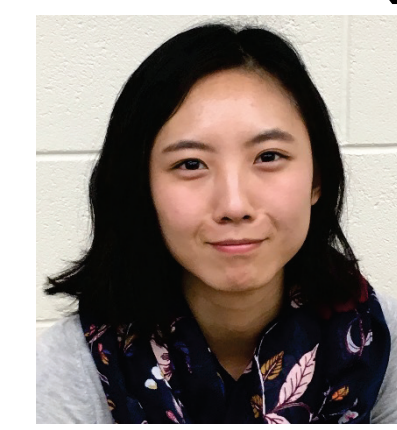




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## INTRODUCTION

Trucking is an industry dominated by diesel, which presents air pollution problems and risk to human health due to carcinogenic exhaust. AB GHG emissions from trucking are expected to be 37.6 Mt CO<sub>2</sub>eq/yr in 2060. Alternatives such as electrification are not viable for long distance trucking. CNG trucks can be deployed with fast pyrolysis RNG to substantially reduce emissions.

Data used in analysis provided by CANESS and G4 Technologies [1],[2]

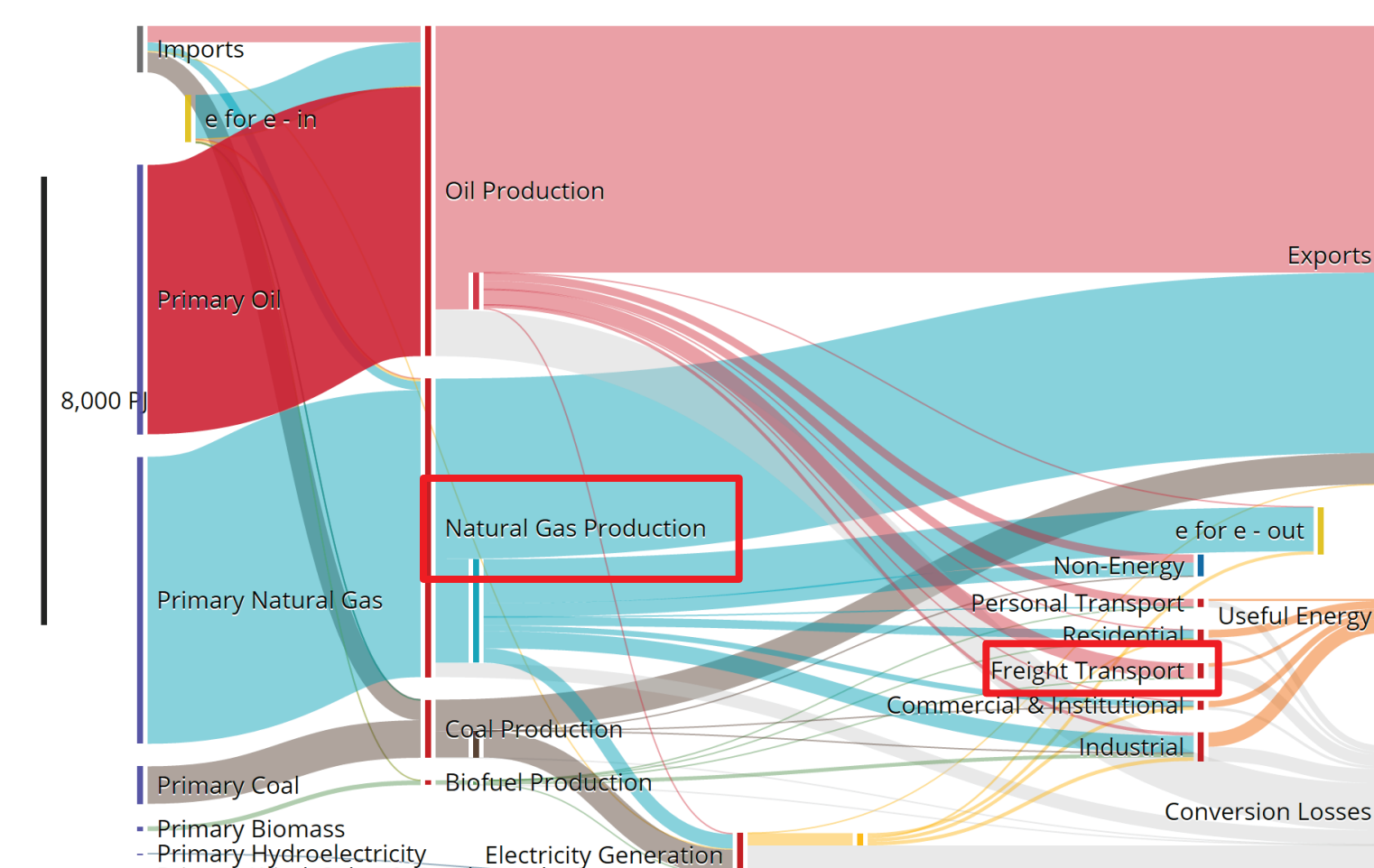
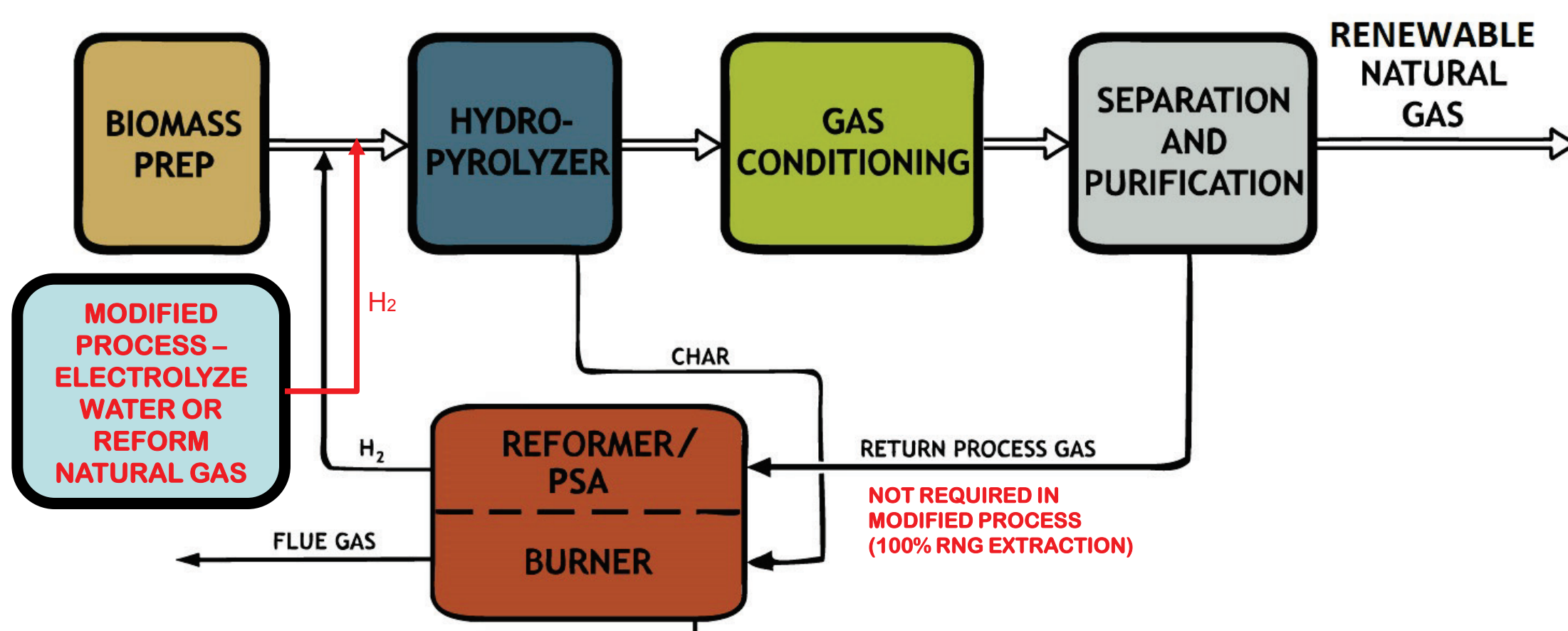


