

Small Scale Biomass Heat Economics and Pre-feasibility



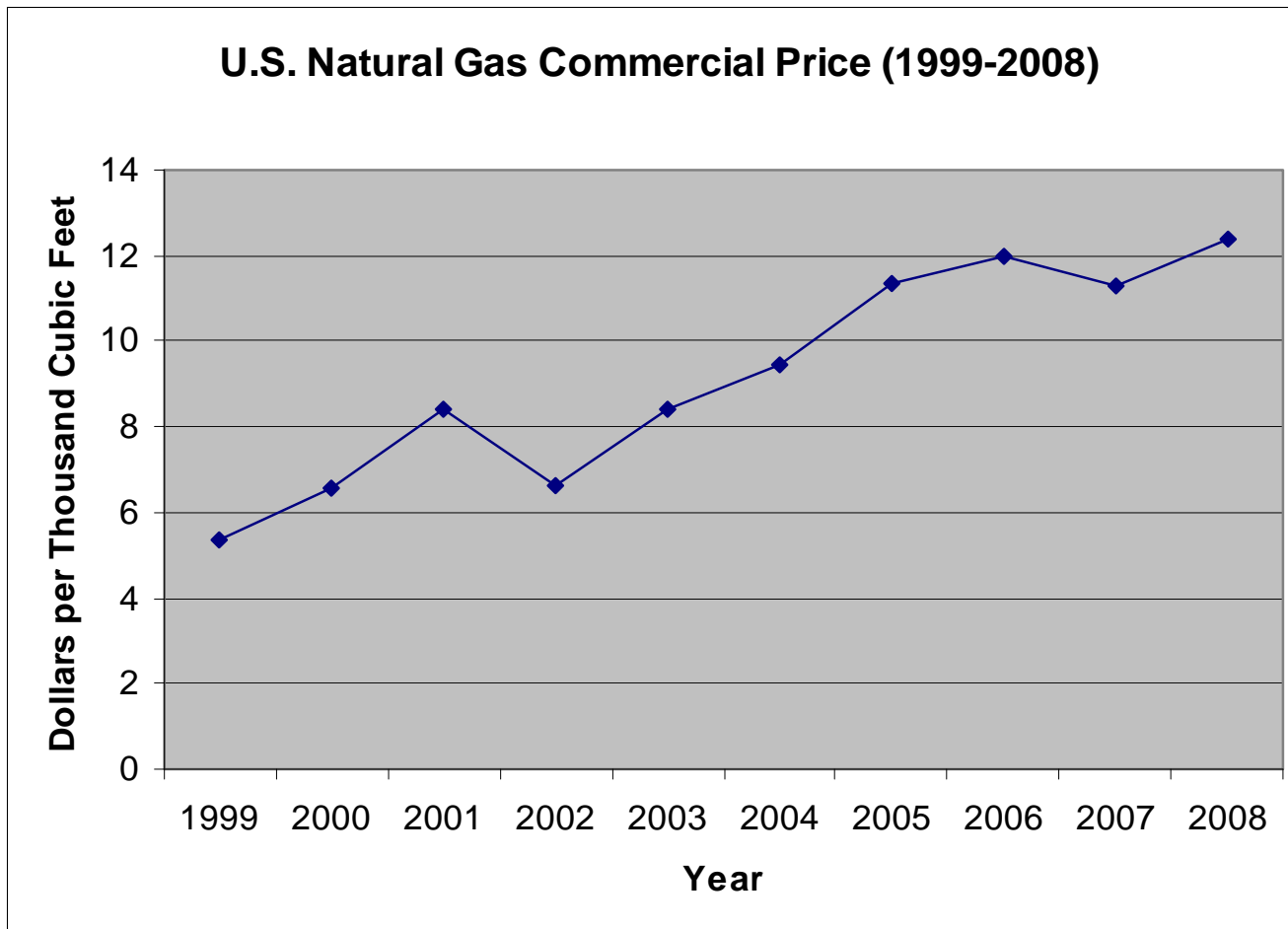
September 26, 2008

