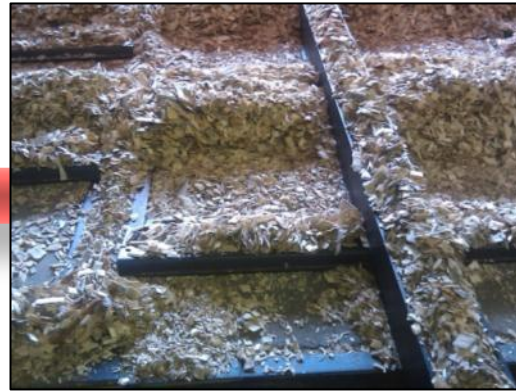


# Forest Biomass Heating and Electricity in Ely, MN

Community Meeting  
*February 9, 2012*



Dovetail Partners  
University of Minnesota  
USDA Forest Service

# Study Teams and Steering Committee



## ***Dovetail Partners, Inc.***

Gloria Erickson, Local Coordinator  
Cheryl Miller, Project Manager  
Kathryn Fernholz, Executive Director  
Dr. Steve Bratkovich  
Dr. Jim Bowyer

## ***USDA Forest Service***

Lew McCreery, NE Area State & Private Forestry  
Dan & Tom Wilson, Wilson Engineering Services



## ***University of Minnesota***

Dr. Dennis Becker, Forest Resources  
Dr. Steven Taff, Applied Economics  
David Wilson  
Ann O'Neill

## ***Ely AETF Steering Committee***

Roger Skraba, Mayor  
Harold Langowski, City Engineer  
Dave Olsen, Retired Engineer  
Rebecca Spengler, Business Owner  
Mark Akeson, USDA Forest Service



# Community-Driven Sustainable Bioenergy

- Funded by the *Environment and Natural Resources Trust Fund* as recommended by the Legislative-Citizen Commission on Environmental Resources (LCCMR)
- Provide objective information on the conversion of forest biomass to energy in Ely and Cook County.
- Provide model for local and state decision-makers for use in considering biomass energy options.



# Project Overview

## Objective:

Assess feasibility and impacts of community biomass energy systems in Ely and Cook County, MN

## Tasks:

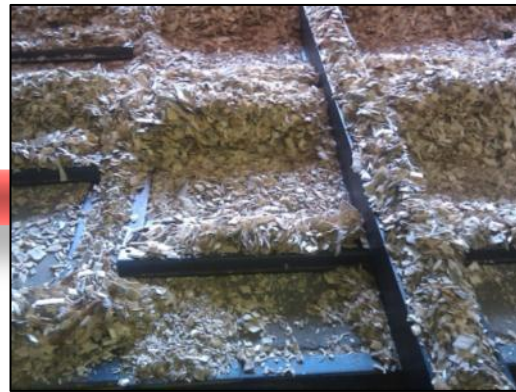
- Technical / engineering assessment of biomass district heating and electricity
- Economic analysis of options over the life of equipment
- Assessment of current and projected biomass supply
- Environmental / lifecycle impacts of biomass energy
- Social assessment of supply chain issues (via community dialogue): forestry, transportation, processing, energy production, and distribution

# Timeline

<b>Fall 2011</b>	<ul style="list-style-type: none"><li>✓ Confirm Ely participation in study</li><li>✓ Hire staff, recruit participants</li><li>✓ Develop work plan</li></ul>
<b>Winter / Spring 2012</b>	<ul style="list-style-type: none"><li>o Identify and assess energy system options (<i>in progress</i>)</li><li>o Assess and project local biomass supply (<i>in progress</i>)</li><li>o Identify community concerns (<i>in progress</i>)</li></ul>
<b>Summer 2012</b>	<ul style="list-style-type: none"><li>o Environmental / lifecycle impact assessment</li><li>o Public outreach on supply chain issues</li></ul>
<b>Fall 2012</b>	<ul style="list-style-type: none"><li>o Public outreach on supply chain and financing issues</li><li>o Community meetings on findings and recommendations</li></ul>
<b>Winter 2012</b>	<ul style="list-style-type: none"><li>o Deliver final report</li></ul>

# Study Approach

- Step 1:** Estimate forest biomass feedstock availability and cost by species and location
- Step 2:** Assess technology options for different sized heating and/or electricity systems
- Step 3:** Evaluate the financial performance of biomass energy systems vs. existing fossil fuel systems



