



Piedmont Geriatric Hospital- Energy Performance Contracting Project

Validation of the PPV (Langseth Engineering) Screening Tool with
data from a fully-developed Biomass ESPC

Presented by:

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Solutions Development Manager
Trane- Virginia District





Presentation Agenda

- We are not just... “It’s Hard to Stop a Trane”
- Brief Look at the PGH Boiler Plant Project (filter to match screening tool model)
 - Adjusted PGH Project cost
 - Screening tool cost
 - Adjusted PGH Project savings
 - Screening tool savings
 - Comparison & Validation of the Tool
- Compare real project cost and guaranteed savings with the Screening Tool
- Renewable and Alternative Energy Opportunities with ESPC
- Q&A

Performance Contracting Experience – Virginia District



Government (State, Federal, Local)

| | | |
|----|--|--------------|
| 1 | Naval Air Station Oceana | \$8,230,000 |
| 2 | Dam Neck Annex | \$32,000,000 |
| 3 | Naval Air Station Oceana, Phase 2 | \$43,994,882 |
| 4 | Wise County Courthouse | \$475,909 |
| 5 | Roanoke County | \$1,470,475 |
| 6 | Southside Virginia Training Center | \$14,369,070 |
| 7 | Central Virginia Training Center | \$5,169,606 |
| 8 | Catawba Hospital | \$2,728,379 |
| 9 | Department for the Blind and Vision Impaired | \$1,717,954 |
| 10 | Southern Virginia Mental Health Institute | \$4,872,405 |
| 11 | Dept. of Forensic Science | \$11,063,199 |
| 12 | DMME Big Stone Gap | \$575,318 |
| 13 | Dept. of General Services | \$7,679,368 |
| 14 | Piedmont Geriatric Hospital* | |
| 15 | Franklin County* | |
| 16 | Town of Rocky Mount* | |
| 17 | City of Martinsville* | |

Higher Education

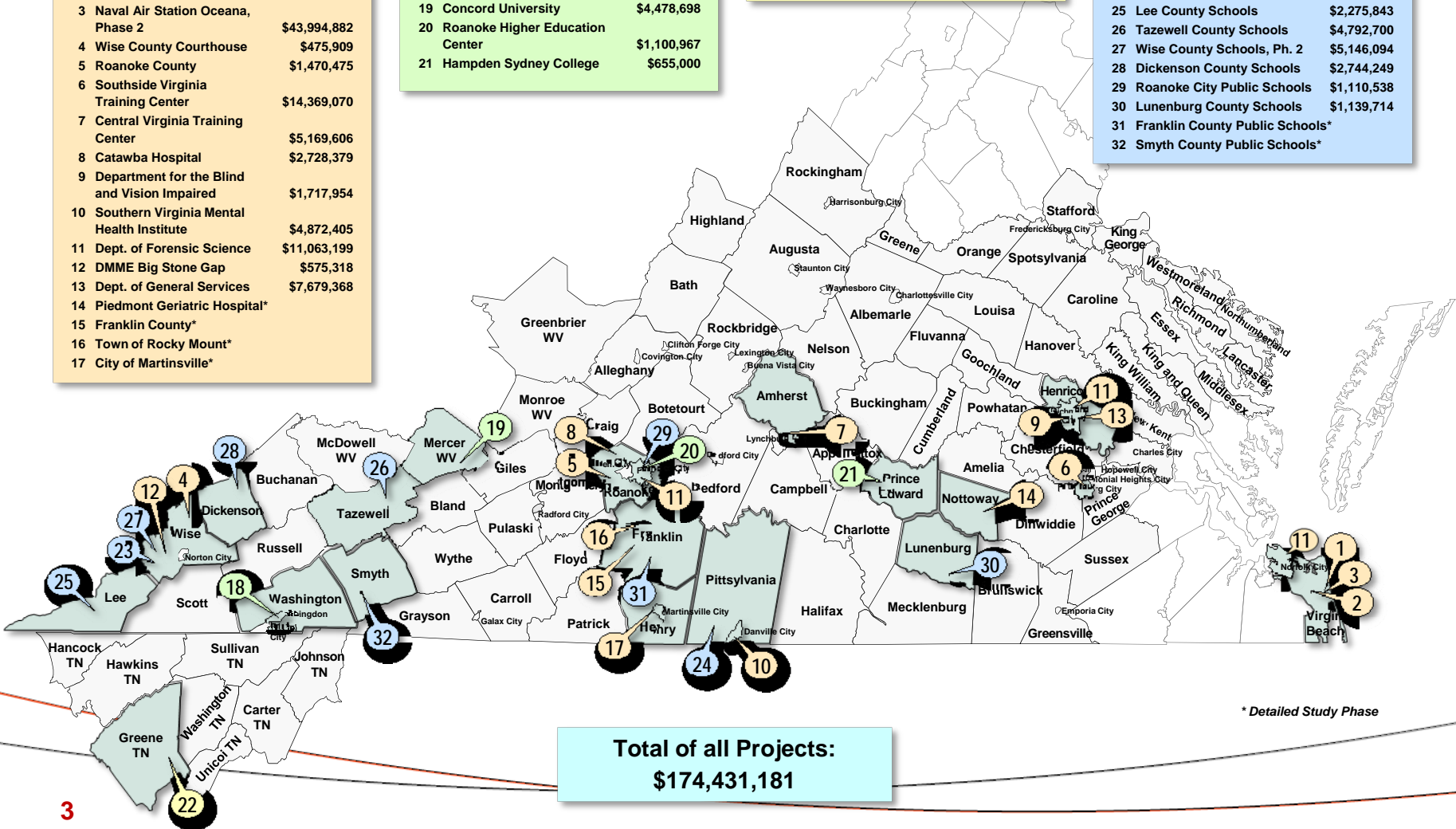
| | | |
|----|--|-------------|
| 18 | Southwest Virginia Higher Education Center | \$887,931 |
| 19 | Concord University | \$4,478,698 |
| 20 | Roanoke Higher Education Center | \$1,100,967 |
| 21 | Hampden Sydney College | \$655,000 |