Fig. 1. Alberta's Energy System in 2010

## METHODS

Fig. 2. G4 PCH Process (PyroCatalytic Hydrogenation) [2]

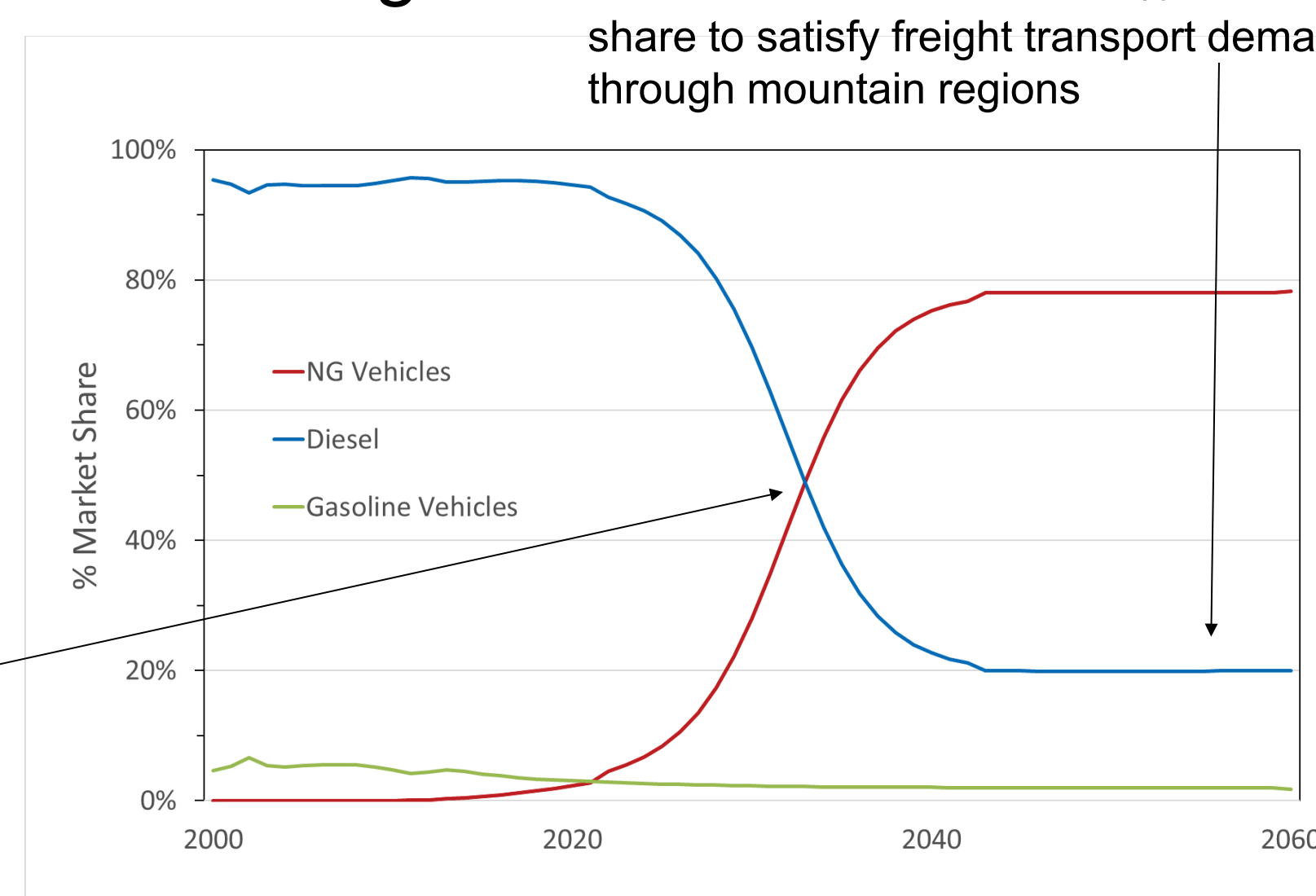


- **Phase 1:** CNG trucks are deployed to replace diesel trucks to reduce GHG emissions
- **Phase 2:** Renewable natural gas (RNG) is deployed to further