



Arctic Energy
Alliance

Biomass District Heating System Prefeasibility Analysis

Arctic Energy Alliance

Who are we?

- We are a non-profit working in the Northwest Territories in Canada.
- We cover energy conservation, efficiency and renewables
- Our services include information, advice, planning, project coordination, rebates

Topics

- **Background**
- **Walk through a sample analysis**

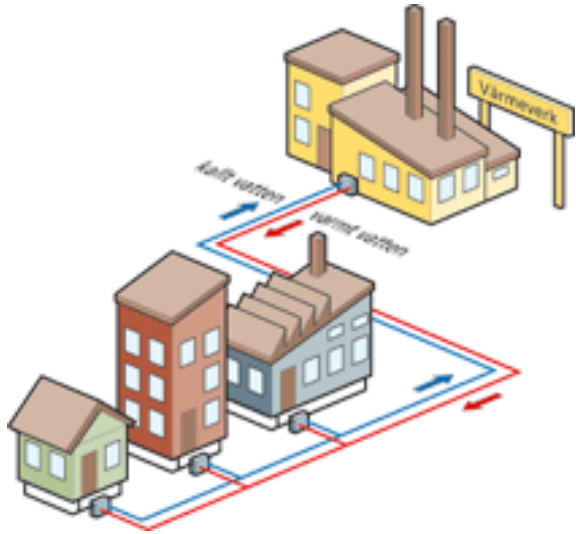
What is biomass?



- Wood pellets
- Wood chips
- Cordwood



What is district heating



- Heat water at 1 main heating plant
- Passes through pipes to houses, school, hotel ...
- District heating station installed in your house (bathroom cabinet size)
- Fan coil or hot water loop through furnace/boiler

What makes a good candidate for district heating?

- High density of buildings
- Higher energy loads per building
- Combination of both

AEA's Biomass DHS Pre-Feasibility Analysis

- Purpose is to explore options for a set of buildings to see which options, if any, warrant further investigation/analysis.
- Estimates are considered Class 'D', indicative.

The screenshot displays the RETScreen Expert software interface. At the top, there is a navigation menu with options: Energy, Cost, Emission, Finance, Risk, Data, Analytics, Report, and Custom. Below the menu is the RETScreen Expert logo and the text "Clean Energy Management Software - Version 9.1".

The main content area is divided into two sections:

- Getting started - Options:** This section contains a list of options with corresponding icons:
 - Virtual energy analyzer
 - Analysis type - Blank project
 - Benchmark
 - Feasibility
 - Performance
 - All
 - My files
 - Case studies/Templates
- Workflow - Per facility:** This section features a circular diagram illustrating the workflow. The diagram is divided into four quadrants, each representing a different analysis tool:
 - Top-Right (Blue):** Location Benchmark Facility. This quadrant includes the Virtual Energy Analyzer.
 - Bottom-Right (Green):** Energy. This quadrant includes the Smart Project Identifier.
 - Bottom-Left (Pink):** Risk. This quadrant includes the Financial Risk Assessor.
 - Top-Left (Yellow):** Performance Data. This quadrant includes the Performance Tracker.The workflow is represented by a circular arrow starting at the top and moving clockwise through these quadrants. A "Start" button is located at the top of the diagram.

At the bottom of the interface, there is a footer with the text "© Minister of Natural Resources Canada 1997-2024." and a version number "9.1.0.98".