Healthcare

| | | |
|----|----------------------------|-------------|
| 22 | Laughlin Memorial Hospital | \$8,288,817 |
|----|----------------------------|-------------|

K-12

| | | |
|----|---------------------------------|-------------|
| 23 | Wise County Schools, Ph. 1 | \$3,980,000 |
| 24 | Pittsylvania County Schools | \$3,484,065 |
| 25 | Lee County Schools | \$2,275,843 |
| 26 | Tazewell County Schools | \$4,792,700 |
| 27 | Wise County Schools, Ph. 2 | \$5,146,094 |
| 28 | Dickenson County Schools | \$2,744,249 |
| 29 | Roanoke City Public Schools | \$1,110,538 |
| 30 | Lunenburg County Schools | \$1,139,714 |
| 31 | Franklin County Public Schools* | |
| 32 | Smyth County Public Schools* | |



**Total of all Projects:
\$174,431,181**

* Detailed Study Phase



Piedmont Geriatric Hospital- Energy Performance Contracting Project

**Biomass System Inputs/Modeling &
Project Cost Comparison with
PPV (Langseth Engineering) Screening Tool**



Screening Tool for PGH Project- Step 1



| STEP 1 - INPUT FACILITY DATA | | | | |
|---|--|-----------|---------------------------|----------|
| 1. Facility Owner | Piedmont Geriatric Hospital (DBHDS) | | | |
| Contact name & title | L.W. Wilson / Steve Bowen | | | |
| Contact address | Burkeville, VA | | | |
| Contact phone & email | | | | |
| 2. Facility Title | Mental Health Hospital | | | |
| Facility type | Conventional Office or School Building | | | |
| Facility address | | | | |
| Number of bldgs & total square footage | 3 | # Bldgs | 331,236 | Total SF |
| 3. Electrical Utility | | | | |
| Annual power consumption & cost | 5,968,995 | kWh | \$381,120 | \$/Yr |
| Electrical space/HW heating? | No | | | |
| 4. Fossil Fuel Supplier | | | | |
| Fuel type & current delivered unit cost | Fuel Oil | \$3.25 | \$/Gals | |
| Annual fuel consumption & cost | 194227 | Gals/Yr | \$631,238 | \$/Yr |
| Fossil fuel space/HW heating? Type? Capacity? | Yes | Steam | 13 | MMBTU/H |
| Fossil fuel process heat? Type? Capacity? | No | Steam | 0 | MMBTU/H |
| 5. Other Information | | | | |
| Planned equipment replacements | Yes | Describe: | Repl 200HP Sawdust boiler | |
| Expansion considerations | No | Describe: | | |