Phil Chang, COIC

Rising Cost of Fossil Fuels

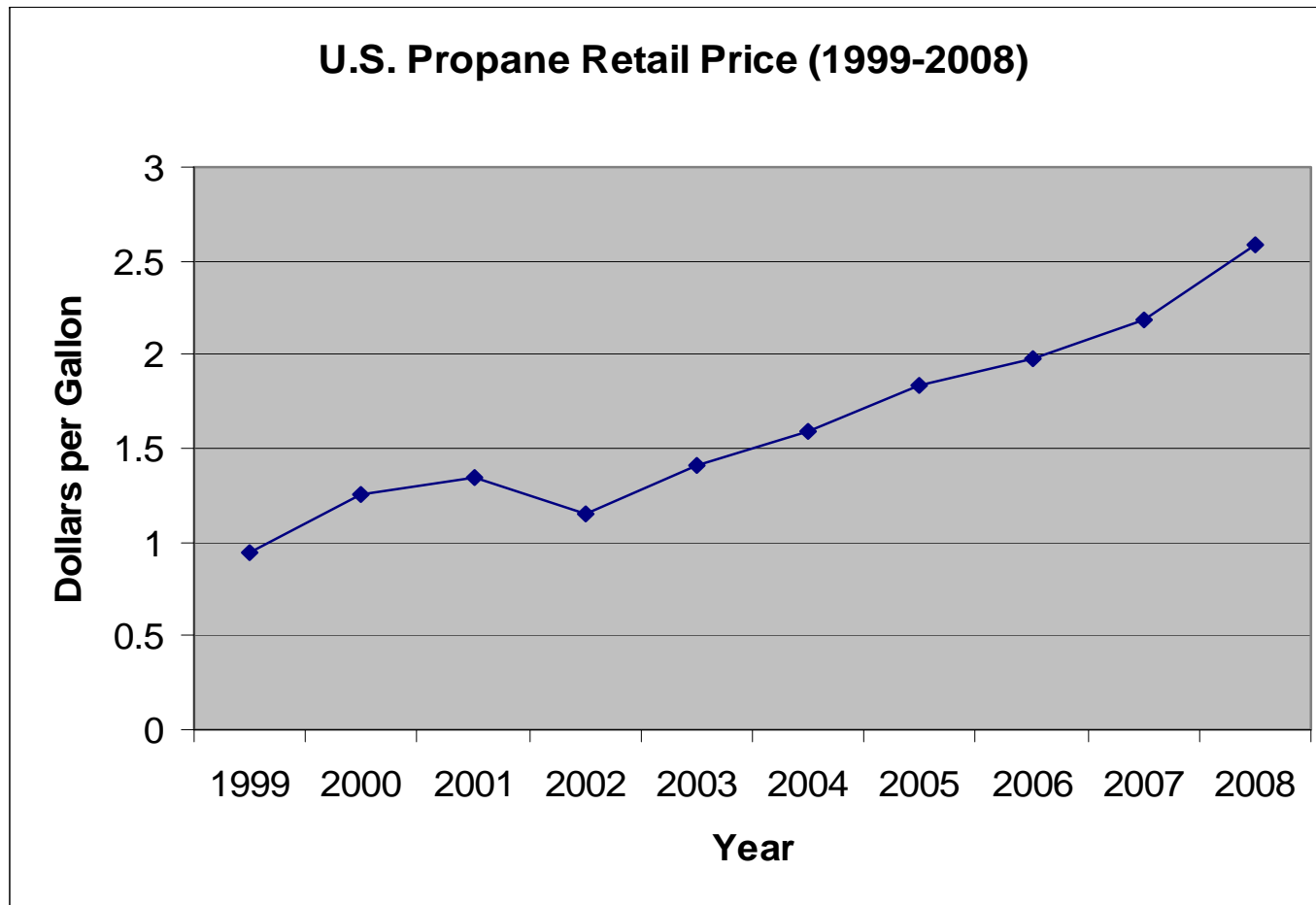


