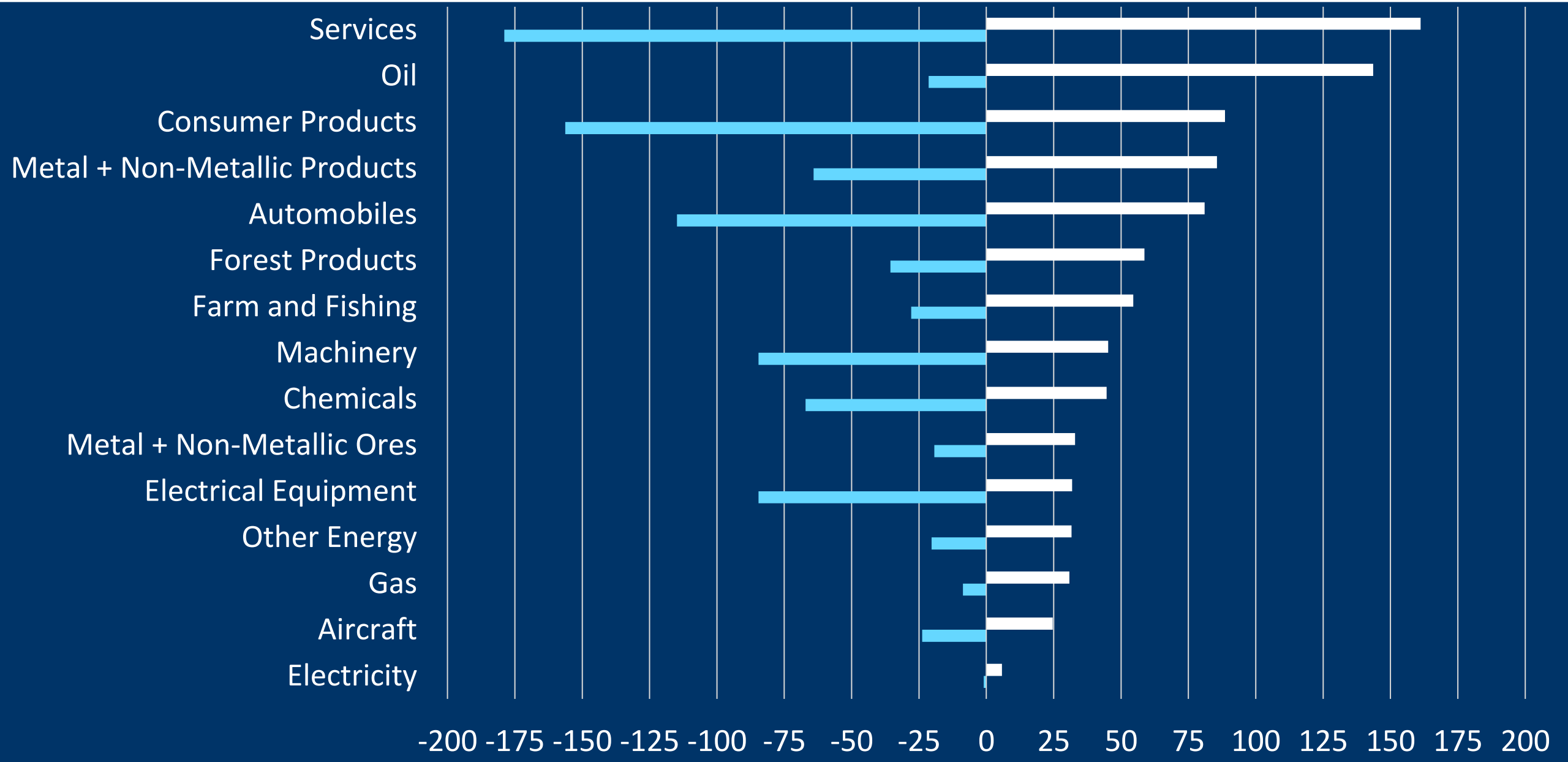
Trade in Canada (C$ B)



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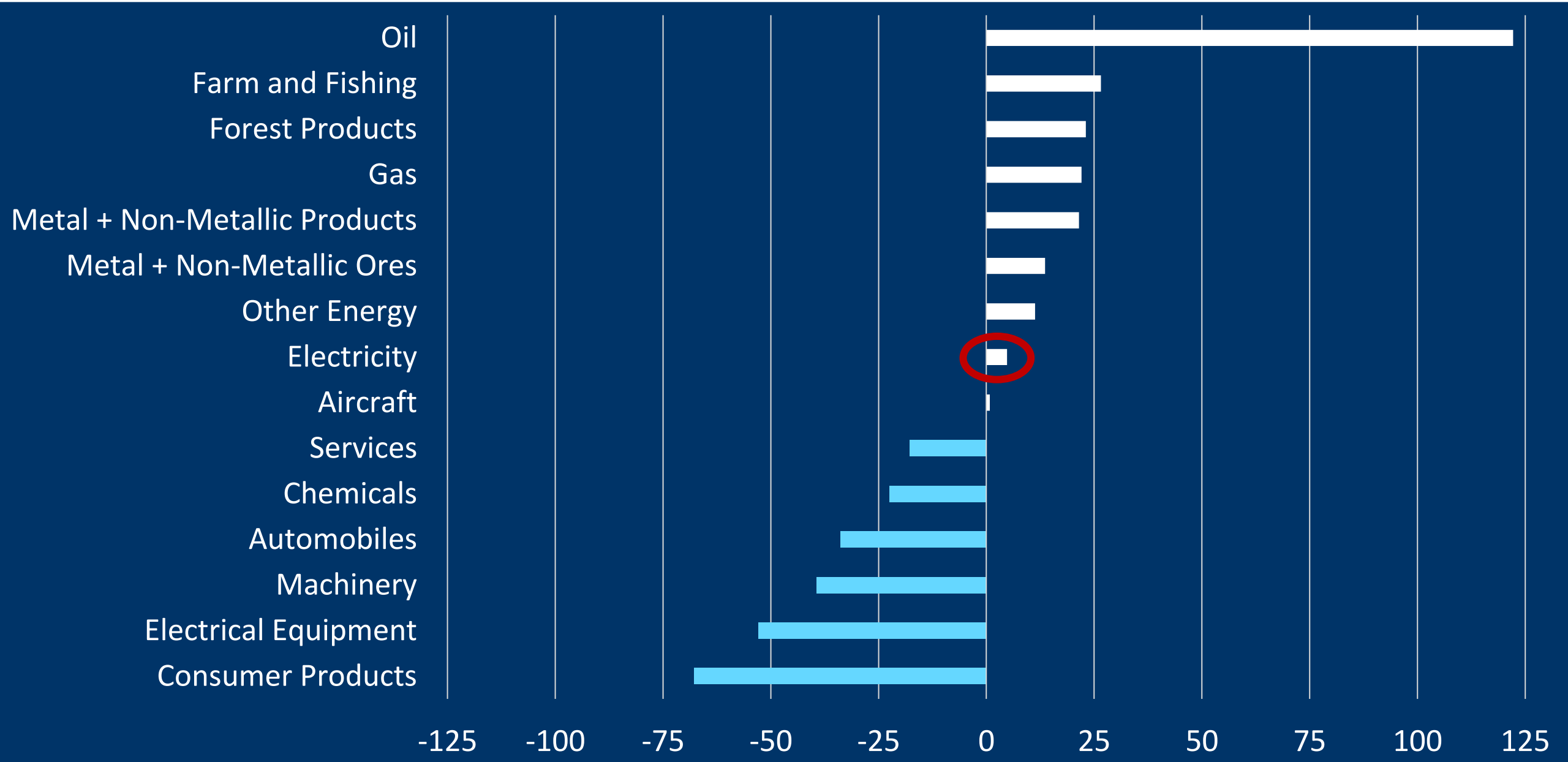
Balance of Trade in Canada (C$ B)



