Needs and Opportunities
To Improve RHC Performance Metrics

June 19, 2018
Renewable Heating & Cooling Workshop
Saratoga Springs, New York

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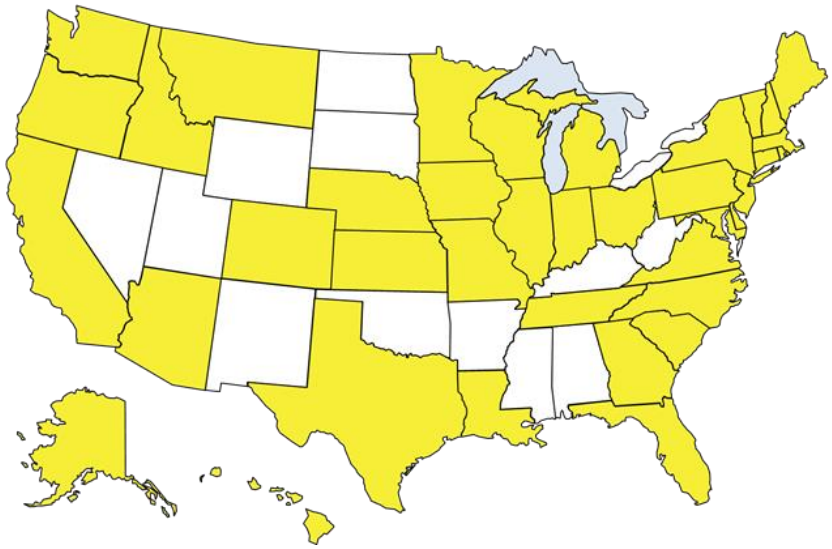
VEIC

BERC Biomass Energy Resource Center

About VEIC



- Mission-driven nonprofit
- 30+ years reducing economic & environmental costs of energy
- Over 300 staff; offices in Vermont, Ohio, & Washington DC
- Design and deliver:
  - ❑ Energy efficiency
  - ❑ Renewable energy
  - ❑ Clean transportation
- We “think and do”:
  - ❑ 30 Consultants
  - ❑ 60 Engineers and TA experts
  - ❑ 8 Financing strategy experts
- Clients
  - ❑ Utilities
  - ❑ States
  - ❑ Regulators / consumer advocates
  - ❑ Foundations / environmental organizations

Based on Technical and Program Support for:

Performance Metrics

Rated Performance of Equipment

- Efficiency
- Particulate Emissions

Installed Heating System Performance over time

- Reliable, consistent supply of heat
- Fossil fuel displacement
- Money saved
- GHG emission reductions

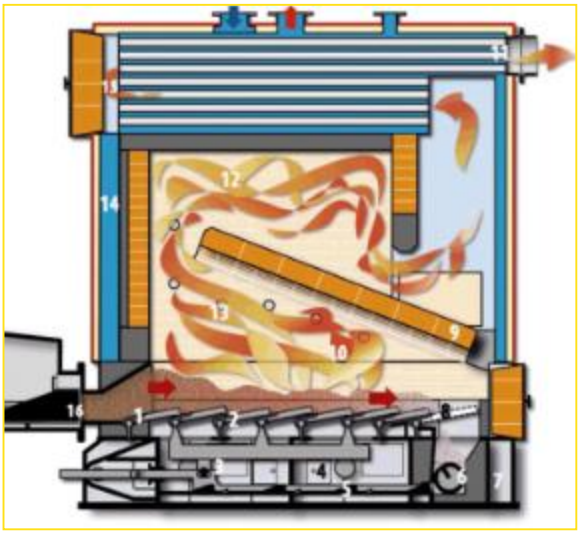
RHC Program Performance

- Number of systems installed
- Fossil fuel displacement
- GHG emission reductions

