Air Pollution Implications of Coal Based Gas-To-Liquid Transportation Fuels

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Research Question

- How do air pollution emissions from coal-based Fischer-Tropsch diesel fuels compare with air pollution emissions from traditional petroleum based diesel fuels?

- Greenhouse Gasses
- Criteria Air Pollutants

Comparison #1: Tailpipe Emissions

- US EPA: Promoting F-T diesel as an ultra-low emission alternative vehicle fuel. Indicates emissions from FTD can be up to 90% lower than for traditional diesel, and that FTD poses no greater threats to human health and safety.
- US DOE: Promoting F-T diesel as low polluting alternative vehicle fuel.

Summary of Existing Research Regarding Tailpipe Emissions

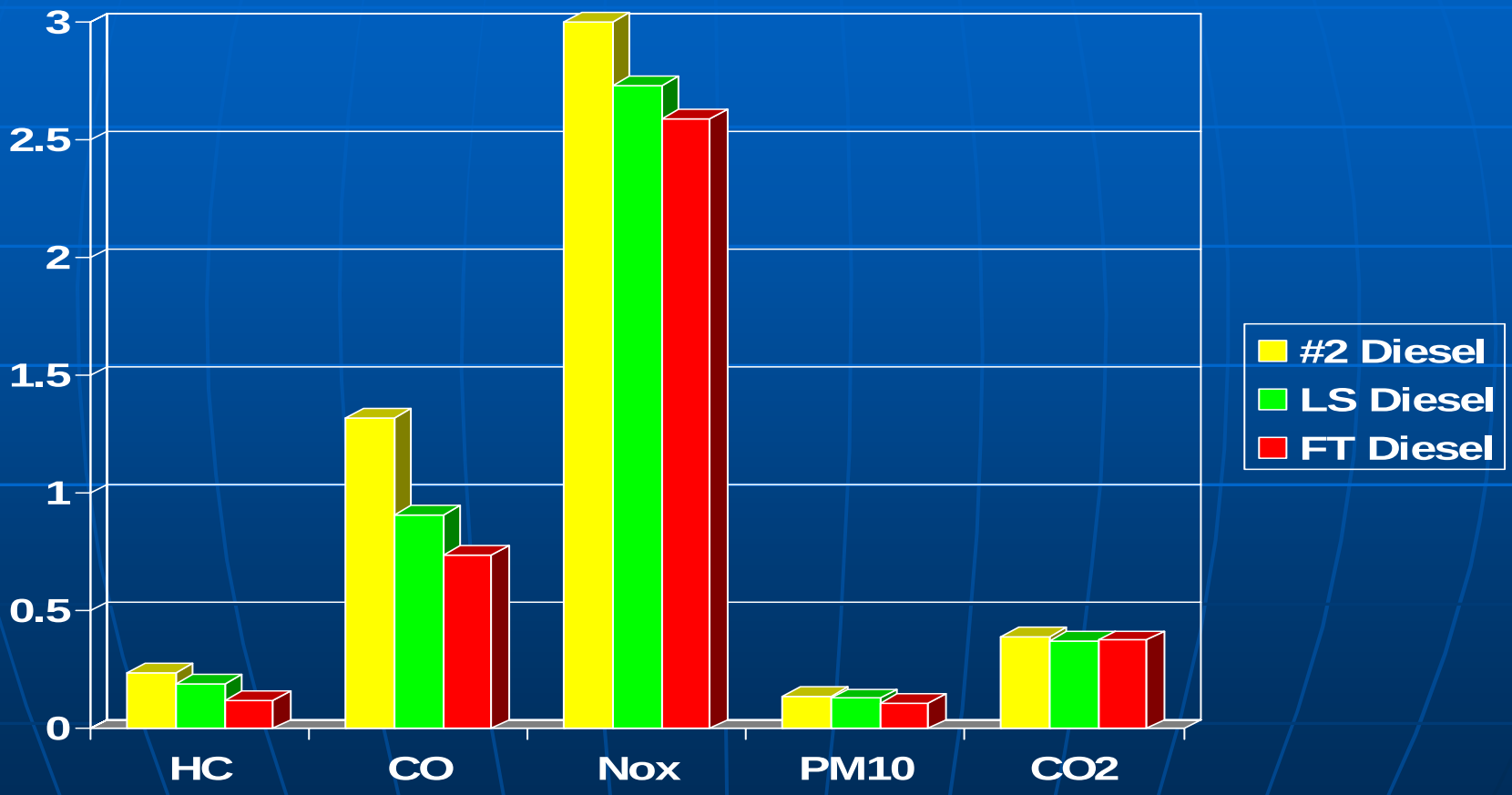
- HC emissions from FTD 38%-49% lower than from traditional diesel
- CO emissions from FTD 33%-46% lower than from traditional diesel
- NOx emissions from FTD 8%-27% lower than from traditional diesel
- PM emissions from FTD 13%-30% lower than from traditional diesel