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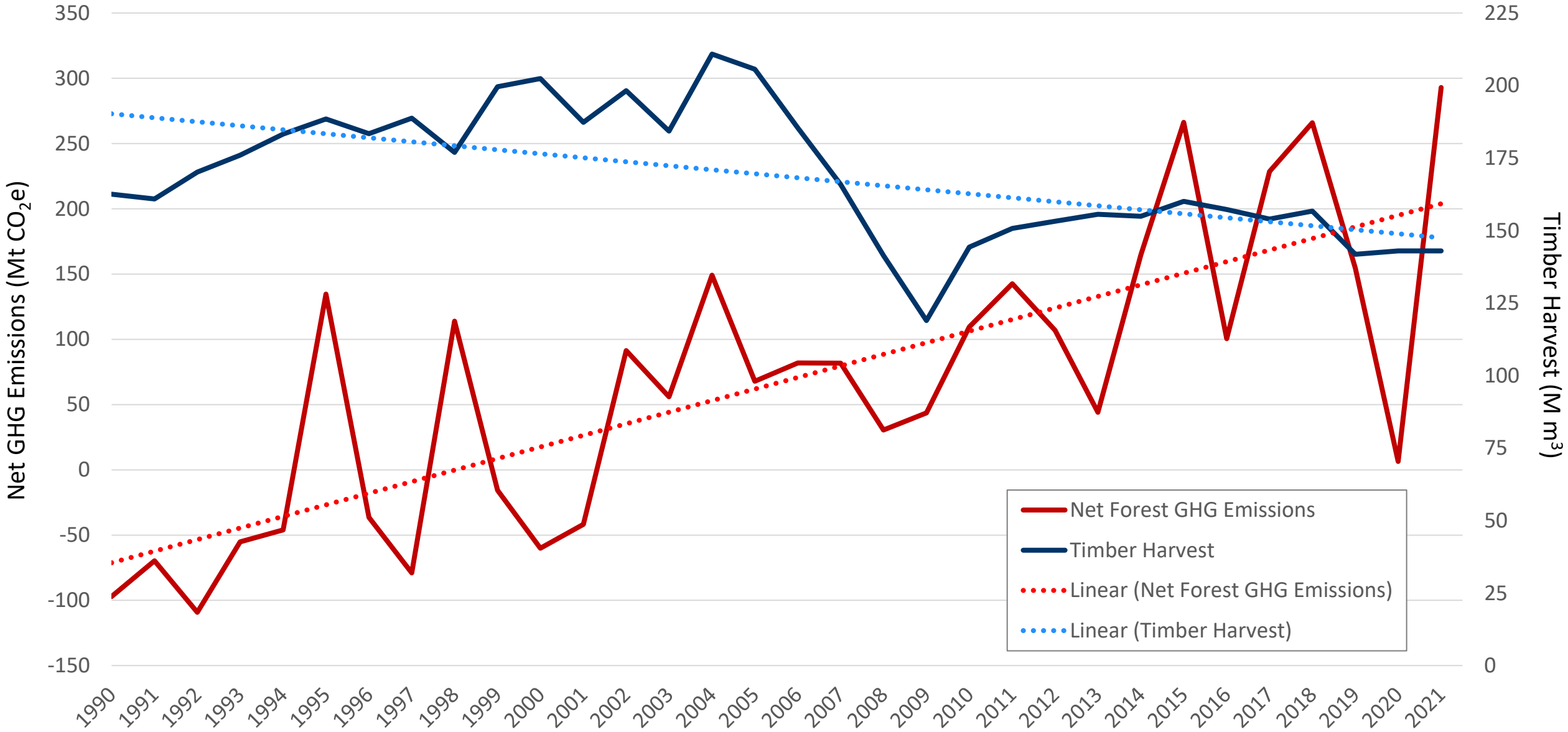
GHGs from Canada's Forests Vs. Timber Harvest



