



Accelerating Market Adoptions of Commercial/Industrial Biomass Thermal Systems

Prepared by: David Dungate, President
Tel: 518-956-2507

dungate@actbioenergy.com

www.actbioenergy.com

ACTbioenergy™
clean, green heating solutions



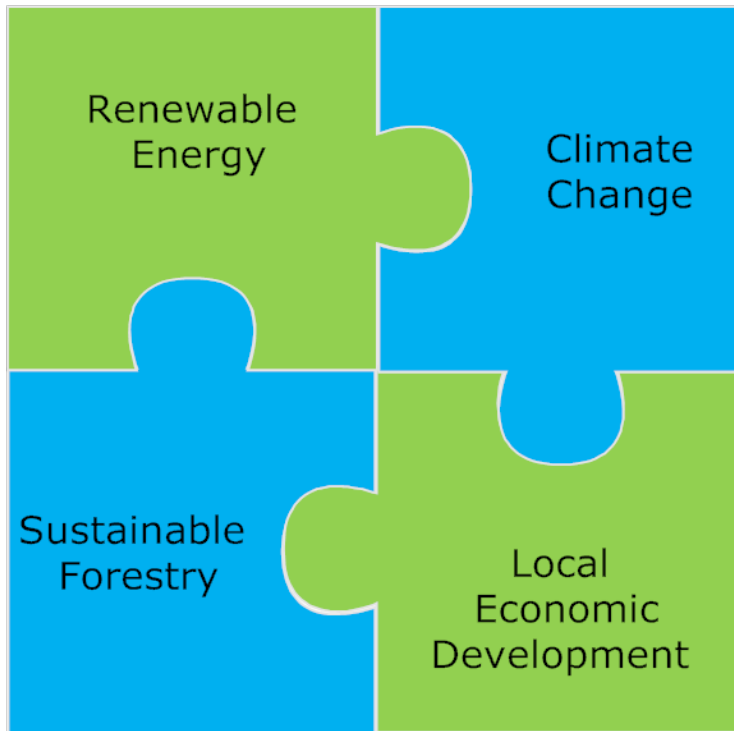
Presentation Outline

- Education - Why Biomass Thermal?
- Current and Future Markets
- Market Barriers/Drivers
- Technology – Safe, Reliable, User-Friendly, Environmental Features
- Economics – Cost Saving, Incentives
- Role of Policy/Regulation
- Final Thoughts



