BIOMASS ENERGY FOR NEW BELGIUM BREWERY

New Belgium Brewing

Fort Collins, CO

June 14, 2017

Colorado State Forest Service

TECHNOLOGY IN SERVICE OF COMMUNITY AND ENVIRONMENT

OUTLINE

- Project background
- Why biomass?
- Study findings
  - **Proposed system**
  - **Fuel use**
  - **Fuel supply**
  - **Emissions**
  - **Costs**
  - **Variants**

ABOUT WISEWOOD ENERGY

Our Mission

We outfit communities and businesses with state-of-the-art biomass energy systems that strengthen local economies, lower heating costs and promote environmental stewardship

Technology in Service of Community and Environment


VIESMANN


SCAFCO

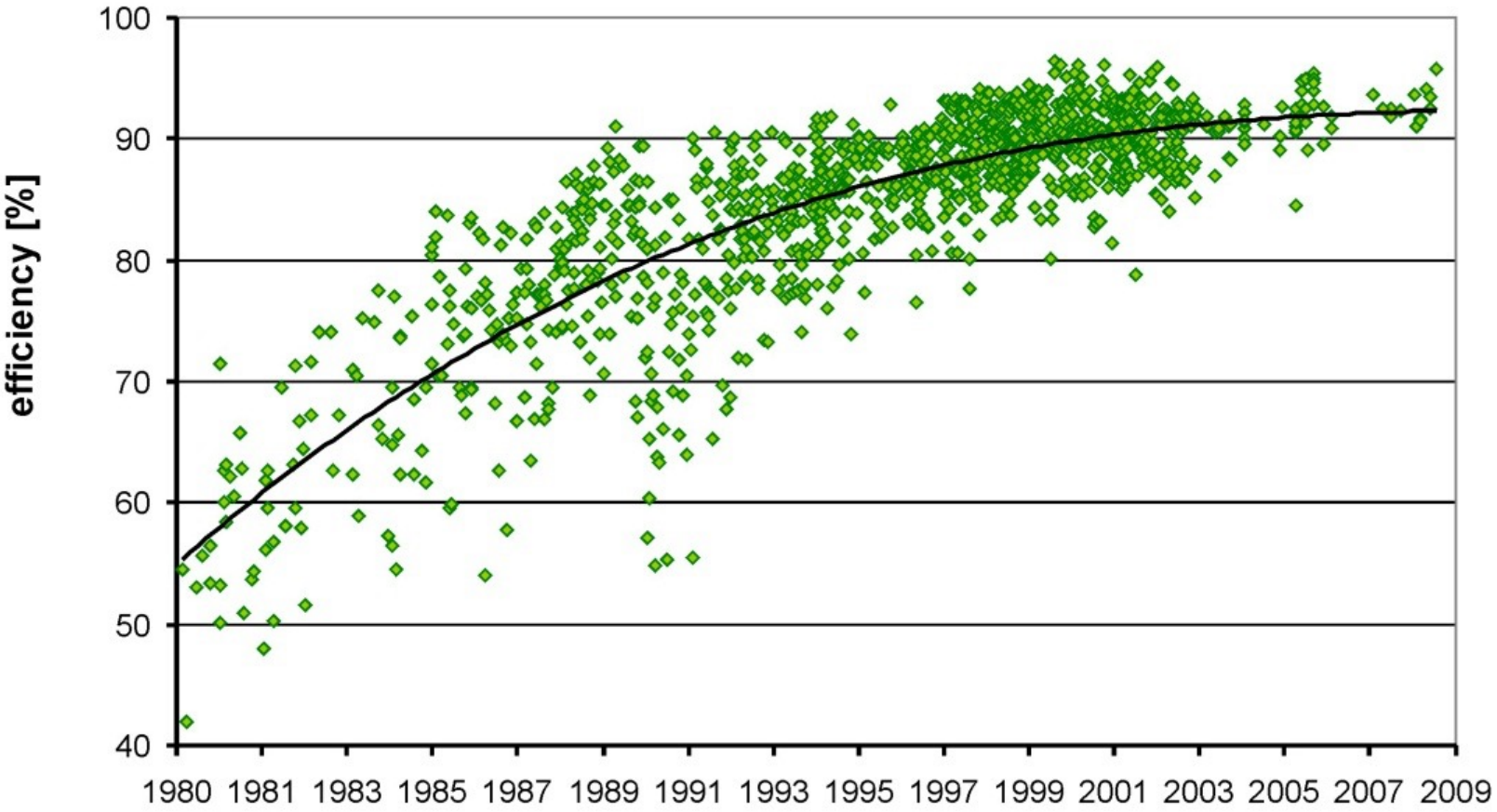
PROJECT BACKGROUND

- CSFS and Dan Bihn met with Wisewood to discuss CO biomass opportunities
- New Belgium Brewing was identified as a compelling process heat project
- CSFS retained Wisewood Energy to conduct a feasibility assessment of biomass process heat at the Fort Collins facility
- Feasibility study completed in May 2017

Biomass Energy for New Belgium Brewery

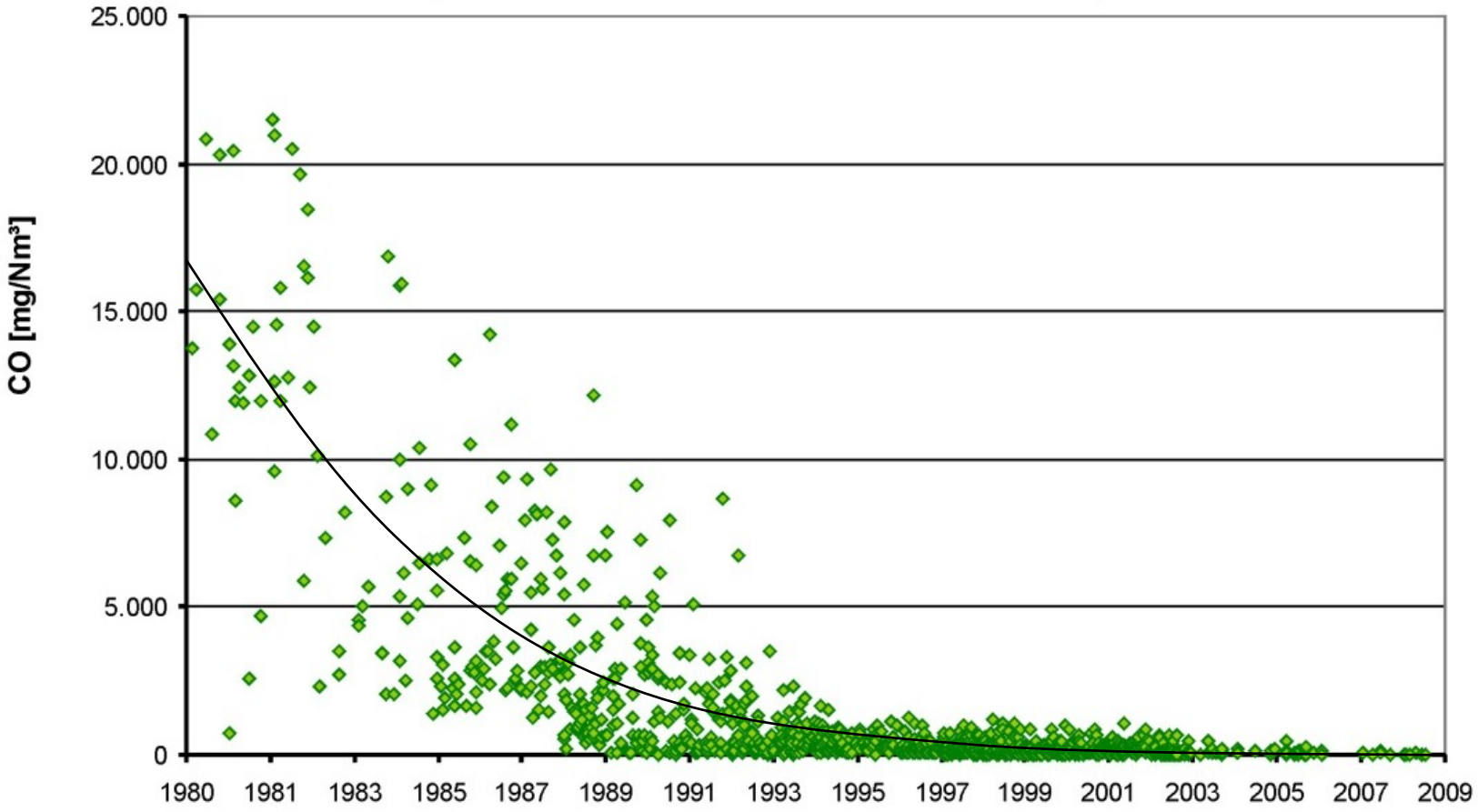
WHY BIOMASS?