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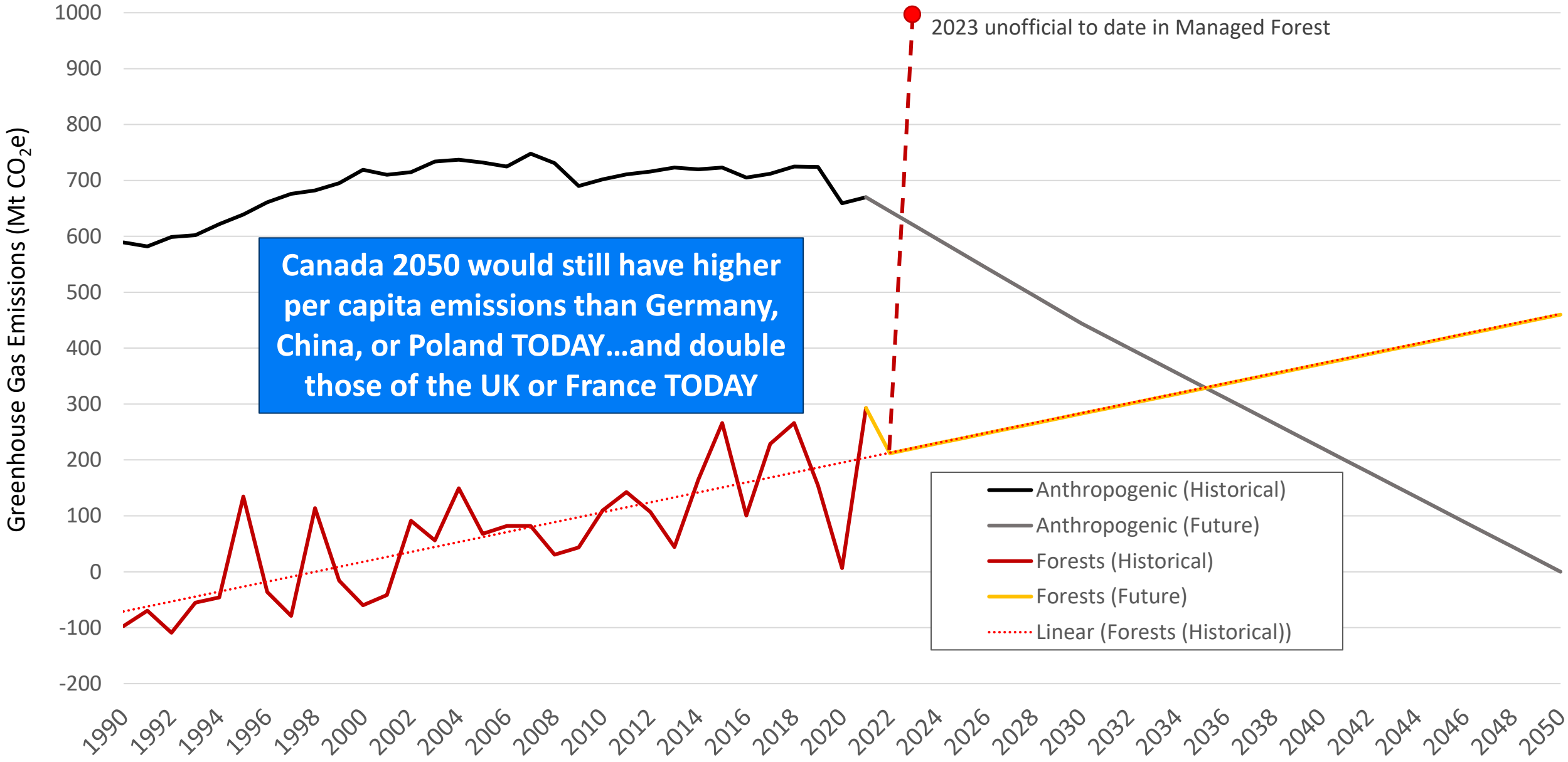
Human Vs. Forest Emissions



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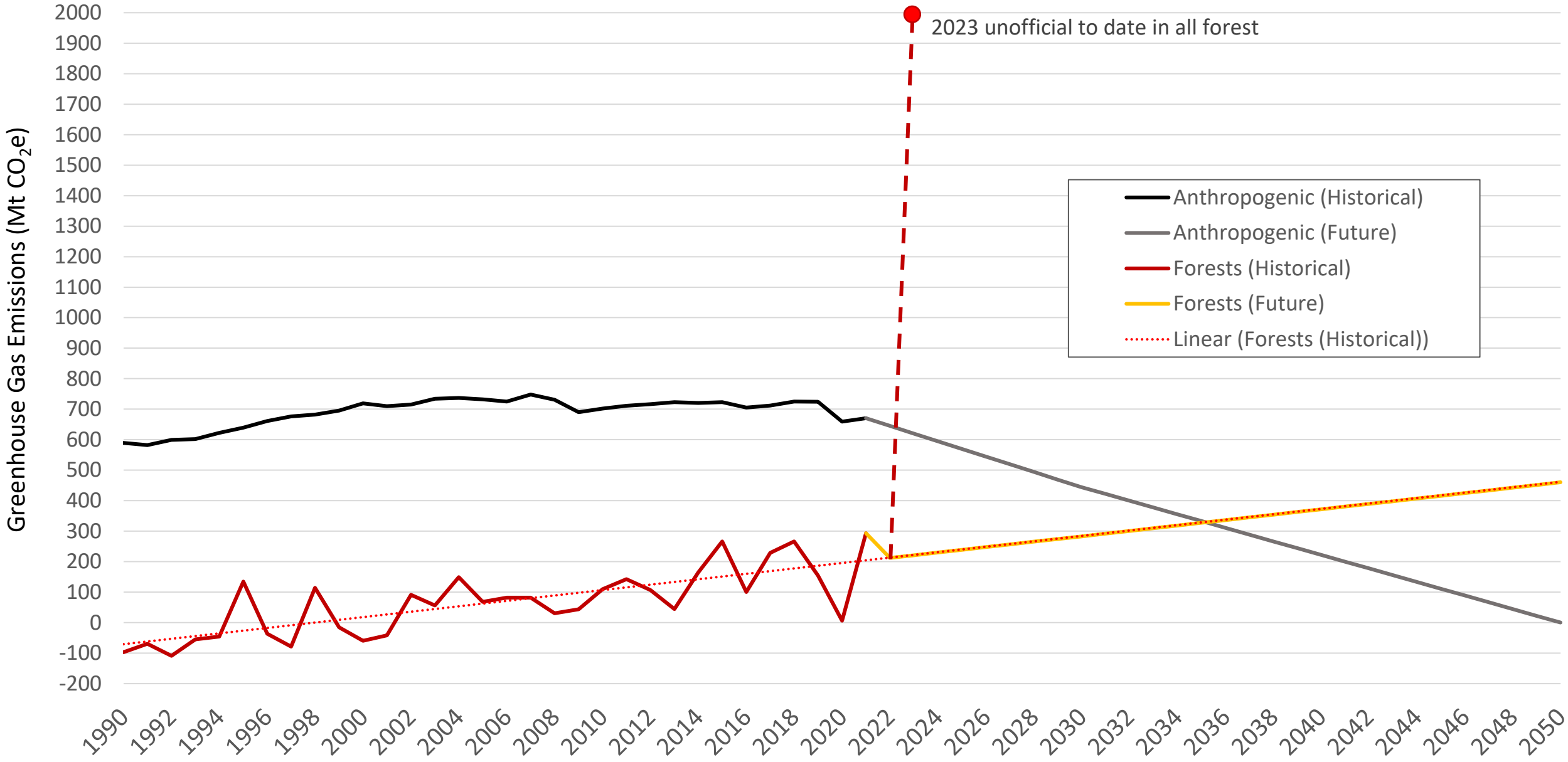
Human Vs. Forest Emissions