reduce emissions from fossil-based natural gas

Diesel is included around 20% market share to satisfy freight transport demand through mountain regions

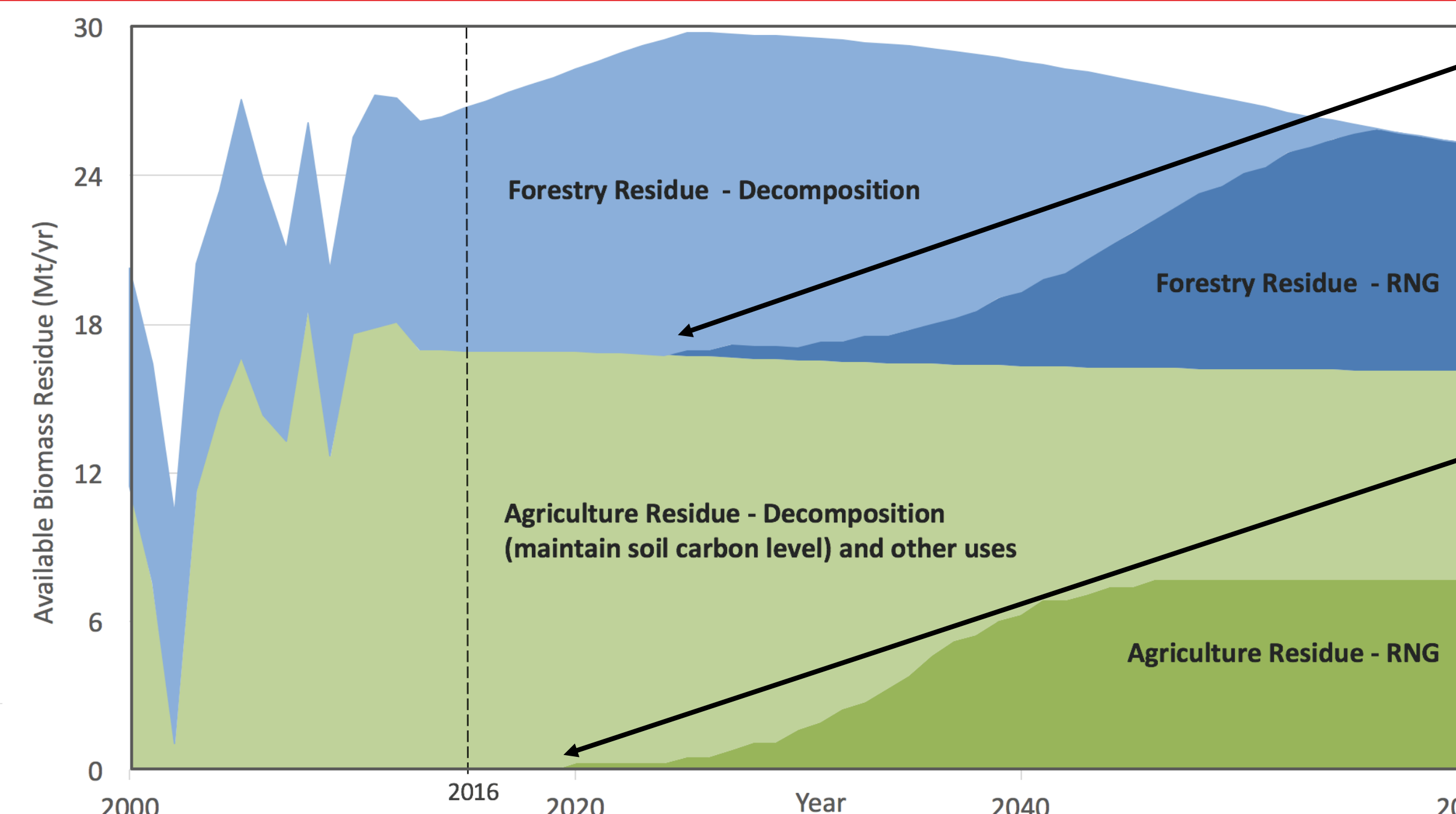
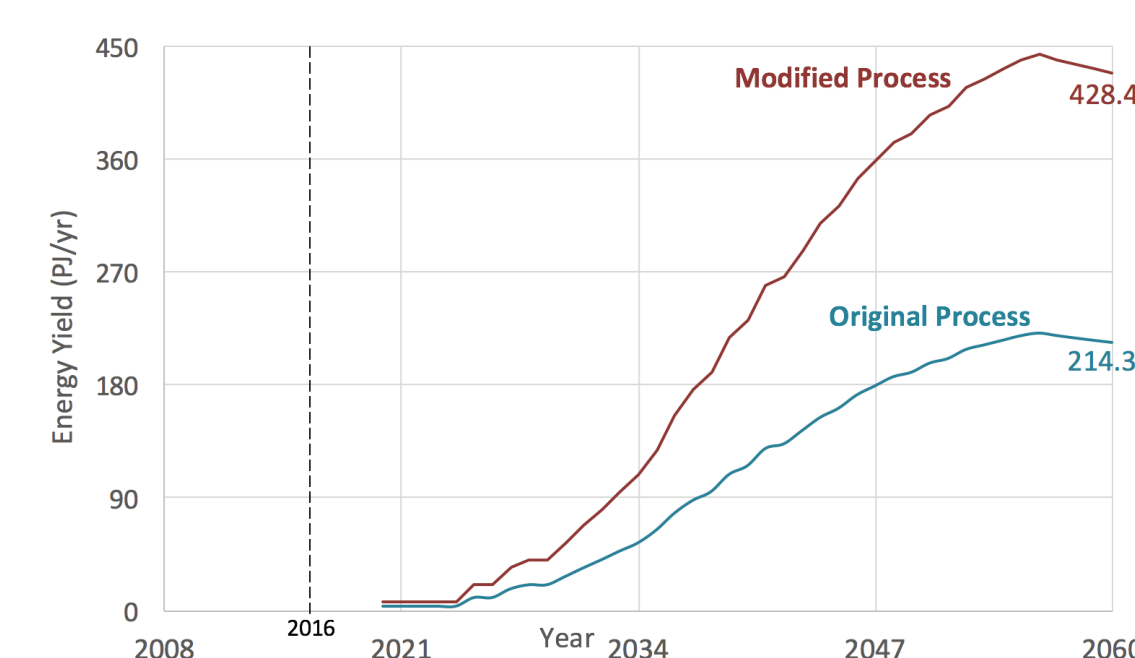
Fig. 3. Natural Gas Vehicle Implementation in Alternative Scenario