# Forest Biomass Availability

**Step 1: Estimate forest biomass feedstock availability and costs**

## Annual Biomass Availability (within 60-miles of Ely; all species)

Ownership	2011 harvest rate (cords) <sup>1</sup>	Biomass Availability (dry tons)			
		Harvest residuals (50% tops & limbs) <sup>2</sup>	+10% of roundwood	+20% of roundwood	Firewise removals <sup>3</sup>
Superior National Forest	161,474	21,299	39,861	58,423	3,189
Minnesota DNR	29,078	3,745	7,070	10,395	na
St Louis County	87,649	12,020	22,086	32,152	900
Private <sup>5</sup>	152,904	22,682	40,359	58,036	na
<b>Total</b>	<b>431,105</b>	<b>59,746</b>	<b>109,376</b>	<b>159,006</b>	<b>4,089</b>

<sup>1</sup> One cord is equivalent to 1.2 dry tons. Source: personal communication with each agency; USDA FIA

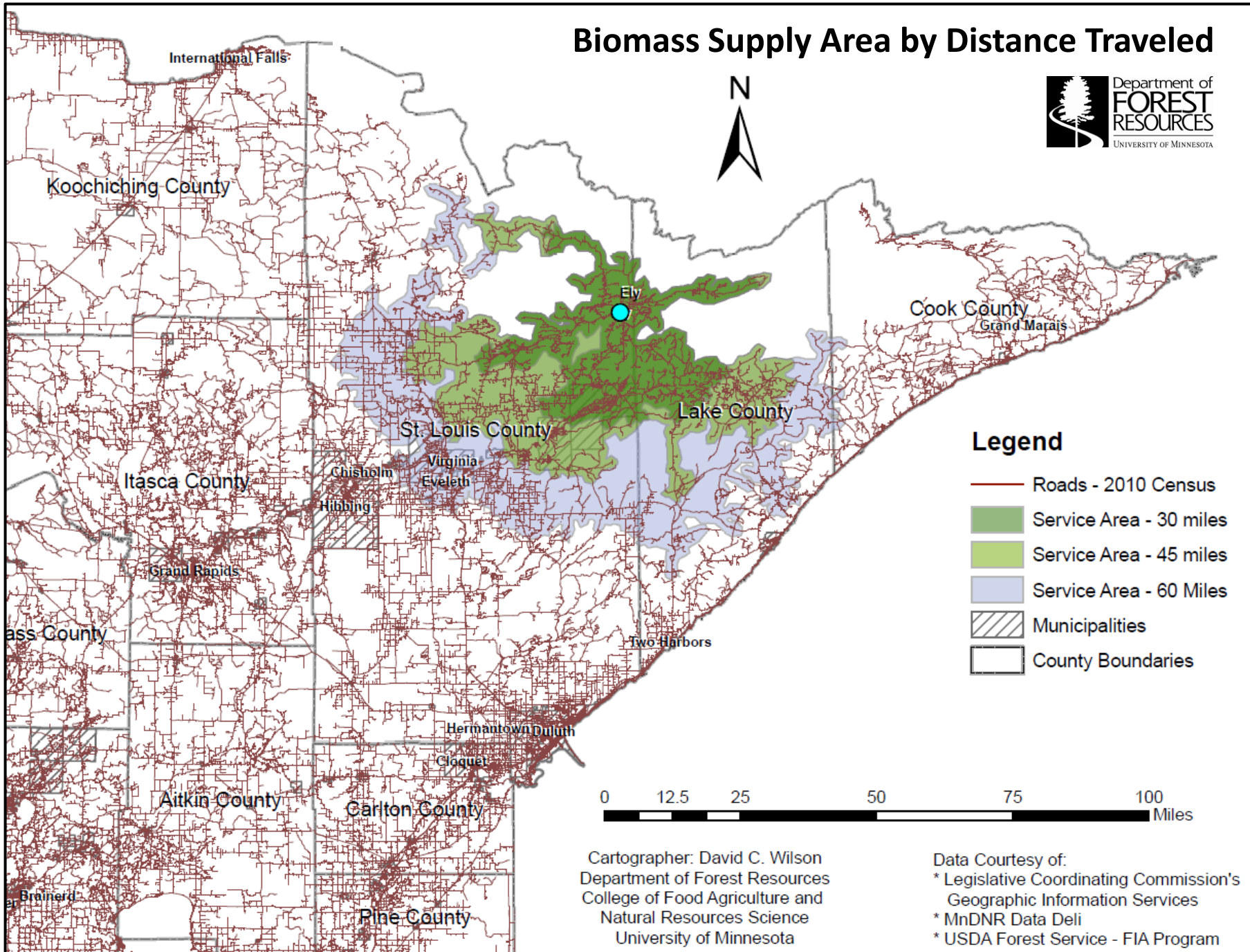
<sup>2</sup> Residual biomass includes tops, limbs, branches and needles as defined by the USDA Forest Service FIA biomass attributes.