BIOMASS IS EFFICIENT...



Development of emissions of Austrian Biomass Boilers, measured by the federal agency for agricultural engineering Wieselburg (BLT)

... AND CLEAN



Development of emissions of Austrian Biomass Boilers, measured by the federal agency for agricultural engineering Wieselburg (BLT)

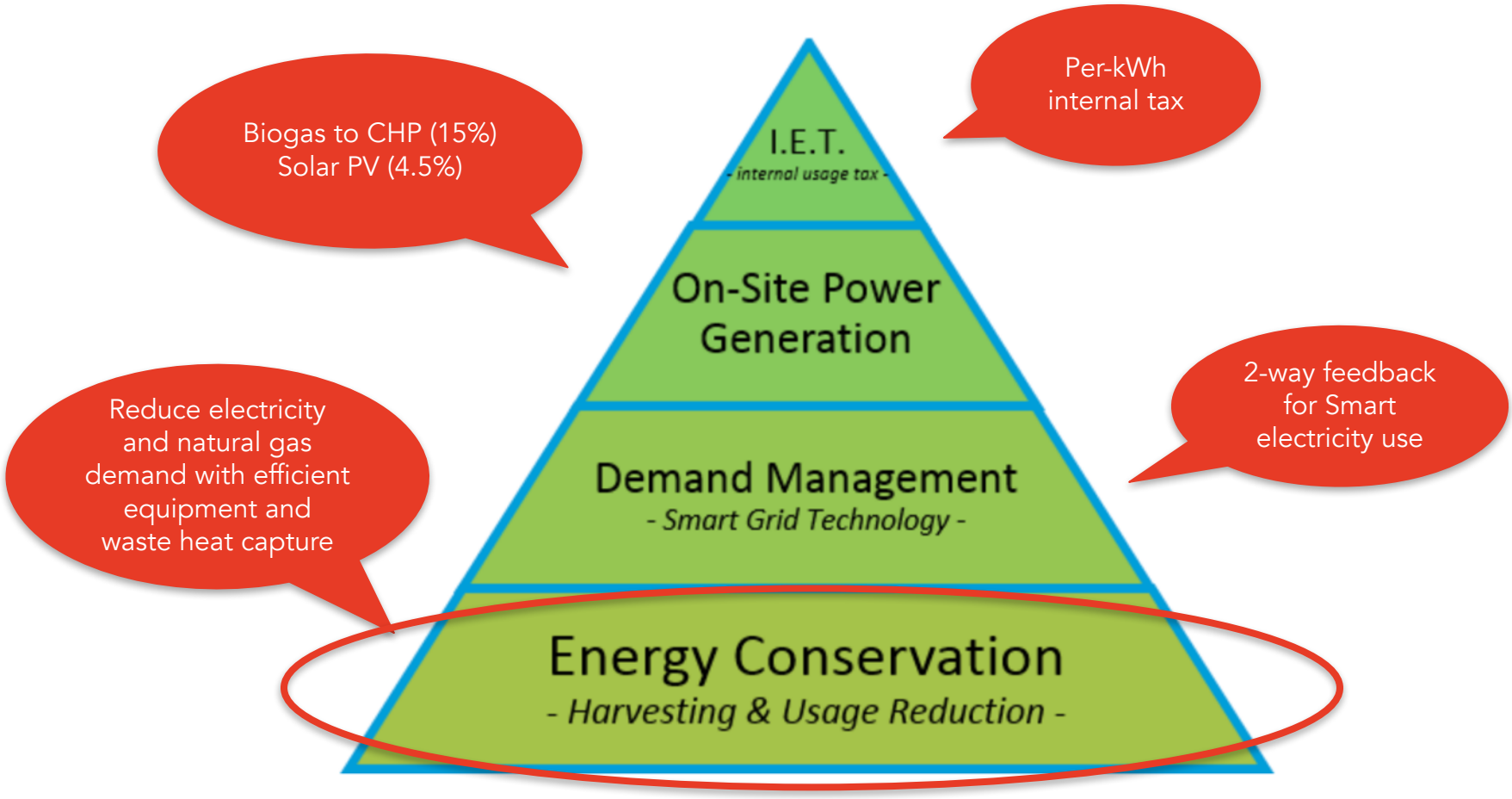
LOCAL FUEL SUPPLY

- New Belgium has its own spent grain supply
- The City of Fort Collins is concerned about Emerald Ash Borer (EAB) impacts in the area
- 15% trees in Fort Collins are ash; entire population expected to die within 5-10 years of initial EAB detection

RELIANCE ON NATURAL GAS

- New Belgium still uses ~88,000 MMBtu/yr of natural gas for the steam brewing process
- Natural gas is cheap, but is not renewable and has environmental costs that are not reflected in the price

A LEADER IN SUSTAINABILITY



Biomass Energy for New Belgium Brewery

WHY BIOMASS?

RENEWABLE STEAM!