Rated Performance of Equipment

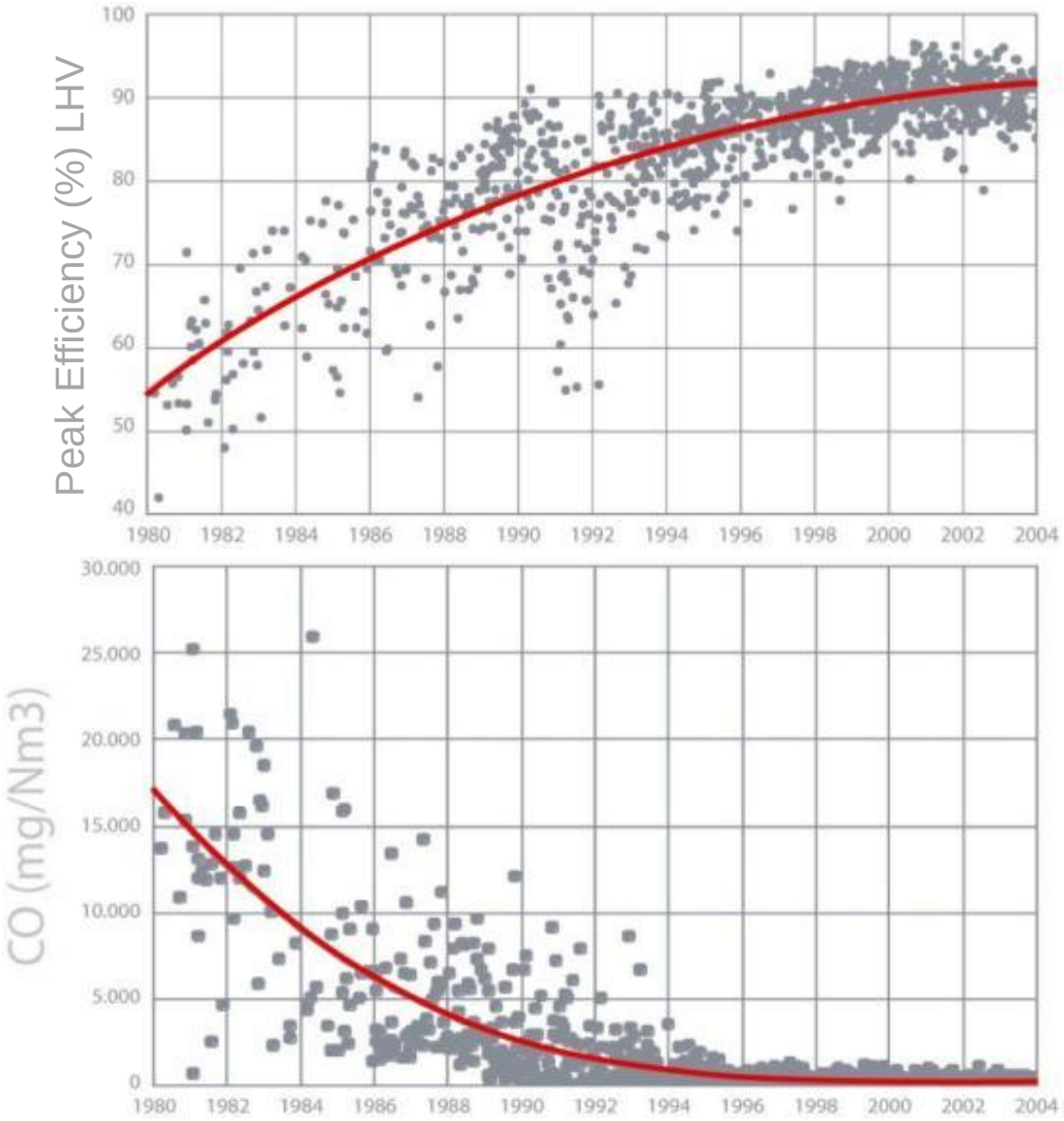
Cordwood system

Pellet system



Woodchip system

Rated Performance of Equipment



Source: Ober Oesterreich Energiesparverband

Rated Performance of Equipment

Good combustion requires:

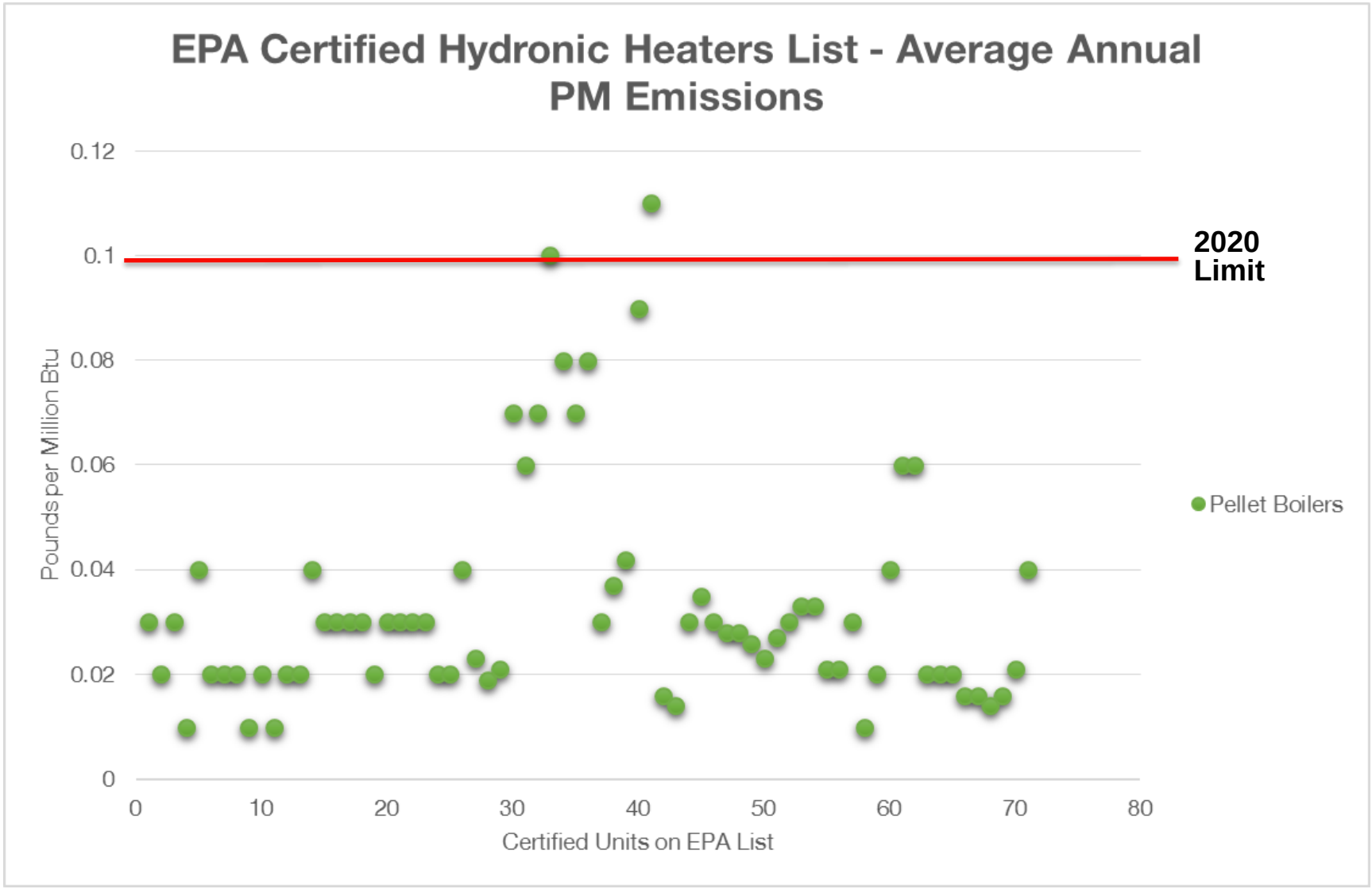
- Best in class equipment (3Ts)
- High-quality consistent fuel
- Optimal air supply
- Load matching and firing control

Rated Performance of Equipment

European vs. US Standards

- EN303-5 standards
  - 6 hour test burns at given % output
- EPA NSPS 2015 and 2020 standards
  - Emission ratings – Annual Average
  - Efficiency ratings – Annual Average

