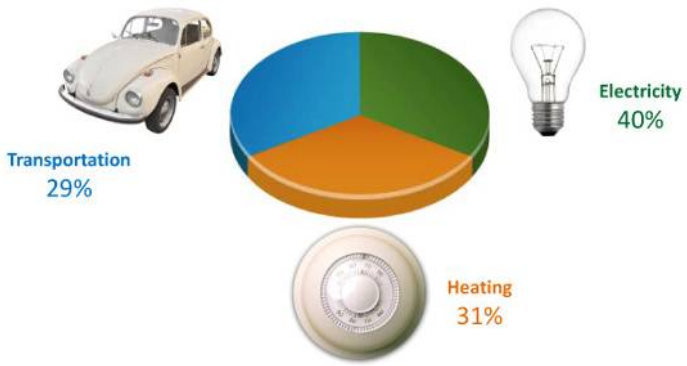
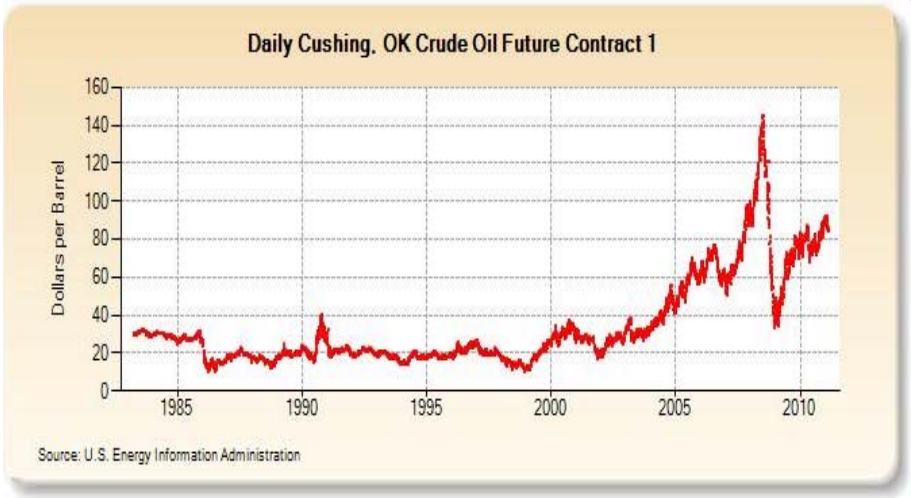
Tarm Biomass

Biomass Central Heating Systems

Why is biomass heating relevant today?

Thermal energy is about 1/3 of America's energy use.





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NRG Systems – 2004

- 46,600 sq. ft. Manufacturing Office Facility Hinesburg, VT
- Super Efficient building-renewable energy inside and out.
- Roof solar PV-42kw
- Solar PV Trackers-32kw (adding more)
- Wind-10kw
- Two Multi-Heat 4.0 boilers
- LEED "Gold" certified

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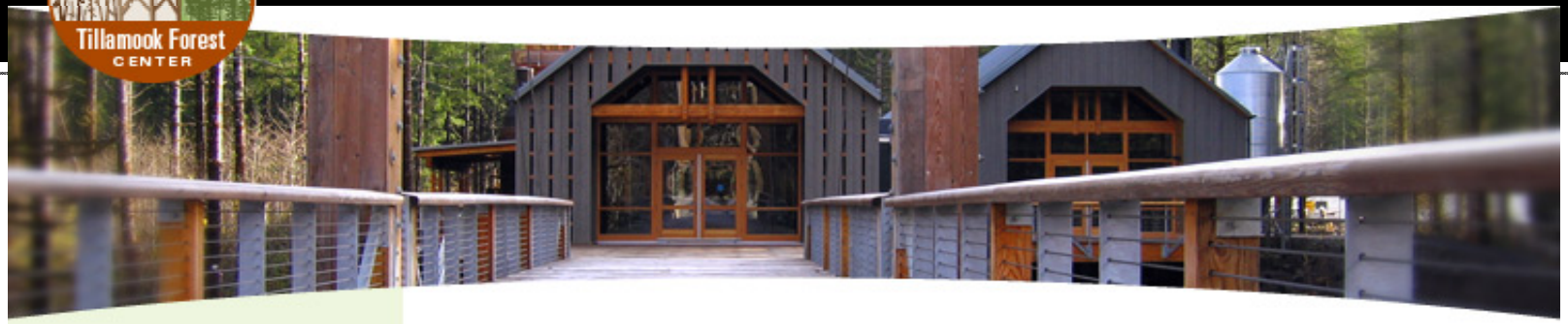
Tillamook Forest Center – 2005



- 13,500 Sq. Ft Building.
- Sustainable Energy and Design
- 30 Percent More Energy Efficient than Code Required
- Three Multi-Heat 4.0.