Biomass Energy for New Belgium Brewery

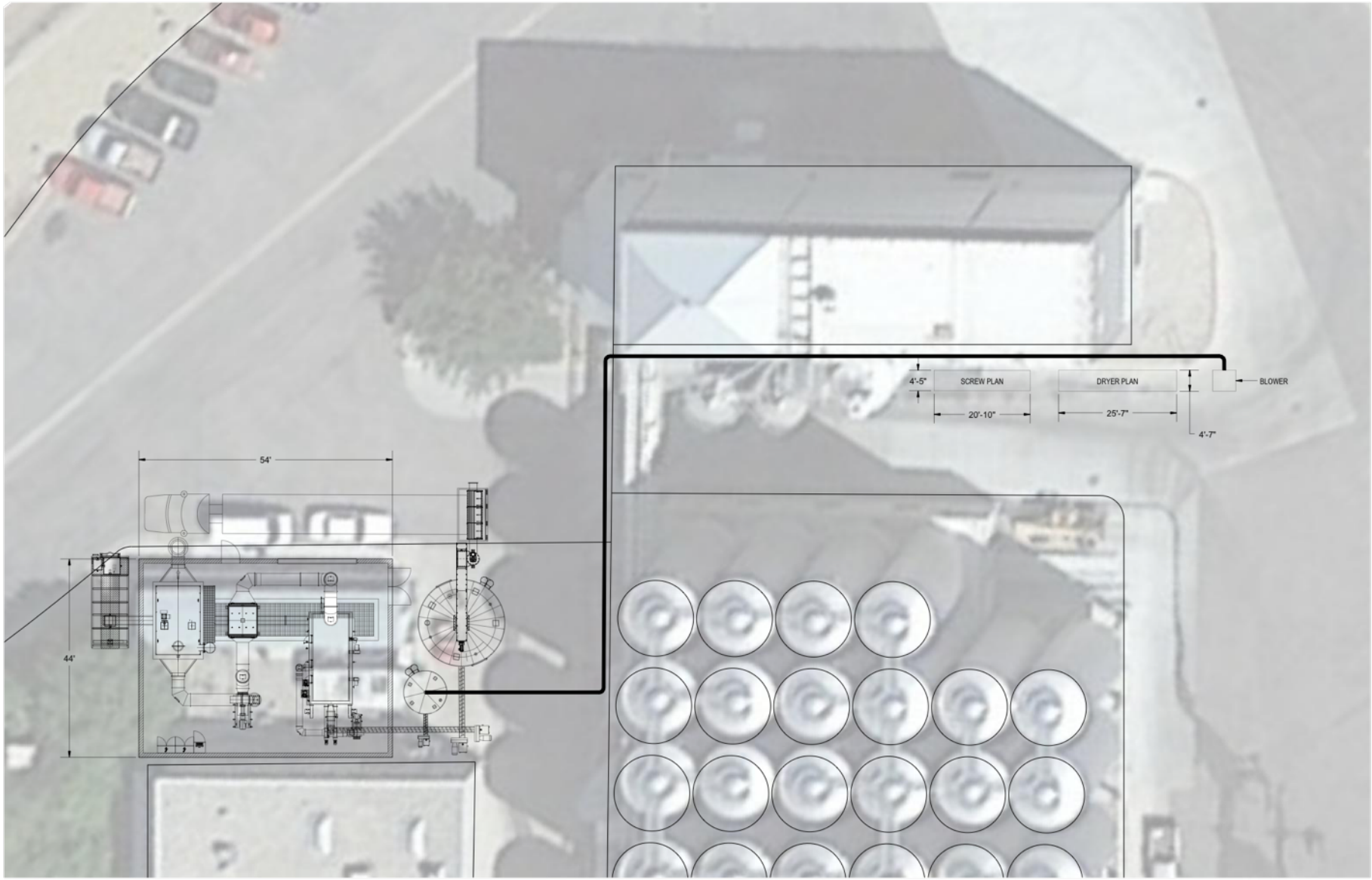
STUDY FINDINGS

EXISTING NATURAL GAS SYSTEM

- 24/7, 5-7 days/wk operations
- Medium pressure steam
- Steam load primarily met by 1 modulating Clayton boiler
- Supplemented by 3 binary output Miura LX-200 boilers
- Consumption of approx. 88,000 MMBtu/yr
- >30,000 tons/yr spent grain produced, sold to cattle farmers for nominal price

PROPOSED BIOMASS SYSTEM

- **25%:75%** spent grain to wood
- **Displace 100%** natural gas steam use with a 13.6 MMBtu/hr boiler
- **2,200 tons** of spent grain per yr, **6,600 tons** of wood per yr
- **Target 35%** combined spent grain and wood moisture content for max fueling flexibility



