

Itasca Community College

Cost Effectiveness of Woody

Biomass as a Heat Source

Bart Johnson

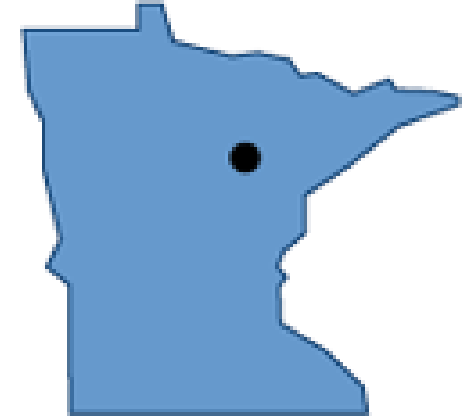
Brad Jones

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Itasca Community College

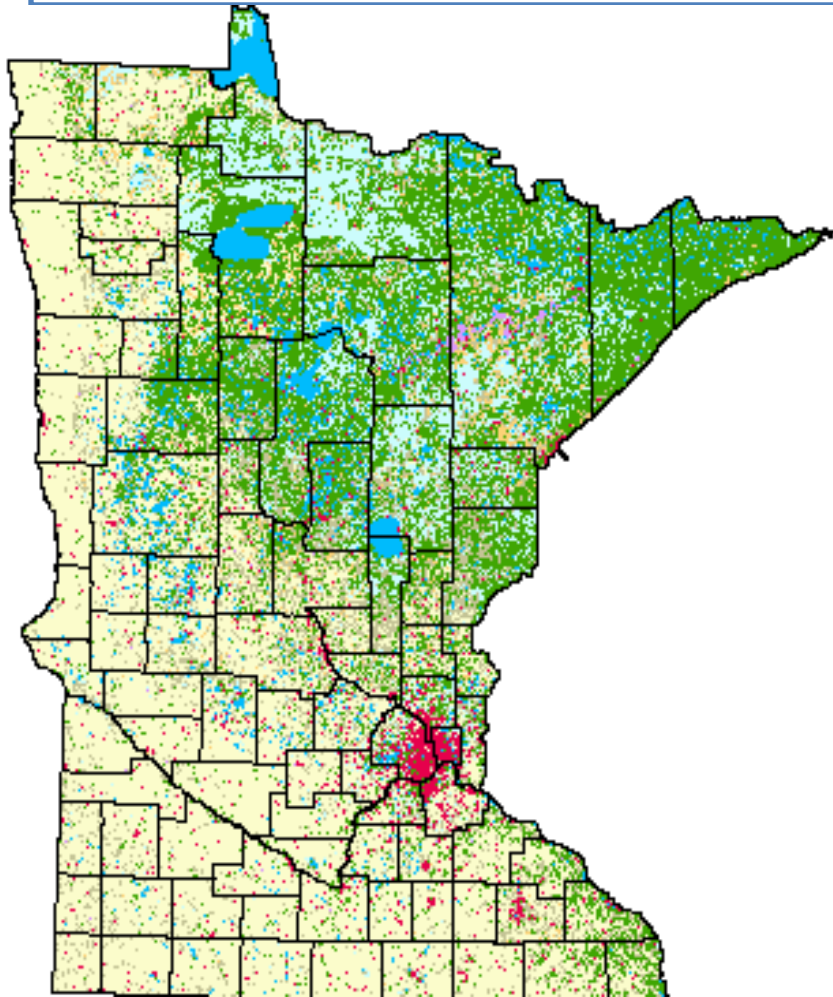
Grand Rapids, MN



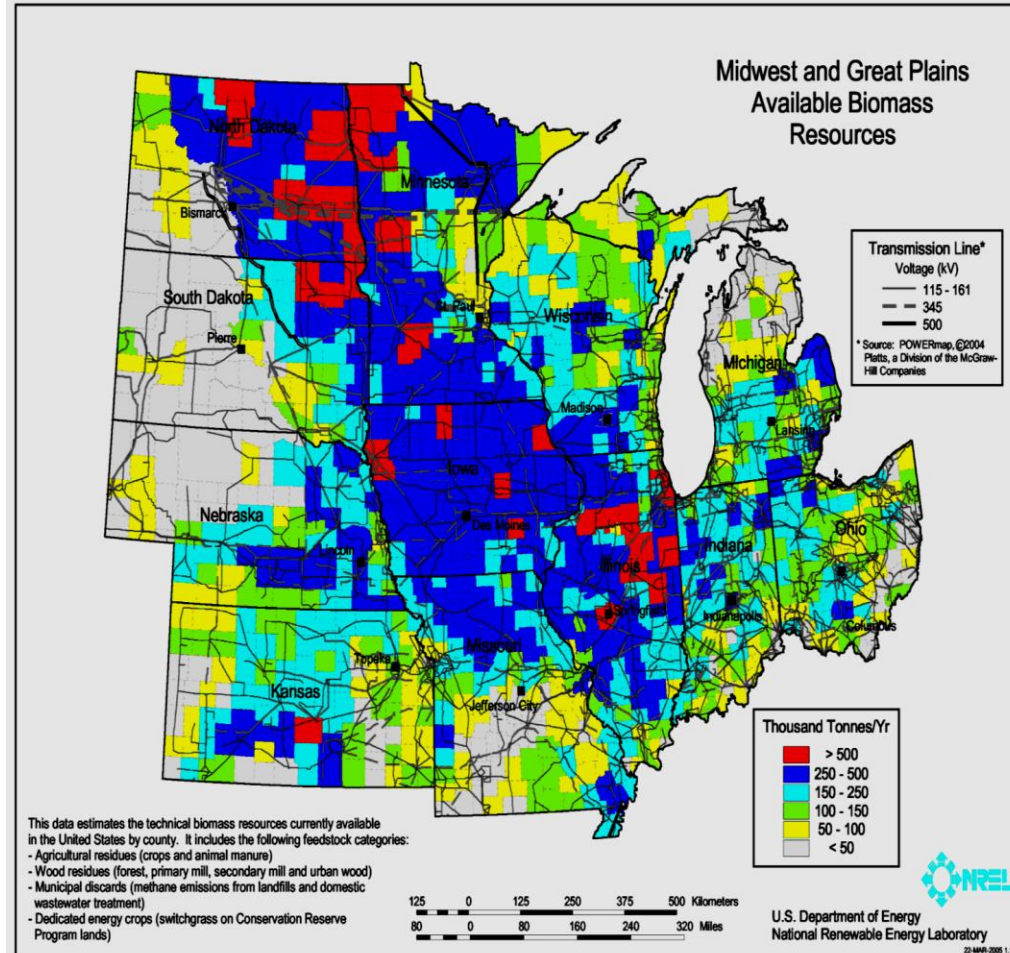
- ~ 1000 Students
- A.A. & A.A.S Degrees
- Programs in:
 - Engineering
 - Natural Resources
 - Power Generation

Minnesota State Colleges and Universities System - **MNSCU**

Forest Region of Minnesota



Midwest Biomass Resources



Itasca Campus



- 3.5 MW Hot water district heating system
- 6" loop for main campus and 3" loop for engineering building

Itasca Community College Woody Biomass Project

Objective: Demonstrate the Effective Use of Woody Biomass for Heating a Mid-Sized Facility

Purpose: Supporting the Wood Product Industry

The Boiler - Phase 1:

Development of Wood Boiler for Applied Research

The Materials - Phase 2:

Examine Woody Biomass Fuel Sources and Develop Procurement Options

The Future - Phase 3:

Upgrade Boiler Facility

Demonstration Site –Educational Cooperative

The Boiler: Duel Boiler System



Existing Natural Gas Boiler

- Current Natural Gas Pricing
 - \$0.5386/Therm
 - \$5.39 per million Btu (MMBtu).
- ICC is on an interruptible gas pricing plan
- '08-'09 \$1.19/Therm