Biomass Thermal Opportunity

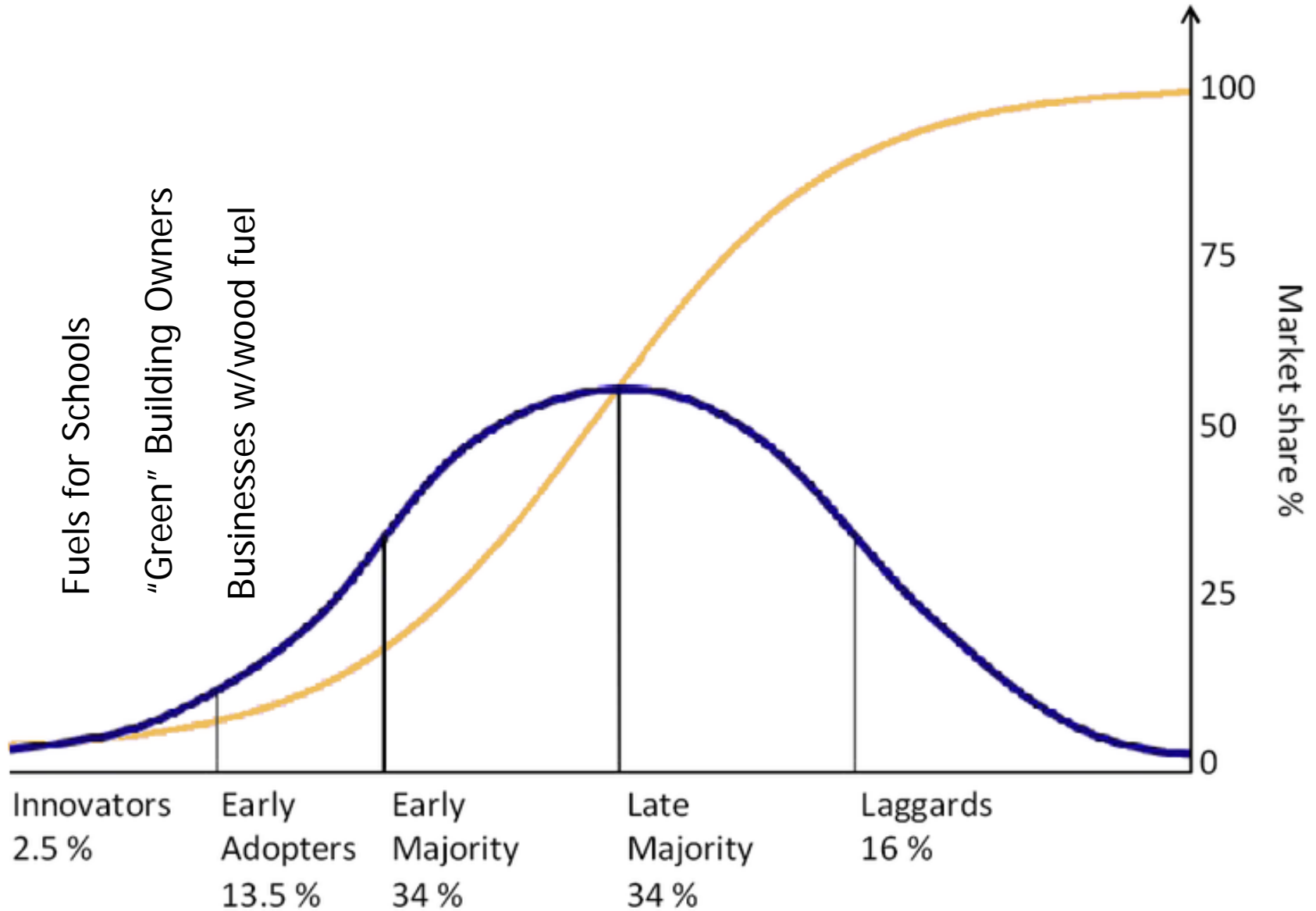
Biomass Thermal



- Addresses key energy, economic environmental and social problems problems at the local and global scale



Market Adoption Curve





Market Barriers/Misperceptions

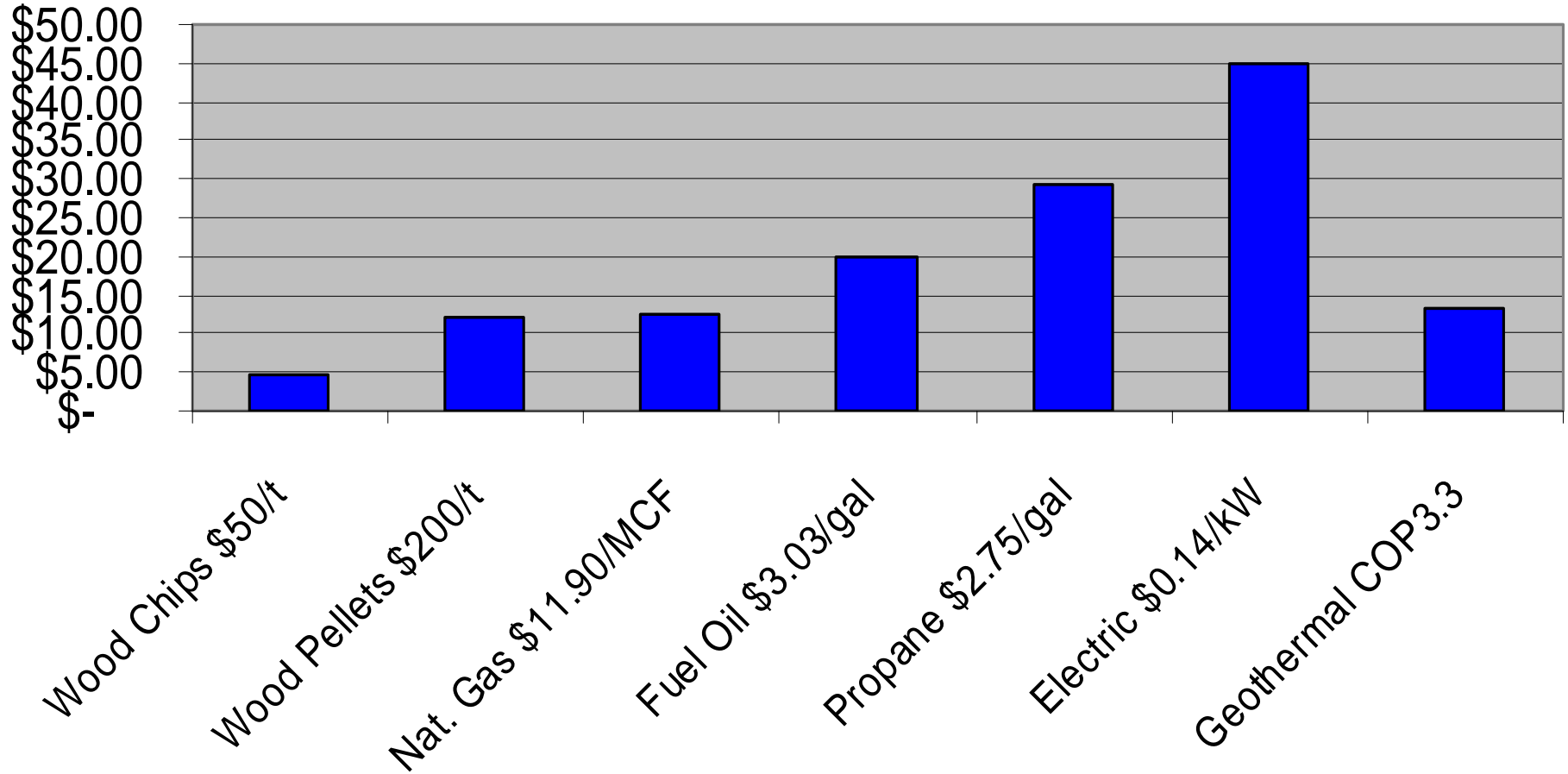
- Lack of awareness of advanced wood boiler technology
- Perception that wood burning must be smokey
- Belief cutting trees is bad
- Systems are expensive so paybacks are too long
- Fuel supply is uncertain – price/standards
- Uncertainty on service and maintenance