Estimating Emissions Using the GREET Model

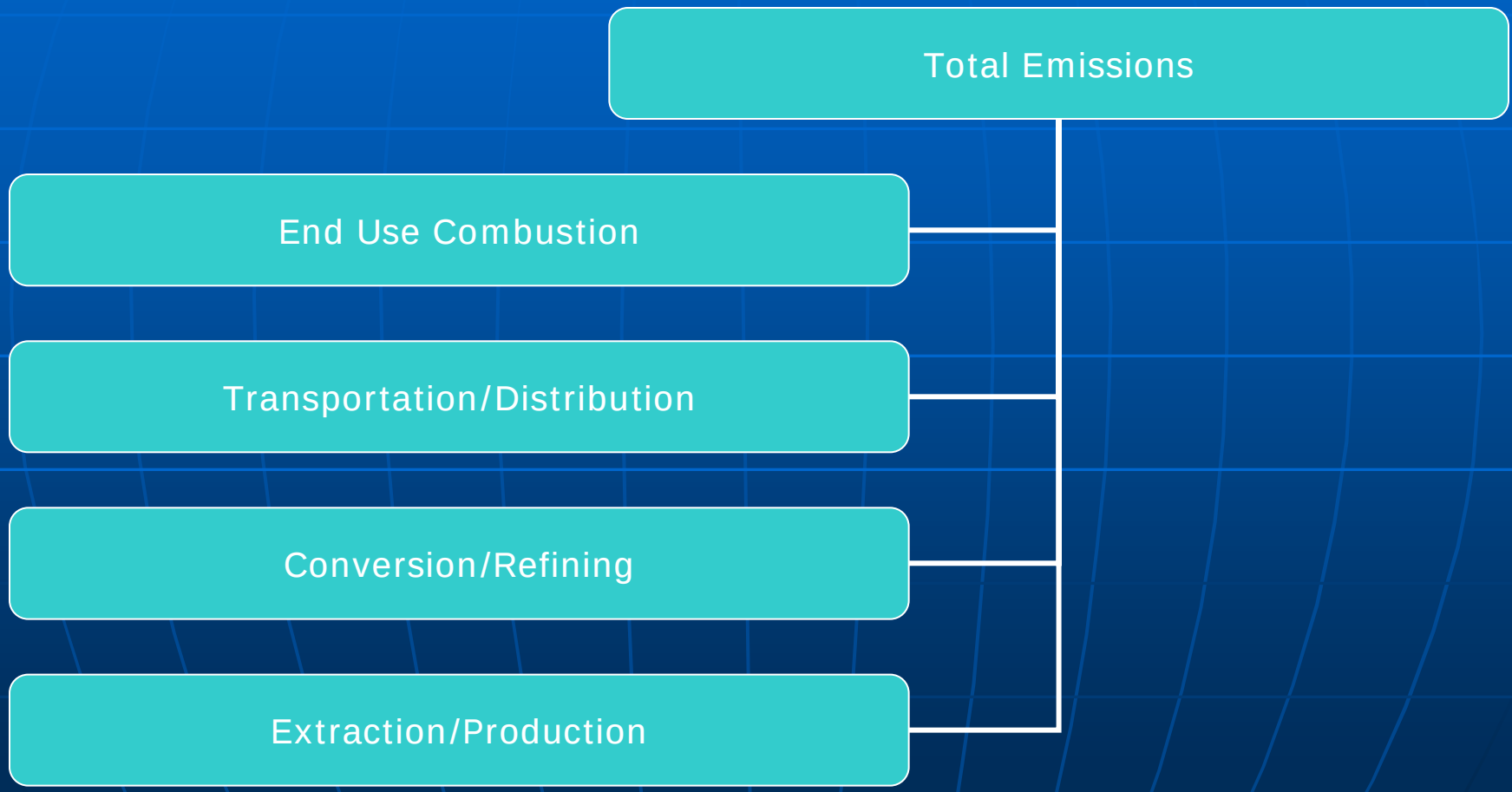
- Greenhouse Gasses, Regulated Emissions, and Energy Use in Transportation Model (Wang 1999)
- Assumptions:

1. FTD produced from Illinois #6 coal
2. FT process maximizes distillate
3. FTD produced at mine mouth plant
4. 26.6mpg diesel, 24.4mpg FTD

Tailpipe Emissions for Criteria Pollutants and GHG



Comparison #2: Lifecycle Assessment



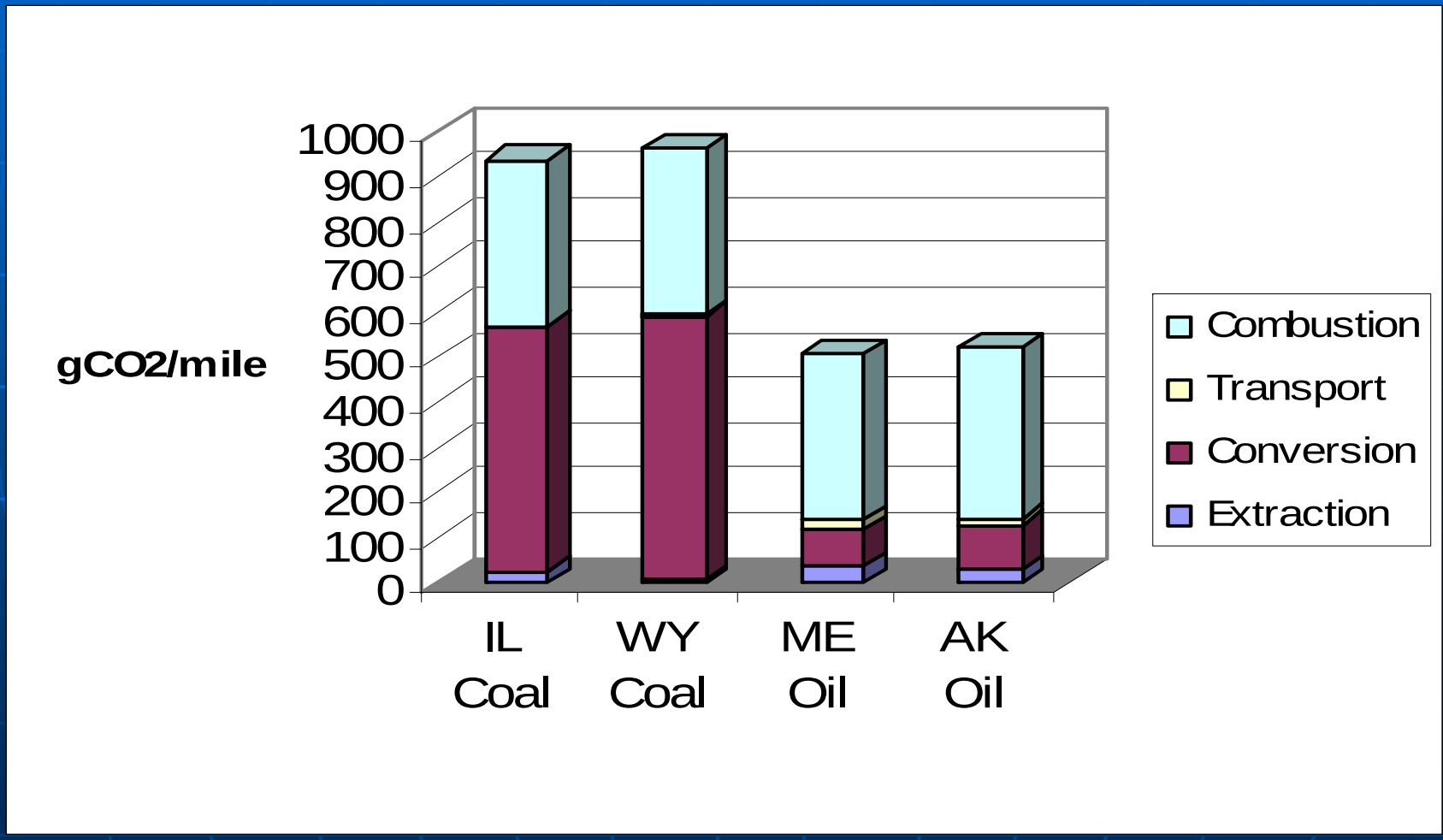
National Renewable Energy Lab Position on Lifecycle Emissions