Screening Tool for PGH Project- Step 2



| STEP 2 - ESTIMATE BIOMASS SYSTEM SIZE | | | | |
|---|----------------|---------|---------------------------|----------|
| Determine the System Size | Estimated Size | | Annual Energy Use (MMBTU) | |
| Combined space/process heating systems | 13.3 | MMBTU/H | 11970 | MMBTU/Yr |
| System size based on building SF | 8.3 | MMBTU/H | 9937 | MMBTU/Yr |
| System size based on fossil fuel use data | 21.0 | MMBTU/H | 25250 | MMBTU/Yr |
| System size based on electric power/thermal use | 0.0 | MMBTU/H | 0 | MMBTU/Yr |
| System size based on electric & fossil fuel | 21.0 | MMBTU/H | 25250 | MMBTU/Yr |
| Estimated Biomass System Size | 13.3 | MMBTU/H | Heating system | |
| | | kW | Power generation | |



Screening Tool for PGH Project- Step 3



| STEP 3 - ESTIMATE BIOMASS PROJECT CAPITAL COST | | | | |
|--|------------|------|----------------|--------------|
| System Type | Applicable | Size | Unit | Capital Cost |
| New biomass heating system | No | 0.0 | - | \$0 |
| Replacement or expansion heating system | Yes | 13.3 | MMBTU/H | \$1,417,204 |
| Combined biomass heat and power system | No | 0.0 | - | \$0 |
| New thermal distribution system required | Yes | +10% | of system cost | \$141,720 |
| Estimated Biomass System Capital Costs | | | | \$1,558,924 |