**Assumes 50% retention on-site.**

<sup>3</sup> Fuels reduction removals from the Superior National Forest based upon an estimated 12,599 cu. yards of slash generated in 2010. St Louis County estimates based upon amount of slash processed into mulch at seven local transfer sites.

<sup>4</sup> Includes non-industrial private woodlands, corporate, non-governmental conservation/natural resources organizations, unincorporated local partnerships/associations/clubs, and tribal timberlands.

# Biomass Supply Area by Distance Traveled



- ### Legend
- Roads - 2010 Census
  - Service Area - 30 miles
  - Service Area - 45 miles
  - Service Area - 60 Miles
  - ▨ Municipalities
  - ▭ County Boundaries

Cartographer: David C. Wilson  
Department of Forest Resources  
College of Food Agriculture and  
Natural Resources Science  
University of Minnesota

Data Courtesy of:  
\* Legislative Coordinating Commission's  
Geographic Information Services  
\* MnDNR Data Deli  
\* USDA Forest Service - FIA Program

# Forest Biomass Availability

*Step 1: Estimate forest biomass feedstock availability and costs*

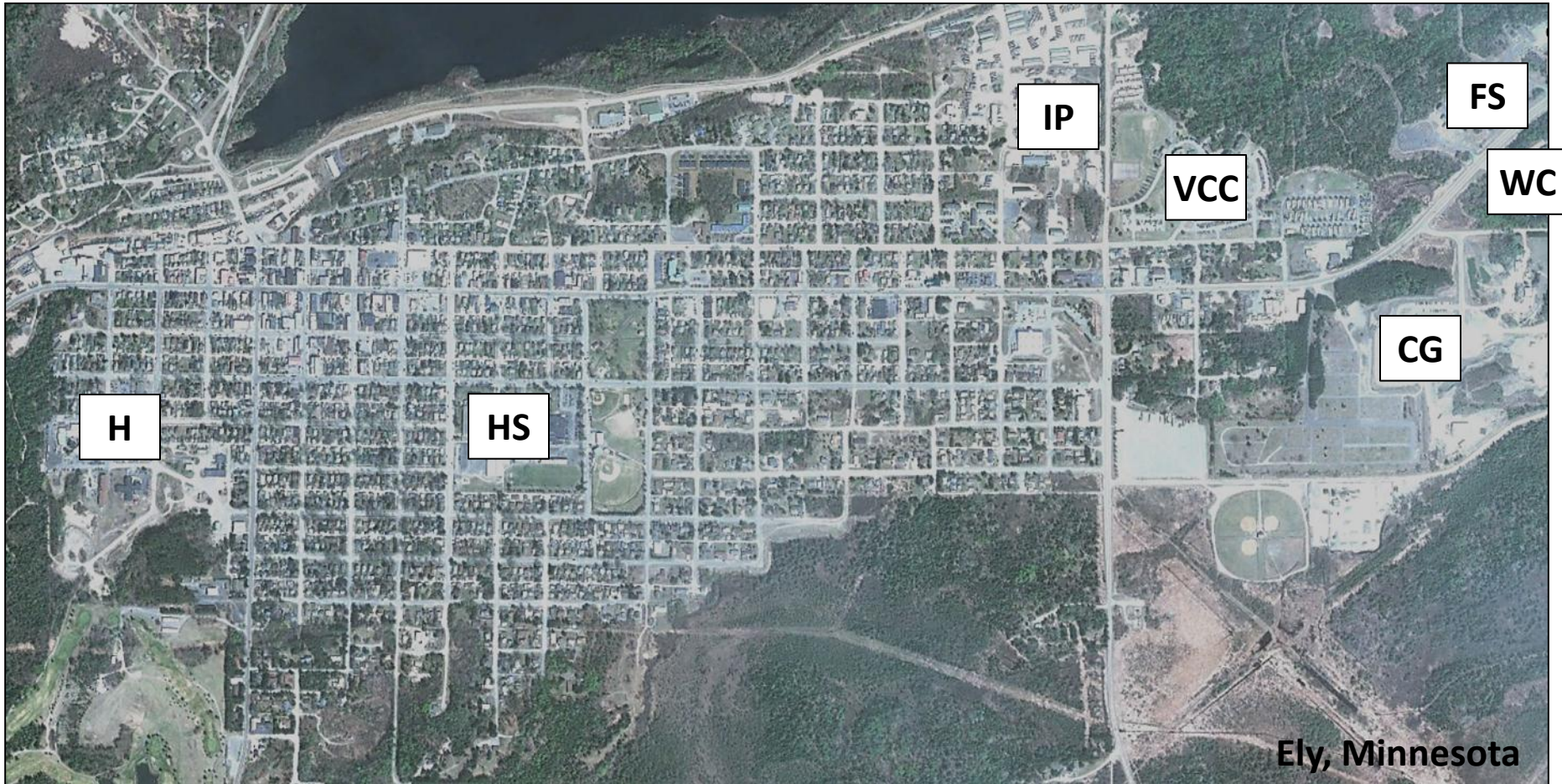


**Stumpage Cost + Harvest Costs + In-woods Processing + Transport Costs = Delivered Cost**

<b>Clean chips</b>	=	bolewood portion of tree only
<b>Hog (hogged) fuel</b>	=	limbs, tree tops, small diameter wood
<b>1 truckload of wood</b>	=	23-26 green tons
<b>1 green ton of wood</b>	=	0.70 dry tons (30% moisture content)
<b>1 cord of roundwood</b>	=	1.2 dry tons (128 cu ft)
<b>1 dry ton of wood</b>	=	7,600-9,600 Btu/lb (18-22 GJ/t)

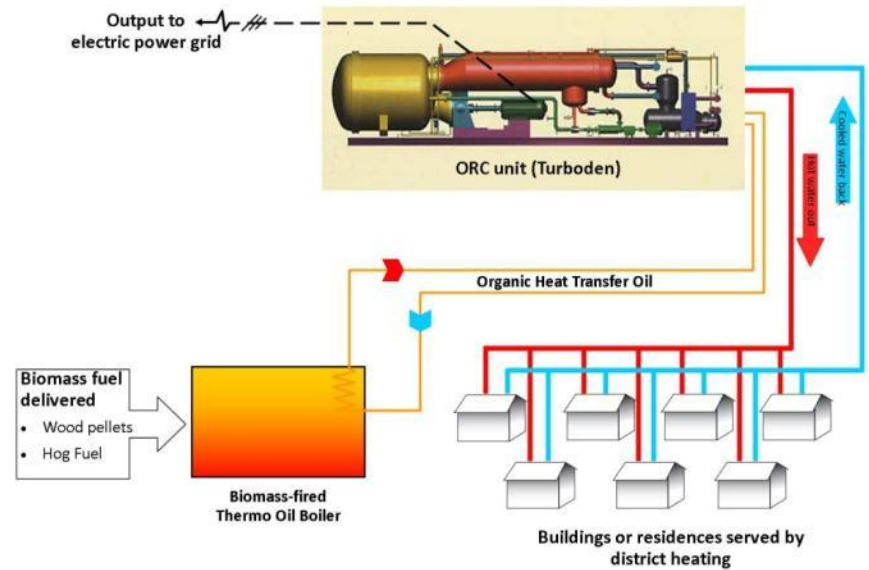
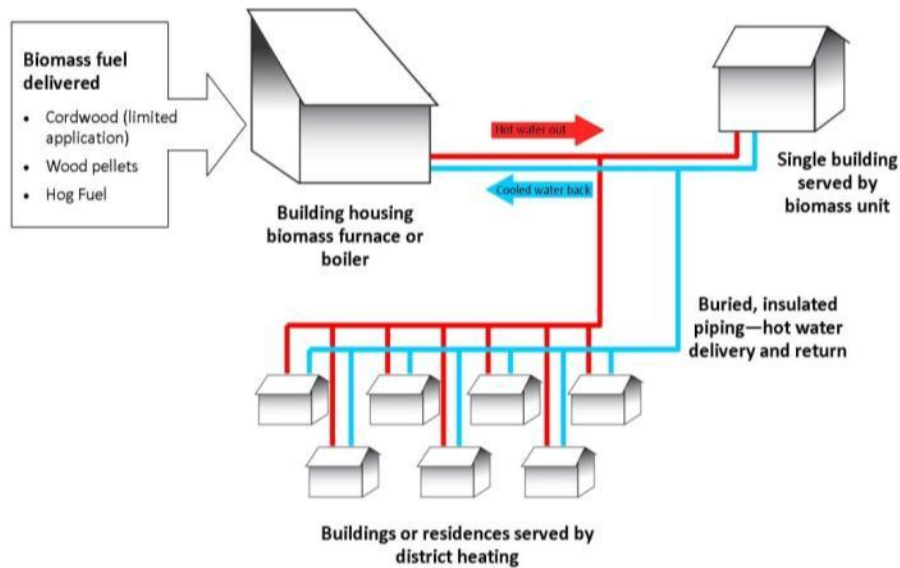
# Bioenergy Technology Options