Support for Early Innovators

- State and Fed Programs (VT, NY, MA, USFS)
- ARRA Stimulus
- BCAP
- Political
 - Renewable Portfolio Standards - Targets
- Legal
 - Mandates for Renewables
- Administrative
 - R&D Support
- Financial
 - Grants, Tax Breaks

Fuel Cost Comparison in \$/MMBtu



Notes: Pellets = 15.6 MMBtu/ton, chips @30% moisture = 10.9 MMBtu/ton, geothermal heat pump using electricity at \$.14/kW.

Data Source: www.nyserdera.org/Energy_Information/energy_prices_supplies.asp

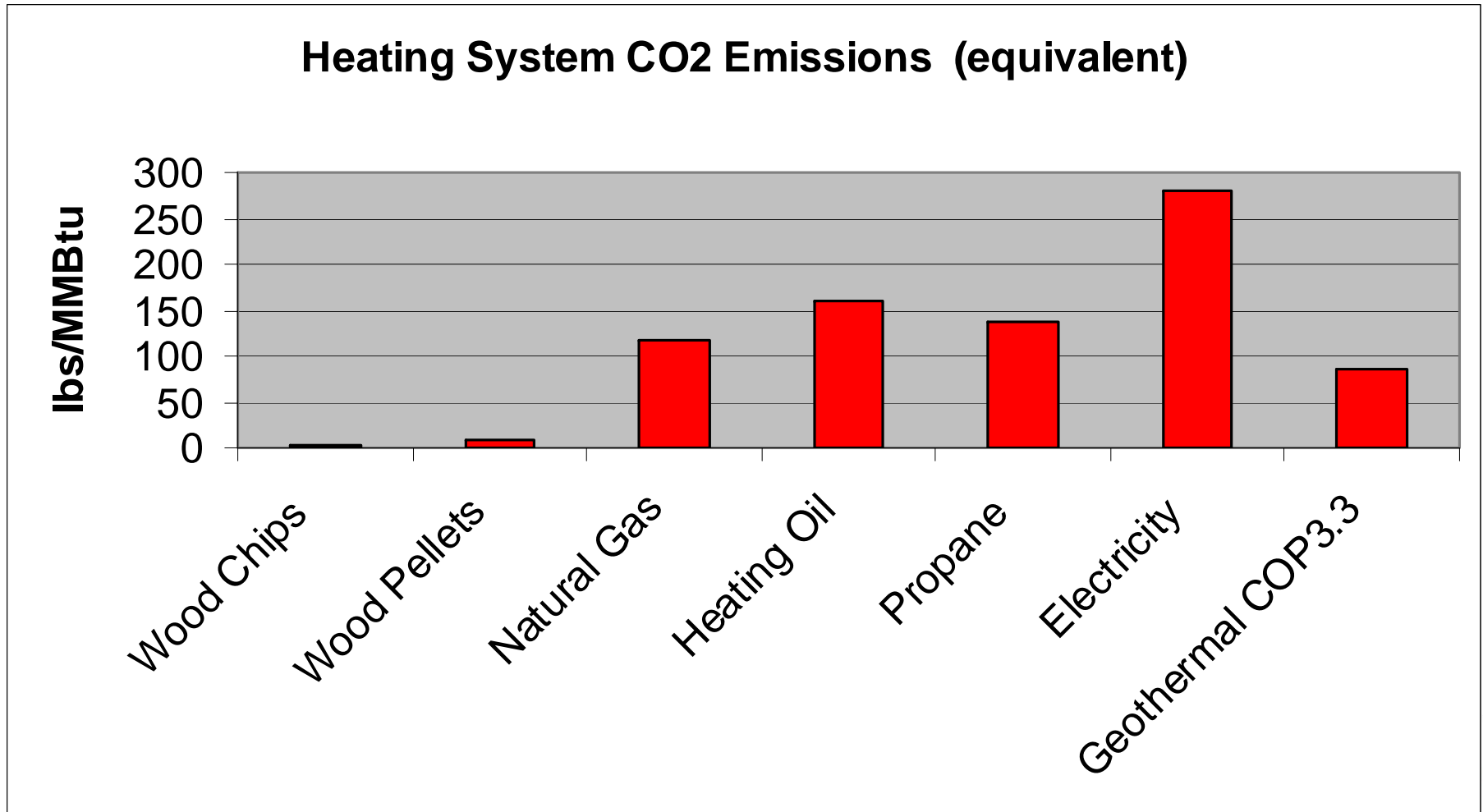


Northeast Oil Economics

- 13.3 million Northeast US Households
- 33% heat with oil
- Average oil price of \$3.59/gal. over next 10 years (EIA)
- Consumption = 260 Million gallons/yr. avg.
- Cost = \$9.3 Billion/yr. and \$7.0 Billion/yr. leaves US to overseas
- If 10% of NY homes convert to wood pellet heating over 10 years = 2118 direct jobs and 124,000 multiplier jobs in the Northeast
- (Sources: Energy Information Agency, Census, Strauss - Futuremetrics 2009)