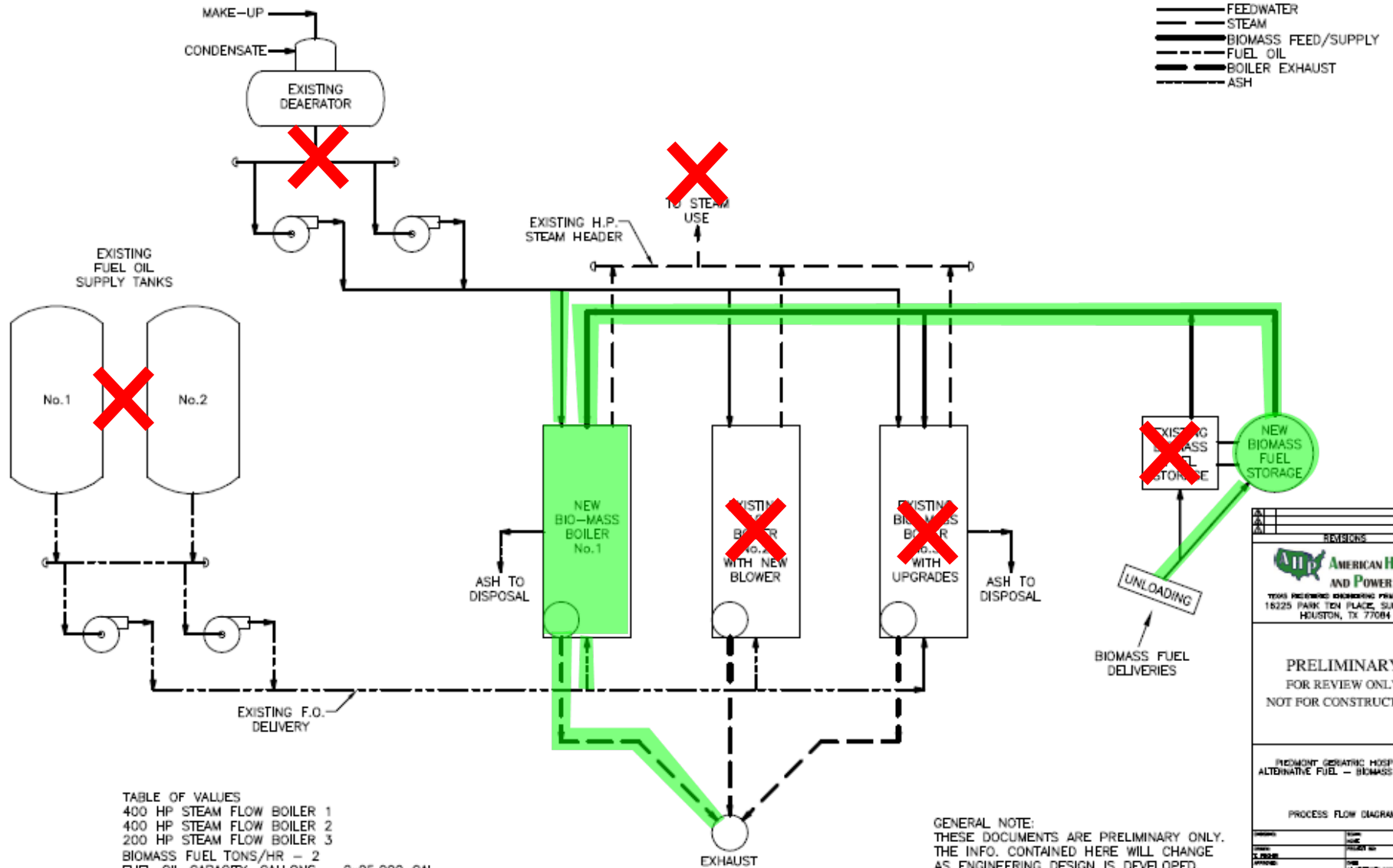
PGH Project Scope



Modified to Match Screening Tool

- Lighting Retrofits- 5 Buildings
- De-Commission Kitchen Hoods & 100% Outside Air Units serving abandoned Kitchen in B15 / Install Steam Heat
- Boiler Plant Renovations:
 - Demo Existing #2 Fuel Oil Boiler & Install New 400 HP Hybrid Biomass/Oil Boiler ← **100%**
 - Re-furbish existing 200 HP Sawdust Boiler
 - Install PLC Controls on 3 boilers ← **33%**
 - Install Electrostatic Precipitator (*for new Boiler MACT requirements*)
 - Fuel Storage & Handling Systems: Silo, Unloader, Elevator, etc. ← **67%**
 - Electrical Upgrades to accommodate new Biomass fuel handling systems ← **50%**
 - Engineering & Design Services ← **67%**
- Install 20kW electric generator in B25
- Building Controls Upgrades & Optimization- B15 Heating & Cooling Plant, B15/VCBR Electricity Demand Limiting, VCBR DDC Controls Optimization
- Install Refrigerant Monitor in B15 Chiller Room
- Web-based Boiler Plant Controls Monitoring/Reporting System

PGH Boiler Plant Schematic



| | |
|--|---|
| <p>AMERICAN HEAT AND POWER LLC 7005 FREDERICK ENGINEERING PARK #404 18225 PARK TEN PLACE, SUITE 500 HOUSTON, TX 77084</p> | |
| <p>PRELIMINARY FOR REVIEW ONLY NOT FOR CONSTRUCTION</p> | |
| <p>FREDMONT GENERATING HOSPITAL ALTERNATIVE FUEL - BIOMASS BOILER</p> | |
| <p>PROCESS FLOW DIAGRAM</p> | |
| <p>DATE: _____ DRAWN BY: _____ CHECKED BY: _____ APPROVED BY: _____</p> | <p>DATE: _____ DRAWN BY: _____ CHECKED BY: _____ APPROVED BY: _____</p> |
| <p>M-302</p> | |