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Current Innovations

- Pellet Boilers Innovations include:
  - Automatic Ignition
  - Automatic Heat Exchanger Cleaning
  - Automatic ash handling
- Combustion Gas monitoring and real-time combustion adjustments for wood and pellet boilers

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Current Innovations-High Efficiency and Cleaner Emissions

Lambda Controlled Combustion

- Monitoring of exhaust gas residual oxygen content and temperature
- Real-time adjustment of:
  - Primary and secondary air controls
  - Fan speed
  - Fuel feed rate on automatically fed appliances

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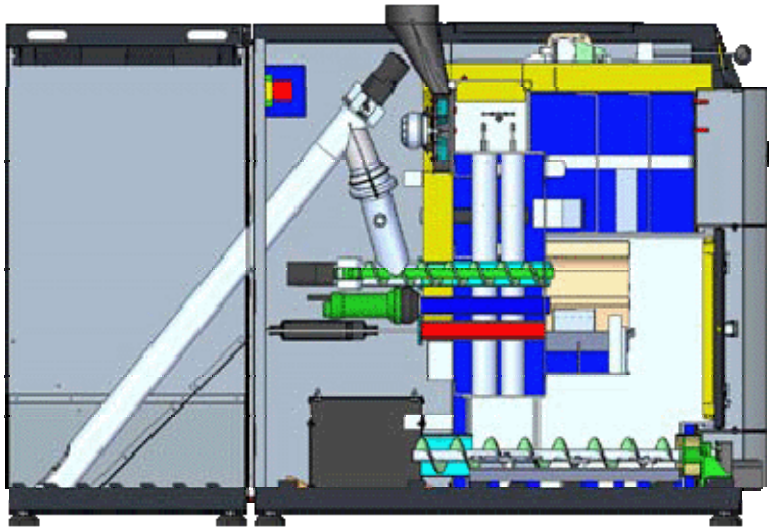
Biomass Boiler Technology, Now a Broader Appeal

Multi-Granulate Boilers

- Wider ash content and characteristic acceptability for greater fuel flexibility.
- Designed to convey numerous types of solid biomass.
- Lambda sensor optimizes combustion as fuel type and quality changes



Chips

Pits

Low grade Pellets

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Biomass Boiler Technology, Now a Broader Appeal

Fully Automatic Pellet Boilers

- Minimum owner interaction
- Extremely safe
- Extremely clean
- Built-in fuel conveyance
- Work best with premium and super premium pellet fuel.

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Biomass Boiler Technology, Now a Broader Appeal

Today's Wood Boiler

- Lambda Control
- Smoke containment
- Insulated jacket
- Exterior HX cleaning
- Firebox Cladding

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East Montpellier Fire Department - Montpellier, VT

- Fire station with emergency management and community meeting facilities.
- 20,000 sq ft
- Fröling P4 - Model 60, 198 k Btuh
- DHW
- Multifunction pellet storage
- Ongoing performance monitoring

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Residential Biomass Solar Integration - Putney, VT

- House Area - Approx. 6,500 sf
- Pool House Area - Approx. 2,500 sf
- Pool Size - 16,000 gallons
- Fröling P4 - Model 60, 198 k Btuh,
- 14 Ton automated pellet bin
- Renewable Energy used for elec. and heat to reach Net Zero

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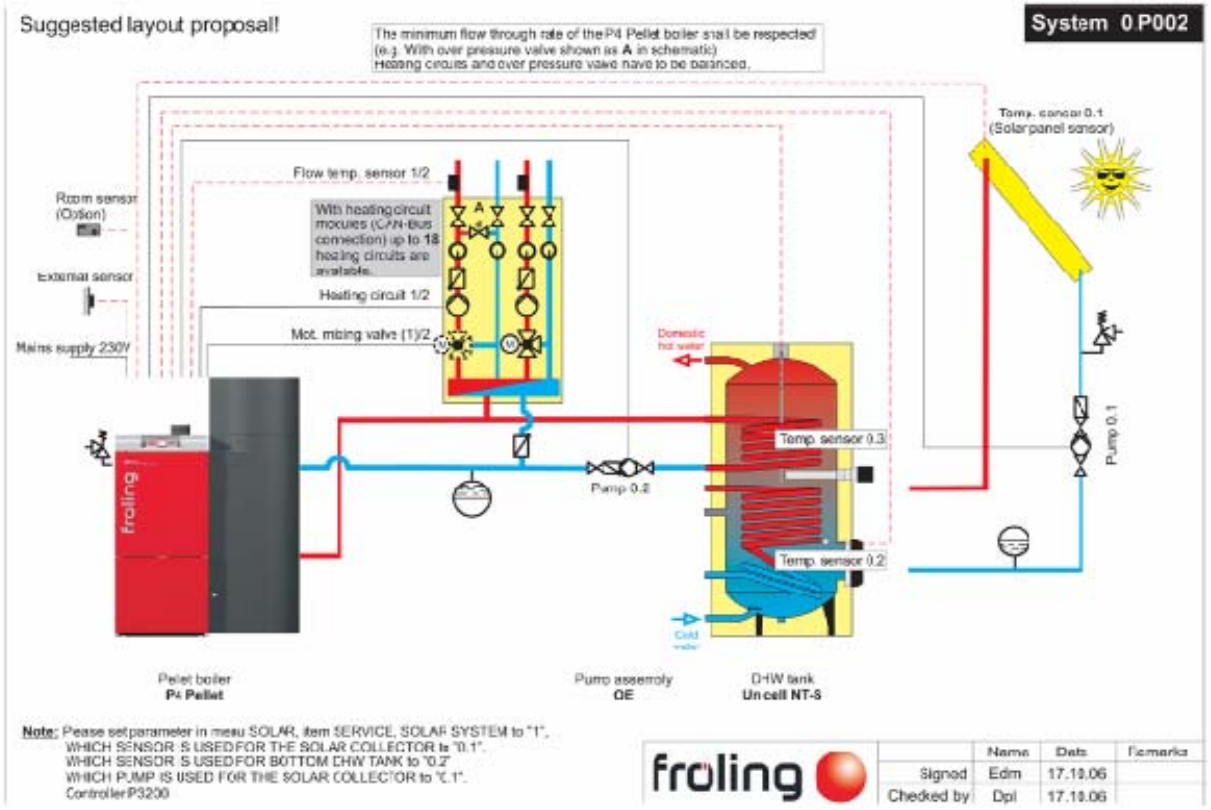
Example System