Comparative CO2 Emissions



Source: Emission factors from www.nyserda.org and www.eia.doe.gov

clean, green heating solutions



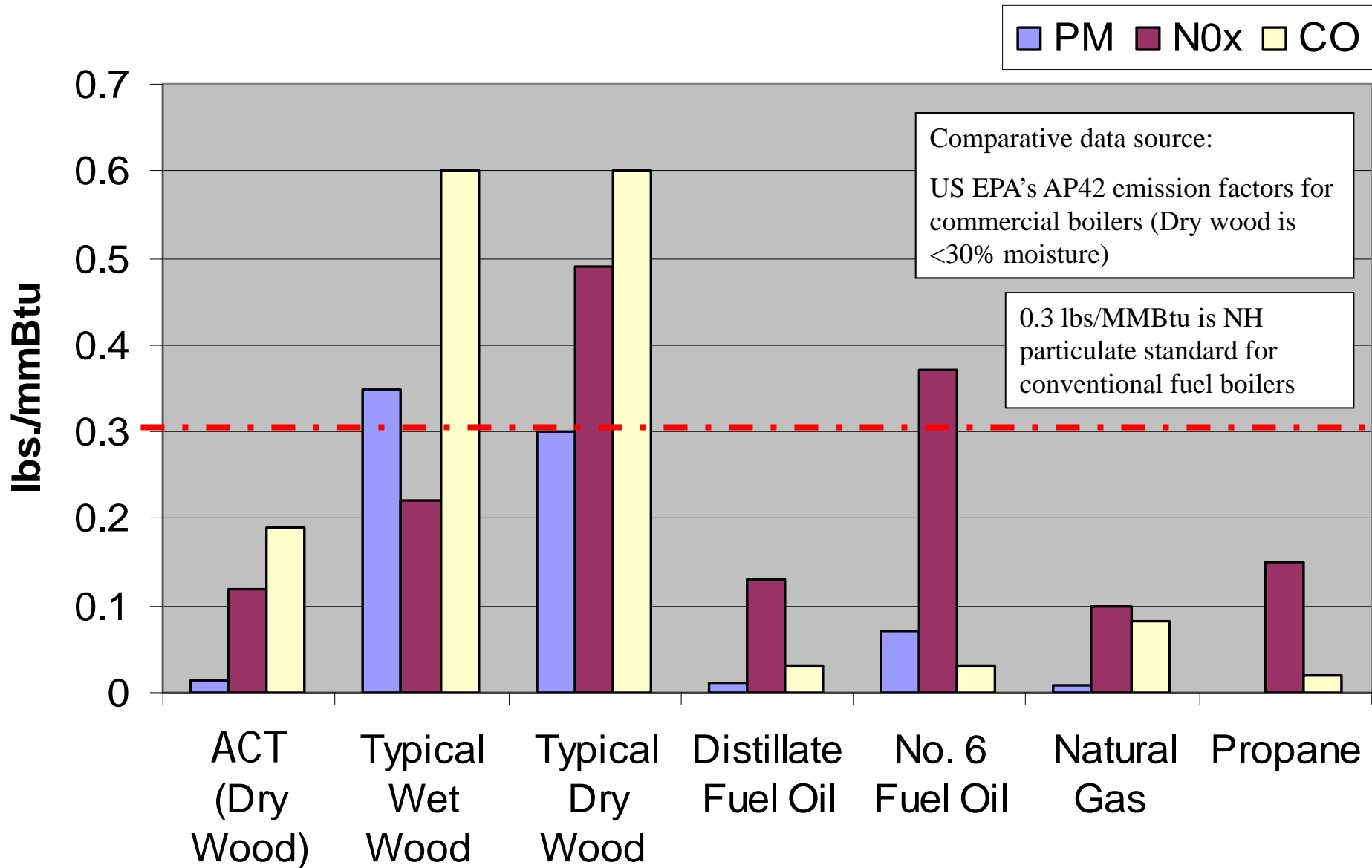
Energy Consumed to Refine Fuel

Wood Chips	0.5-1%
Wood Pellets	2-6%
Oil/Natural Gas	10-20%
Corn Ethanol	60-100%

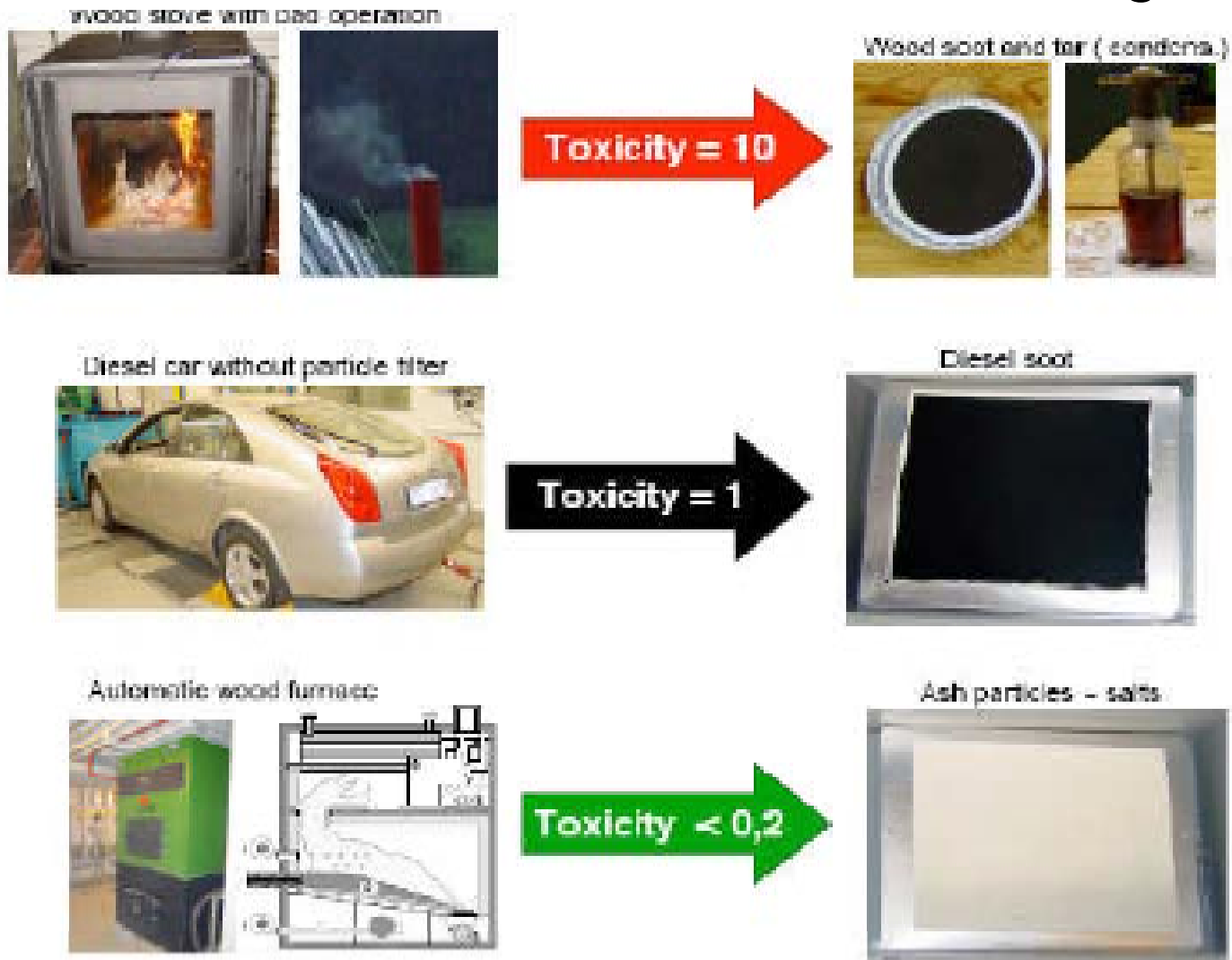
Note: Percent of energy in final product that was consumed during processing/refining

Source: Planning and Installing Bioenergy Systems: A guide for installers, architects and engineers. James & James. 2007

Commercial Boiler Emission Comparison



High efficiency wood combustion particulate is 5x less toxic than diesel emissions (home heating oil)



Source: 15th European Biomass Conference and Exhibition, 7-11 May 2007, Berlin

N. Klippel and T. Nussbaumer. **HEALTH RELEVANCE OF PARTICLES FROM WOOD COMBUSTION IN COMPARISON TO DIESEL SOOT** www.verenum.ch