Sample Energy Costs

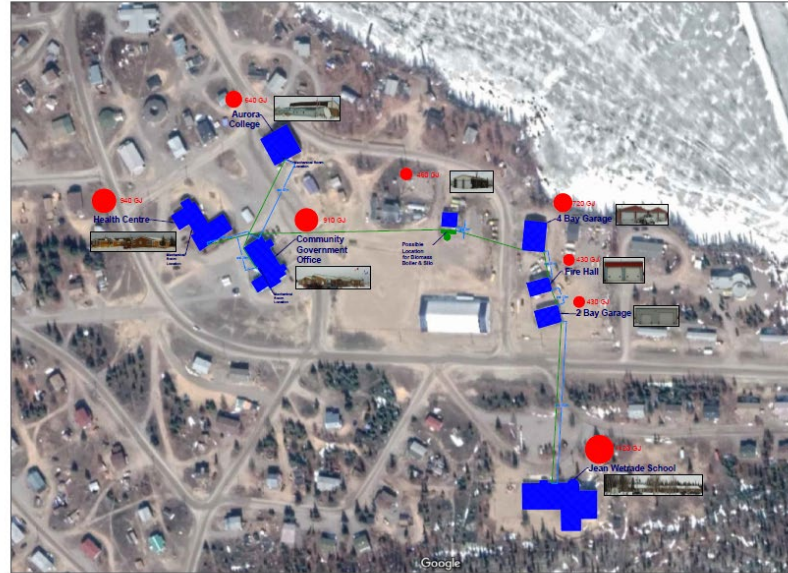
Cost of Heating Energy
(\$ per GJ of delivered heat)



