Modern Wood Pellet Heating

Proposal for a Wood Pellet Initiative for the Municipality of the District of Argyle to Reduce Energy Poverty and Drive Forest Sector Economic Development



Jamie Stephen, PhD Managing Director Jstephen@TLBio.com



What is 'Modern Wood Heating'?





Renewable Energy in the EU

Total: 8.5 EJ

Solid biomass heating has 84% renewable heat market share and equal to ALL renewable electricity combined



- Hydropower
- Onshore Wind
- Offshore Wind
- Solar PV
- Concentrated Solar
- Solid Biomass
- Biogas & Liquids
- Geothermal & Other
- Solid Biomass
- Biogas & Liquids
- Heat Pumps
- Geothermal
- Solar Thermal
- Biodiesels
- Biogasolines
- Other Biofuels
- Electricity Road



Bioenergy in the EU

Bioenergy in 2017: 211 Mt CO_2e reductions (more than any other renewable)

Canada consumes 5x as much bioenergy as wind and solar combined



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EU Wood Pellet Boilers (Top 8 Countries)

- Installed base of >900,000 residential pellet boilers <50kW
- >60,000
 commercial pellet
 boilers of >50kW
- Canada has <250 commercial wood pellet boilers





Residential & Commercial Pellet Boilers



GREHLIGHT Fine Particulate Matter (PM_{2.5}) Emissions





Modern Wood Heat In Canada

- >450 Commercial/Institutional Bioheat Projects in Canada (75-5,000 kW scale)
- Industry growing at 15% per year
- >99% wood chips or wood pellets
- Wood chips generally preferred >250 kW if near forested region



Prince County Hospital, Summerside, PEI



Pellet Bulk Delivery & Storage









Example: Austrian Forest Sector



Highly profitable mass timber industry supported by heat market

All figures in Mm³ Total Fibre Supply in ON ~34 M m³



Why Bioheat Utilities?

- 1. Enable use of LOCAL wood fuels to keep energy expenditures local
- 2. Greatest number of **JOBS** per unit energy
- 3. The **PROVEN** approach: 90% renewable heating/cooling market share in EU
- 4. Lowest **COST** renewable, clean, and low-carbon heat supply
- 5. Fuel supply is **ABUNDANT** with little competition in many regions of NS
- 6. Energy price is **PREDICTABLE** via 10-20 year supply agreements
- 7. A market for low quality wood essential for **SUSTAINABLE** forests
- 8. Source of **INCOME** for municipalities



- 1. Municipality sources infrastructure funding for wood pellet boilers
 - 73.3% CapEx; remainder from private sector partner or financed
- 2. Municipality sources infrastructure funding for wood pellet storage hub
- 3. Wood pellet boilers installed in residential and commercial buildings
- 4. Private partner manages pellet supply & distribution, boiler maintenance
- 5. Heat consumption measured by boilers; data uploaded to server
- 6. Building owners receive monthly bill, including capital recovery & fuel
- 7. Environmental attributes owned by municipality/partner



- Wood pellet boilers have a high upfront capital cost but lower fuel cost
 - Lower heat costs over 20 years, but homeowner uncertainty
- Municipalities are committed to long-term economic success of region
 - Wood fuel use keeps expenditures in region
- Access to infrastructure grant funding
- Leadership on pellet fuel supply infrastructure required
- 'Distributed utility' business model for rural/low density regions

ORCHLIGHT Space and Hot Water Demand



GHG Emissions in Nova Scotia, 2017 (15.6 Mt CO₂e)



GHG Emissions in Nova Scotia, 2017 (15.6 Mt CO₂e)





Carbon Intensity of Useful Heat





- Municipal participation in utility is essential
- Federal-Provincial Investing in Canada Infrastructure Program:
 - \$700 M grants allocated to 'Green Stream' in NS
 - Green Transit funds can also be allocated to 'Green Stream' additional \$550 M
 - Application windows: Annual most recent August 2020
- If to municipalities: 73.3% of project costs (40% federal, 33.3% provincial)
- Private sector partner (part) finance, develop, install, fuel maintain
- P3 utility or 100% municipal ownership of assets via private partner concession agreement



Financial Example

- 5 MW of boiler capacity (~200 boilers)
- Generation of 12,000 MWh/yr (2,400 full load equivalent hours)
- CapEx: \$6.5 M (\$1,300/kW)
- Grant support: 73.3% (\$4.75 M)
- Cost of Capital (26.7%): 4.1% (2% debt; 9% ROE) 20-year amortization
- Debt/equity ratio: 70/30
- Delivered Pellet Cost: \$700,000 (\$250/t @ 2,800 t/yr)
- O&M: \$40,000/yr (200 customers @ \$200/yr customer charge)
- TOTAL heat cost: \$72/MWh (\$20/GJ)
 - o \$110/MWh (\$30/GJ) for heating oil (fuel ONLY)
 - \$160/MWh (\$44/GJ) for electric resistance (electricity ONLY)
 - o \$67/MWh (\$19/GJ) for heat pump (electricity ONLY)



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Efficiency of Biomass Boilers

IÓRCHLIGHT BIORESOURCES



Source: Austrian Federal Institute of Agricultural Engineering (FJ-BLT)

CO Emissions of Biomass Boilers BIORESOURCES