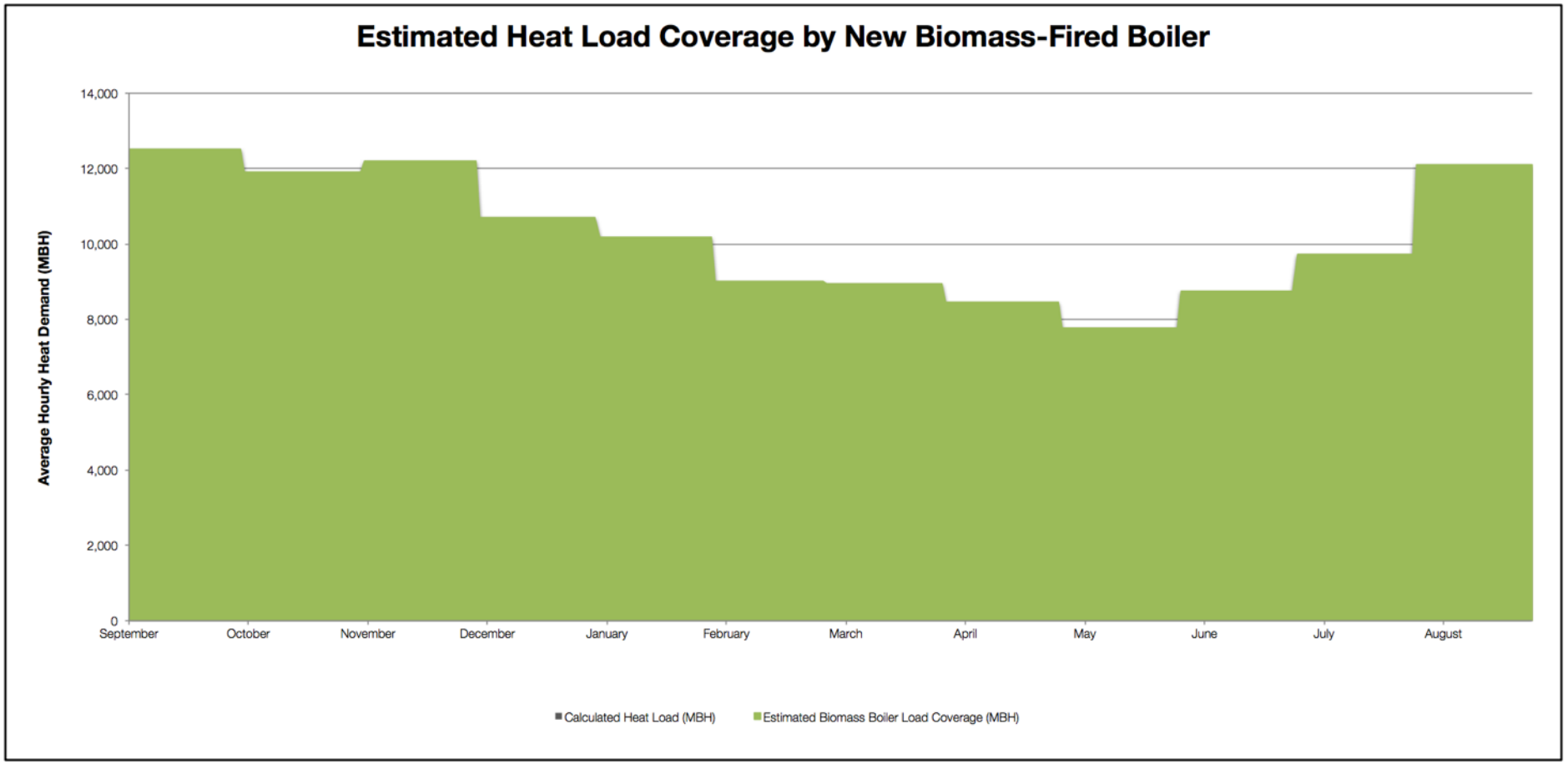
1 M0.1 SITE PLAN AND GENERAL ARRANGEMENT
SCALE: 3/32" = 1'-0"

N

WE

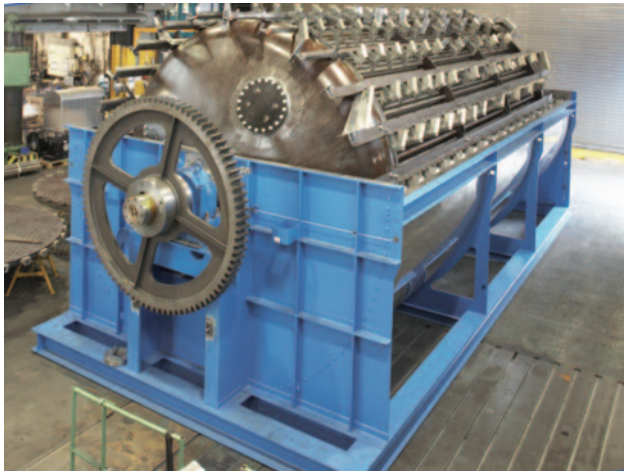

CLARK

BIOMASS ENERGY MODEL



TARGET FUEL MOISTURE CONTENT

	SCENARIO A	SCENARIO B	SCENARIO C
Grain Drying	Dewatering Screw + Active Drying	Dewatering Screw	None
Target Spent Grain Moisture Content	20%	50%	84%
Target Wood Moisture Content	40%	30%	19%