PGH Biomass Plant Cost Summary

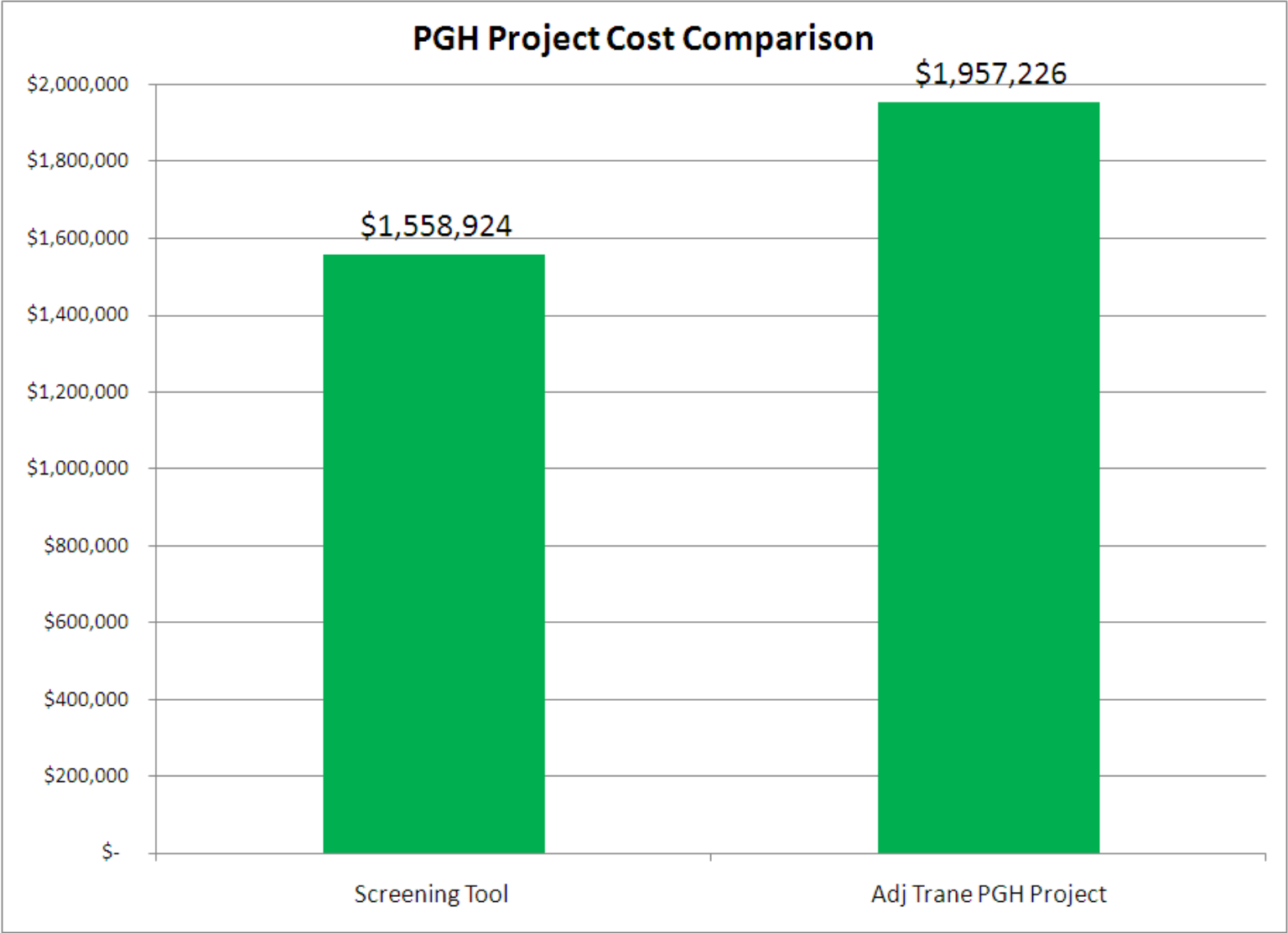
(Adjusted to match Screening Tool Model)



| | | |
|---|-----------|------------------|
| Design Fees & Professional Engineering Services | \$ | 306,860 |
| 400 HP hybrid biomass/fuel oil boiler | \$ | 903,000 |
| Demolition- Existing Walls & Concrete for Boiler installation | \$ | 49,137 |
| Demolition- Existing Fuel Oil Boiler (#3) Piping, Conduit, & valves | \$ | 2,500 |
| Installations 400HP boiler/piping/electrical | \$ | 159,638 |
| Equipment Pads | \$ | 18,225 |
| Biomass Fuel Handling & Conveyance | \$ | 259,685 |
| New Boiler Plant Electrical Distribution System | \$ | 96,790 |
| Boiler Plant PLC Controls | \$ | 7,532 |
| Road relocation & slab removal | \$ | 29,069 |
| Boiler Plant Piping and Steam Traps | \$ | 25,100 |
| Building Modifications- Patching, Exhaust Fans, Louvers, & Structural Steel | \$ | 25,778 |
| Electrical to Boilers, Feedwater, DA, and Fuel Handling Equipment | \$ | 35,438 |
| Rigging/Hauling/Fuel | \$ | 38,475 |
| Total "Adjusted" Project Cost | \$ | 1,957,226 |

| Items not Included in this Example | Comments |
|---|------------------------|
| ESCO Detailed Energy Audit | Required for ESPC |
| Installation of Precipitator | MACT Requirement? |
| Installation of Precipitator Insulation and Testing | MACT Requirement? |
| Refurbish existing 200 HP boiler | Trane Project Specific |
| Panels for existing hopper | Trane Project Specific |
| New burner & controls for Existing Boiler #2 | Trane Project Specific |
| Site MEP piping relocations | Trane Project Specific |
| ESCO "Fees" | Required for ESPC |
| 1st Year Measurement & Verification | Required for ESPC |