The Boiler: Duel Boiler System



Wood Chip Boiler

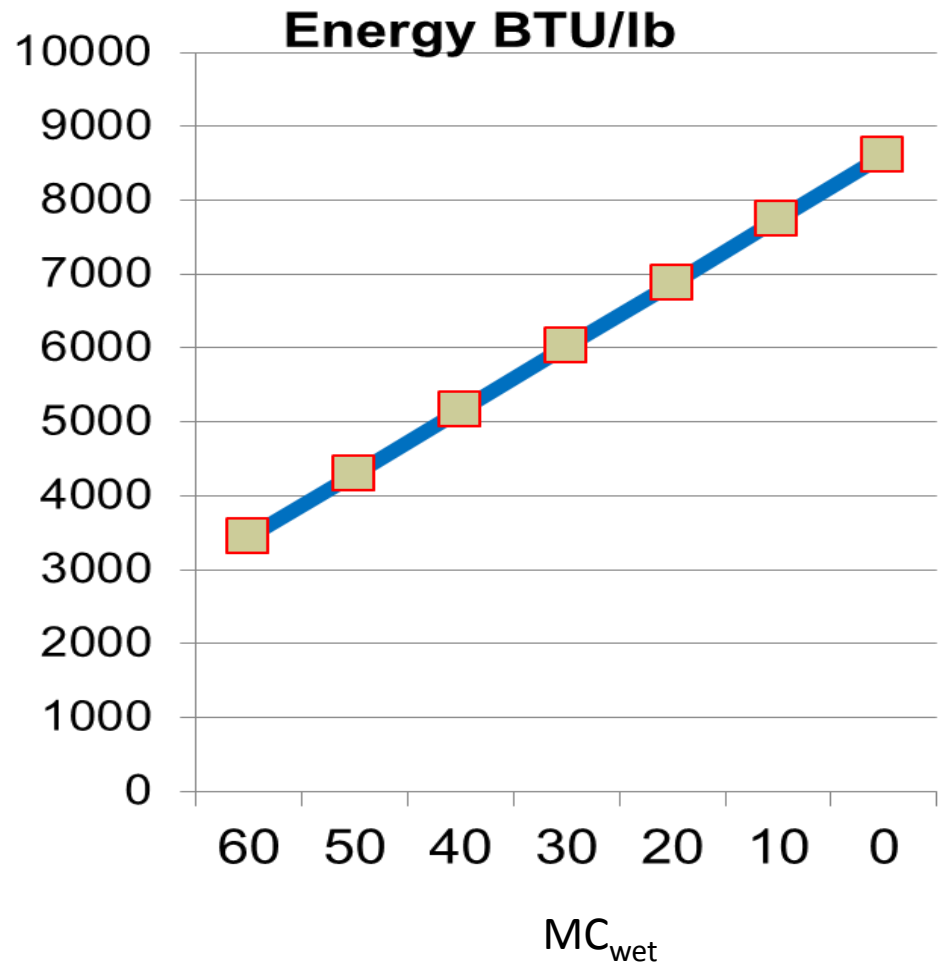
- Burnham Three Pass Generator
- Rated: 12.6 MMBtu/hour
- Peak: 5.2 MMBtu/hr
- 1 TPH at full fire
- Boiler Turndown 2:1

Assuming 75% gas boiler efficiency and 55% wood boiler efficiency

Fuel Use and Economic Impact

Wood Chip Boiler

- 2008-2009
 - \$1.19 therm natural gas
 - \$56/ton wood chip
 - 492 green tons
 - \$27,552 into local economy
 - Annual Savings of \$13,470
- 2009-2010
 - 437 green tons
 - \$24,909 into local economy



The Materials

BAU feedstock used during the 2008/09 and 2009/10 heating season

- Debarked, chipped and screened roundwood
- Paper Quality/
Pharmaceutical Grade Chips
- 40-50% Mc_{wet}
- Value delivered \$56.00/ton



The Materials

Fuel Type	Moisture Content	Heat Value as Received (Therms/Ton)	Price/Ton	\$/Therm
Paper Q Chips	50.60%	70.00	\$56.00	\$0.80
Balsam	59.60%	40.00	\$32.00	\$0.80
Birch	44.40%	60.00	\$32.00	\$0.53
Jackpine/ Balsam '07	46.49%	80.00	\$32.00	\$0.40
Hardwood/ Softwood Chips	47.70%	80.36	\$32.00	\$0.40
Green Aspen	41.80%	87.20	\$32.00	\$0.37
Jackpine/ Balsam '09	41.80%	89.11	\$32.00	\$0.36
Aspen (3yr dry)	36.20%	95.90	\$32.00	\$0.33
Hardwood Tops	39.30%	96.21	\$32.00	\$0.33
Grind Wood	31.10%	105.28	\$32.00	\$0.30

Examination of woody fuel sources

1. Characterization of typical woody residue materials during the 2009-2010 season
2. Develop bids for supply of direct from forest

Thermal energy was analyzed by the NRRI lab in Coleraine, MN

The Materials

Procurement

1. Chip quality

- Size of material
- Bark content
- Moisture content



The Materials

Procurement (cont.)

