

AERTC Conference 2011

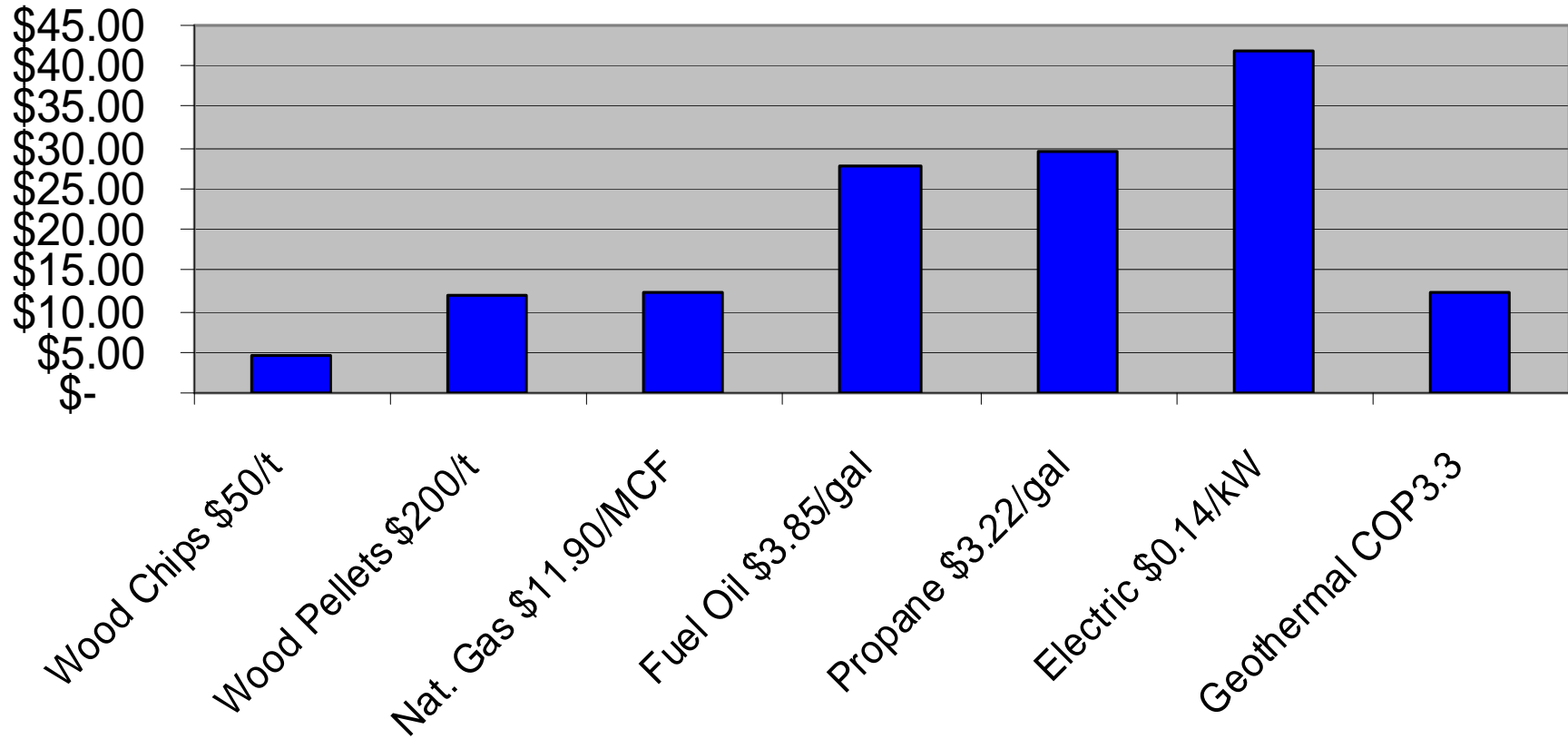
Intro to Commercial-Scale Wood Pellet Boilers

Presenter: David Dungate
ACT Bioenergy, LLC
Tel: 518-956-2507

dungate@actbioenergy.com



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.nyscrda.org/Energy_Information/energy_prices_supplies.asp

Advanced Combustion=Clean Emissions

Wood Stove with incomplete combustion



Toxicity = 10



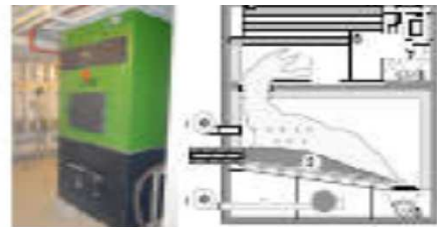
Diesel emissions similar to heating oil emissions



