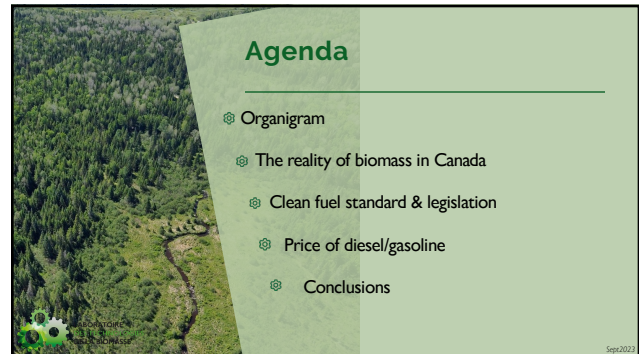
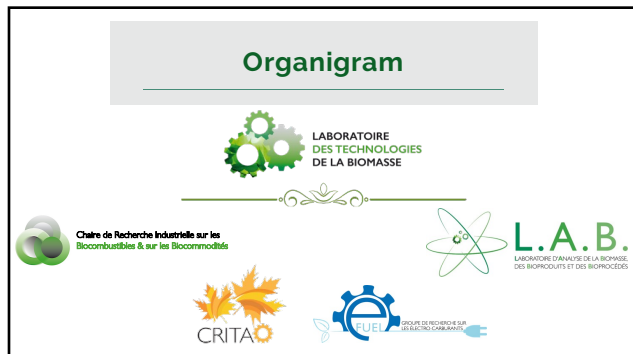


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The industrial players

- Some industries need to transport available cheap biomass on HUNDREDS of km in order to supply their existing factories
- If potential biorefineries were to take residues in the forest it would probably not be such a problem.
- However getting the residues in the forest might be more expensive than competing with the actual biomass supply chain.
- Leading to the most important question – what could a biorefinery afford has a price for their biomass?

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The 3 pillars

- Clean fuel standard (how much biorefineries will get has subsidies from the government)
Funding will come both from federal and provincial government in Canada (at least in Qc). When this study was made it could go up to 0.50 to 0.56CAD per liter of green diesel produced
- The price of diesel and gasoline
When this study was made the price of diesel was in the range of 1.32CAD/L, now it is close to 2CAD/L (more than half for the feedstock (55.8+16% of the value of oil product in Quebec) goes to the oil and its refining
- The costs related to new technologies (CAPEX and OPEX)

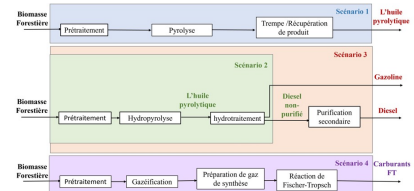
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4 potential technologies

- SCENARIO 1:** Pyrolysis – production of oil and coprocessing
- SCENARIO 2:** Production of green gasoline (from pyrolytic oil)
- SCENARIO 3:** Production of green diesel (from pyrolytic oil)
- SCENARIO 4:** Production of FT products (from gasification)
- We studied all 4 scenarios using 3425 tonnes (dry basis) per day

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Biofuels and technologies



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Scenario 1

- ⊗ 3425 dry tonnes/y leads to 640,4ML of bio-oil per year
- ⊗ Total capital investment – 515,25MCAD (0.04CAD/L over 20 y)
- ⊗ Estimated OPEX costs – 23MCAD
- ⊗ Partial conclusions:
Pyrolytic oil has no real market yet
With a 75% reduction of CI, subsidies would be in the range of 10 cents per/L
Estimated oil value at 125CAD per tonne (compared to 100CAD for pellets)



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Scenario 2 IH2

- ⊗ Shell's IH2 - Integrated Hydrolysis and Hydroconversion
- ⊗ 3425 dry tonnes of biomass/d leads to 296,2ML/y of gasoline and 129,7ML/y of raw diesel per year
- ⊗ Capital investment of 1 009MCAD (0.12 CAD per L) over 20y
- ⊗ OPEX at 58.5CAD/y
- ⊗ Diesel would cost 0.26CAD per L, could generate subsidies in the magnitude of 0.56CAD/L which would leave a large margin of operation for the cost of biomass



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Scenario 3 – IH2 + refining

- ⊗ 3425 dry tonnes/y leads to 296.5ML/y of gasoline and 135.7ML/y of purified diesel
- ⊗ Investment costs of 1 060MCAD (0.12CAD per L over 20y)
- ⊗ Estimated OPEX costs – 61.5MCAD
- ⊗ Partial conclusions:
Diesel would cost slightly more than 0.26CAD per L, could generate subsidies in the magnitude of 0.56CAD/L which would leave a large margin of operation for the cost of biomass



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Scenario 4 Gasification + FT

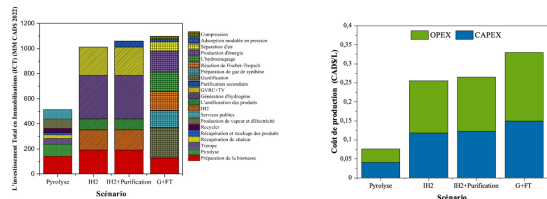
- ⊗ Classical gasification + Fischer-Tropsch synthesis
- ⊗ 3425 dry tonnes of biomass/d leads to 368ML/y of FT fuel
- ⊗ Capital investment of 1097.55MCAD (0.15 CAD per L) over 20y
- ⊗ OPEX at 66.5CAD/y
- ⊗ Diesel would cost 0.33CAD per L, could generate subsidies in the magnitude of 0.56CAD/L which would leave a large margin of operation for the cost of biomass



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Wrap up



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Conclusions

- Many scenario are still possible for the production of biofuels in Canada
- The cost of oil is sufficiently high to make different processes economically viable
- The subsidies should also contribute significantly to the establishment of such ventures
- HOWEVER** – biomass is still a problem even if it is « available »
- Since getting it in the forest may end up being more expensive than buying available feedstock it would infringe on existing well established supply chain



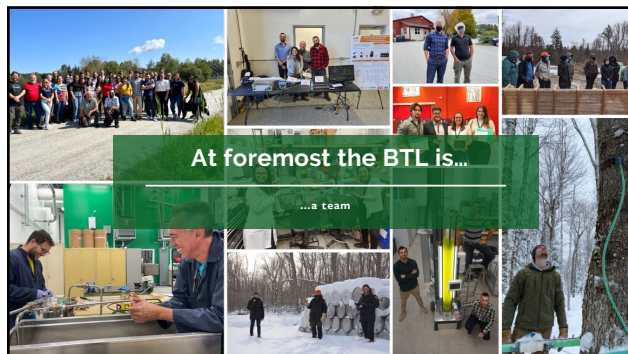
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Partners over the years



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Let's stay in touch!

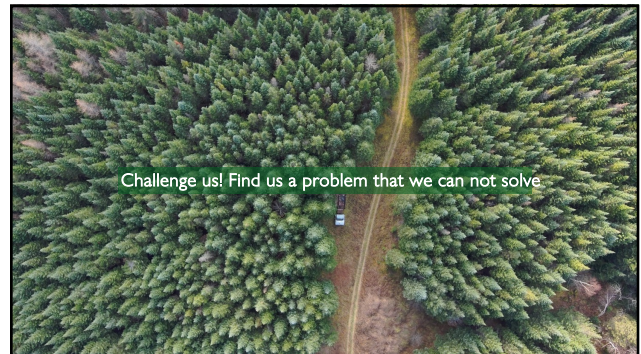
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