

April 16th 2019

Perspectives on Wood-fired CHP

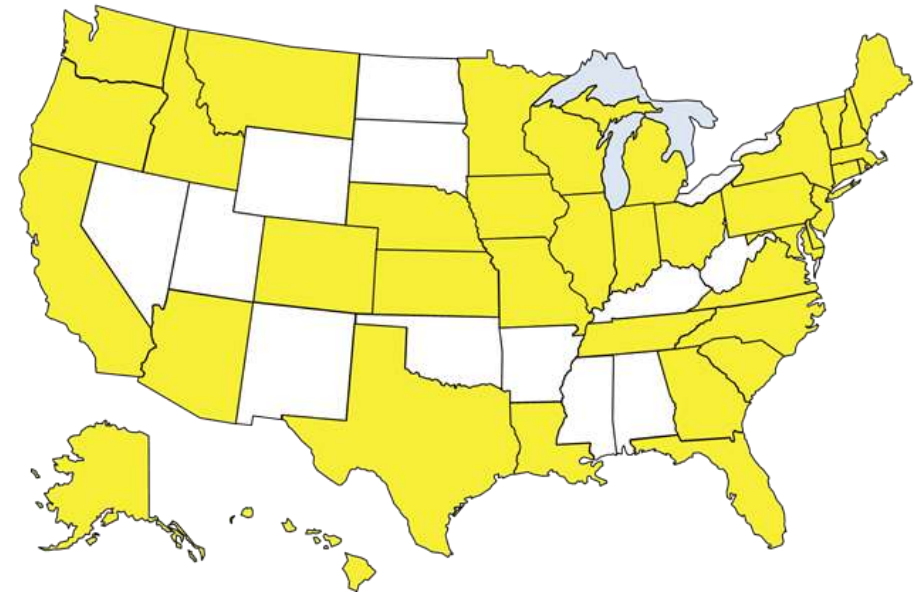
Alaska-Yukon Wood Energy Conference

Adam Sherman



About VEIC

- Mission-driven nonprofit
- 30+ years reducing economic & environmental costs of energy
- 300 staff in Vermont, Ohio, & Washington DC
- Design and deliver:
 - Energy efficiency
 - Renewable energy
 - Transportation efficiency
- We “think and do”
 - 30 Consultants
 - 60 Engineers and TA experts
 - 10 Data analytics and EM&V experts
 - 8 Financing strategy experts



- Clients
 - Utilities
 - Government
 - Regulators / Consumer Advocates
 - Environmental Organizations
 - Foundations

Major Initiatives



Biomass Energy Resource Center (BERC)

Advancing the use of Local Wood Heat and CHP in North America



Technical Consulting

- Project feasibility studies
- Fuel supply assessments and procurement
- Third-party expert review
- Develop and review of standards
- Market assessments



Program Design & Implementation

- Wood heat market expansion potential assessments
- Program design and implementation support
- Training and advisory support services



Advocacy

- Showcasing “best practices” and case studies of successful projects
- Tracking market growth and impacts

Presentation Outline

- Thermal led CHP
- Electric led CHP
- Boiler coupled technology
- Steam vs. ORC
- System sizing to thermal loads
- Grid connected or “behind the meter”
- Economics
- Market opportunities

