

BIOENERGY IN ELECTRICITY GENERATION

Capital Power Perspectives & Initiatives



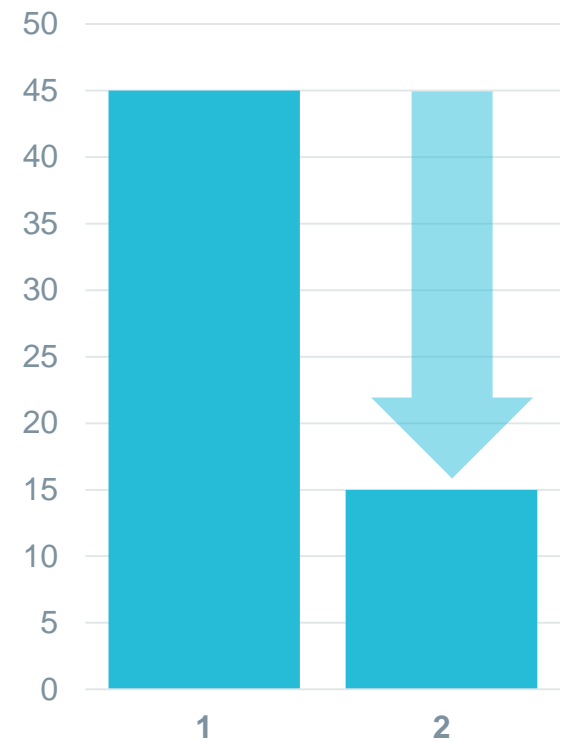
THE CHALLENGE:

Transitioning Away From Coal

Canada is working to significantly reduce coal emissions by 2030:

- Under the Climate Leadership Plan, Alberta will completely phase out coal emissions by 2030, affecting 2,500 MW of coal-fired generation that would have otherwise operated after 2030
- All other provinces will be required to reduce emissions from coal to a standard of 0.42 tonnes/MWh CO₂e by 2030 (a reduction of more than half from current emissions)
- All fossil fuel electricity generators are subject to a carbon price targeted to be \$50/tonne by 2022 for emissions above a performance threshold

Alberta Electricity Sector GHG Emissions (MT)



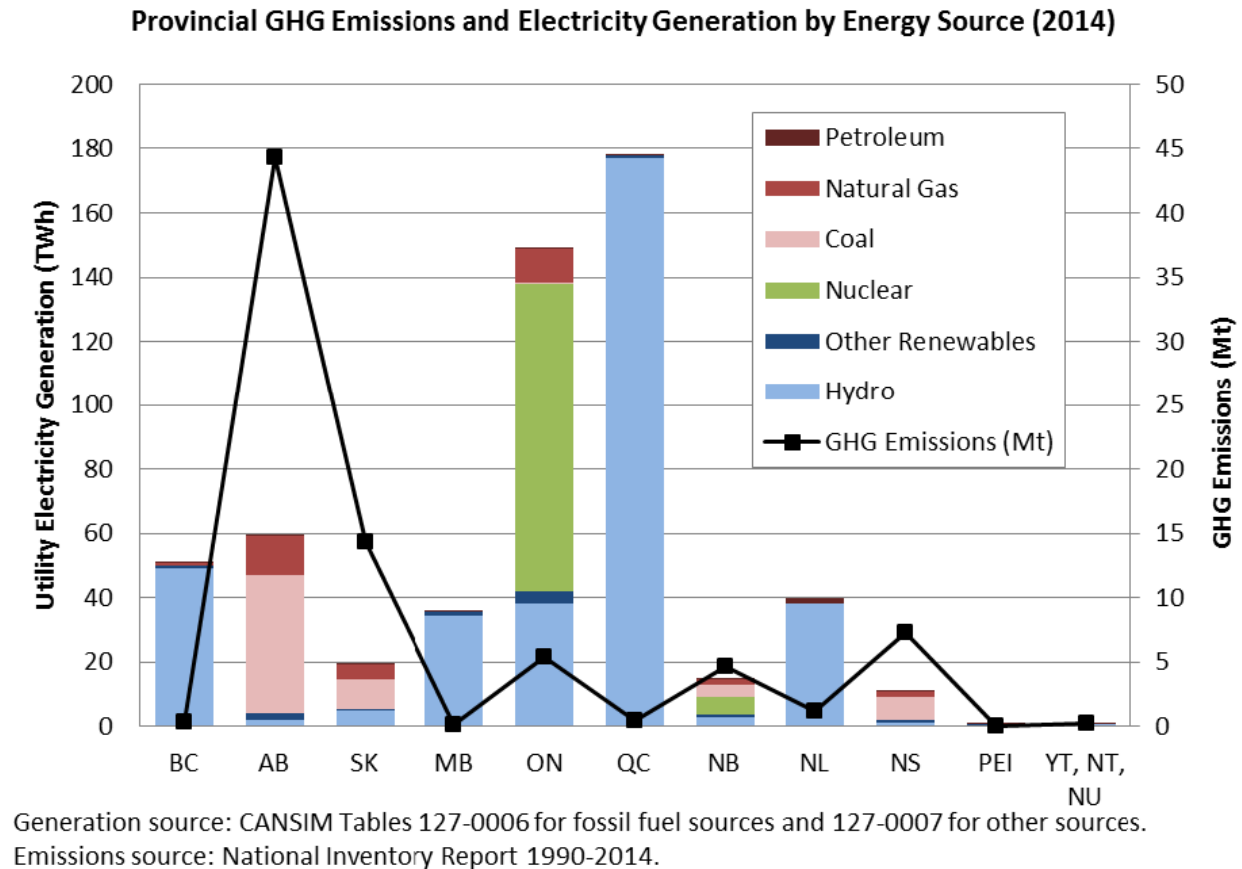
THE CHALLENGE:

Transitioning Away From Coal

Provinces with Coal Generation

- Alberta
- Saskatchewan
- New Brunswick
- Nova Scotia

Emissions from coal-fired electricity account for 8% of Canada's GHG emissions.



A strategy to utilize bioenergy in place of coal at existing electrical generation facilities represents a significant opportunity to lower GHG emissions.

Defining the Opportunity

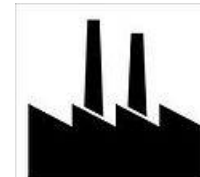
Woody biomass residuals from existing forestry operations are a significant potential renewable energy resource that can enable transformation of the electricity generation sector, while helping to sustain a strong forestry sector

Forestry Industry

Seeking value-add opportunities for low-grade fibre (in-forest and mill residuals)



Convert residual wood fibre to green energy, creating rural employment, cleaner air & reduced GHG emissions



Rural & Indigenous Communities

Seeking value-added industries that create local jobs

Coal-Fired Electricity Generators

Seeking pre-2030 emission reductions and medium to long-term fuel conversion opportunities

Why Bioenergy?

Compared to Natural Gas Conversions or Carbon Capture and Storage:

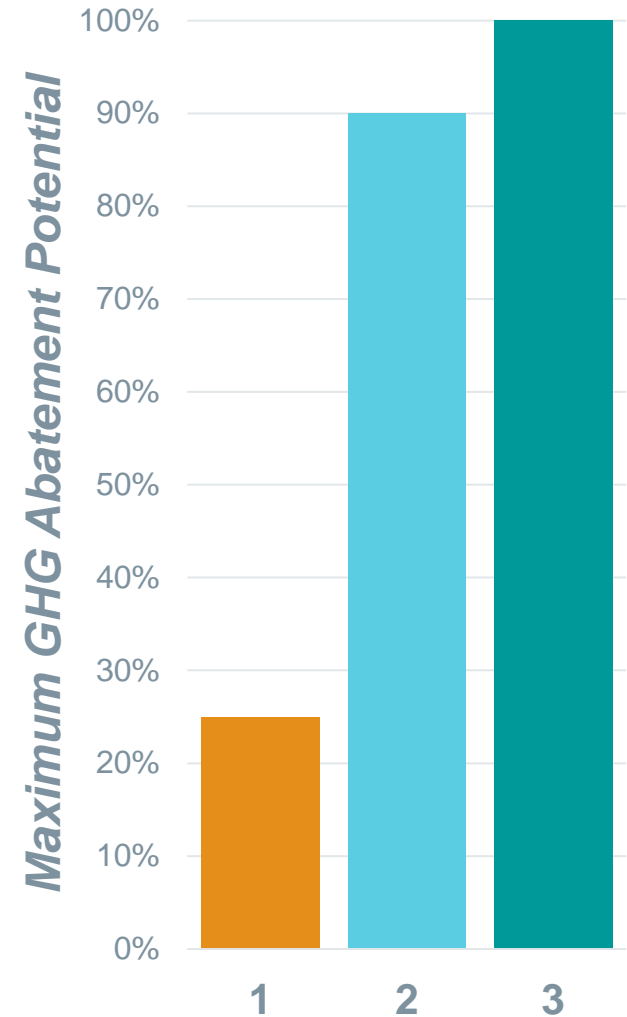
CO₂ abatement potential for replaced portion of fuel in an existing boiler:

- 100% abatement using biofuel
- ~25% abatement using gas

Compared to New Nuclear or Hydro:

- Deployable within short to medium time frames (2-5 years instead of 15-20 years)
- No requirement for new generation or transmission facilities; therefore no new impacts to traditional land uses and no need for new host communities
- Significant ongoing rural and Indigenous employment opportunities for biofuel processing and logistics

GHG Abatement Options for Existing Coal Generators



Environmental Benefits of Utilizing Residual Wood Fibre In Place of Coal

Reduction in Emissions from Electricity Generation

- Every dry tonne of wood fibre replacing coal eliminates ~2 tonnes of CO₂, and reduces SO_x and mercury emissions

Reduction in Methane Emissions from Stockpiling

- Every tonne of residual mill fibre reduces methane emissions by 0.5 tonnes CO₂e

Reduction in Black Carbon Emissions from Slash Piles

- Significant reduction in black carbon emissions, a priority identified in *Canada's Mid-Century Long-Term Greenhouse Gas Development Strategy*

Reduction in Particulate Emissions from Slash Piles

- Significant reduction in particulate emissions from slash pile burning, resulting in health benefits