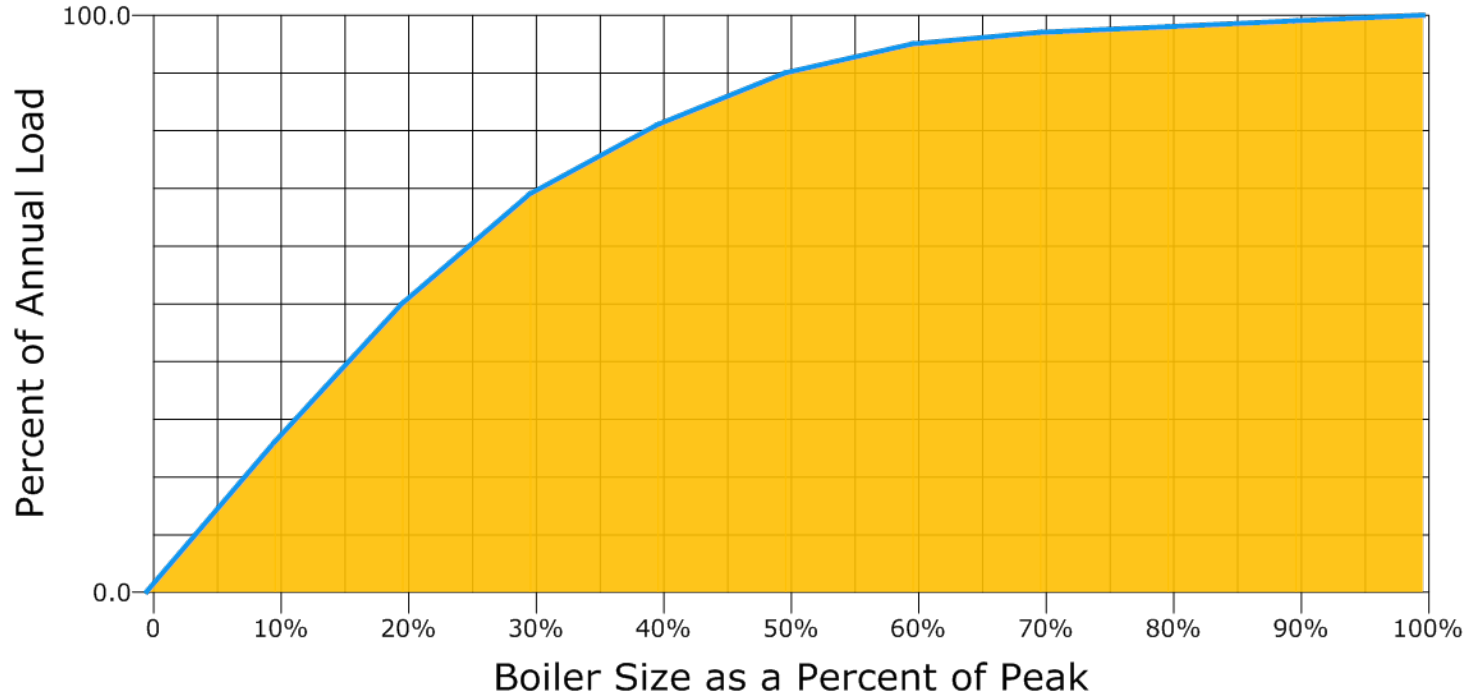
Technical Issues

1. Need to isolate biomass boiler from fossil fuel boiler so that inactive boiler - usually the fossil fuel boiler - is cold and not losing energy through its jacket and vent.
2. Need to set up controls to keep the fossil fuel boiler from firing unless absolutely necessary, which involves setting delta T's and time delays appropriately.
3. Need to prevent the fossil fuel boiler from influencing the controls of the biomass boiler and causing the biomass boiler to reduce its firing rate.
4. Need to size the biomass boiler appropriately (don't make it too big).
5. Recommend full fossil fuel backup for schools and housing projects and most other applications.



Biomass Boiler Sizing

Boiler Sizing vs. Percent Load Met





Economic Issues

1. Market penetration is largely driven by the cost of biomass vs. fossil fuels and the equipment costs.
2. Below 1 MM Btu/hr pellets systems will likely be the most cost effective and above 5 million wood chips are likely to be the most cost effective with the crossover point somewhere in the middle.
3. Life cycle cost analysis is important and will likely play a major role in any decisions. Typically biomass has a good payback or return on investment when fossil fuel costs are equivalent to oil at over \$4.00 per gallon with pellet or woodchip costs or say \$200 - 250/ton or \$60 -80/ton, respectively.



Manufacturing Issues

- Pressure Vessel Standards ASME vs. European
- Low Production Volumes
- Emission Standards
- Fuel Supply/Distribution
- Installation and Service
- Financing
- Insurance
- R&D



Advanced Boiler System Design

- Automated Features
 - Fuel metering
 - Automated ignition
 - Ash removal
 - Combustion modulation and optimization with oxygen sensor
 - Residence Time - excess air at 50%
 - Combustion Temperatures 1200-1600F.
 - Turbulence – tangential air/turbulators
- Thermal buffering – Hot water storage tank
100gal/100,000 Btu/h output
- Can be integrated with Building Management System