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Public Carbon

Public GHG Emissions

Public Air Pollution

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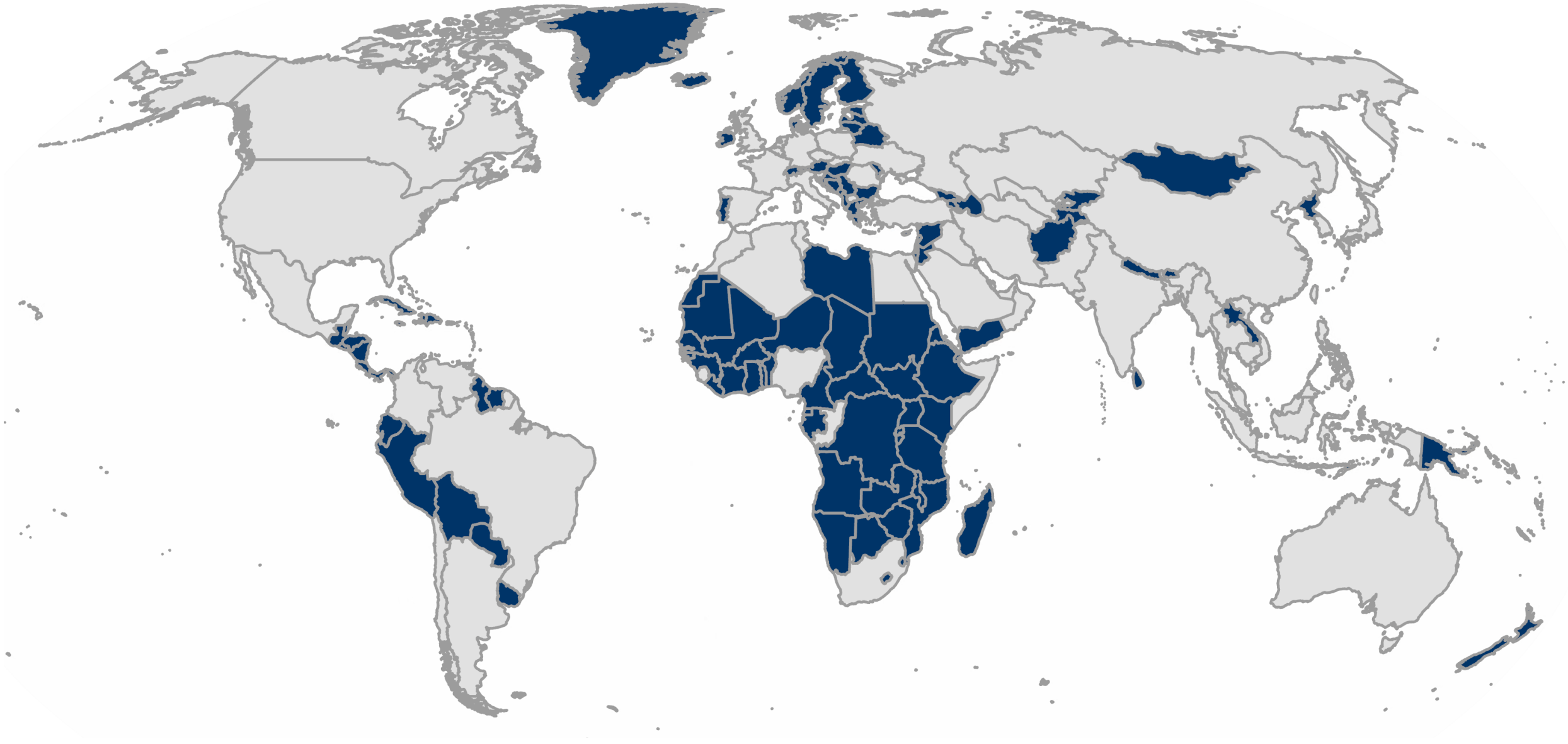
More than 138 Countries



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83% of EU Emissions

Wildfire Rate (per Ha)

Canada vs Sweden

50

Per Capita GHG (incl. Forests)

Canada = 68

Sweden = 0.7

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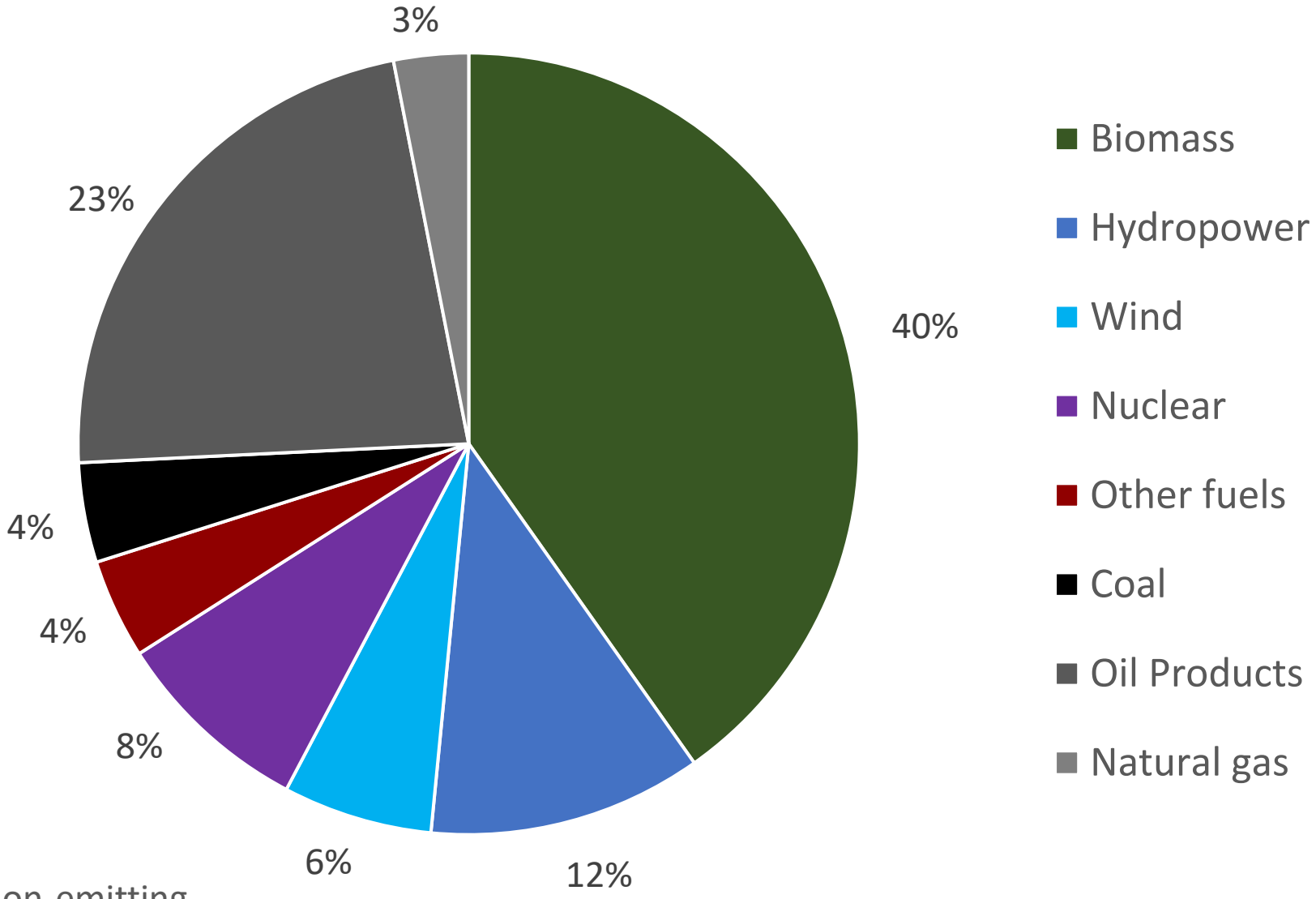
Harvest Rate