2. Delivery time

- Mobilization
- Shut down/breakdown
- Break-up



The Materials

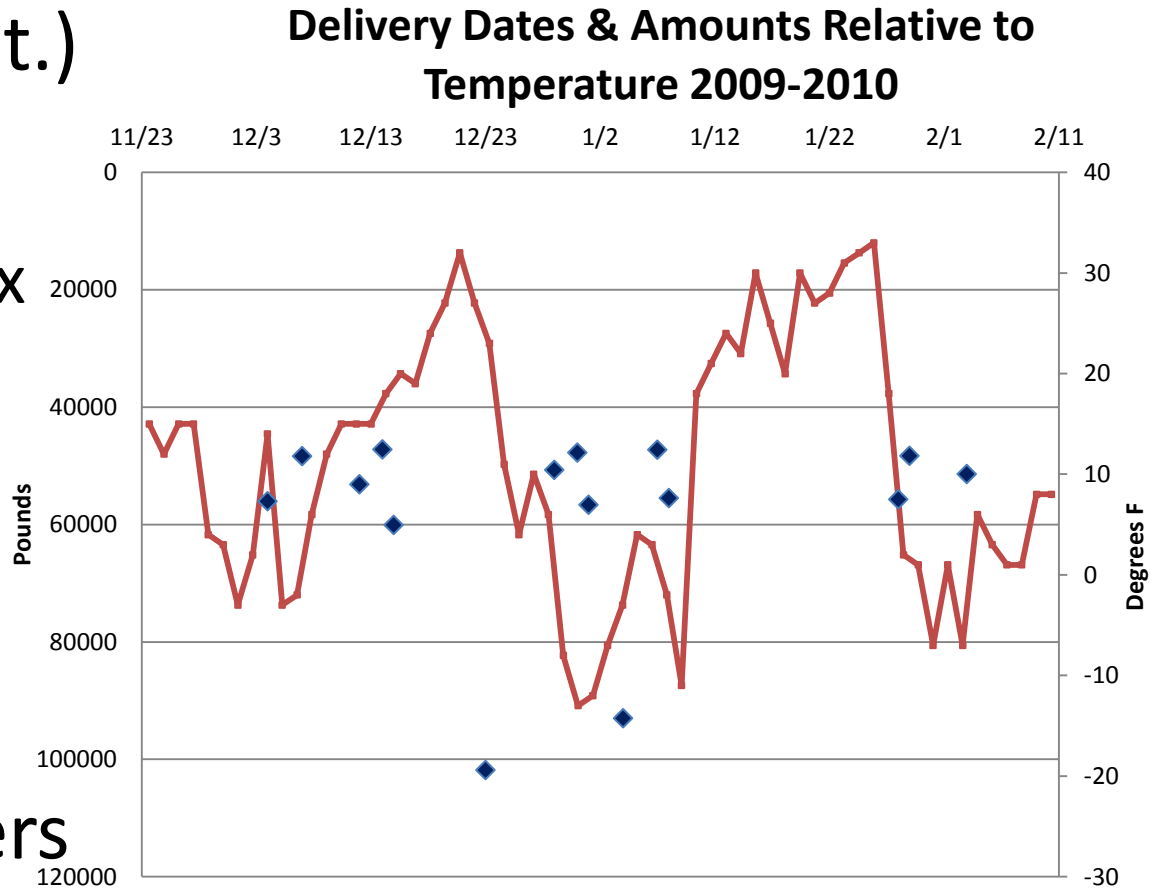
Procurement (cont.)