NGV market share changes over a 20-year period as percentage of adopters increase and fueling infrastructure is expanded



## RESULTS

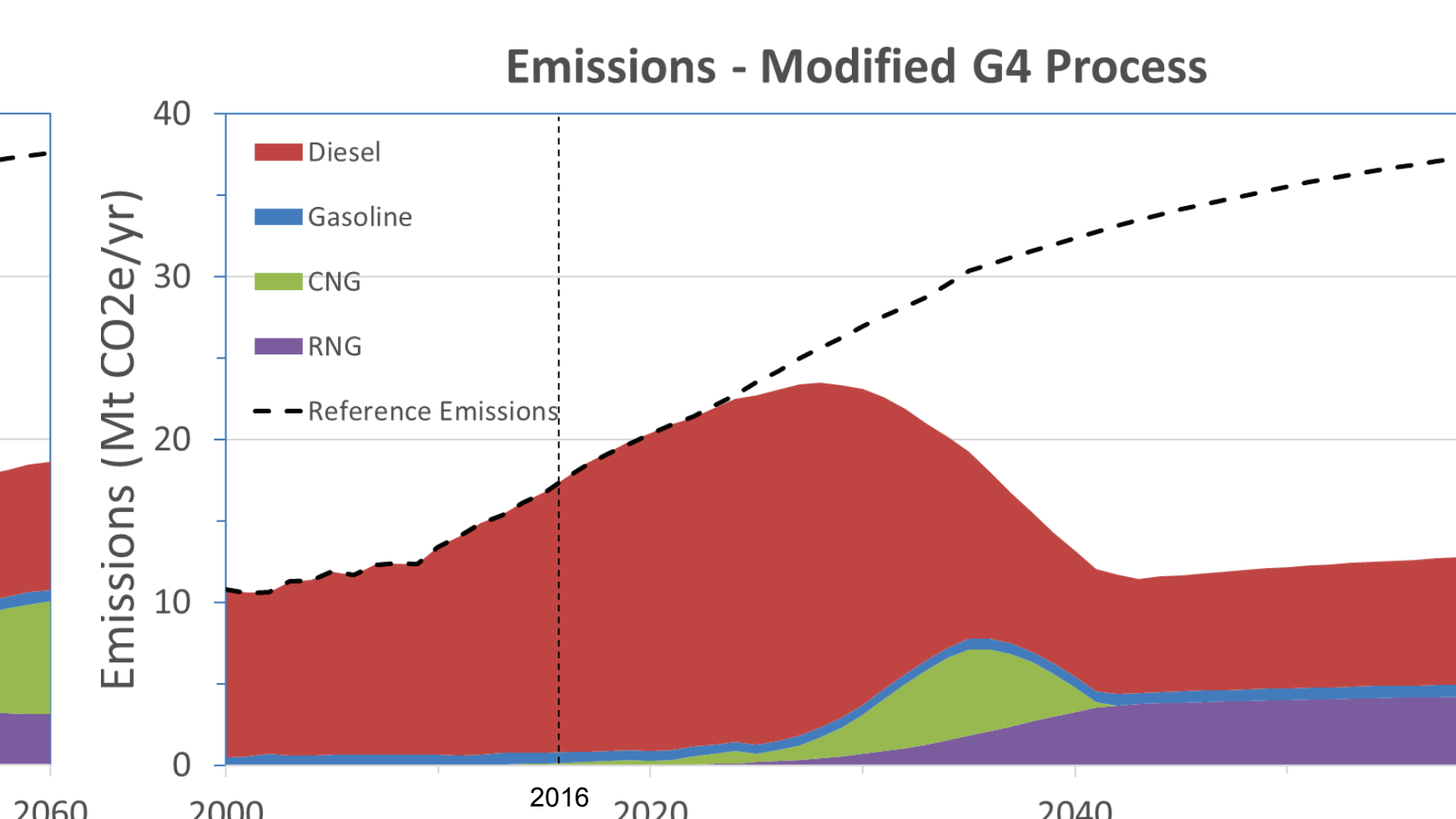
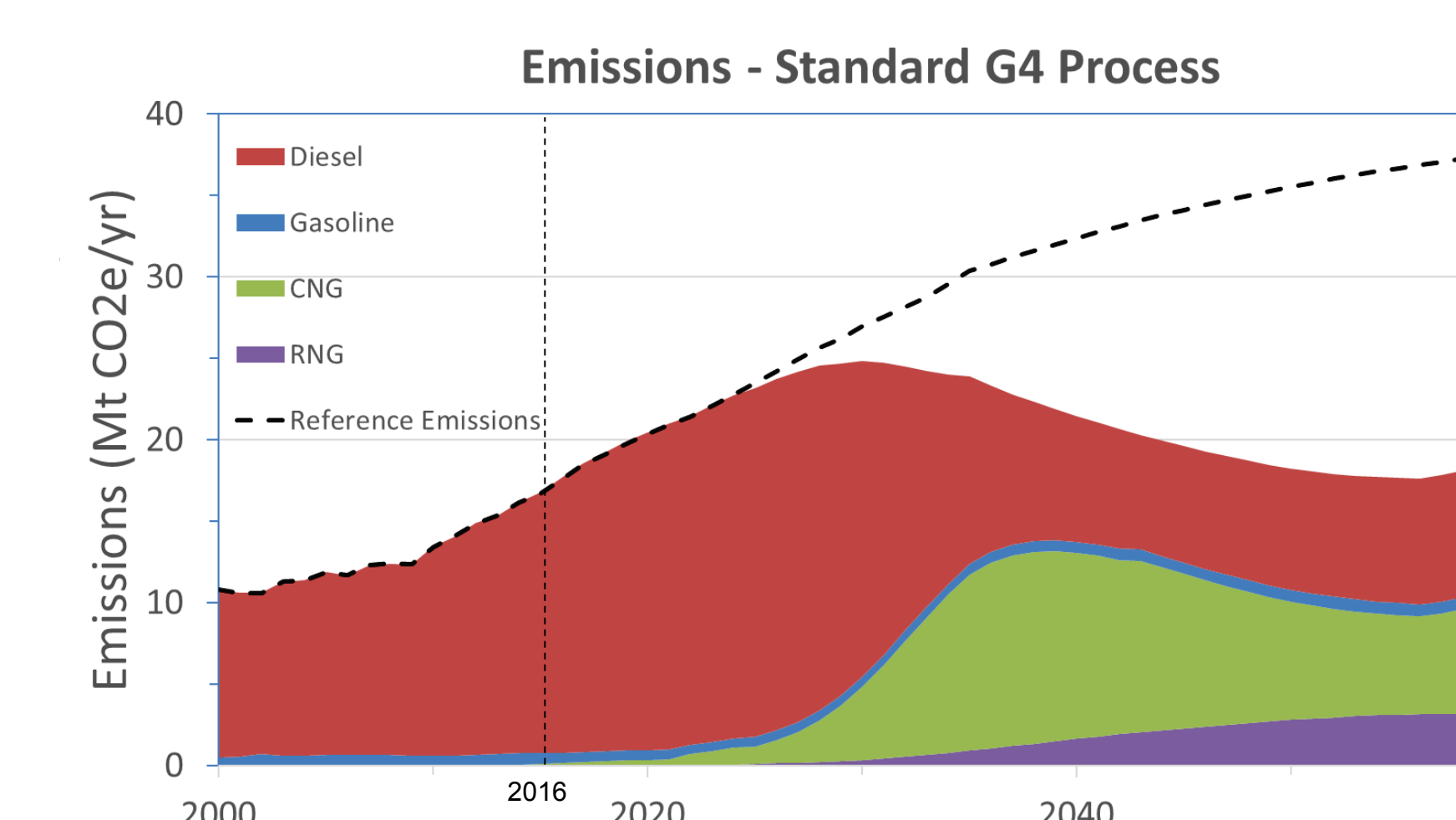