Steam Tube Bundle Dryer

Dewatering Screw

WOOD SUPPLY OPTIONS

- **Commercial arborists**
  - Expected to be challenged by influx of wood from Emerald Ash Borer
  - Currently paying to dispose of wood
  - 1,000 – 5,000 tons/yr available
- **Morgan Timber**
  - Currently supplying wood chips to existing biomass systems
  - Reliable, steady, plentiful supply
- **Hageman's Earth Cycle**
  - Additional market for wood waste
  - 15,000 – 20,000 GT/yr woody material
  - More expensive to access
- **Larimer County Landfill**
  - 87,000 – 100,000 tons/yr woody material
  - More expensive to access

EMISSION CONTROLS

- Dynamic feedback from oxygen and temperature sensors in the combustion chamber and flue gas stream to optimize combustion
- Multi-cyclone array
- Electrostatic precipitator
- Other options if needed/desired for specific criteria pollutants (NOx)

Stabilized year operating costs compared to existing natural gas system.

EXISTING HEATING SYSTEM		BIOMASS HEATING SYSTEM	
NATURAL GAS	$433,900	WOOD FUEL	$66,100
ELECTRICITY	$2,800	ELECTRICITY	$42,500
OPERATIONS	$5,000	OPERATIONS	$66,200
TOTAL	$441,700	TOTAL	$174,900

Summary comparison of lifetime operating costs.

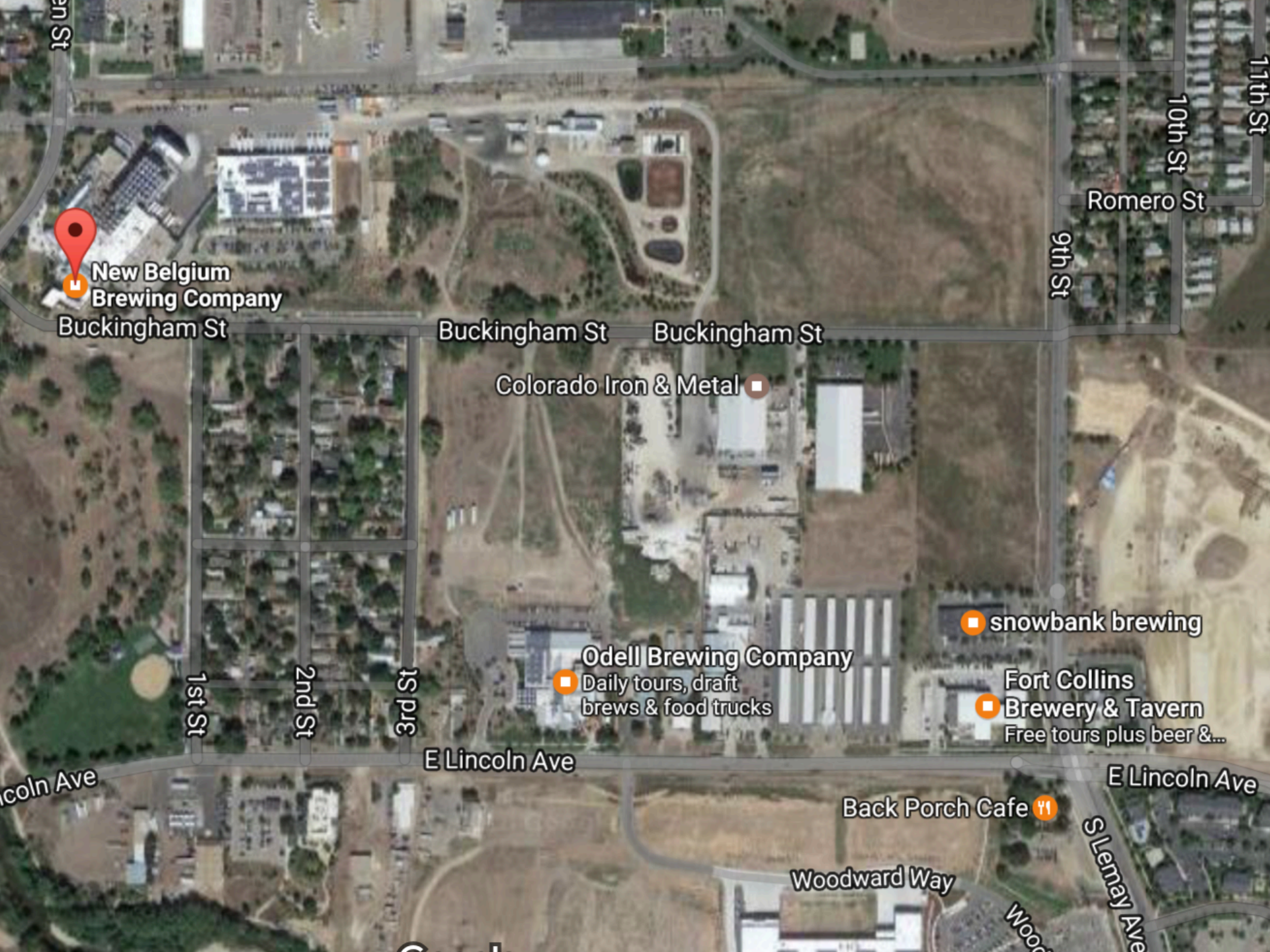
	YEAR 1 COST	YEAR 25 COST	CUMULATIVE COST (25 YEARS)
EXISTING SYSTEM	$442,000	$1,125,000	$18,320,000
BIOMASS SYSTEM	$175,000	$281,000	$5,601,000
BIOMASS SYSTEM SAVINGS	$267,000	$843,000	$12,719,000