Rated Performance of Equipment



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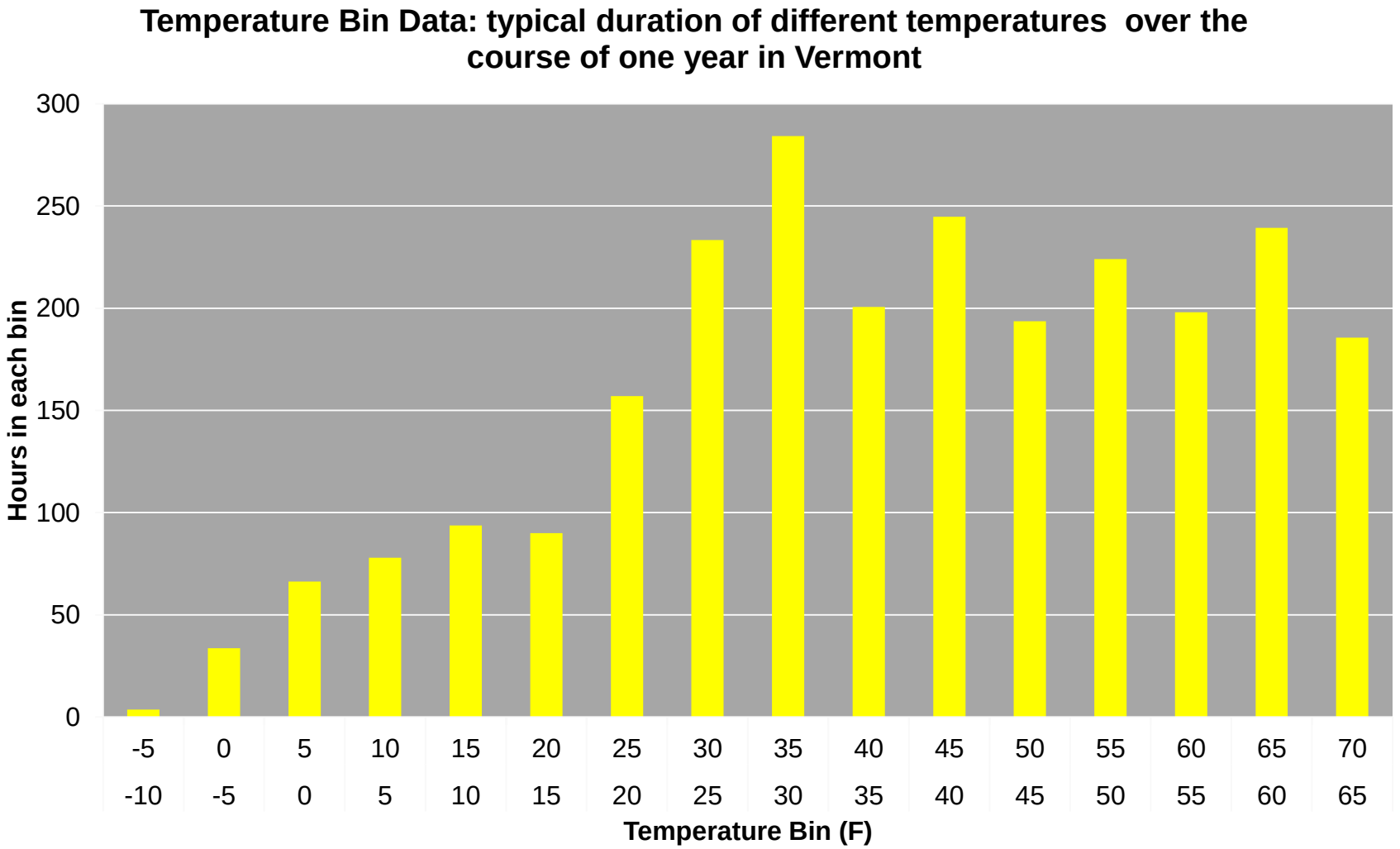
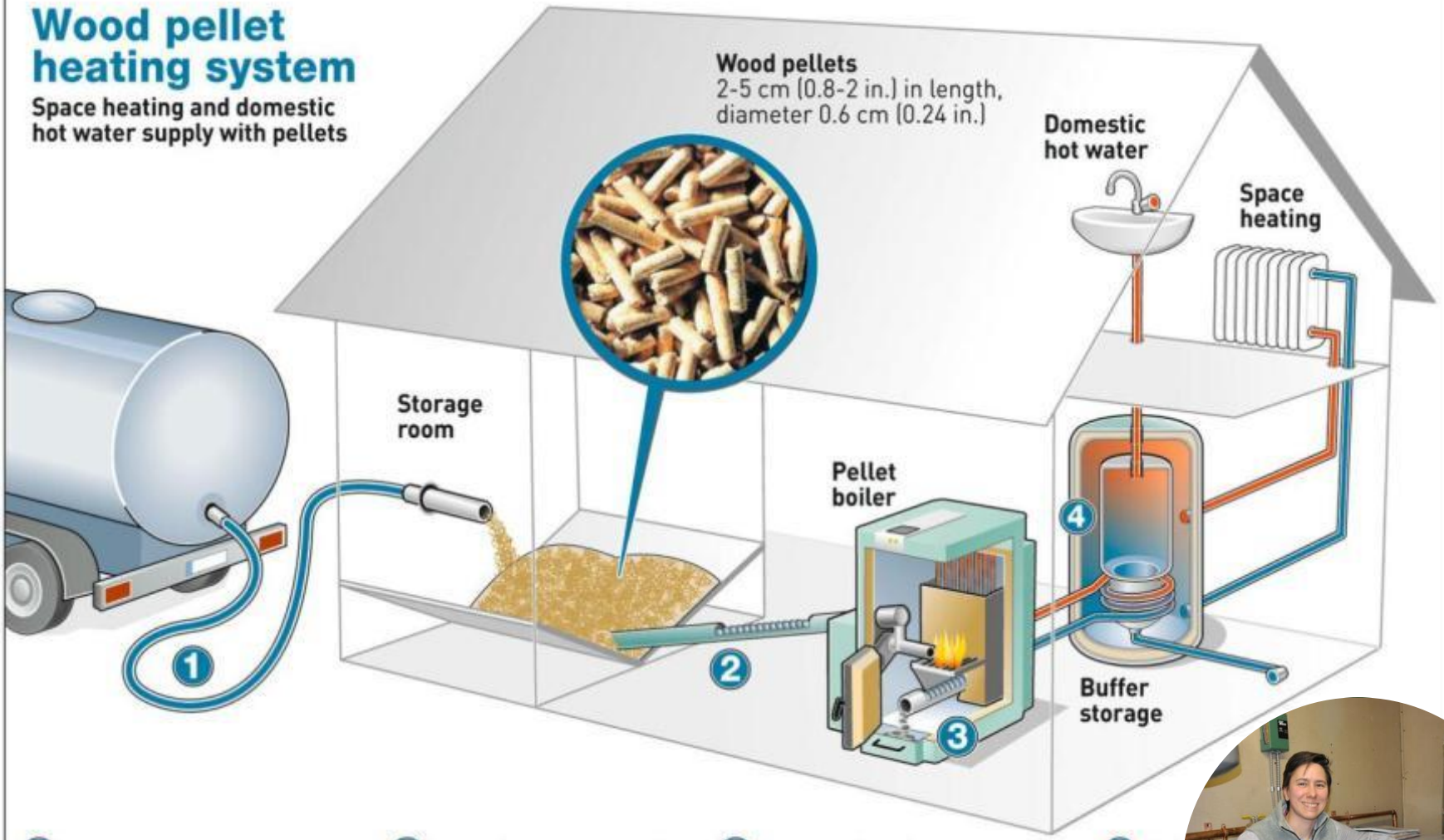
Installed Heating System Performance