Sweden/Canada = 7

CA: Harvest <3.9% of growth

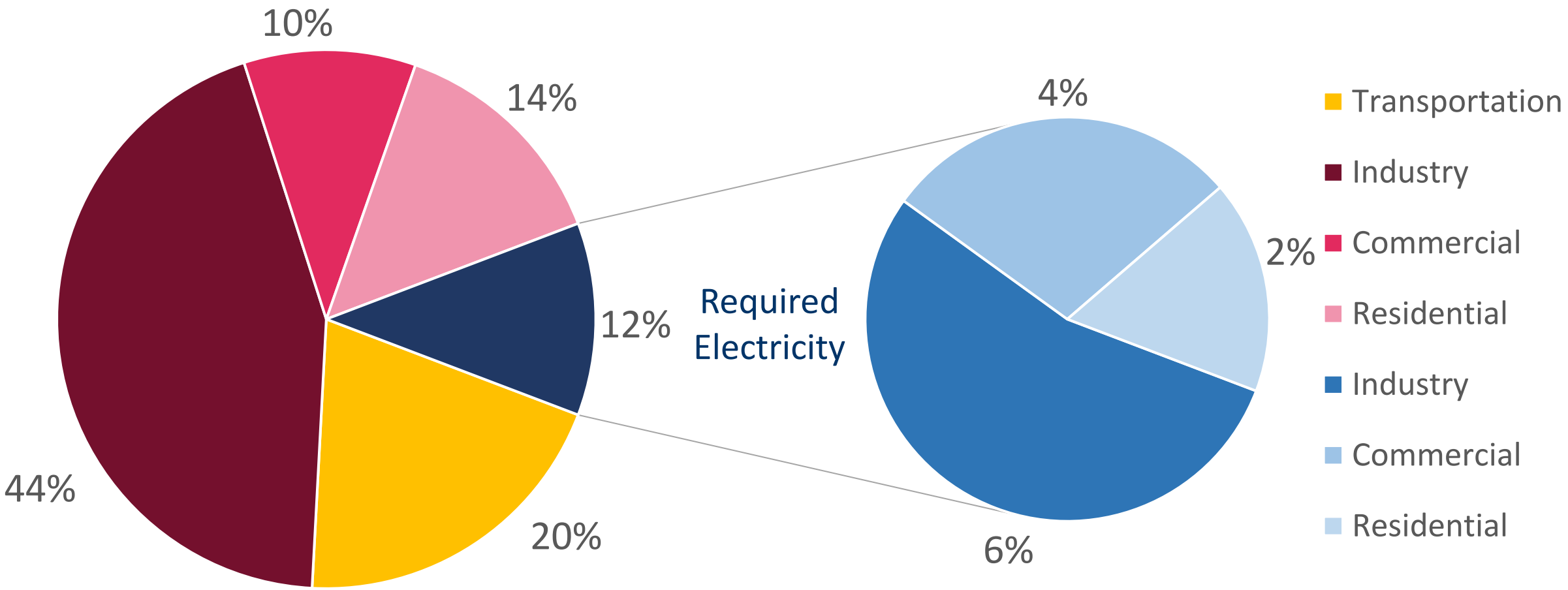
Δ = 1,000 Mt CO_2/yr

Energy Consumption in Sweden



- 58% renewable energy, 65% non-emitting

Energy Demand in Canada



- **<u>Thermal energy (red shades)</u>** is approximately 60-65% of Canada's energy demand
- Excluding existing electrical heating, electricity (blue shades) is 12% of Canada's energy demand
- Heating residential buildings requires more energy than ALL of Canada's electricity demand

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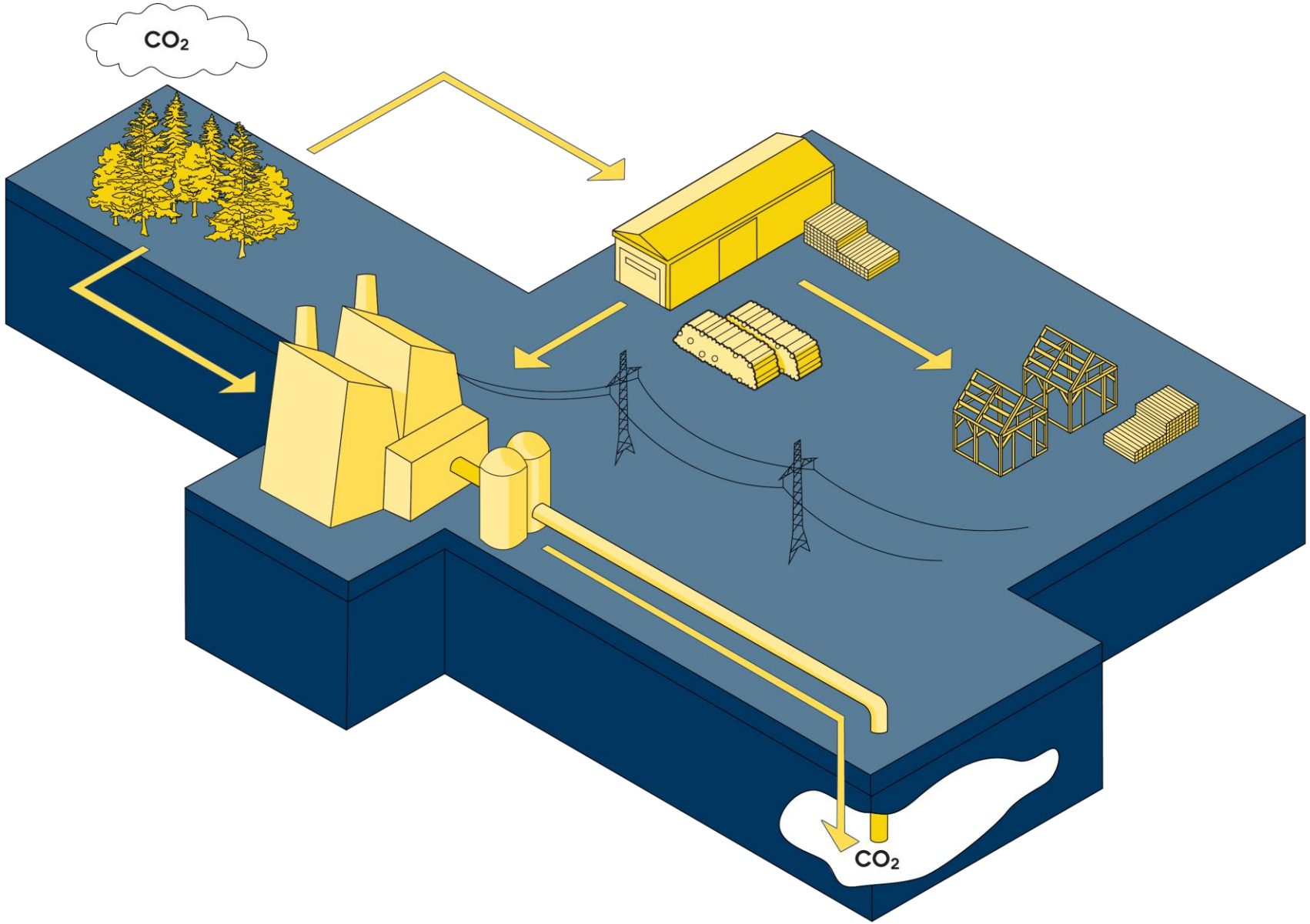
Bioenergy Carbon Capture & Storage