CAPITAL COST OPINION

Item Description	Est. Hours	Install Equipment	Install Materials	Install Labor	Line Total	% Total Project
Construction Costs						
Civil/Structural	Included	Included	$ 240,000	Included	$ 330,000	5.4%
Mechanical Installation	3,270	$ -	$ 3,030,000	$ 490,000	$ 3,570,000	58.1%
Electrical	400	$ -	$ 100,000	$ 50,000	$ 150,000	2.4%
Permitting					$ 20,000	0.3%
Miscellaneous					$ 50,000	0.8%
Contingency and Unlisted Items					$ 620,000	10.1%
Subtotal Direct Costs	**3,670**	**$ -**	**$ 3,360,000**	**$ 540,000**	**$ 4,740,000**	**77.1%**
General Contractor Costs					$ 950,000	15.4%
Subtotal Construction Costs					**$ 5,680,000**	**92.5%**
Engineering, Procurement and Construction Management						
Engineering, Procurement and Construction Management					$ 460,000	7.5%
Finance Fees and Management					$ -	0.0%
Subtotal Development Costs					**$ 460,000**	**7.5%**
Total Capital Costs					**$ 6,140,000**	**100%**

BIOMASS SYSTEM VARIANTS

- **Smaller biomass boiler**
  - 8 MMBtu/hr displaces 78% of facility's demand
  - Avoids federal regulatory compliance
    - System will be equally clean, but less paperwork
- **District steam system**
  - Renewable process steam for breweries in the vicinity
  - Increase boiler size, footprint, and storage system
  - Allows for significant expansion of brewery operations in the "district"


New Belgium
Brewing Company
Buckingham St
Buckingham St
Buckingham St
Colorado Iron & Metal
Romero St
11th St
10th St
9th St
snowbank brewing
Odell Brewing Company
Daily tours, draft
brews & food trucks
Fort Collins
Brewery & Tavern
Free tours plus beer &...
1st St
2nd St
3rd St
E Lincoln Ave
E Lincoln Ave
Back Porch Cafe
Woodward Way
S Lemay Ave

THANK YOU!

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