Boiler coupled energy options



Large steam or hot water boilers



Steam or Hot Water for Space Heat & DHW

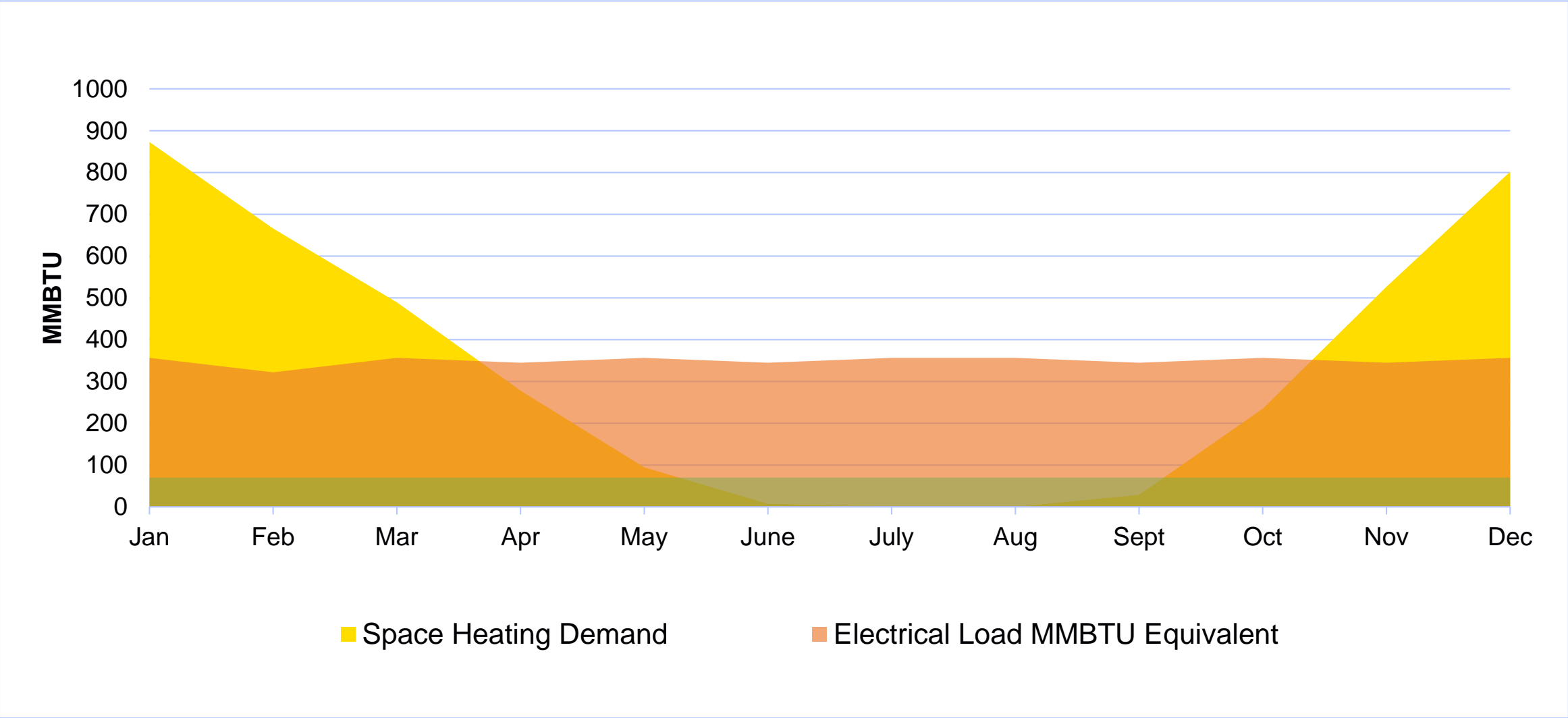


Absorption Chillers for Cooling

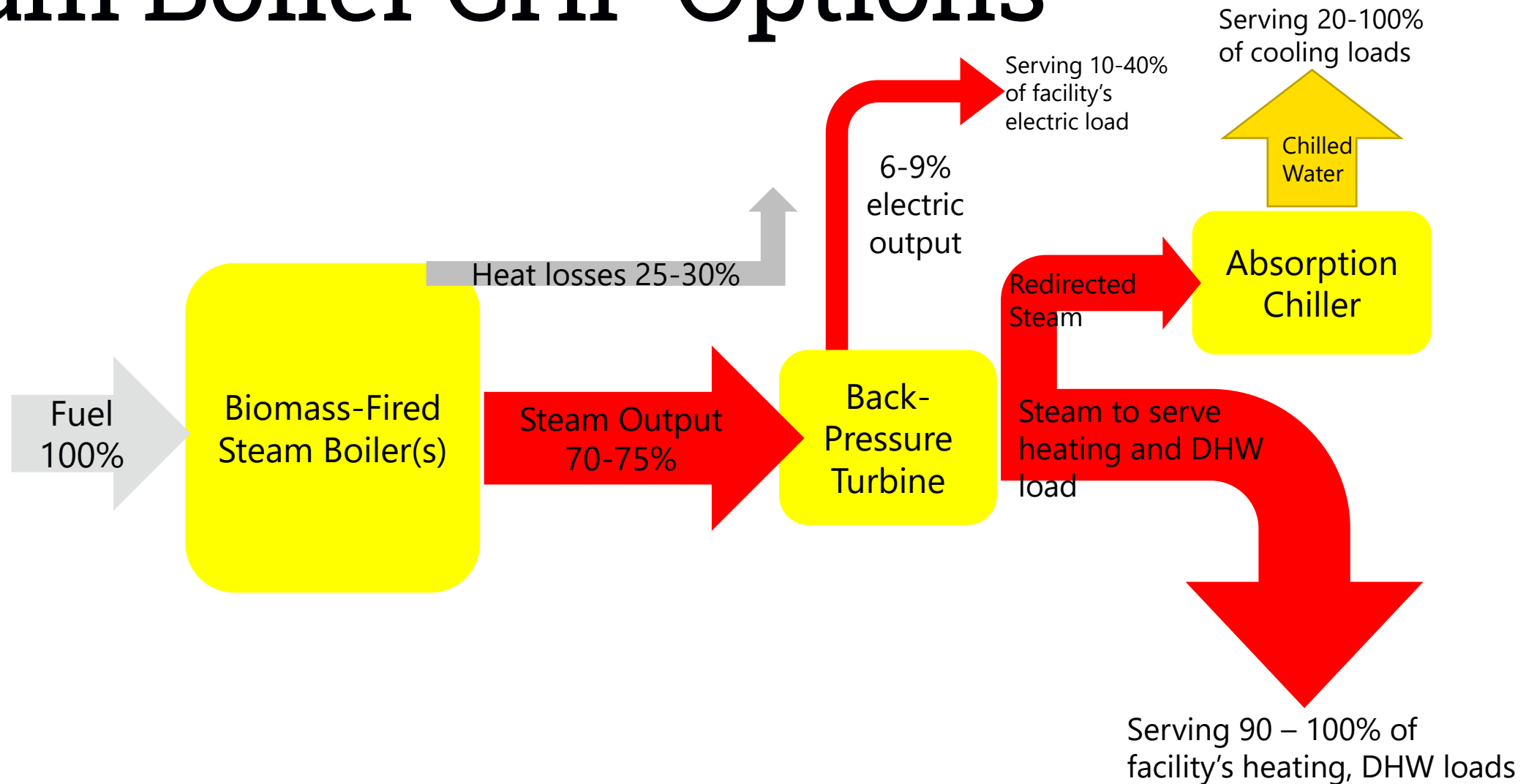


Back-pressure Steam Turbines for On-site Electric Generation

Energy Loads of an Example Commercial Building



Steam Boiler CHP Options



Example Projects

Installed Projects	Location	Generation Connection to Utility?	Wood-Fueled Boiler Capacity (MMBtu/hr.)	Turbine Capacity (kW/h)	MBtu per kW Capacity Ratio
North country Hospital	Newport, VT	No	17	350	49
Tok School	Tok, Alaska	Yes	5.5	120	46
Northern Michigan University	Marquette, MI	No	40	645	62
Middlebury College	Middlebury, VT	No	30	1,500	20
Green Mountain College	Poultney, VT	No	14	150	93