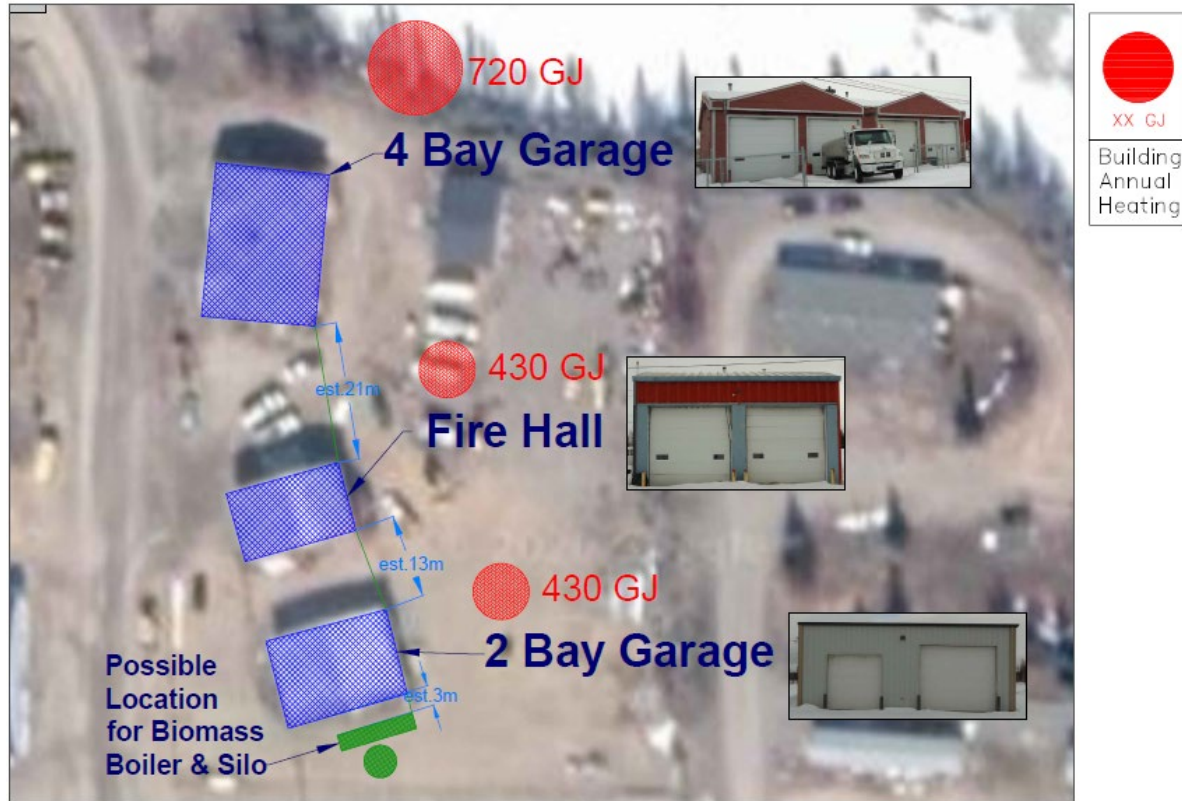
Rough Building Heating Cost Comparison

Building	Annual Heating Fuel Cost	Equivalent Pellets (tonnes/yr)	Equivalent Annual Cost of Pellets	Gross Potential Annual Savings
Building 1	\$33,300	47	\$13,500	\$19,800
Building 2	\$34,300	49	\$13,900	\$20,400
Building 3	\$23,400	33	\$9,500	\$13,900
Building 4	\$26,200	38	\$10,700	\$15,500
Building 5	\$15,500	22	\$6,400	\$9,100
Building 6	\$15,700	22	\$6,400	\$9,300
Building 7	\$40,900	58	\$16,600	\$24,300
Building 8	\$16,700	24	\$6,800	\$9,900

District heating layout options

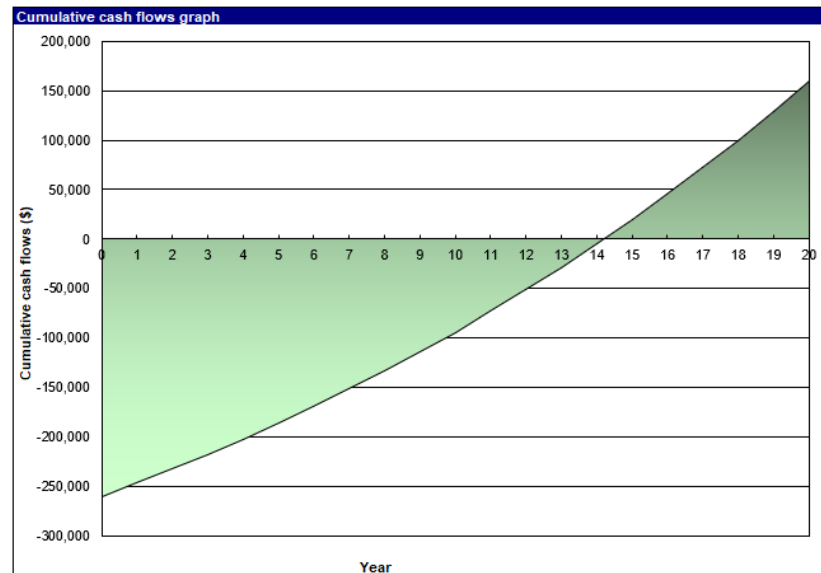


Biomass Boiler Option 1



Biomass Boiler Option 1

- Estimated Cost: \$941,000
- Potential Funding: \$681,000
- **Net Cost to Community: \$260,000**
- **Annual Savings: \$12,900**
- Net Simple Payback: 14 years
- Boiler Size 150 kW (512 MBH)
- Pellet consumption: 79 Tonnes/year



Next Steps

- Decide if it's worth investigating more
- Select implementation team
- Decide on scope of biomass project
 - Detailed feasibility work
 - Design
 - Quotes
- Budget funds for project & apply for funding
- Implement project
- Follow-up to make sure it's all going as planned

Thank you
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Questions?

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How to get the most out of biomass

- Determine heating strategy
 - What is your backup or peak heating system?
 - How will it all be connected?
- Size boiler correctly
 - Biomass burns most efficiently when boiler is running at maximum for a long time
 - Biomass boilers need less maintenance if they run at high capacity
- Use a buffer tank
- Use excellent storage

Sample Energy Costs

Fuel	Units	Cost	Net Heat Content (MJ)	Cost of Heat (\$/GJ)
Oil - Mid Efficiency	(Liters)	\$1.40	31	\$46
Oil - Best Efficiency	(Liters)	\$1.40	35	\$40
Cord Wood	(cord)	\$500	14025	\$36
Wood Pellets - Wholesale	(tonnes)	\$284	16320	\$17
Electricity	(kWh)	\$0.31	3.6	\$86
Electricity	(kWh)	\$0.69	3.6	\$192
Electricity	(kWh)	\$2.13	3.6	\$592