Rising Cost of Fossil Fuels for Heat



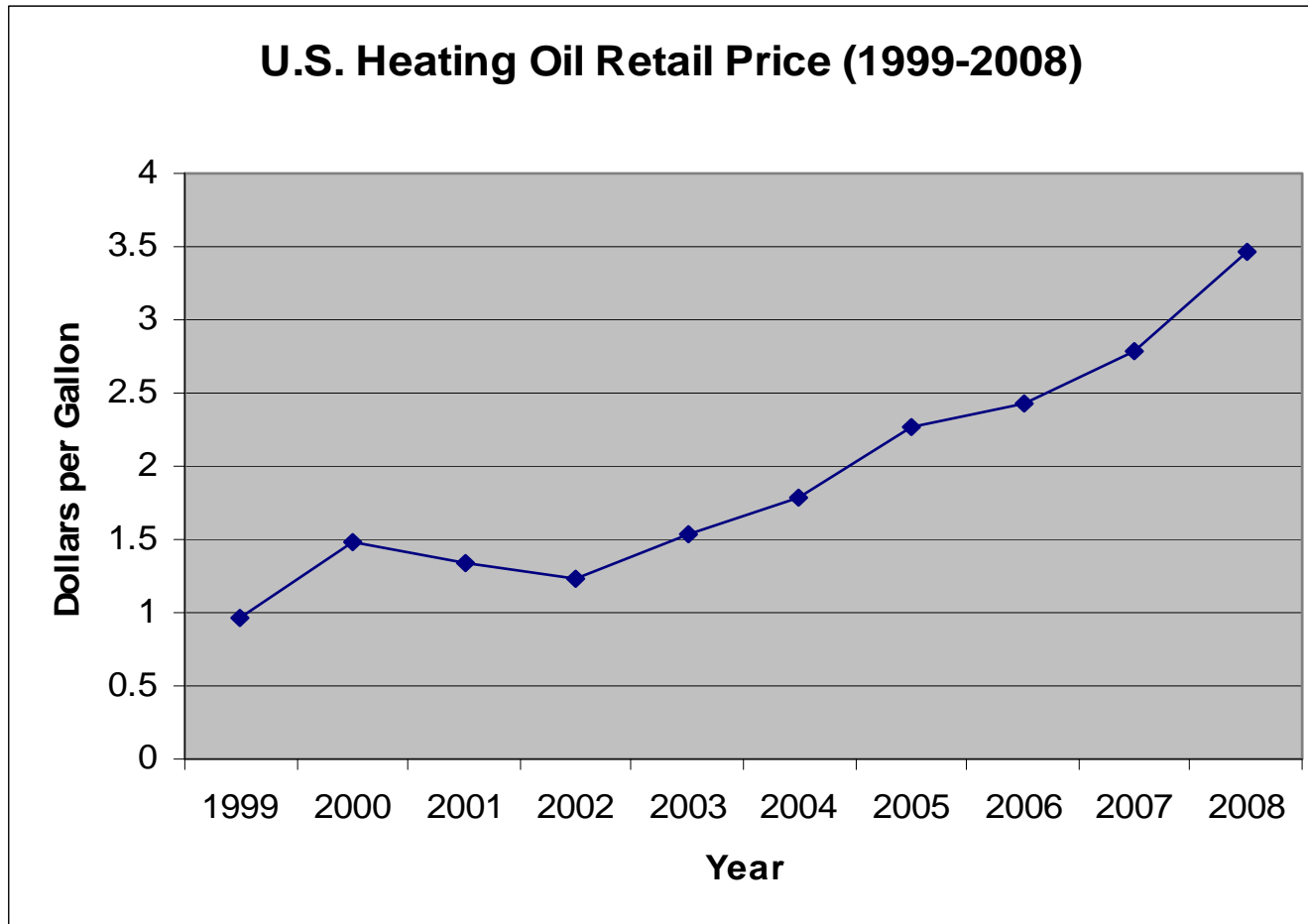
Source: US DOE Energy Information Administration