Pellet Boilers Integrated with Solar Thermal Systems



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Beyond Boilers-High Efficiency and Emissions

Thermal Storage

- Reduced cycling
- Enhances combustion
- Integration with solar thermal and other heat sources
- Allows year around production of domestic hot water
- Makes appliance a thermal energy power house.
- Enhances the operations and efficiency of wood pellet boilers and biomass boilers too!

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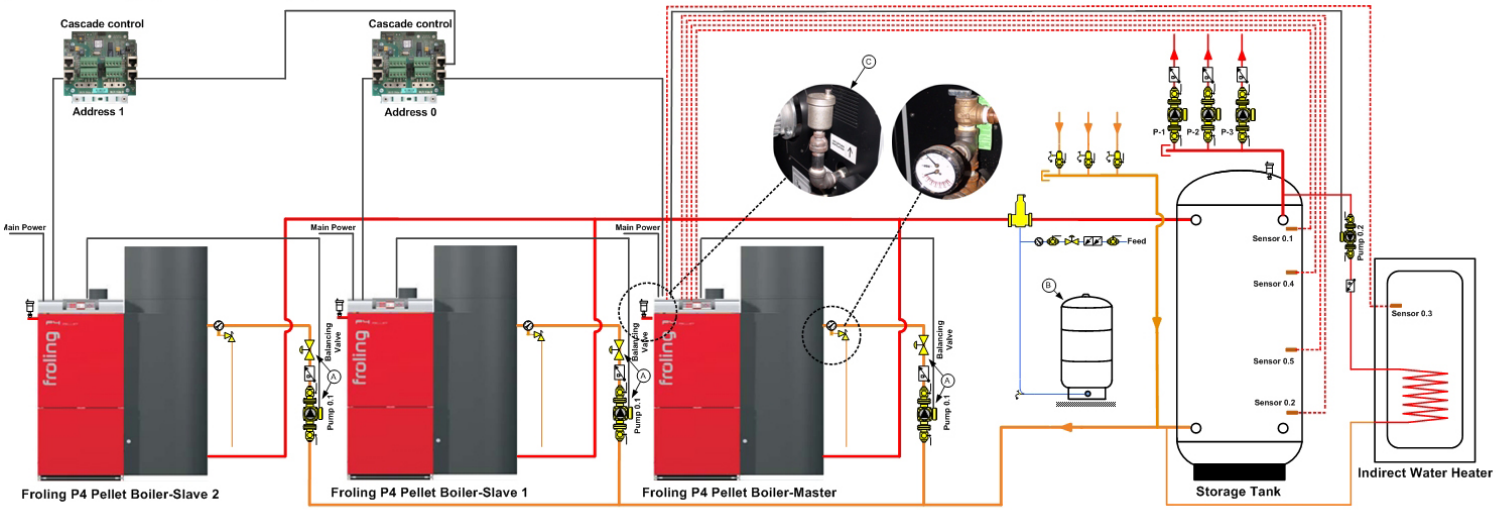
System Example Multiple Boilers

- Cascade controller
- Wider load heating load range
- 60 kBTU/hr to 800 kBTU/hr
- System redundancy



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Solid Biomass Heating Trends

- Sustainability of the fuel source.
- Bulk delivery of wood pellets.
- Standardized emissions and efficiency testing.
  - Exhaust gas combustion tuning.
  - Total heating system efficiency.

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Thank you

Please contact me if you have any follow up questions

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