

BIOCLEANTECH

— FORUM —

NOVEMBER 1–3, 2016 | OTTAWA, CANADA

How Can BioCleantech Reduce Emissions? Examples from Alberta & Ontario

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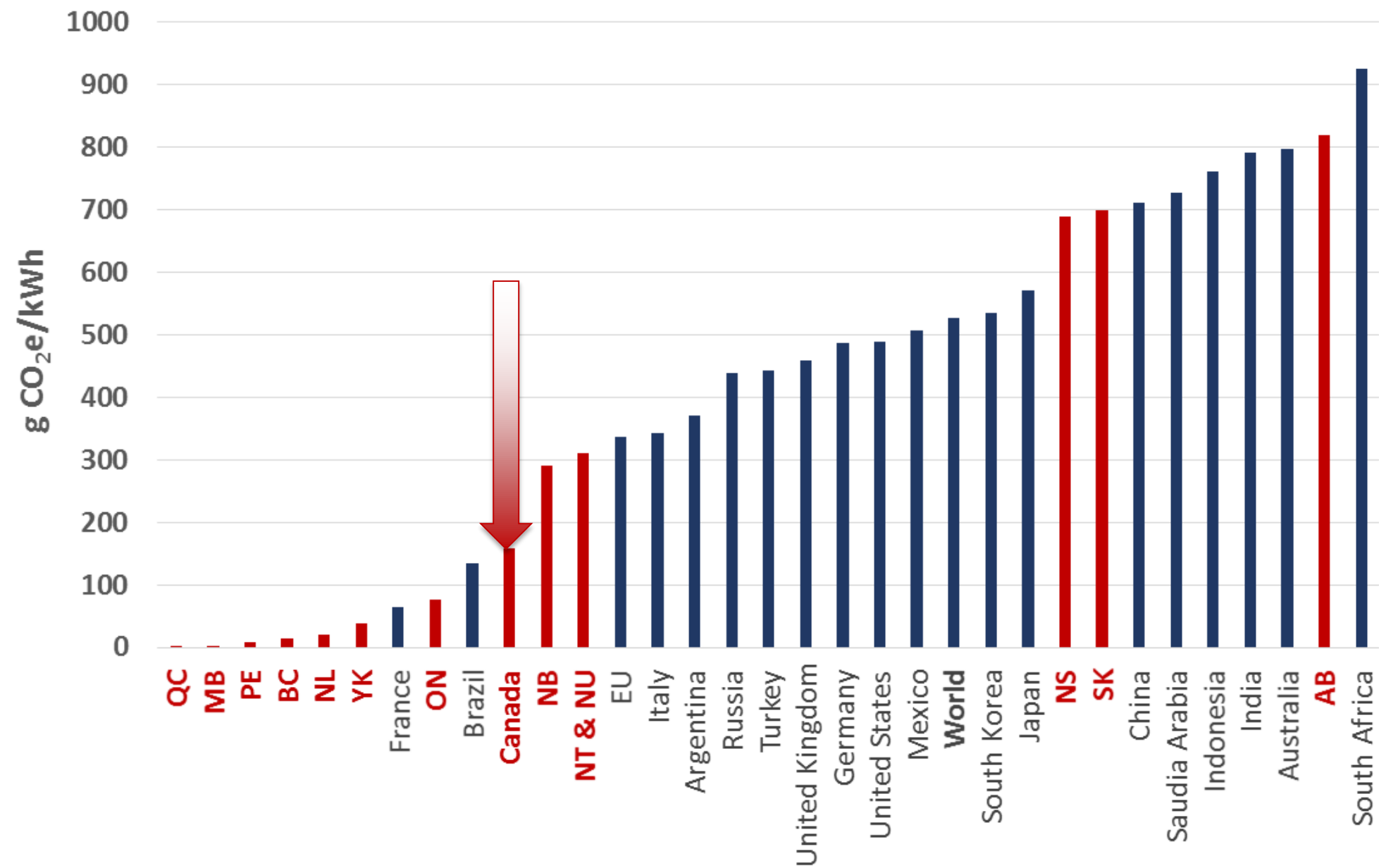
Biomass In Existing Infrastructure



Northern, Geographically Large, Natural Resource-Dependent

1. **Bioheat including District Energy**
2. **Renewable Natural Gas in Pipelines**
3. **Liquid Transportation Fuels**
4. **Co-Processing Biocrude in Upgraders & Oil Refineries**
5. **Firing in Coal-fired Power Plants – AB, SK, NS, NB**
6. **Process Heat for Cement Production**
7. **Biocoke for Steel Production – ON**