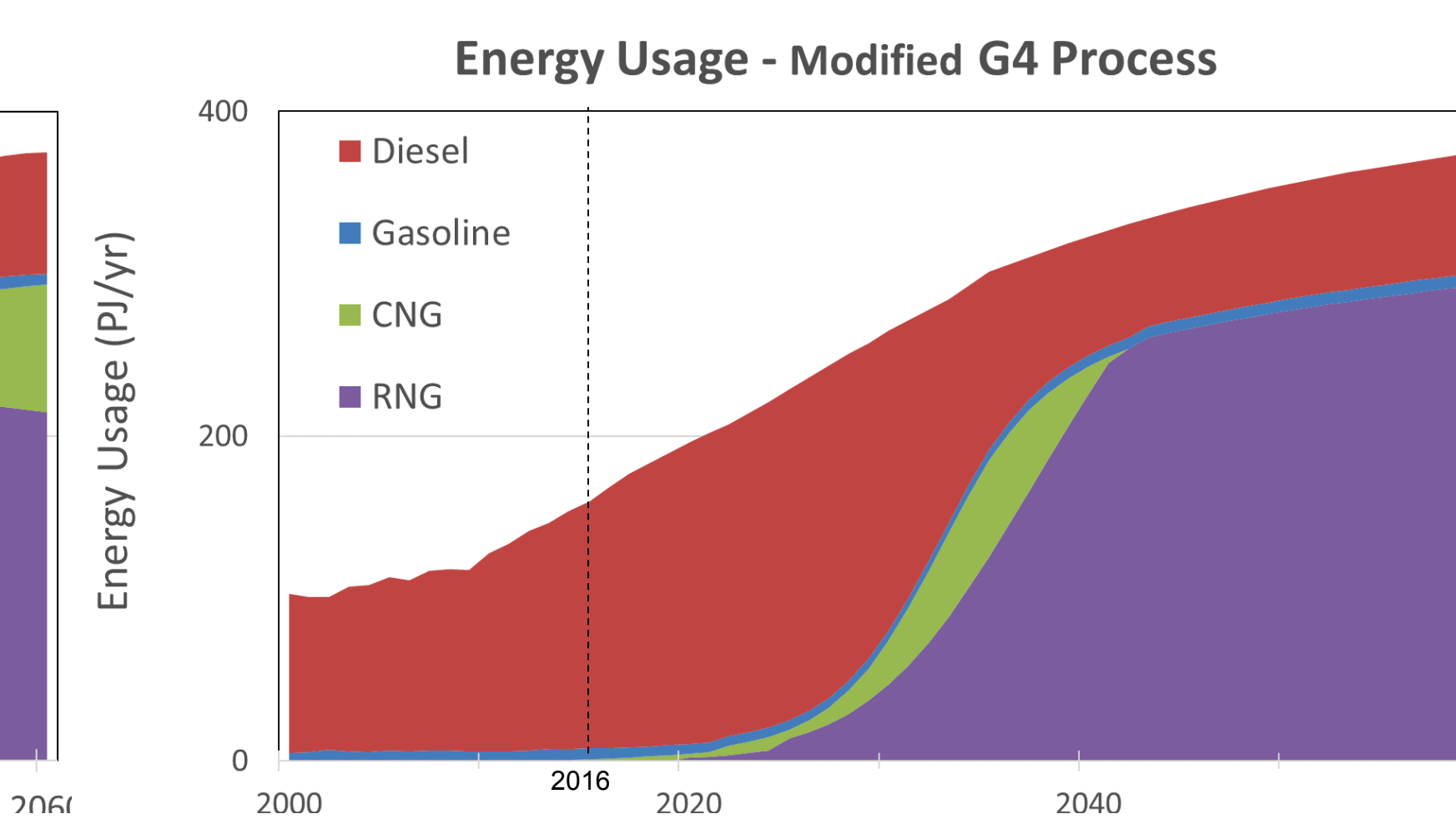
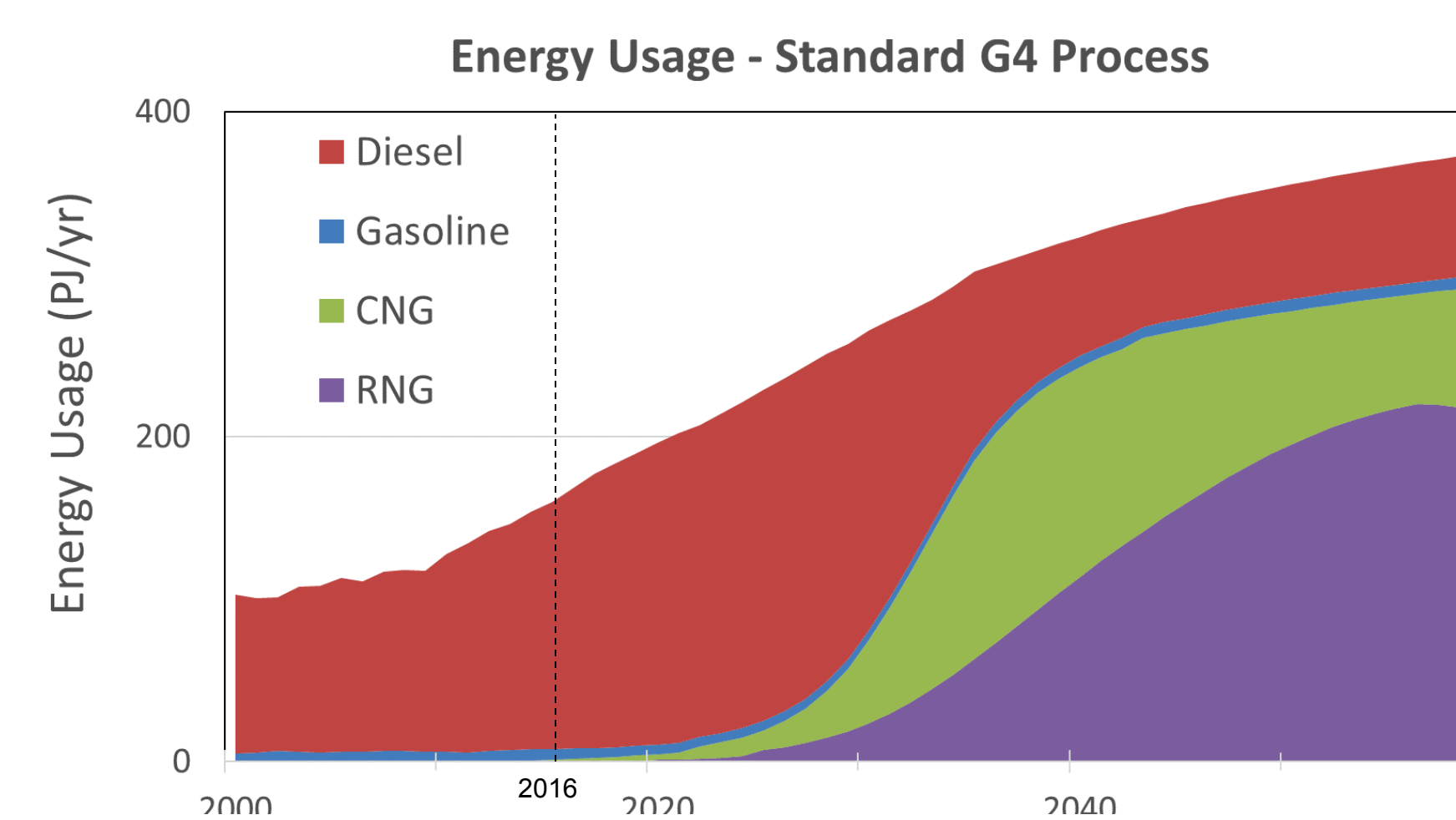
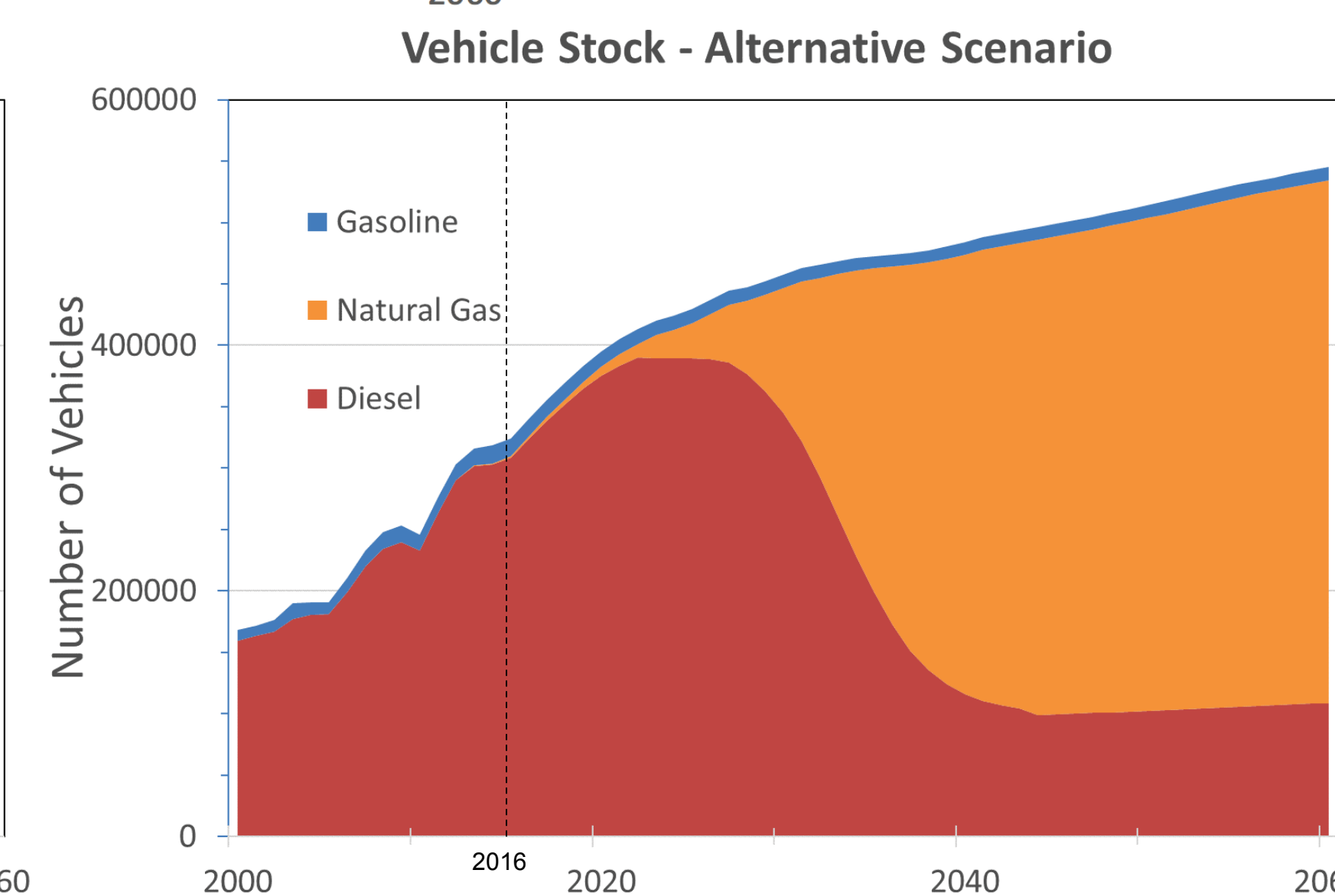