Installed Heating System Performance



Wood pellet heating system

Space heating and domestic hot water supply with pellets



1. Once or twice a year the pellets are delivered by a silo tanker. A loaded storage room of 4.5 m² is enough to keep a single-family house warm for one year.

2. The pellets are carried from the storage room to the boiler by a fully automatic pellet feed.

3. After the burning process all that's left is ash – with a weight of only 0.5 per cent of the original pellet. The ash can be disposed of with the domestic waste.

4. If th… interc… storag… reduced… increased…

www.unendlich-v…

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Installed System Performance

Existing data points on modern boilers

- Amount of fuel burned
- Number of run hours at different output rates
- Number of on/off cycles
- Residual oxygen levels
- Stack temperature

Installed System Performance

Simple strategies to help ensure the performance:

- Rely on equipment eligibility requirements.
- Rely on the application review process.
- Rely on installer training.

Installed System Performance

Simple strategies to evaluate the performance of installed systems:

- Issue an annual survey of incentivized systems
- Conduct spot inspections on a random sample of installed systems
- **Commission a one-time engineering assessment to characterize real-world system performance across a range of systems types, sizes, and integration with hydronic systems**

RHC Program Performance

CEDF Goals

- Fossil fuel displacement
- Limiting carbon emissions
- Strengthening the Vermont economy
- Enhancing and sustaining Vermont's working landscape

Program Performance Metrics

Key Vermont Policy Goal	Metric	Recommended Approach
Fossil fuel displacement	Estimated annual and cumulative fossil heating fuel displacement	Use historic heating fuel consumption information already gathered in the SSREIP application. This can be used to estimate annual fossil fuel displacement using calculations already used in the Self-Review Tool.
Limiting carbon emissions	Estimated annual and cumulative carbon emission reductions	Use the fossil fuel displacement value and apply EIA CO_2 emission factors to each fuel to calculate annual carbon emission reductions. Use wood fuel consumption values to calculate the emissions related to wood.
Strengthening the Vermont economy	Estimated annual and cumulative fuel cost savings from installed systems	Use fossil fuel displacement and wood fuel consumption values to calculate annual heating fuel savings. Update annually using averaged annual fuel prices for heating fuels.
	Estimated annual and cumulative wealth retention from avoided expenditures on imported fossil fuels	Use estimates from heating fuel savings and apply economic value retention ratio to the estimated annual expenditures on fossil and wood fuels.
Enhancing and sustaining Vermont's working landscape	No simple, effective metrics identified	TBD