GHG Intensity of Electricity: Canada & G20 (2013)



Bioheat – From Home to City



- A. Pellet Boiler
- B. Fortum Värtan
- C. Spittelau
- D. Creative Energy

Renewable Natural Gas Blending



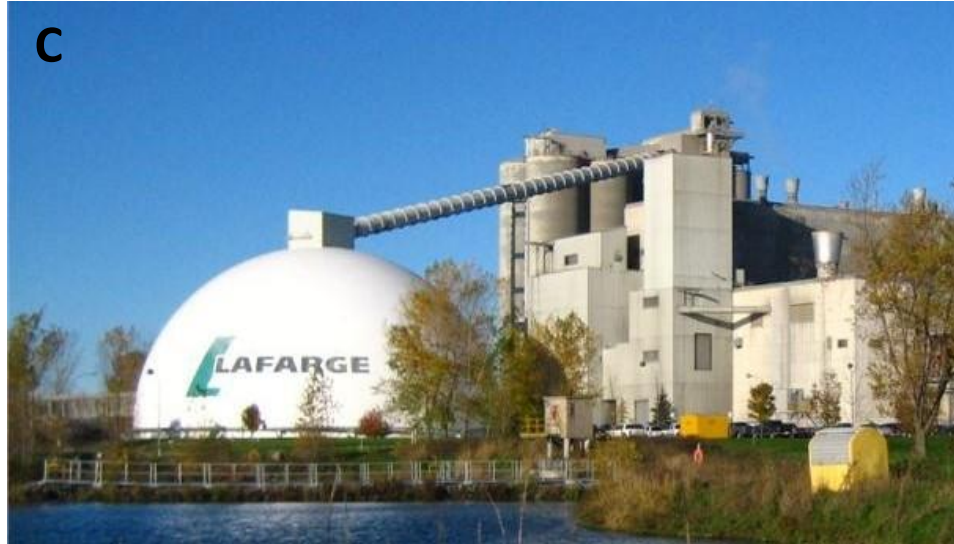
- A. Manure Biogas
- B. Hamburg
- C. GoBiGas
- D. Biotransport

Transportation Fuels & Co-Processing



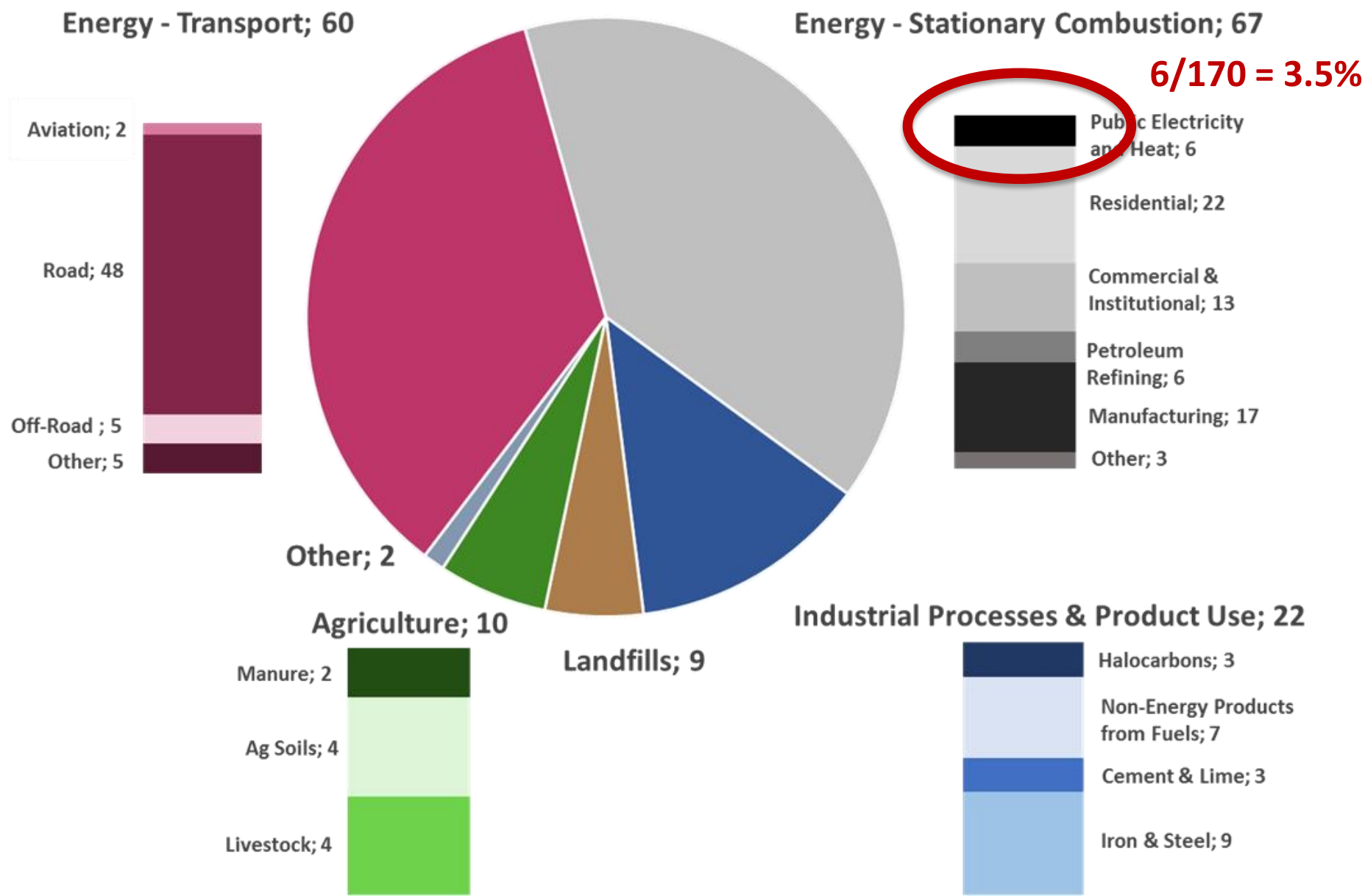
- A. DuPont Nevada
- B. Neste Rotterdam
- C. Great Green Fleet
- D. Biojet