Rising Cost of Fossil Fuels for Heat



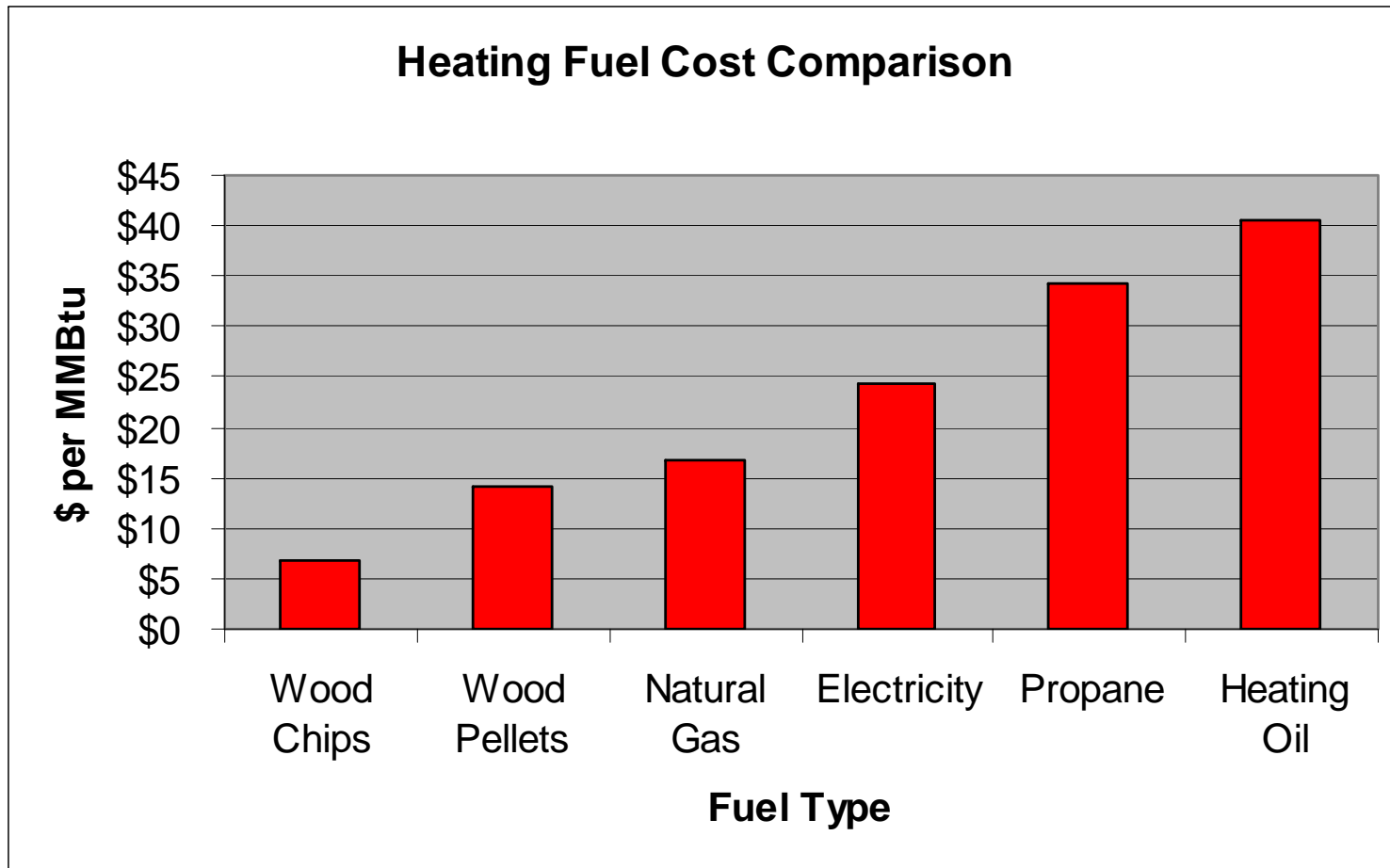
Source: US DOE Energy Information Administration

Rising Cost of Fossil Fuels for Heat



Source: US DOE Energy Information Administration

Biomass Fuel Cost Savings



Source: US DOE Energy Information Administration

Likely Candidates for Biomass Heat

- Where the fuel cost savings justify the extra commitment
 - Schools
 - Hospitals
 - Recreation and Aquatic Centers
 - Correctional Facilities
 - College Campuses
 - Shopping Complexes
 - Large Warehouses or Garages
 - Large Greenhouse Operations
 - Industrial Process Heat

Basic Feasibility Questions

- ❑ Fuel Supply Availability and Predictability
- ❑ Commitment: Maintenance, First Cost
- ❑ Site Layout: Space, Existing Structures
- ❑ Air Quality: Non-attainment Area?
- ❑ Project Cost Supported By The Savings