Toxicity = 1



Advanced biomass combustion



Toxicity < 0,2



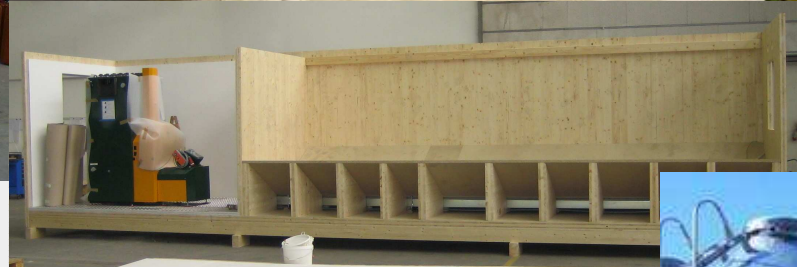
Source: 15th European Biomass Conference and Exhibition, 7–11 May 2007, Berlin
N. Klippel and T. Nussbaumer. **HEALTH RELEVANCE OF PARTICLES FROM WOOD COMBUSTION
IN COMPARISON TO DIESEL SOOT** www.verenum.ch

Advanced Boiler System Design

- Automated Features
 - Fuel metering
 - Automatic ignition
 - Automatic ash cleaning and removal
 - Combustion modulation and optimization with oxygen sensor
- Thermal buffering – Hot water storage tank 100gal/100,000 Btu/h output
- Can be integrated with building automation system and be remotely monitored