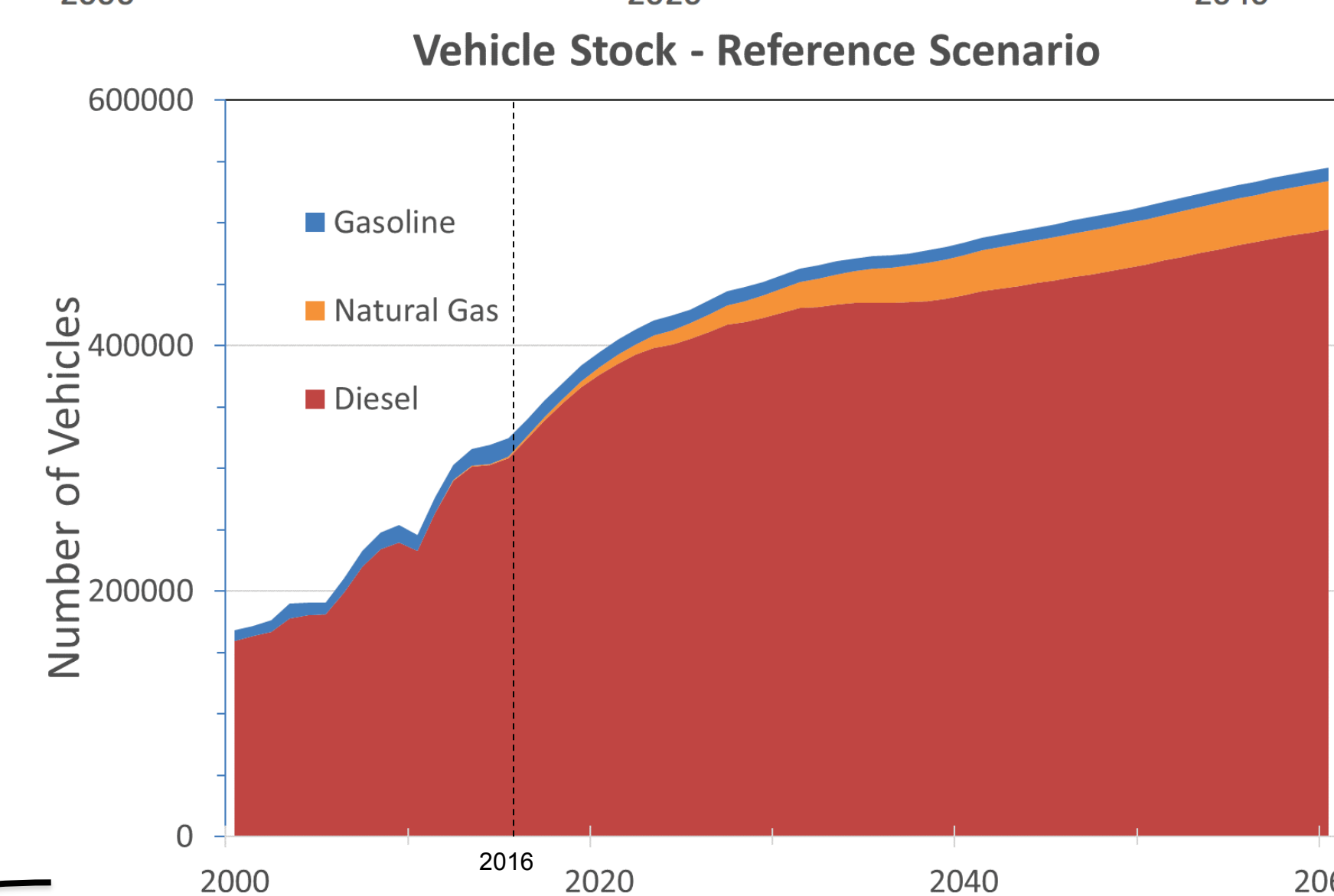
Fig. 4. Biomass Residue for RNG Production