PGH- Trane Project & Screening Tool Cost Comparisons



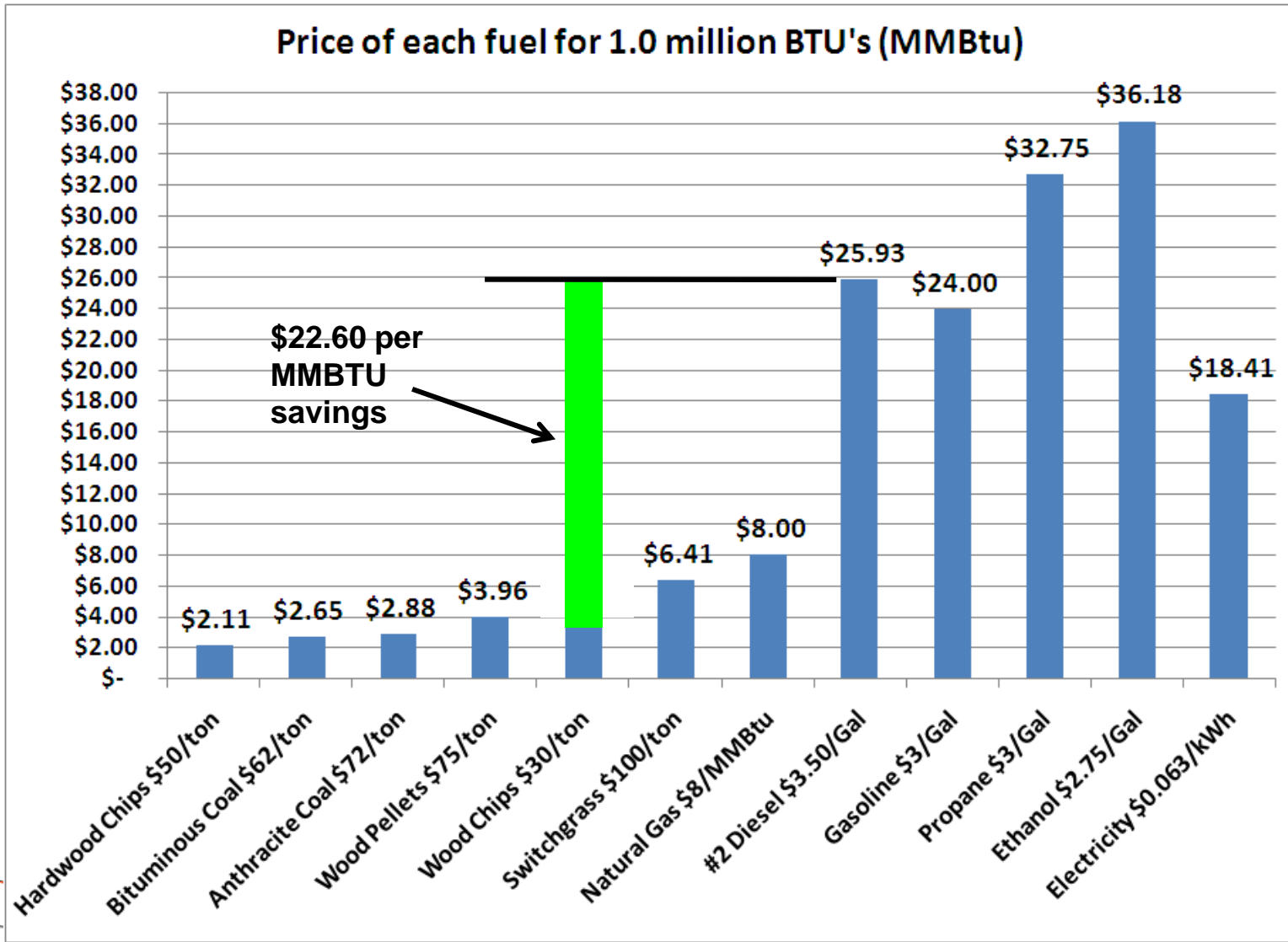


Piedmont Geriatric Hospital- Energy Performance Contracting Project

Project Savings Comparison with
PPV (Langseth Engineering) Screening Tool



PGH- Fuel Price Comparison



Screening Tool for PGH Project- Step 4



| STEP 4 - ESTIMATE BIOMASS PROJECT SAVINGS | | | | |
|---|------------|-----------|-------------|-------------|
| Existing Heating System Energy Use & Cost | Annual Use | Units | Annual Cost | Fossil Fuel |
| Fossil fuel used for space/process heating | 25250 | MMBTU/Yr | \$631,238 | Fuel Oil |
| Electrical power used for space/HW heating | 0 | MMBTU/Yr | \$0 | - |
| Existing Heating system - Total | 25250 | MMBTU/Yr | \$631,238 | - |
| Biomass Heating System Energy Use & Cost | Wood | Grasses | Pellets | Not Used |
| Heat Value - LHV (MMBTU/ Ton) | 9 | 15 | 15 | - |
| Unit Costs (\$ / Ton) | \$30 | \$100 | \$75 | - |
| Annual Energy Use - Biomass (Tons / Yr) | 2806 | 1683 | 1683 | - |
| Annual Energy Cost - Biomass (\$ / Yr) | \$84,165 | \$168,330 | \$126,248 | - |
| Estimated Annual Biomass Fuel Savings - Heating | \$547,073 | \$462,908 | \$504,990 | - |
| Biomass Power Production (CHP System Only) | Wood | Grasses | Pellets | Not Used |
| Annual Power Production (kWH / Yr) | 0 | 0 | 0 | - |
| Estimated Annual Power Savings (\$ / Yr) | \$0 | \$0 | \$0 | - |
| Biomass System Added Costs | Wood | Grasses | Pellets | Not Used |
| Additional Operations & Maintenance Costs | -\$7,795 | -\$7,795 | -\$7,795 | - |
| Additional Staffing | - | - | - | - |
| Biomass Fuel for Power Production (Tons Yr) | 0 | 0 | 0 | - |
| Biomass Fuel for Power Production (\$/ Yr) | \$0 | \$0 | \$0 | - |
| Estimated Added Biomass System Costs | -\$7,795 | -\$7,795 | -\$7,795 | - |
| Estimated Annual Biomass System Savings - Net | \$539,278 | \$455,113 | \$497,196 | Not Used |