3. Volume

- Range/Min-Max
- Scaling

4. Break-up demands

Results: Three competitive bidders at ~\$30.00/ton



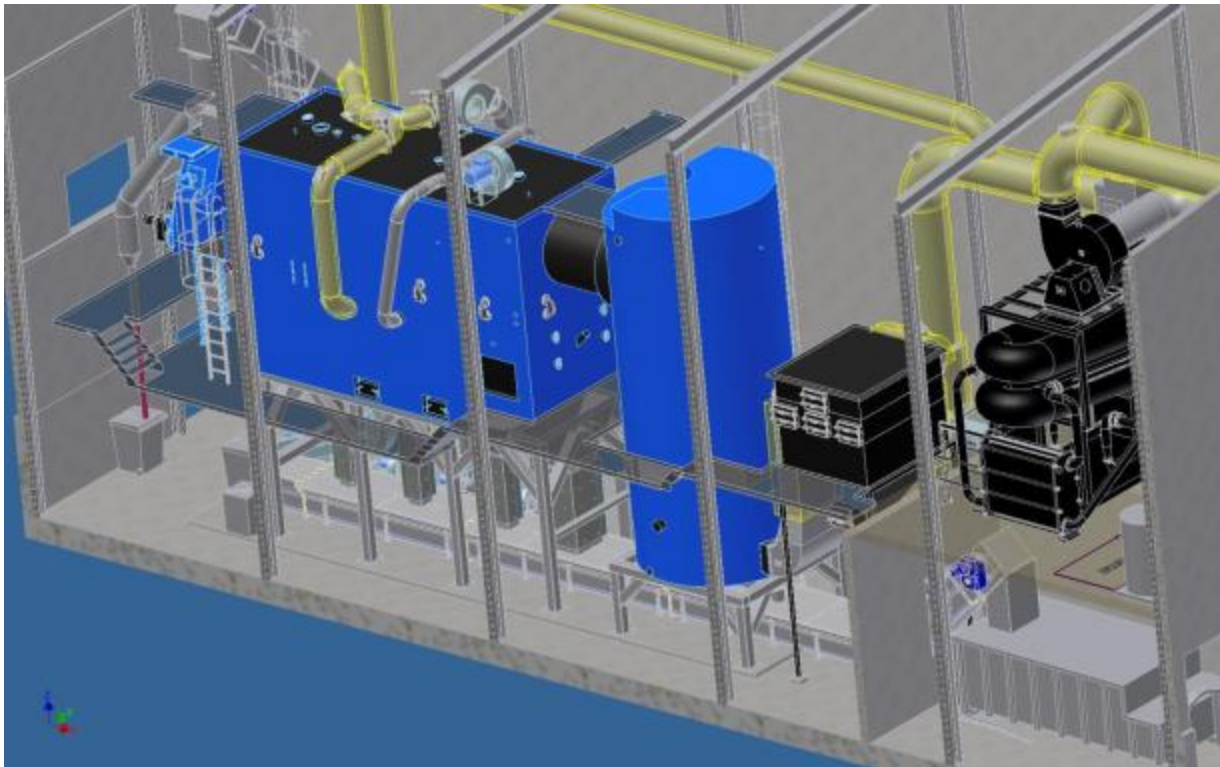
The Future

Upgrade Boiler – Proposal for Funding (2012 FVB Study)

- Annual Operating Cost Savings vs. Natural Gas
 - \$14,434 Year 1
 - \$40,116 Year 20
 - Total Savings \$331,000
 - \$15,000 Annual Fuel Purchase in Local Economy
- \$887,000 Capital Investment
- 2014 Capital Bonding Request

The Future

Demonstration Site: Upgraded Boiler



HOTAB Eldningsteknik AB: 700 kW Biomass Boiler Plant

LIN-KA 700kw (2.39 MMBtu) High Moisture Boiler

The Future

Utilizing information from the study

- Skogforsk: Educational Cooperative
 - Demonstration Site – Upgraded Boiler
- Expand Heating District to the University of Minnesota – North Central Research and Outreach Center
- Woody Biomass Education

Questions

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- 2.8 MMBtu/hr (817 kW) with a fuel moisture content of 45%, would provide about 90% of the heat energy requirements for either scenario. The existing natural gas boiler would provide peaking capacity and warm weather capacity when the turndown limits of the biomass boiler are reached

Current System

- Walking-floor hopper



- Auger Feed System



Current System cont.

- Day Hopper



- Slanted Fire Grate



- Injection System



- Combustion Air Supply



Current System cont.

- Heat Exchangers



- Forced Air Exhaust



- Natural Gas Boiler