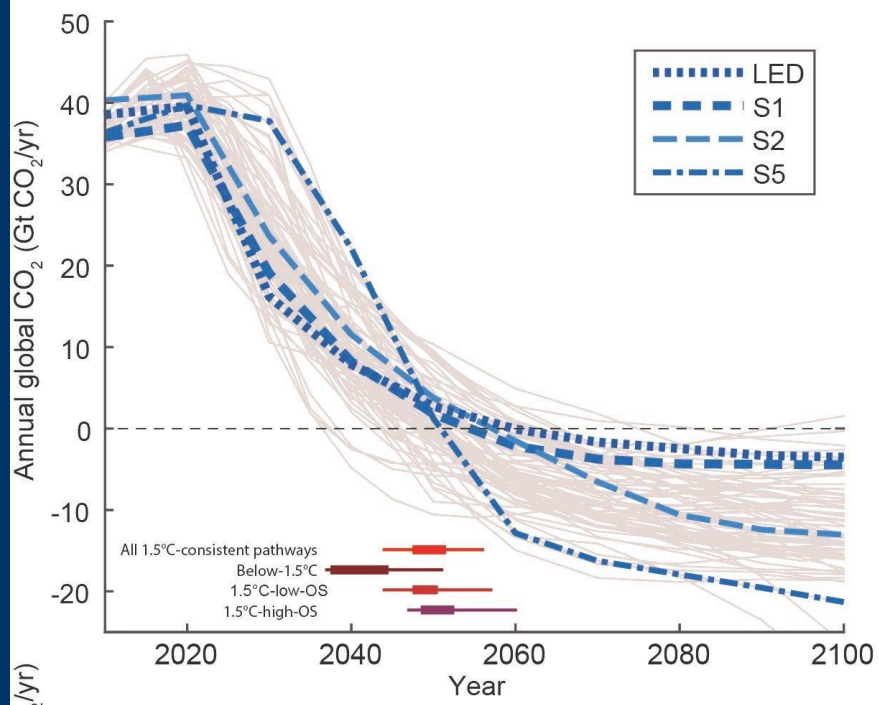


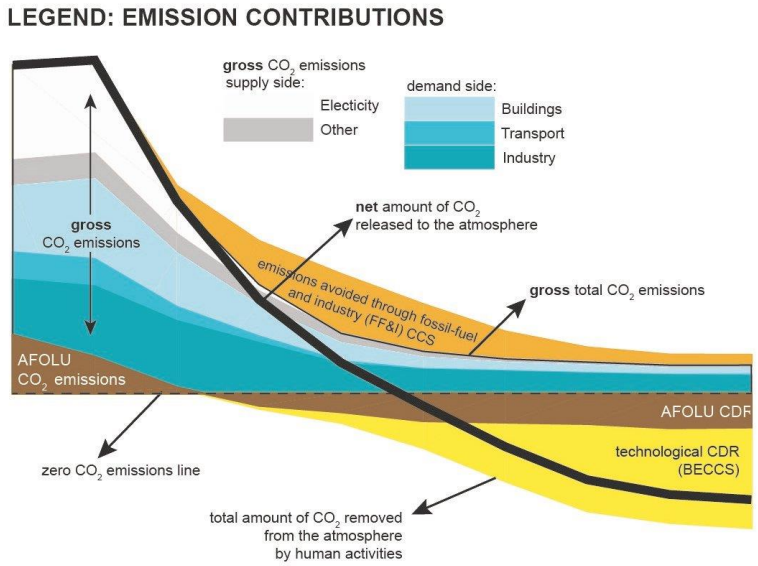
BECCS

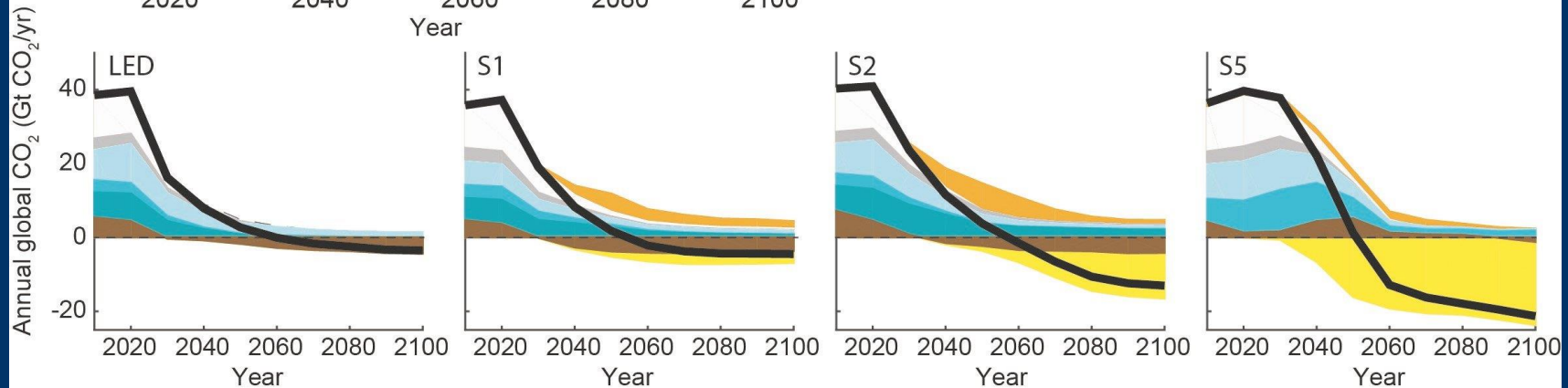
- Lowest cost for CDRs (negative emissions)
- 4 decarbonizations:
    1. Electricity
    2. Heat
    3. Hard-to-abate (CDR)
    4. Avoided wildfires
- 3+ sources of revenue
- Carbon Dioxide Removals are an EXPORT product
- 6x the GHG reduction per tonne of wood as SAF

BECCS is Required to Meet Climate Goals

IPCC Mitigation Pathways Compatible with 1.5 C







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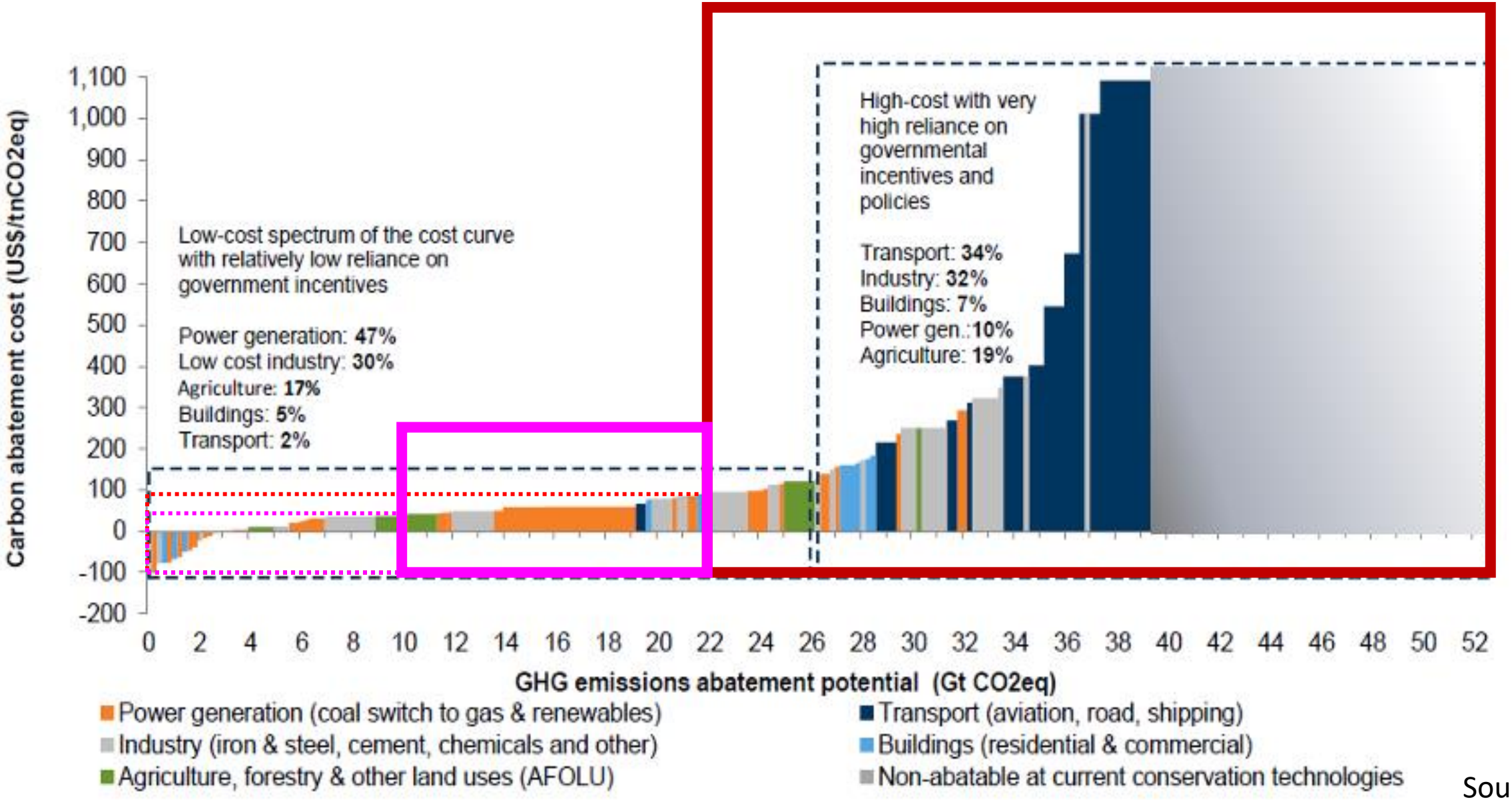
Cost Abatement Curve



Source: GS

BECCS in Other Countries