Leveraging Canadian BioCleantech



Ontario Power Generation

- *Atikokan and Thunder Bay 100% Biomass Conversions*
- *Advanced Fuel Analysis & Testing Program*



Capital Power

- *Genesee Generating Station 2016-2017 Biomass Test Program*
- *Alberta-wide Woody Biomass Feedstock Inventory Development*
- *Active development of a 15% co-firing project using forestry mill residual fibre*

Canadian Advanced Biofuel Technology Developers:



Next Step: Make Effective use of Readily Available Residual Fibre

Starting with 15% Co-firing At Genesee Generating Station Unit 1

- There is a unique opportunity to make use of residual mill fibre, currently being stockpiled at certain facilities
- This fuel represents the lowest cost fibre available because it is already concentrated in central locations and on major highways
- By utilizing this material, methane emissions are avoided and materials that would otherwise be wasted can be used to displace coal-fired emissions
- Processing and co-firing these materials at Genesee represents the lowest cost solution for many forestry mills
- Subject to receiving policy support, the project could be up and running by early 2019

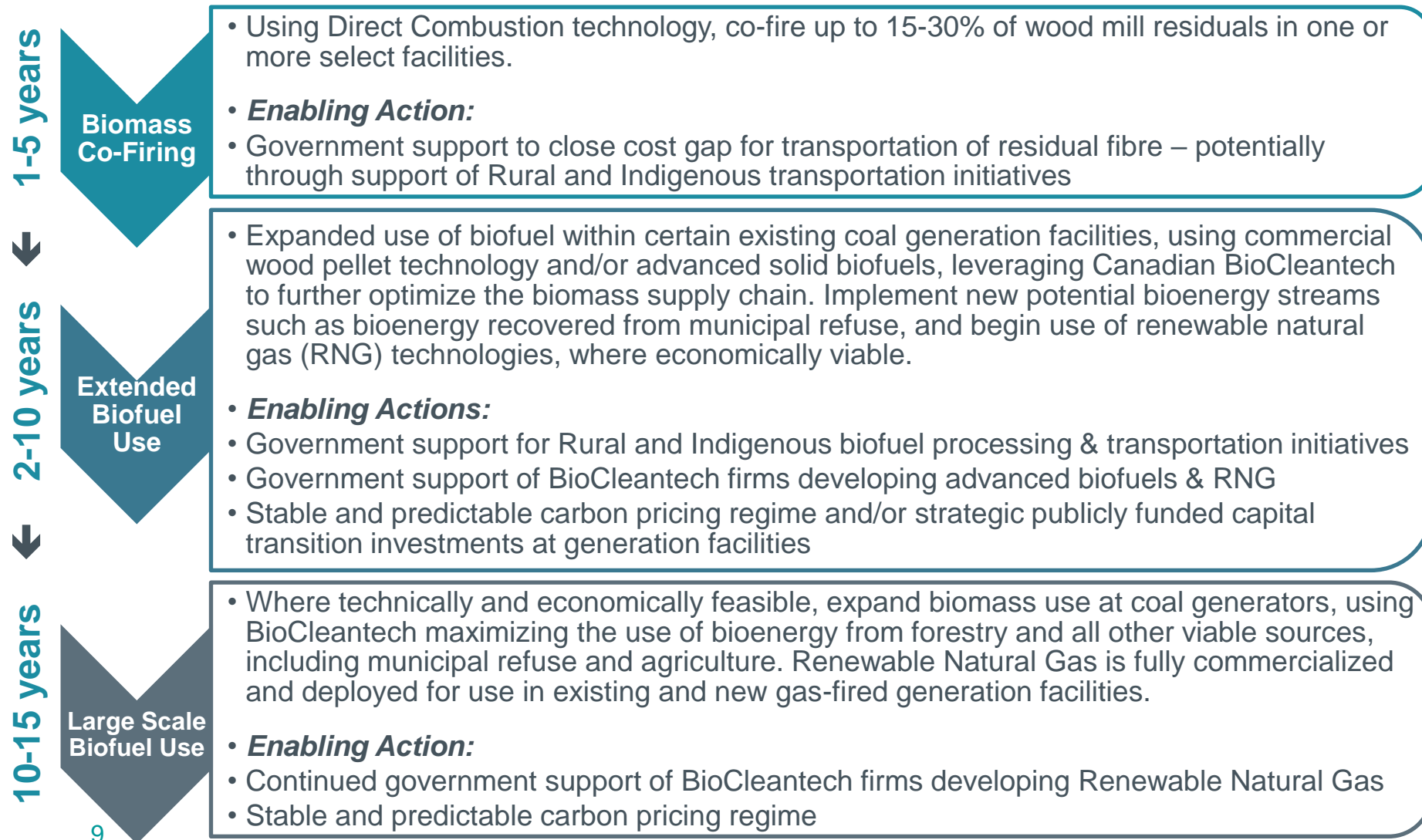


**Mill Residual
Co-Firing**



Potential Canadian Pathway for Renewable Bioenergy Electricity Development

Starting with Co-firing to Enable Transformational Technologies by 2030





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