Industrial Facilities – Fuel, Heat, & Carbon



- A. Drax
- B. Vaasa - Valmet
- C. Lafarge Bath
- D. ArcelorMittal BR

Ontario's GHG Emissions (2014)



- 170 Mt CO₂ eq
- 23% of national
- 12 t per person
- Transportation & Heat dominate
- Large Emitters 25%

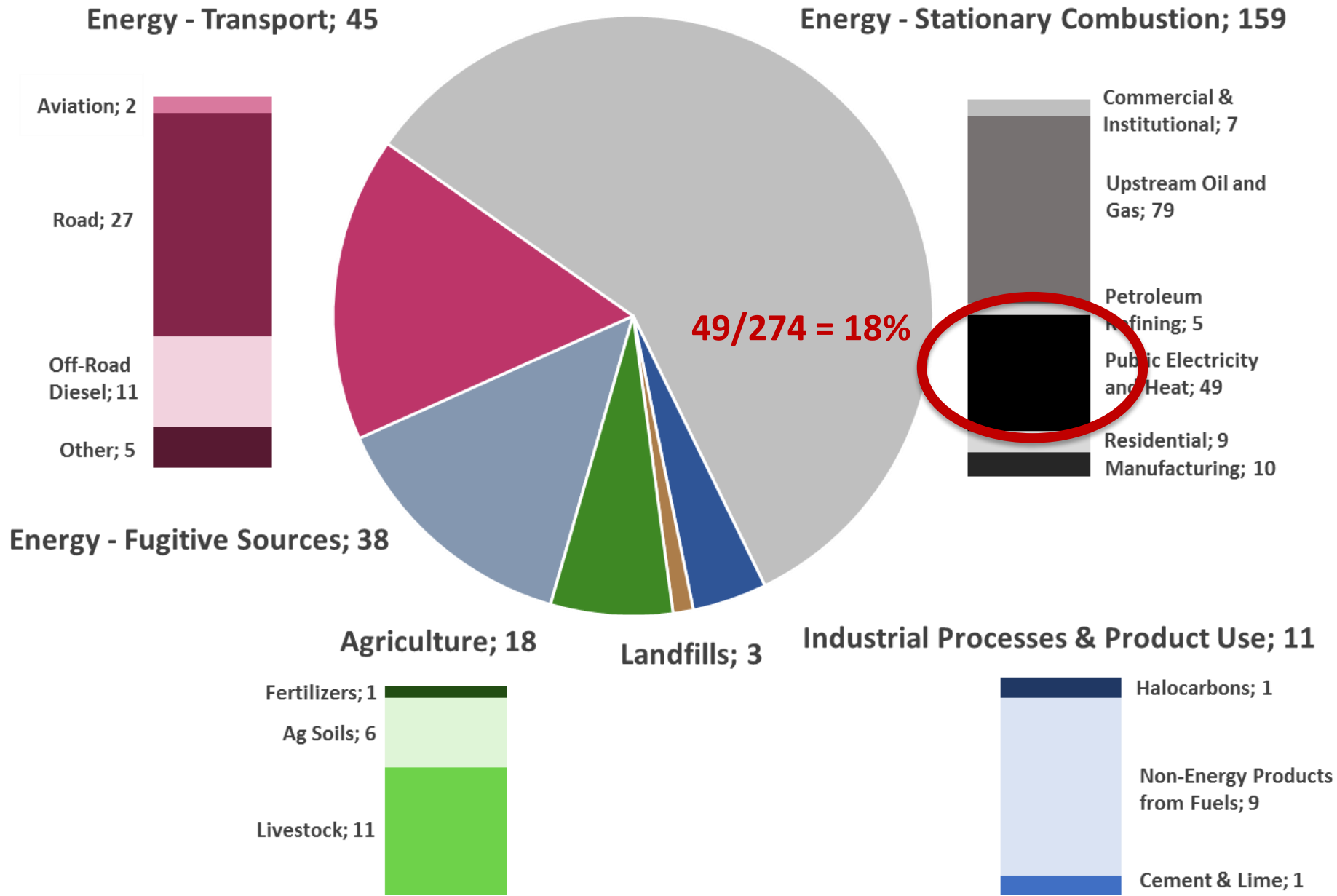
Ontario GHG Reduction Estimates

42.5 Mt CO₂ eq (25%)



- Bioheat (Space & Hot Water): 12 Mt CO₂ eq
- RNG & Biogas Management: 8 Mt CO₂ eq