- Emissions of GHG (CO2 and methane) from FTD 2x higher than from traditional diesel
- Emissions of many other criteria pollutants from FTD significantly higher than from traditional diesel

Assumptions for Lifecycle Assessments

1. FTD produced from Illinois #6 coal
2. FT process maximizes distillate
3. FTD produced at mine mouth plant
4. 26.6mpg diesel, 24.4mpg FTD
5. All GHGs transformed to CO_2 equivalents

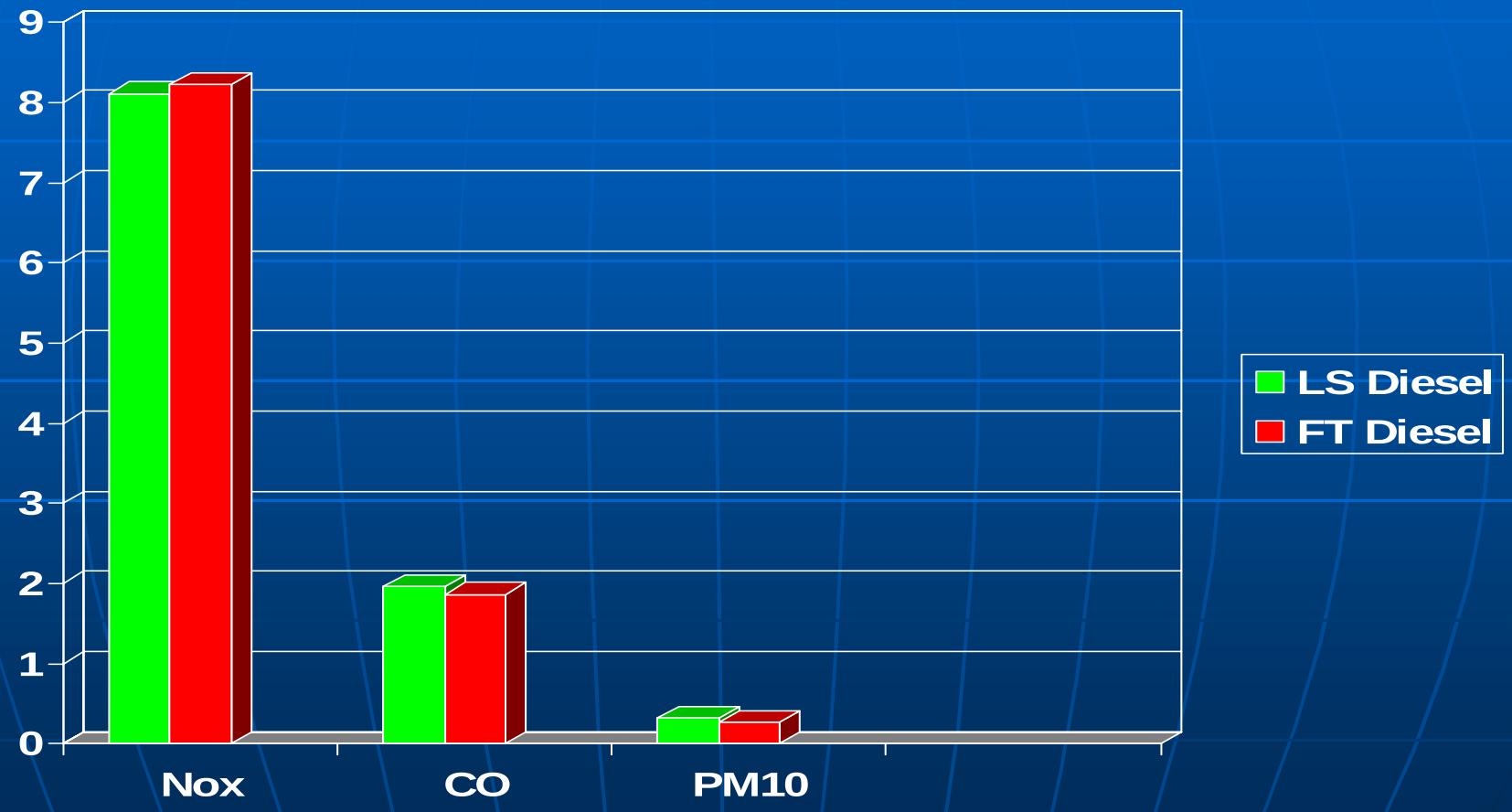
Lifecycle Assessment of Greenhouse Gas Emissions



GHG Mitigation Strategies for FT Diesel Production

- Co-produce FTD with coal bed methane reduces GHG intensity 25%
- Co-produce FTD with biomass reduces GHG intensity 17%
- Co-generation of fuel and electricity reduced GHG intensity 32% (but limits diesel production)
- CO2 sequestration can reduce GHG intensity by 48% (expensive)

Lifecycle Assessment of Criteria Air Pollutant Emissions



Mitigating Factors for Criteria Pollutant Emissions

- Upstream emissions of criteria pollutants from FTD are released in rural areas (mine mouth plants).

1. Rural areas generally attainment areas for criteria pollutants
2. Emissions in rural areas generally pose smaller marginal and aggregate health risks

Conclusions

1. Tailpipe emissions of GHG from FTD are significantly higher than from traditional diesel.
2. Tailpipe emissions of criteria pollutants from FTD are significantly lower than from traditional diesel.
3. Total emissions of GHG from FTD are significantly higher than from traditional diesel.
4. Total emissions of criteria pollutants from FTD are on a par with traditional diesel.

Important References

- Marano, John, and Jered Ciferno. 2001. *Life-Cycle Greenhouse Gas Emissions Inventory for Fischer-Tropsch Fuels.* National Energy Technology Laboratory.
- Spaeth, P.L. and M.K. Mann. 1999. *Life-Cycle Assessment of Coal Fired Power Production*. National Renewable Energy Laboratory.
- Beer, Tom, et al. 2004. *Life-Cycle Emissions Analysis of Alternative Fuels for Light Vehicles*. CSIRO.
- Wang, Michael. 1999. *The Greenhouse Gasses, Regulated Emissions, and Energy Use in Transportation (GREET) Model. Version 1.5.* Argonne National Laboratory.