Sullivan County Complex	Claremont, NH	No	5	40	125
Chillicothe VA Hospital	Chillicothe, OH	No	20	350	57
Gunderson Lutheran Hospital	Lacrosse, WI	No	27	400	68
White River VA Hospital	White River, VT	No	18	250	72
Colby College	Waterville, ME	No	28	600	46
Cooley Dickenson Hospital	North Hampton, MA	No	20	500	40

Other Technology Innovations - CHP



Pellet boiler + Sterling engine



Down-draft gasifier coupled with IC engine



Organic Rankine Cycle (ORC) system

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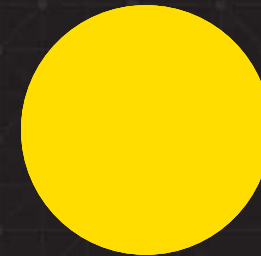
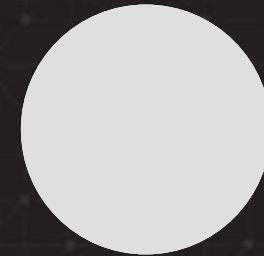
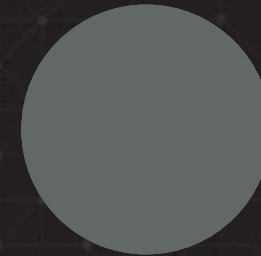
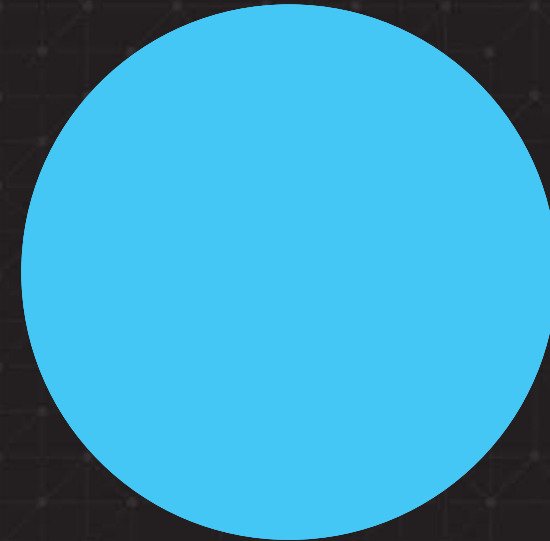
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Thank
you!