- Cellulosic Ethanol & Renewable Diesel: 7.5 Mt CO₂ eq
- Biocrude Co-Processing: 9 Mt CO₂ eq
- Biomass for Cement Process Heat: 2 Mt CO₂ eq
- Biocoke in Steel Production: 2 Mt CO₂ eq
- Agricultural Management Practices: 2 Mt CO₂ eq

Alberta's GHG Emissions (2014)



- 274 Mt CO₂ eq
- 37% of national
- 67 t per person
- Upstream O&G, Electricity, Fugitive
- Large Emitters 50%

Alberta GHG Reduction Estimates

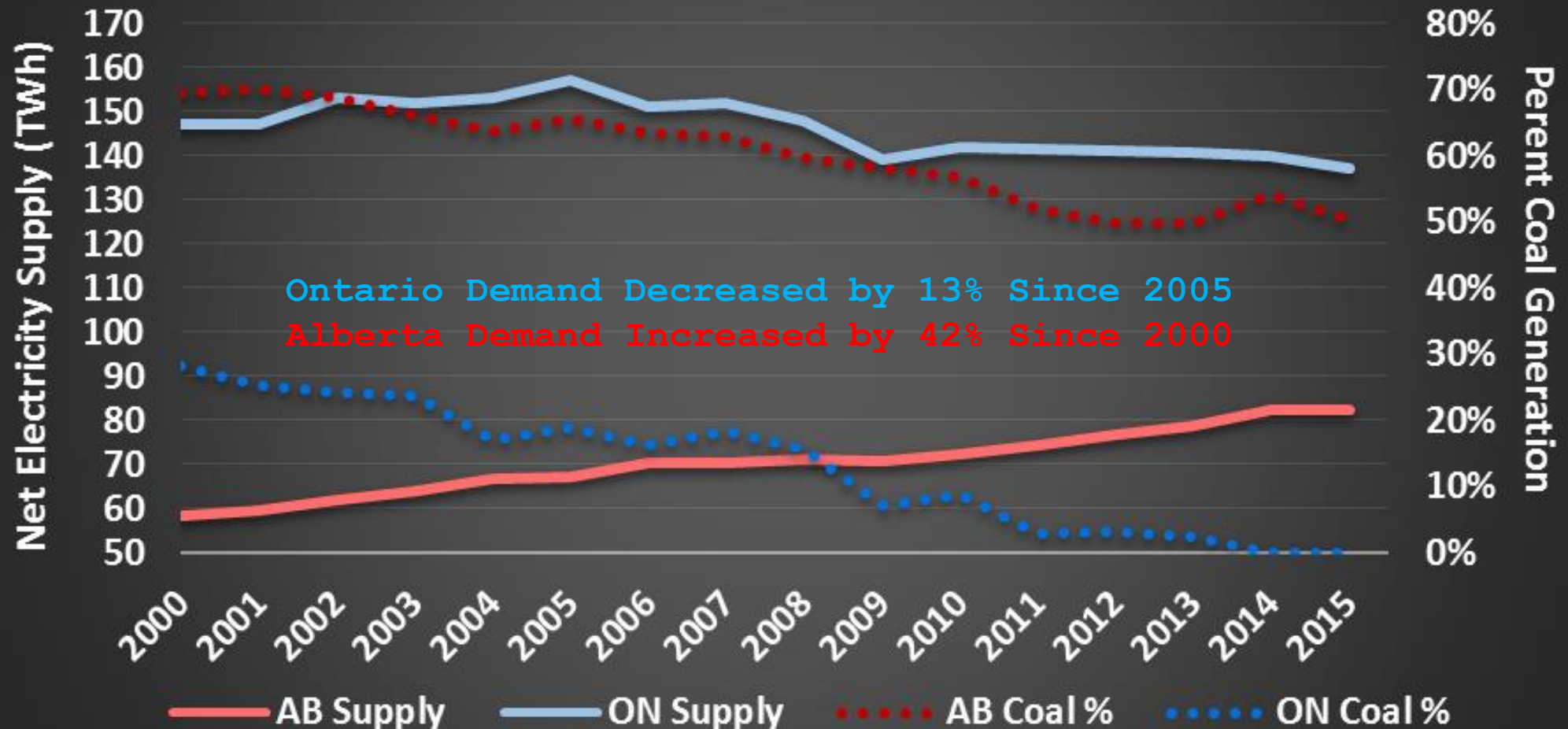
50 Mt CO₂ eq (18%)