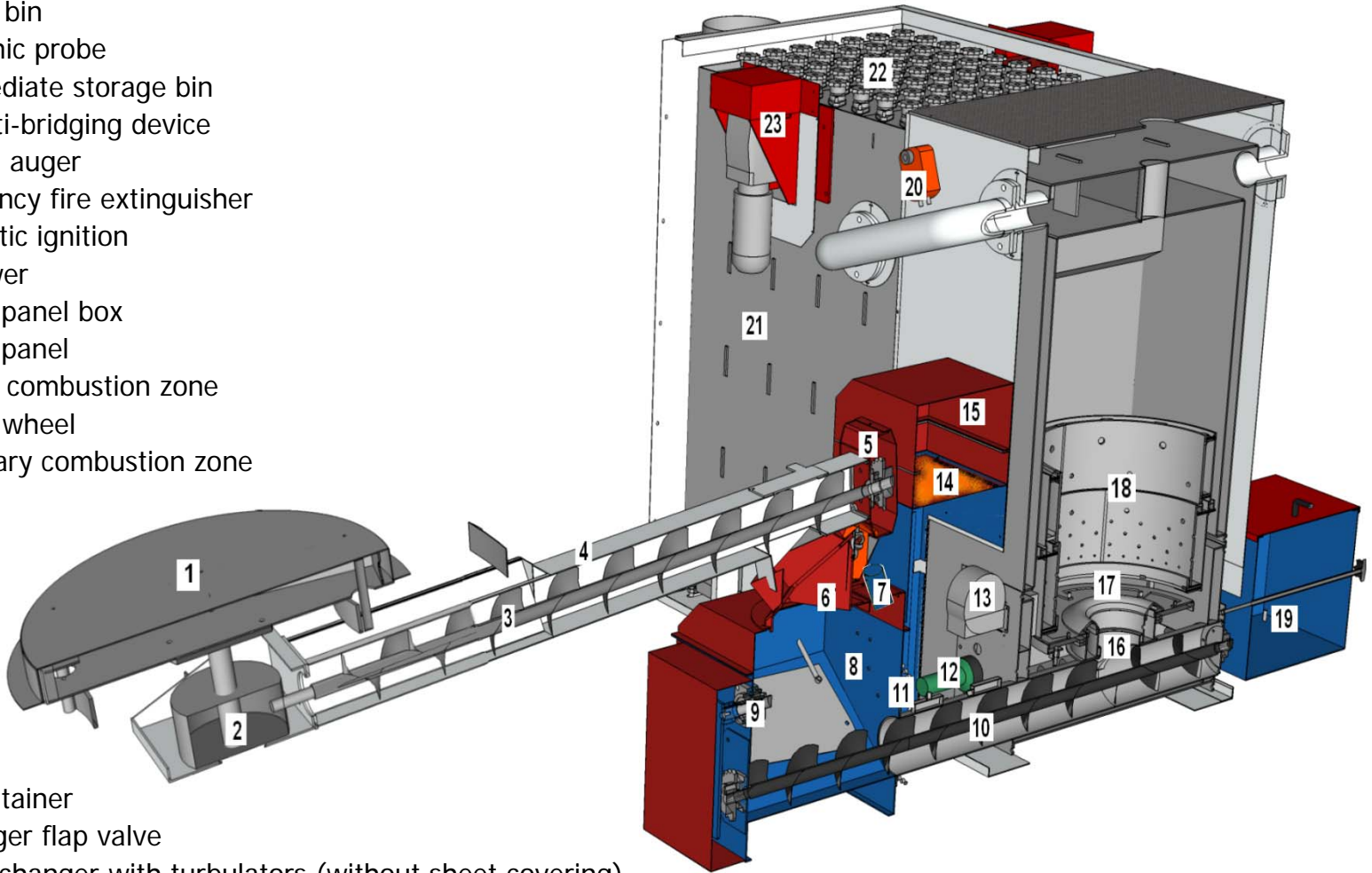
ACT Bioenergy Boiler



ACTbioenergy™
clean, green heating solutions

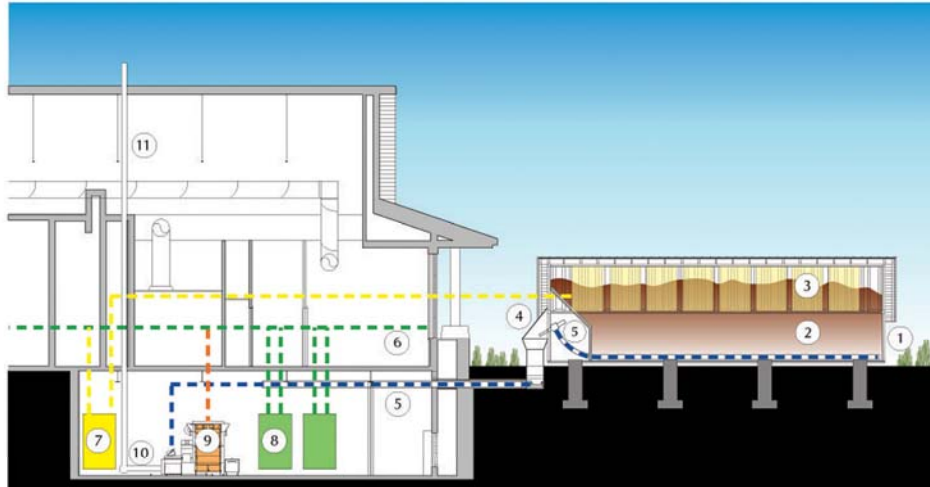
ACT Boiler Configuration

1. Fuel bin stirrer
2. Gear motor
3. Fuel auger
4. Fuel auger channel
5. Auger drive motor
6. Separating flap valve for the channel and intermediate storage bin
7. Ultrasonic probe
8. Intermediate storage bin
9. Fuel anti-bridging device
10. Feeding auger
11. Emergency fire extinguisher
12. Automatic ignition
13. Air blower
14. Control panel box
15. Control panel
16. Primary combustion zone
17. Grating wheel
18. Secondary combustion zone
19. Ash container
20. Exchanger flap valve
21. Heat exchanger with turbulators (without sheet covering)
22. Turbulators
23. Turbulator drive



W!ld Center Project

- ① RE-USED STORAGE CONTAINER
- ② 30 TONS OF WOOD PELLETS
- ③ SOLAR THERMAL PANELS
- ④ PELLET DISTRIBUTION DISPLAY
- ⑤ WOOD PELLET DELIVERY AUGER
- ⑥ EXISTING MUSEUM HEATING LOOP
- ⑦ SOLAR THERMAL STORAGE TANK
- ⑧ EXISTING PROPANE FIRED BOILERS
- ⑨ NEW WOOD PELLET BOILER SYSTEM
- ⑩ EMISSIONS TESTING EQUIPMENT
- ⑪ CHIMNEY