Klemetsrud WtE Plant, Norway

- Part of Longship/Northern Lights
- Capture being added to waste-to-energy plant heating Oslo
- Shell Cansolv
- Under construction
- 400 kt CO_2/yr, North Sea storage
- Pilot plant and FEED showed technical viability

Mikawa Biomass Power, Japan

- 50 MW_e BECCS demonstration plant owned by Toshiba
- Operational

Avedøre Biomass Plant, Denmark

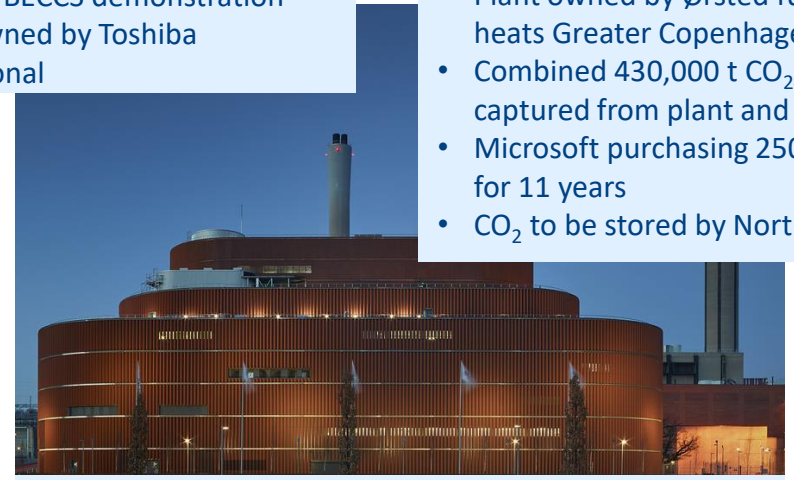
- Plant owned by Ørsted fueled by straw heats Greater Copenhagen
- Combined 430,000 t CO_2/yr to be captured from plant and Kalundborg CHP
- Microsoft purchasing 250,000 t CDR/yr for 11 years
- CO_2 to be stored by Northern Lights