Feasibility: Fuel Availability/Predictability



Feasibility: Fuel Availability/Predictability



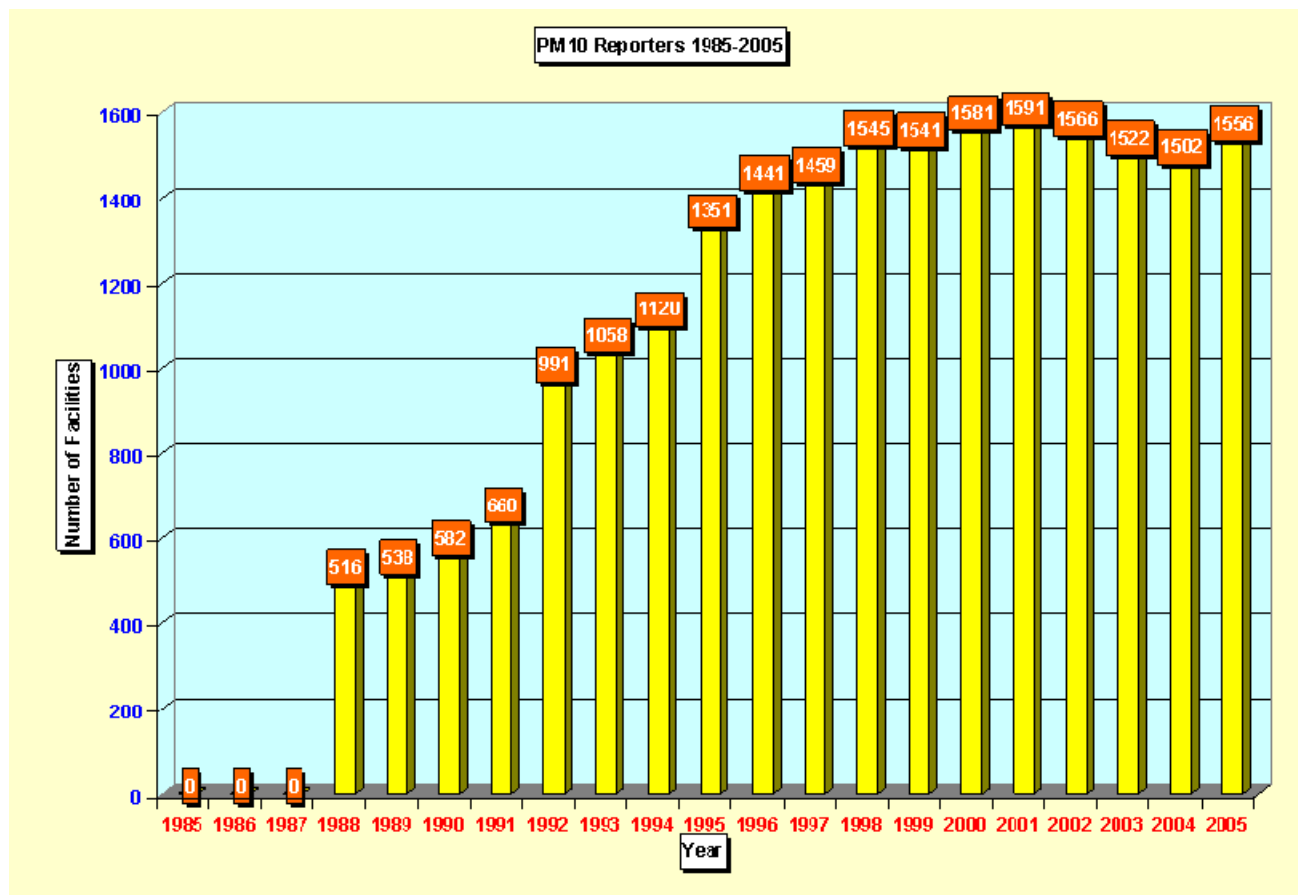
Feasibility: Commitment



Feasibility: Site Layout



Feasibility: Air Quality



Financial Feasibility Analysis

Basic Tools

- Simple Payback
 - Project Cost, Fuel Cost Savings

- Cash Flow (Annual, Cumulative)
 - Also consider Financing, Operation & Maintenance, Repairs/Replacements, Fuel Price Inflation

- Life Cycle Cost Analysis

Financial Feasibility: Payback Calculation

□ Example: Deschutes County Correctional Facility Expansion

■ Project Cost	\$595,468
■ Fuel Savings (1 st Year)	\$86,061
■ Simple Payback	6.92 years