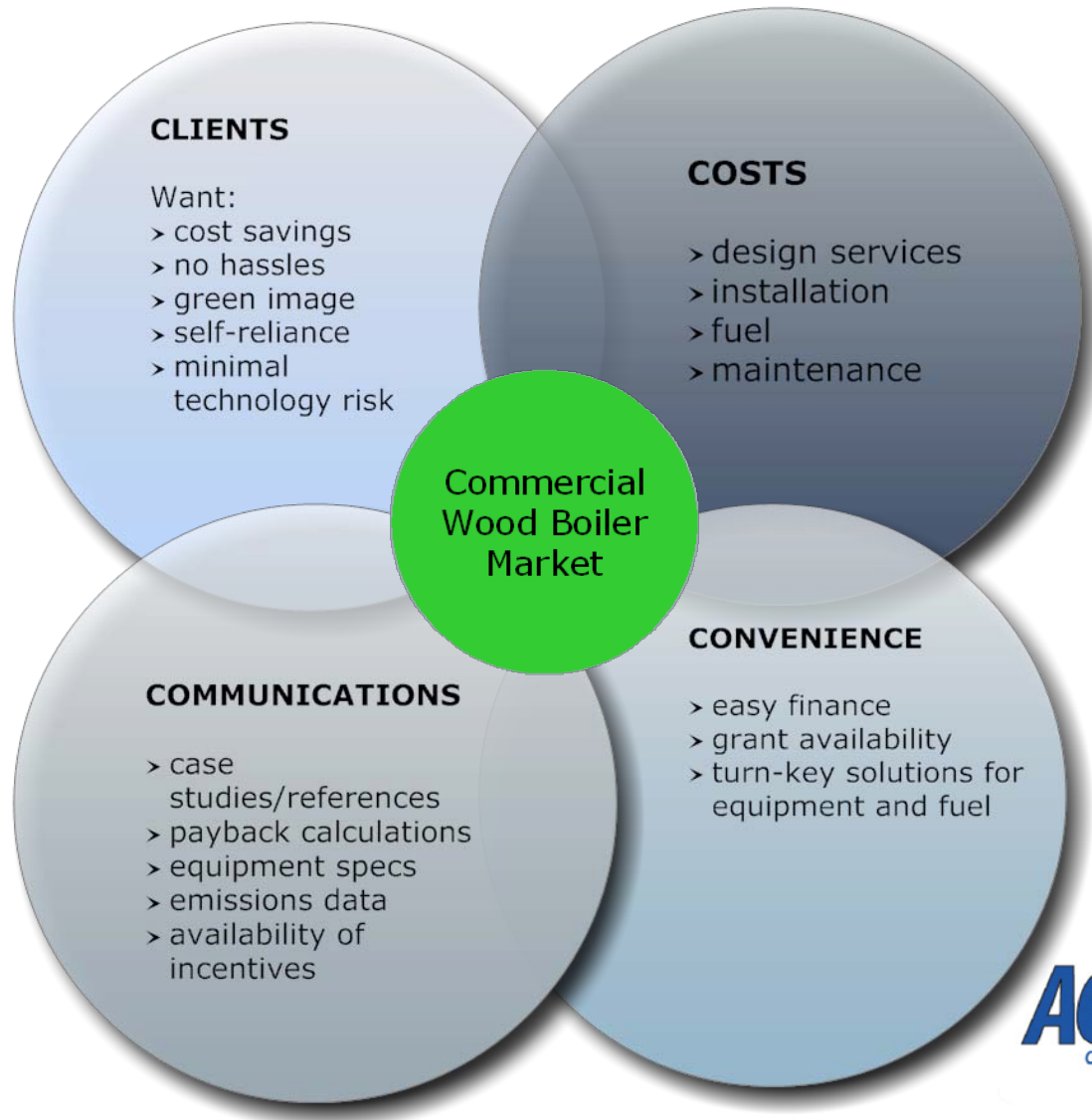


Wild Center Payback

- Boiler size 1.7 MMBtu/h
- Building heat load 6000 MMBtu/yr.
- Propane @\$1.75/gal replaced with wood pellets @\$190/ton
- Installed Cost \$415,000 (\$50K solar)
- Simple ROI = <6 yrs. (without incentives)
- 15 yr savings = \$1,134,000
- 410 t/yr of GHG reduction



4 C's of Marketing





Final Thoughts

- Need enhanced collaboration between fuel suppliers, designers, installers, building owners, equipment manufacturers, community/environmental groups and gov't officials.
- Need more R&D and publishing of case studies (State Energy Offices, BEREC)
- Send a consistent message to public and policy makers to help raise awareness and solicit appropriate support/incentives (BTEC)



Thank You

David Dungate
ACT Bioenergy
Schenectady, NY
Tel: 518-956-2507

Email: dungate@actbioenergy.com

Web: www.actbioenergy.com