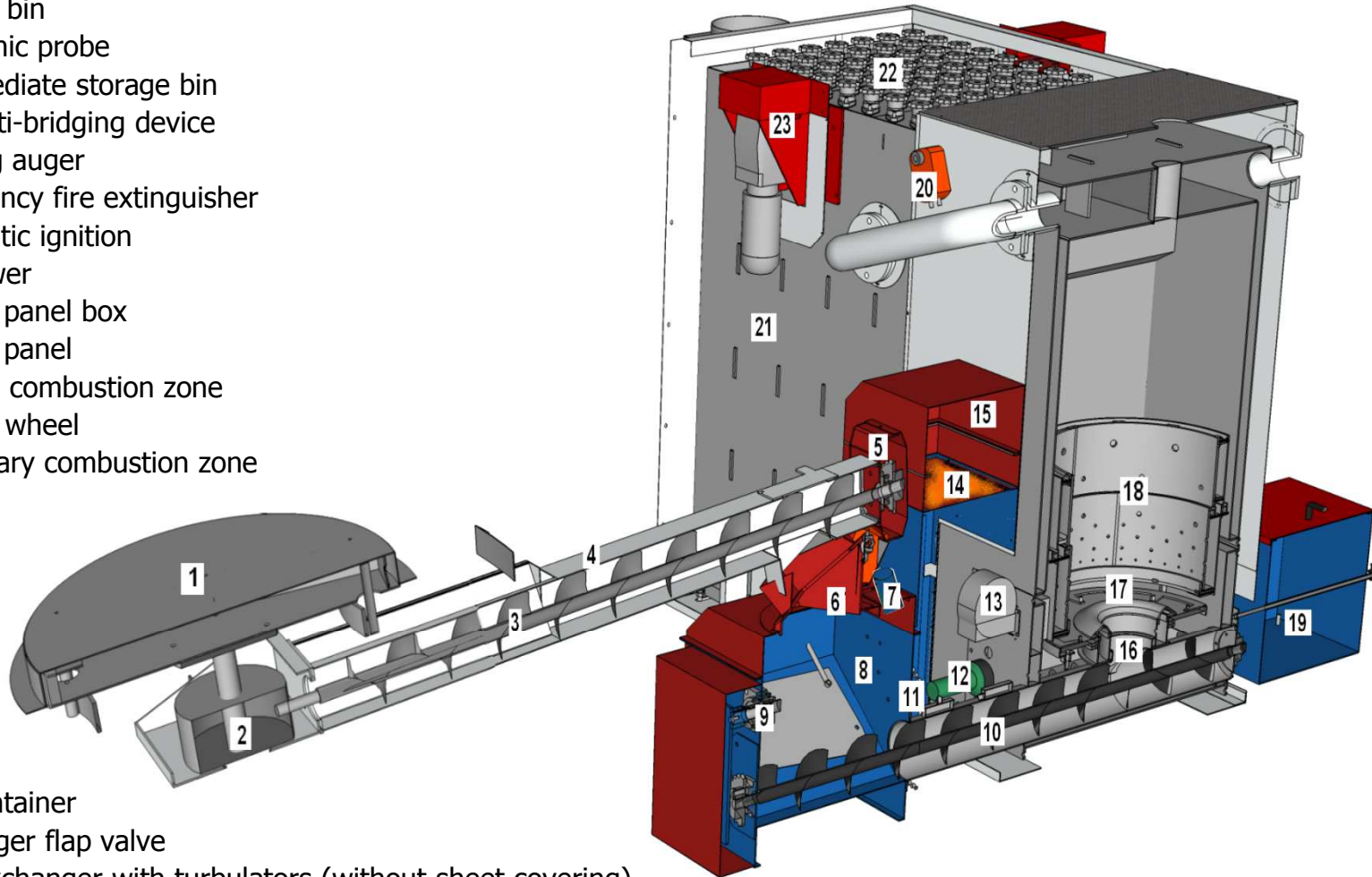


Advanced Biomass Boiler Systems

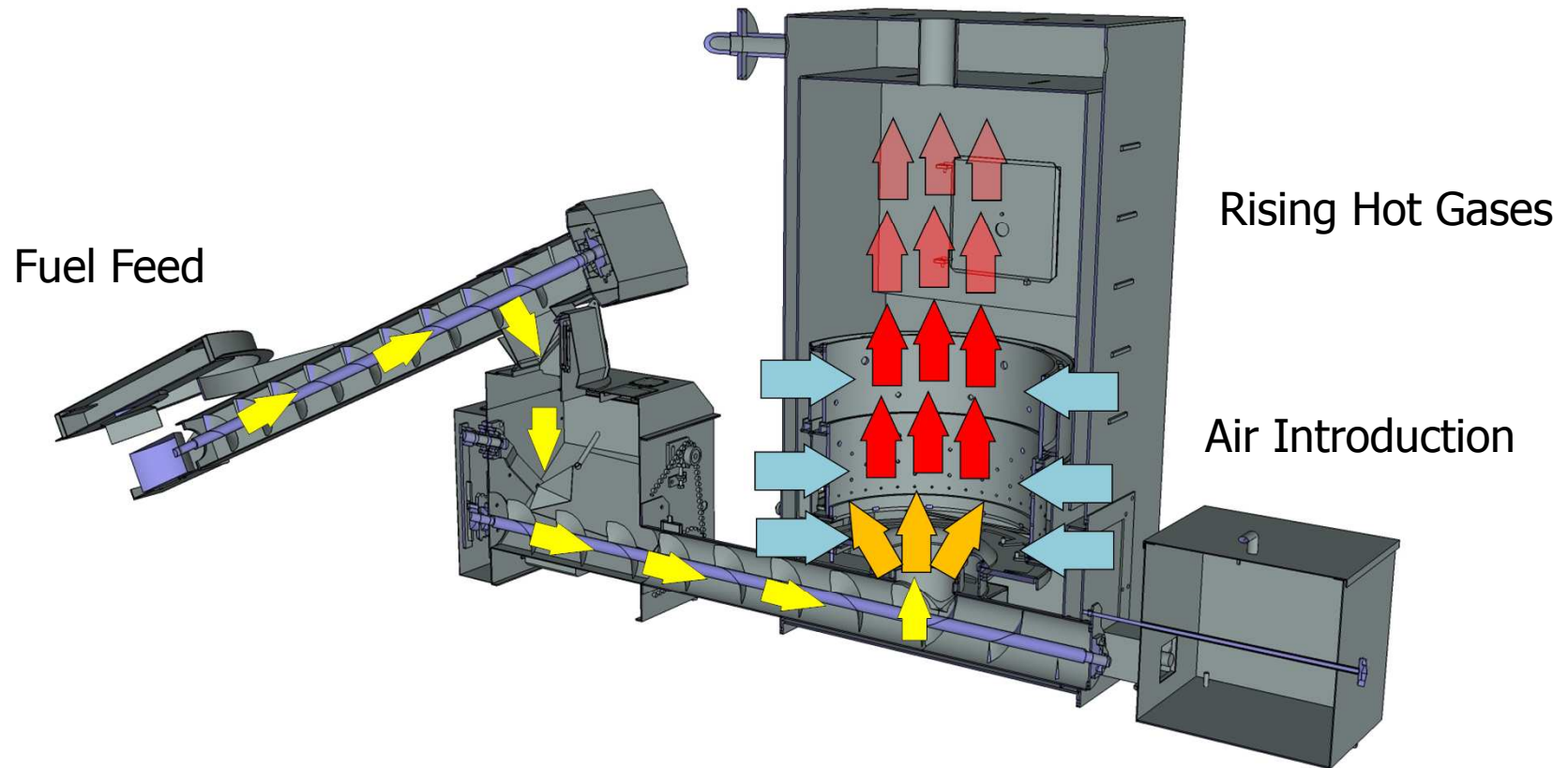


Boiler Configuration

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



Fuel and Air Flows for Complete Combustion

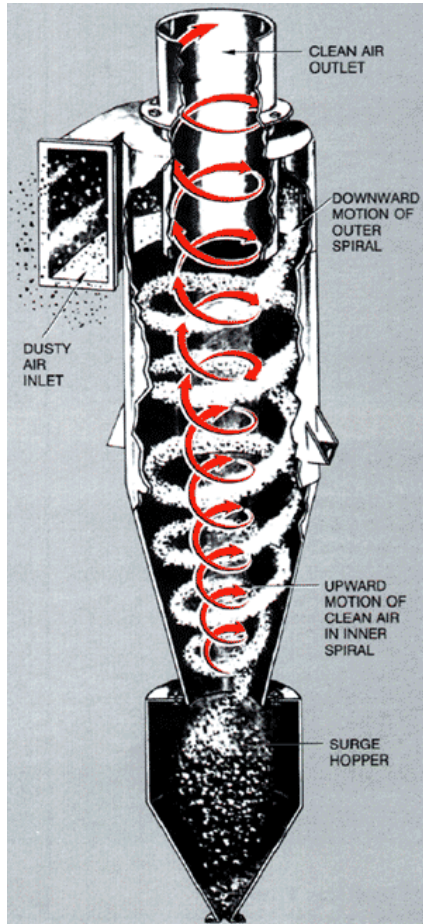


Achieving High Efficiency Combustion

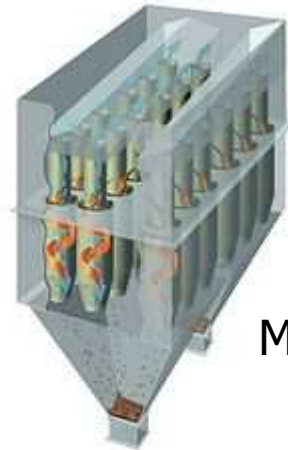
1. Combustion residence time >0.5 sec
2. Excess air at 50%
3. Combustion Temperatures >1500 F. Controlled to reduce particulates and NO_x. (Pre-heated air)
4. Turbulence – tangential air/turbulators
5. PLC controls with oxygen (7-9%) monitoring and pressure sensors
6. Thermal buffering – Hot water storage tank
100gal/100,000 Btu/h output
7. Optimization with other systems (solar/fossil fuel)
8. Fuel Control (Clean)
9. Regular Boiler Servicing
10. Post Combustion Gas Scrubbing