Forestry residue is harvested starting in 2022 (it is less accessible and more expensive than agriculture residue)

Agriculture residue is harvested starting in 2020  
Curves are influenced by increasing CNG demand.

Total number of vehicles and total mileage is held constant between the reference and alternative scenarios



Two alternative scenarios are modelled:  
**Standard G4 Process** (Left) and **Modified G4 Process** (Right)

Modified process includes using excess wind energy to electrolyze water and reforming natural gas but capturing CO<sub>2</sub> emissions

## REFERENCES

- [1] whatIf? Technologies Inc., 2014. Canadian Energy Systems Simulator (CanESS) - version 6, reference scenario. [www.caness.ca](http://www.caness.ca)
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## DISCUSSION

Successfully decreasing emissions using RNG and CNG technology is highly dependent on decisions for policy and investment. To achieve significant fuel reductions, the government must introduce stricter fuel standards and a higher carbon tax. However, government would need to consider what policy is reasonable (e.g. is the additional natural gas cost of \$2.53/GJ at \$50/ton carbon tax reasonable?) [3].

This work is similar to previous studies [4] in terms of looking at the use of RNG to reduce GHG emissions. However, G4's technology uses fast pyrolysis instead of gasification, which is able to operate at low temperatures. This study is limited by the current implementation of fast pyrolysis to produce RNG. Another limitation could be potential lobbying against policies that would threaten widespread diesel usage.

## CONCLUSIONS

Using RNG fuel to power CNG trucks has the potential to reduce emissions by **23.8** and **29.1** MtCO<sub>2</sub>e by 2060 in the **standard G4 process** and **modified G4 process** scenarios respectively.

These reductions can be achieved through more stringent fuel standards motivated by health and safety in addition to an increased carbon tax.

## ACKNOWLEDGEMENTS

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