Financial Feasibility: Payback Calculation

□ 'Less Simple' Example: Deschutes County Correctional Facility Expansion

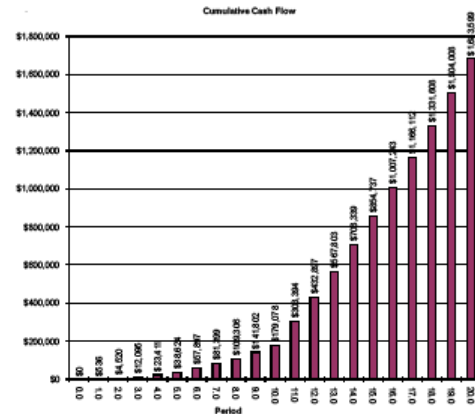
■ Project Cost	\$595,468
■ Annual O & M	\$6,000
■ Fuel Savings (1 st Year)	\$86,061
■ Simple Payback	6.99 years
■ Simple Payback w/ BETC	4.67 years

Financial Feasibility: Cash Flow

Table 4.3 - Cash Flow Analysis

Cash Flow Analysis

Customer:	Sisters VES, M/S and B/S
Group and Phase:	Phase 1A
Scenario:	Phase Biomass Boiler System
Financing Source:	10 Year Financing at 5.0%
Financial Data for Scenario:	
First Cost	\$950,189
Utility Rebate	\$0
NETC	\$218,822
Net Customer Cost	\$731,367
Capital Inflation	\$0
Annual Financial	\$253,648
Annual Utility Savings	\$93,301
Annual Operational Savings	\$0
Cash Flow Analysis Period	20.0
Include Depreciation (1=Yes, 0=No)	0.0
Life of Equipment (For Depreciation)	10.0
Number of Years for O&M Savings	10.0
Annual Measure and Verification Fee % MV of Utility Savings	\$0
M&V Start Year	2.0
M&V End Year	5.0
Financing Term (Years)	10.00
Annual Interest Rate %	5.00%
Payments per Year	1.00
First Payment Due Date	\$7000
Discount Rate	0.00%
Inflation Rate	0.00%
Scenario Simple Payback (yrs)	7.80
Net Present Value (NPV) Year 10	\$170,078
Net Present Value (NPV) Year 15	\$264,737
Net Present Value (NPV) Year 20	\$1,693,599



Period	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0		
Period	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029		
First & Reboilment																							
Equipment Depreciation																							
Tax Credit Impact																							
Subtotal																							
Annual Utility Savings		\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	
Utility Escalation		4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	
Total Utility Savings		\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	\$93,301	
Annual O&M Savings		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
O&M Escalation		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Total O&M Savings		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
M&V and Energy Generation Fee		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Annual O&M and Repair Costs		(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	(\$1,800)	
First Asset Savings		\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	\$12,500	
Unallocated Savings		\$67,296	\$168,696	\$228,275	\$251,652	\$268,928	\$280,228	\$285,521	\$285,798	\$280,244	\$259,680	\$1,123,695	\$1,283,399	\$1,218,606	\$1,123,695	\$1,027,846	\$1,123,695	\$1,123,695	\$1,123,695	\$1,123,695	\$1,123,695	\$1,123,695	\$1,123,695
Annual Finance/Lease Payment		(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	
Finance/Lease Factor		(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	(\$82,060)	
Annual Cash Flow		\$636	\$1,994	\$7,275	\$11,214	\$15,213	\$19,273	\$23,302	\$27,307	\$31,286	\$35,236	\$39,156	\$43,036	\$46,866	\$50,636	\$54,346	\$58,006	\$61,616	\$65,176	\$68,686	\$72,146	\$75,556	\$78,916
Cumulative Cash Flow		\$636	\$4,529	\$11,604	\$22,818	\$38,031	\$57,233	\$80,535	\$107,841	\$139,147	\$174,453	\$213,759	\$257,065	\$304,371	\$355,677	\$411,983	\$483,289	\$569,595	\$671,901	\$790,207	\$934,513	\$1,105,819	\$1,404,125
Present Value (PV) Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Cumulative PV		\$636	\$4,529	\$11,604	\$22,818	\$38,031	\$57,233	\$80,535	\$107,841	\$139,147	\$174,453	\$213,759	\$257,065	\$304,371	\$355,677	\$411,983	\$483,289	\$569,595	\$671,901	\$790,207	\$934,513	\$1,105,819	

Notes: (1) BECC is assumed to be 23.4%, the total utility contract costs may be lower. This reduces the BECC.
 (2)
 (3)
 (4)

Factors That Favor Biomass Heat

- Expensive Fuel Alternatives
 - Heating Oil
 - Propane

- New Construction vs. Retrofit

- Renewable Energy Incentives