Post-Combustion Air Scrubbing

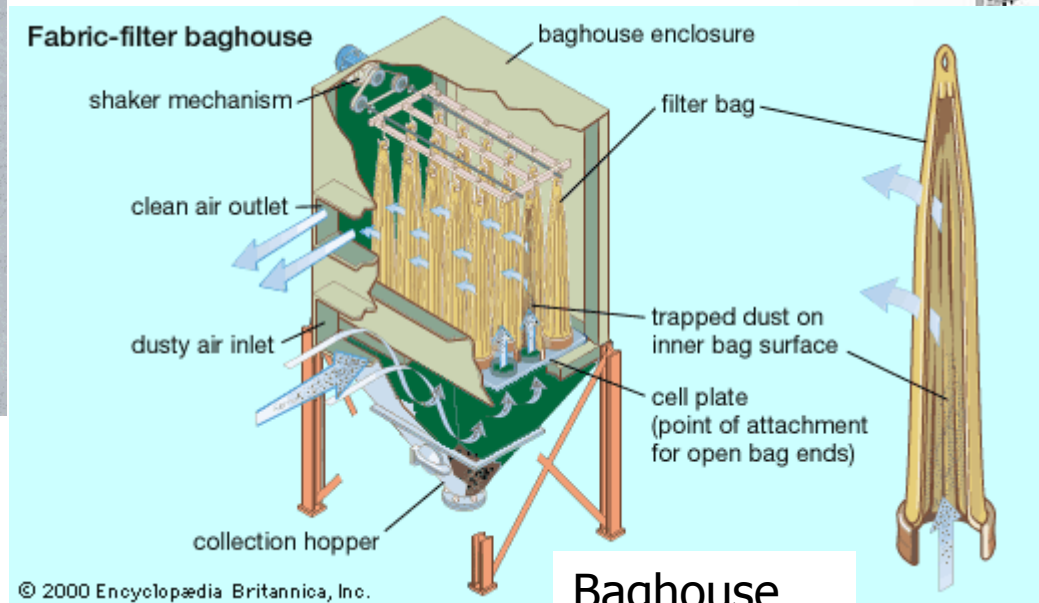
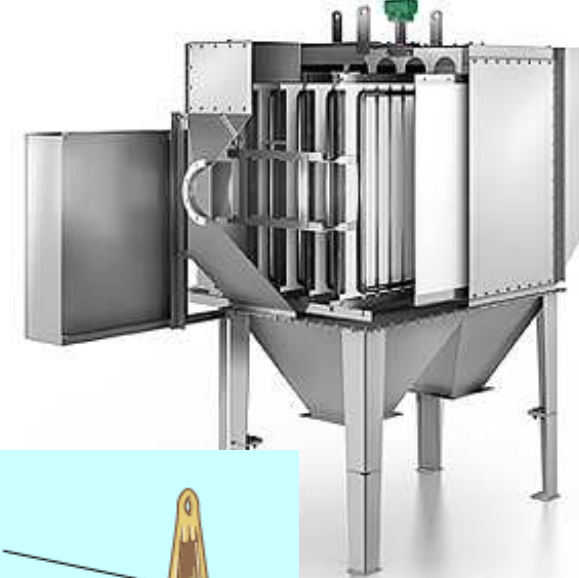


Cyclone



Multiclone

Electrostatic Precipitator



Baghouse

Pellet Boiler Federal Bldg. Ketchikan, AK



1.7 MMBtu Pellet Boiler Integrated with Solar Panels

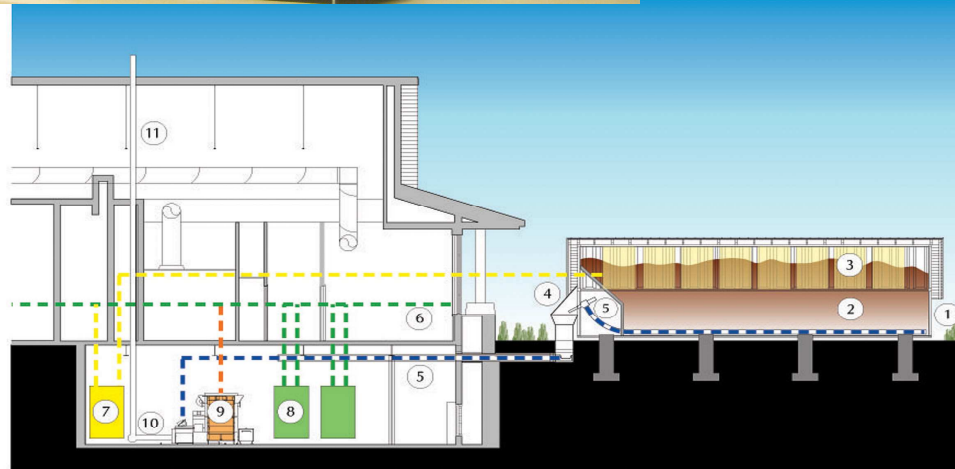
Pellet Boiler



Natural History Museum of the Adirondacks – The Wild Center



- 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



Pellet storage

Pellet Boiler System 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

Pellet Boiler Industry Future

- Industry drivers – fossil fuel costs, local self reliance, GHG concerns
- Industry challenges – capital costs of equipment, lack of consumer awareness, unclear emissions regulations
- NYSERDA has been a key supporter of R&D for biomass thermal and NY is emerging as a leader with 5 companies currently manufacturing biomass boiler and CHP systems.



Conclusions

- Wood pellet boilers save reduce heating costs and support local jobs
- Modern boilers are user-friendly and have exceptionally low emissions.
- U.S. wood heating market is primed for expansion with increasing energy costs and advanced technologies now being manufactured in the U.S.



David Dungate
Tel: 518-956-2507
Email: dungate@actbioenergy.com