- Displace Coal in Generating Stations: 15.5 Mt CO₂ eq
- RNG & Biogas Management: 6 Mt CO₂ eq
- Bioheat: 5 Mt CO₂ eq
- Co-generation at Oil Sands *In Situ* sites: 11 Mt CO₂ eq
- Cellulosic Ethanol & Renewable Diesel: 2.5 Mt CO₂ eq
- Biocrude Co-Processing: 6 Mt CO₂ eq
- Biomass for Cement Process Heat: 0.5 Mt CO₂ eq
- Agricultural Management Practices: 3.5 Mt CO₂ eq

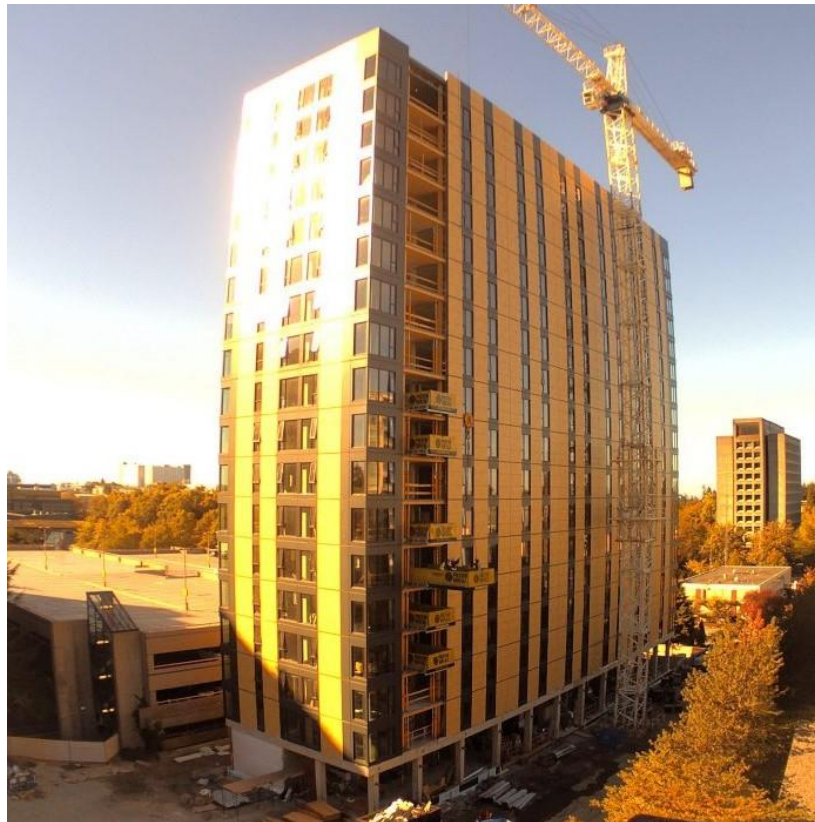
Coal Phase-Out

Ontario Vs. Alberta



BioCleantech...

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Brock Commons, UBC
18-Storey CLT Building
>2,400 t CO₂ eq Saved

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