Drax Power Plant, UK

- 4,000 MW pulverized coal power plant fuel switched to wood pellets (8-9 Mt/yr)
- Formerly largest GHG emitter in Europe
- Plan to initially add capture (MHI) to 2 of 6 units
- 8 Mt CO_2/yr (2 units), North Sea storage
- >$20 M FEED underway (Worley, MHI)
- MHI operated pilot plant at site to test flue gas

PT Tanjungenim Lestari Pulp & Paper, ID

- Pertamina and Marubeni (TELPP owner) partnering to develop BECCS plant at Kraft pulp mill in Indonesia (Sumatra)



KVV8 Biomass CHP, Stockholm

- Wood chip-fuelled plant heating Stockholm via district energy system owned by Stockholm Exergi
- Plan to add capture (hot potassium capture by Capsol); pilot plant operated for multiple years
- >$250 M in EU grant funding
- 800 kt CO_2/yr, North Sea storage via Northern Lights
- FEED study complete, 2026 commissioning planned

Mönsterås Pulp and Paper, Sweden

- Njord Carbon partnership on BECCS between Equinor, Södra (major forest products company), and Verdane (Nordic private equity firm)
- Södra owns three pulp mills, with Mönsterås the largest (~2 Mt CO_2/yr)
- CO_2 shipping via Northern Lights

Canada Energy Regulator

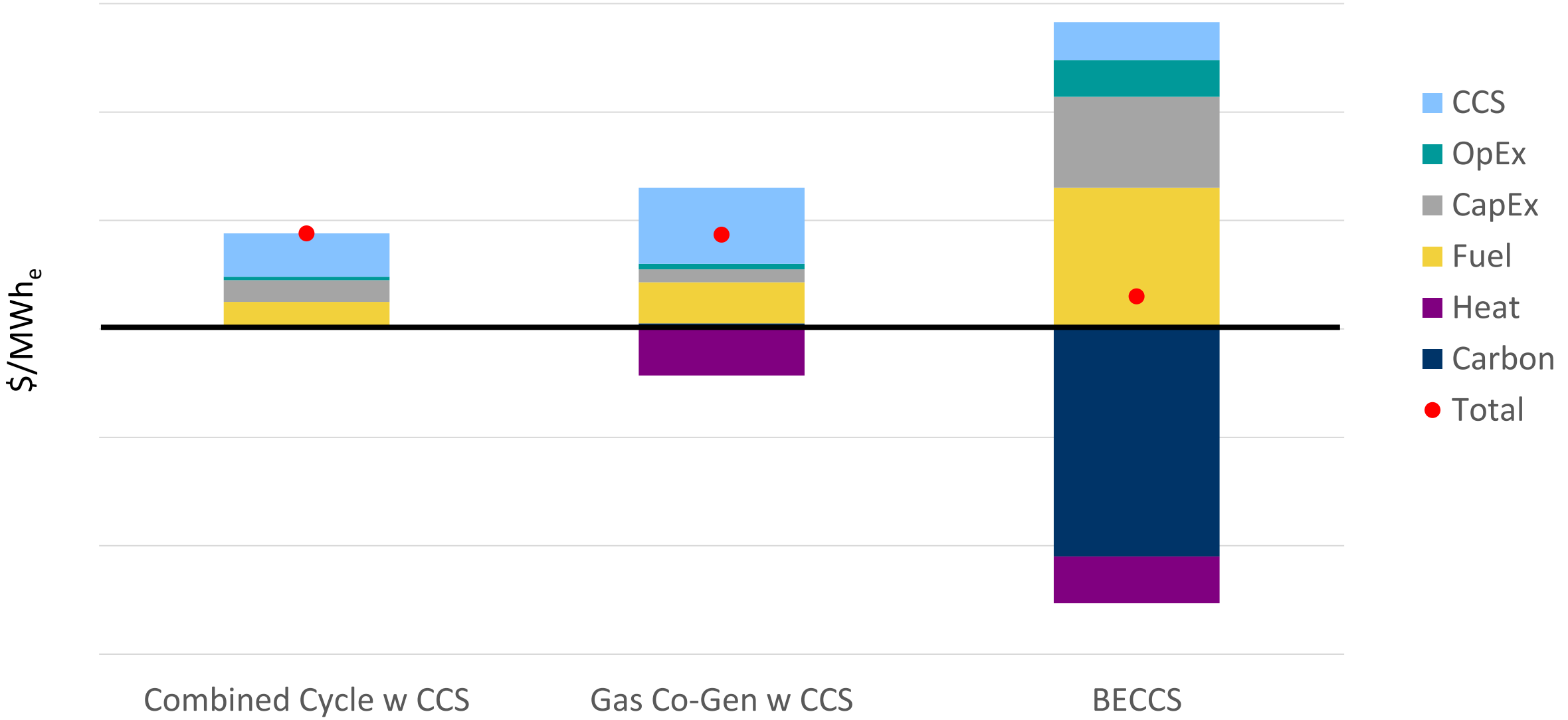
- No Net Zero Grid without BECCS
- In 2050 Global Net Zero, biopower is:
  - #1 source of electricity in Saskatchewan
  - #2 source of electricity in Alberta
- Modelled limit is biomass supply, not cost
- Artificial constraints on biomass supply and CO_2 storage

Canada Energy Regulator

"As the carbon price increases, biomass CCS units become a negative cost generation option, where its average cost of production in 2050 is -$85/MWh. Therefore, biomass CCS partially displaces all other generation technologies in Alberta and Saskatchewan."

* Only AB & SK modelled as having CO_2 storage capacity

Multiple Products = Economic Viability



Co-Development of Canada's First BECCS Project

ROCKY MOUNTAIN CARBON

- 1.4 Mt CO_2/yr of carbon dioxide removals (CDRs)
- $16 M FEED study funded by governments & partners
- CO_2 storage rights Alberta secured – RMC Vault
- Commercial capture, compression, storage technology
- CDR monetization required for FID
- www.rockymountaincarbon.com

VAULT 44.01

West Fraser

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