PGH Project Savings Breakdown

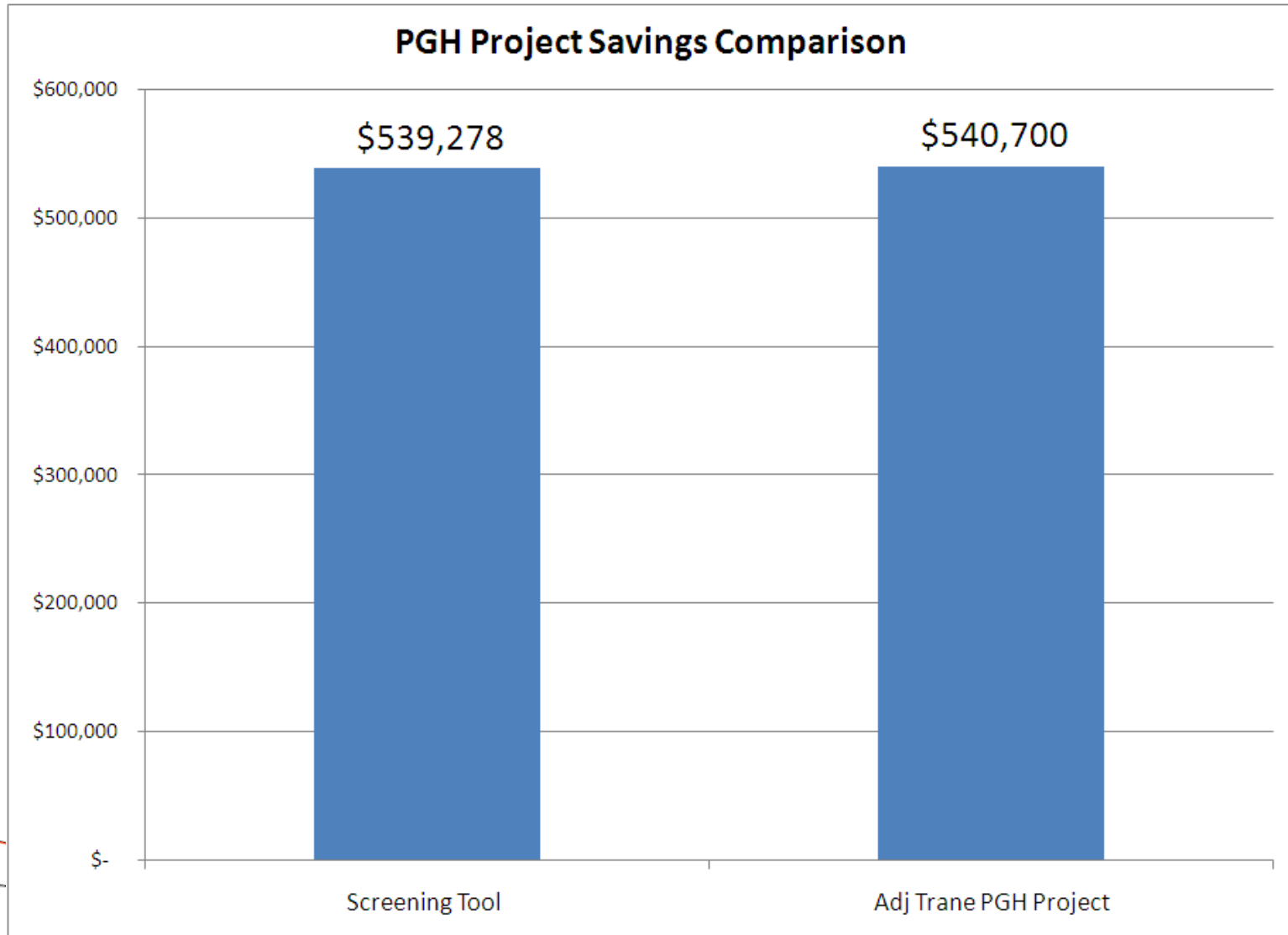


| Energy Conservation Measures | Annual Energy Savings | % of Total Savings |
|------------------------------|-----------------------|--------------------|
| Lighting Renovations | \$ 7,195 | 1.2% |
| Controls Upgrades | \$ 3,087 | 0.5% |
| HVAC Systems Renovations | \$ 6,800 | 1.1% |
| Biomass Plant Upgrades | \$ 589,850 | 97.2% |
| Totals | \$ 606,932 | |

***Biomass savings are all inclusive of Trane Scope. Savings attributed to 200HP refurbished boiler are not included in the screening tool comparison figures.**

***Actual savings for 400HP oil boiler replacement with Biomass is approximately **\$540,700** per year (using \$3.25 per gallon oil and \$30 per ton woody biomass)**

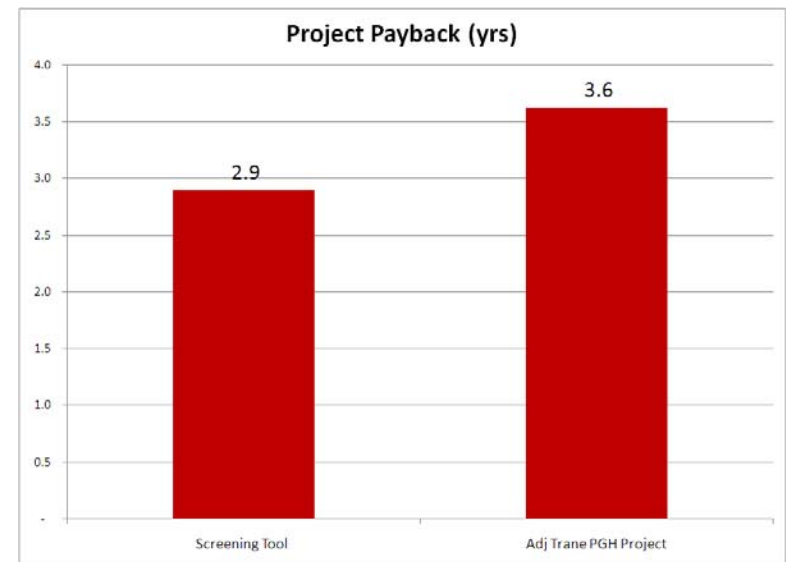
PGH- Trane Project & Screening Tool Savings Comparisons



Screening Tool Validation- PGH Project



- Trane Scope Cost was 26% Higher than Screening Tool Model
 - Raw Quoted Costs
 - No ESCO OH&P (match “By Owner”)
 - Some errors in assumptions to match scopes perhaps
- Trane and Screening Tool Savings was less than 1% apart
- Trane Simple Payback was 0.7 years longer than Screening Tool Model
- Overall, Screening tool seems to be an excellent first step to determine viability of a biomass project...





Other Renewable, Alternative & Waste (RAW) Energy Opportunities considered at Piedmont Geriatric Hospital

A Deeper Shade of **Green**



Other Renewable & Alternative Energy Options Studied at PGH...



Excluded due to project economics; possible Phase 2?

- Combined Heat & Power
 - Topping Cycle Turbine
 - Increased Steam Pressure
- Net Metering tie in to Dominion grid
- Absorption Chilled Water
 - Make chilled water with biomass steam
 - Centralized Plant in Abandoned Laundry
 - Install new campus chilled water lines
 - Existing electrically-driven chillers as back-up



Thank You for your interest...



Questions?