Extra Slides

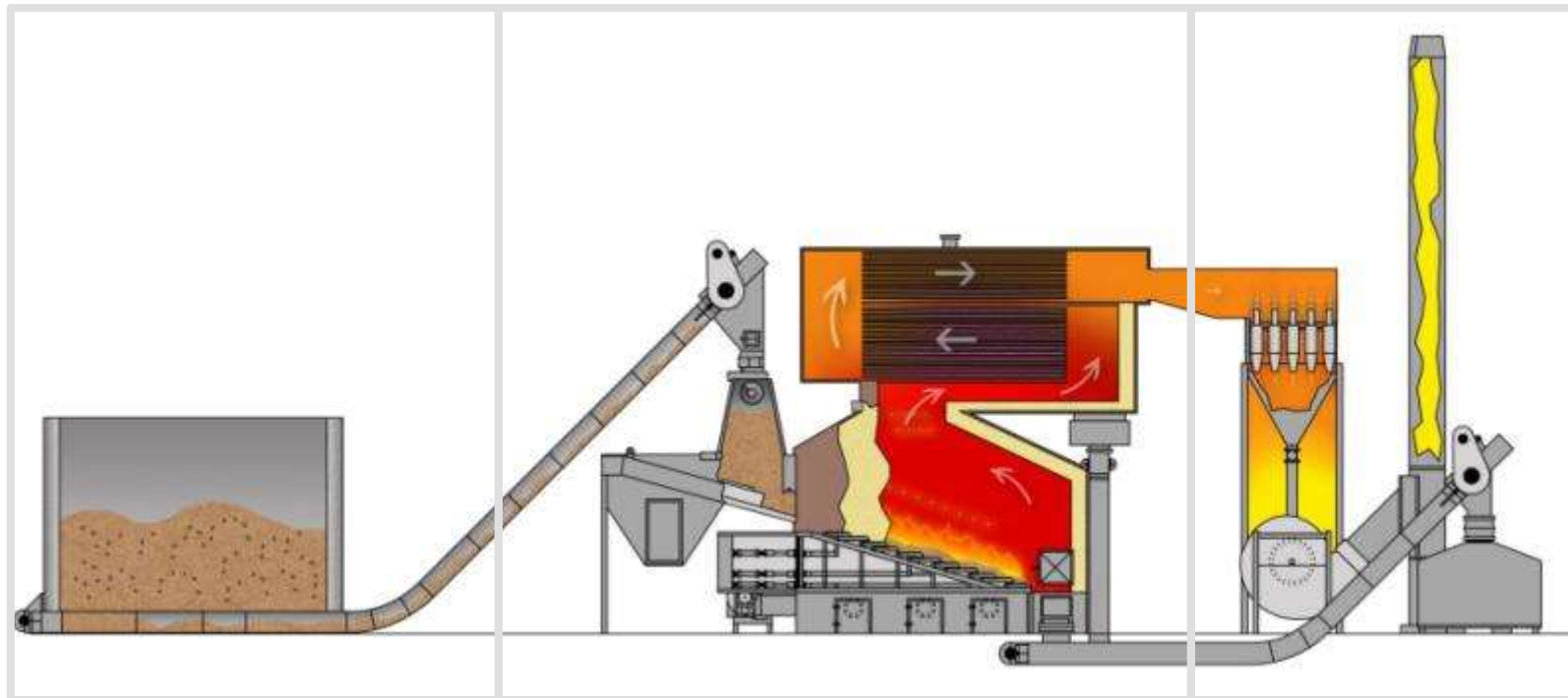


Automated Wood Heating System Configuration

Fuel Storage

Combustion Equipment

Emissions Control Equipment & Stack

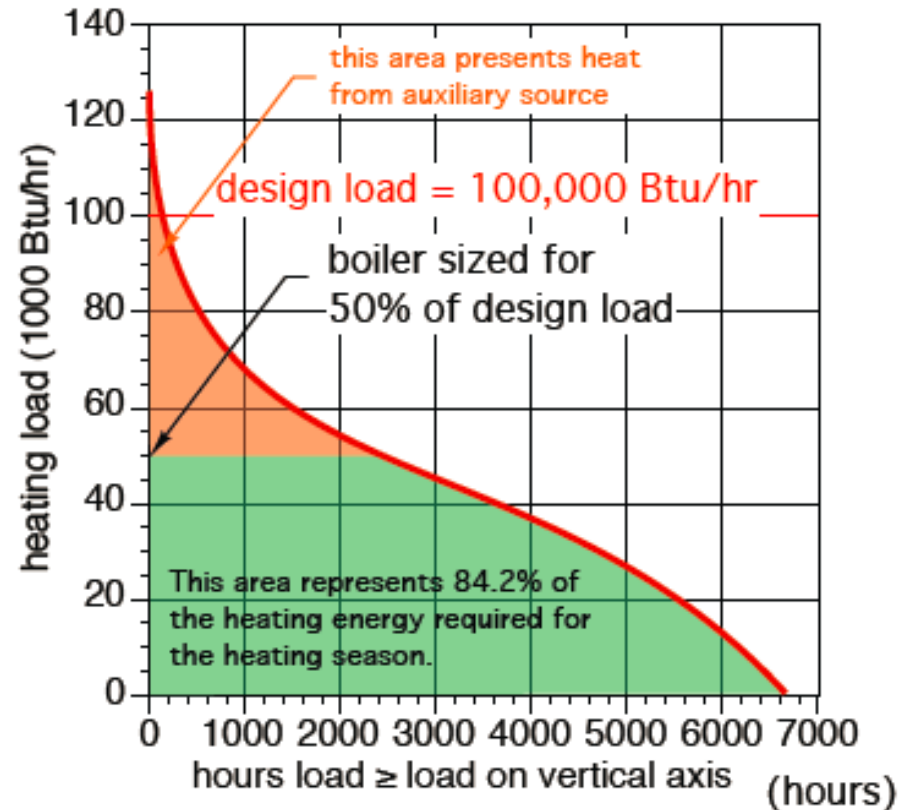
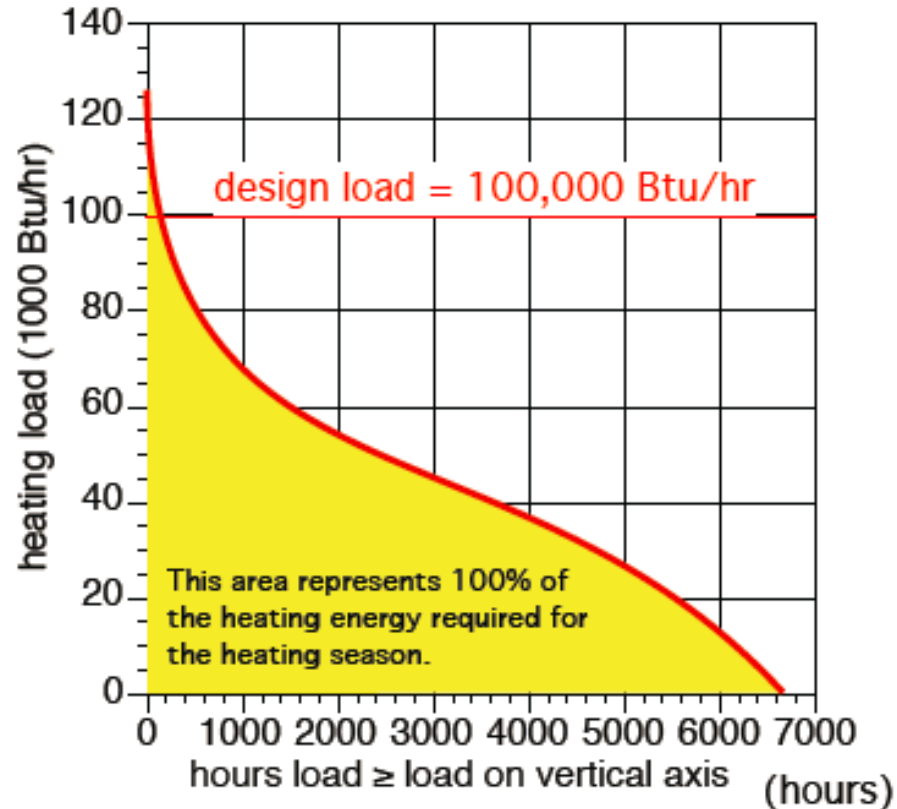


Pellet Silos
Slab chip bins
Below grade chip bins

Stoker/fixed grate
Stoker/moving grate
Pneumatic/suspension
Fluidized bed

Single cyclone
Multi-cyclone
Baghouse
ESP

Under-sizing Wood Boilers



Typically:

- A boiler sized to meet **50%** of peak load conditions will cover **84%** of annual heat load
- A boiler sized to meet **75%** of peak load conditions will cover **96%** of annual heat load