*Step 2: Analyze technology options*



# Bioenergy Technology Options

## Step 2: Analyze technology options



Ely District Energy Engineering Study (Nov 22, 2010)

# Bioenergy Technology Options

## *Step 2: Analyze technology options*

Configuration	Annual energy demand equivalent	Fuel type	Annual biomass demand (dry tons/yr) <sup>1</sup>	Annual truckloads (25 tons; 40% MC)
Ely Homes & Businesses <sup>2</sup>				
Combined-Heat-Power (CHP)	197,000 mmBtu	Hog fuel	13,500	900
District Heating (DH)	125,000 mmBtu	Hog fuel	8,500	570
West End Cluster (high school, hospital)	----- in-progress -----			
East End Cluster (VCC, Forest Service, others)	----- in-progress -----			

<sup>1</sup> 59,746 dry tons of residual biomass generated in 2011 from within 60-miles of Ely

<sup>2</sup> LHB, 2011

# Evaluate Financial Performance

*Step 3: Financial performance of biomass vs. existing systems*

## New system costs:

- Boiler/ building/ turbine
- Backup equipment
- Annual fuel price
- Annual operations
- Piping
- Hookups

## New system revenues:

- Annual heat sales
- Electricity sales (if any)
- City taxes
- Financing / debt service

## Current system costs:

- Annual fuel price (rising?)
- Annual operations expenses
- Equipment replacement
  - Cost?
  - When?
  - How financed?
- Annual **average** cost of heat comparison with new system

# Evaluate Financial Performance

## Step 3: Financial performance of biomass vs. existing systems

**Example**

	Grand Marais, MN Heat for public buildings north of 5 <sup>th</sup> St N	
Thermal demand	12,100 mmBtu/yr	
20-yr effective fossil fuel price <sup>2</sup>	\$32.60/mmBtu	
Fuel type	Clean Chips	Pellets
Capital construction costs		
Site prep & building	\$208,000	\$180,000
Boiler and fuel receiving	\$520,000	\$460,000
Back-up boilers	\$200,000	\$150,000
Piping & pumping	\$775,000	\$775,000
Other misc <sup>1</sup>	\$434,000	\$399,000
<b>TOTAL</b>	<b>\$2,137,000</b>	<b>\$1,964,000</b>
Annual operating costs (20 yrs)		
Delivered wood costs	\$89,000	\$185,000
O&M, utilities & electric	\$7,000	\$3,500
<b>TOTAL</b>	<b>\$96,000</b>	<b>\$188,500</b>
Financial Return		
Cost of heat (\$/mmBtu)	\$24.20	\$31.00
Simple payback period	7 yrs	10 yrs
Return on investment	186%	111%
Outstanding capital needed	\$0	\$0

**Example**

# Other considerations

- Analysis of environmental impacts from transportation, harvesting, carbon emissions, and ash disposal
- Sustainability guidelines for biomass harvesting
- Community and stakeholder outreach and education to select preferred options
- Decision tools for other communities

# Questions?

**For further information, please contact:**

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