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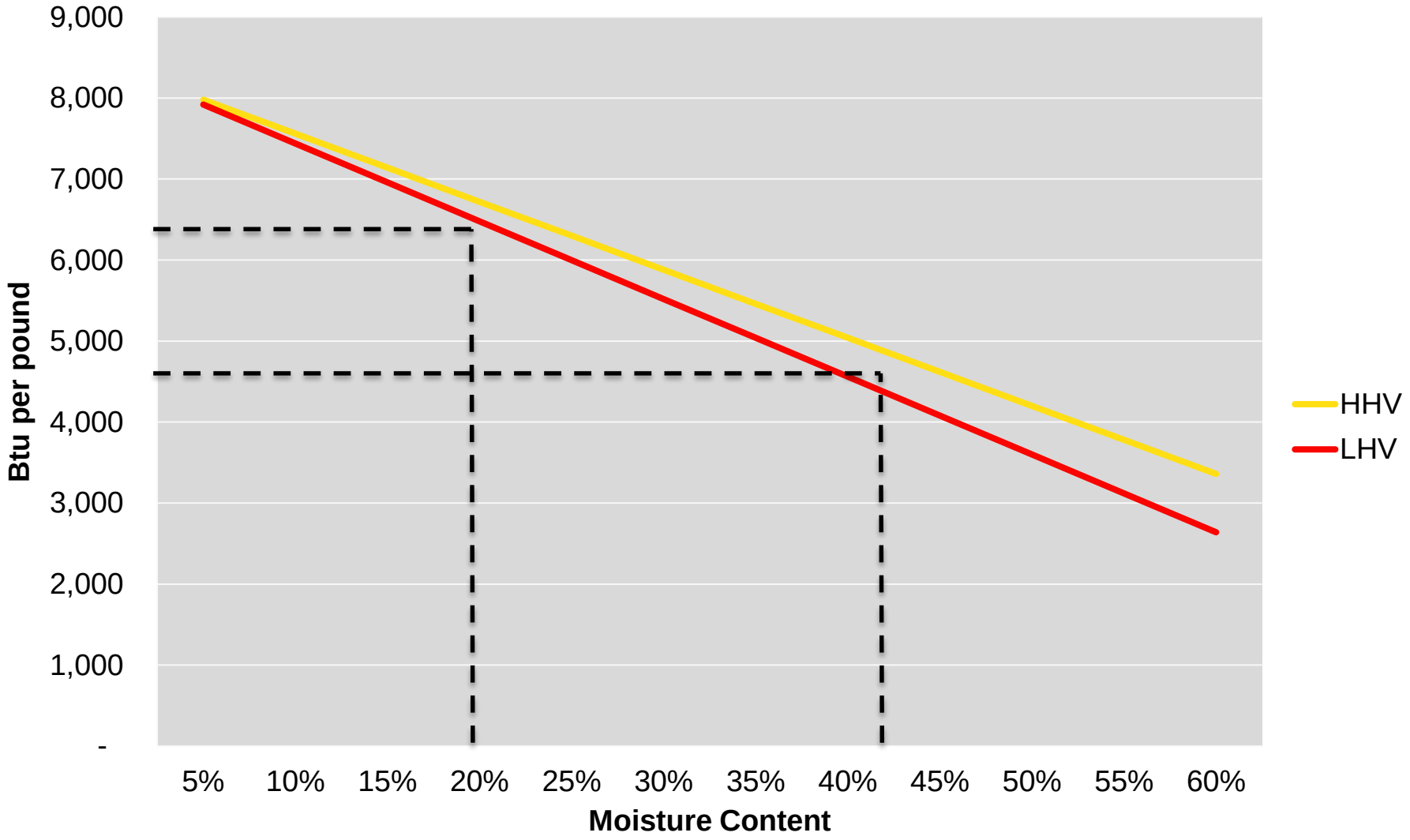
Contact Information

Additional Slides

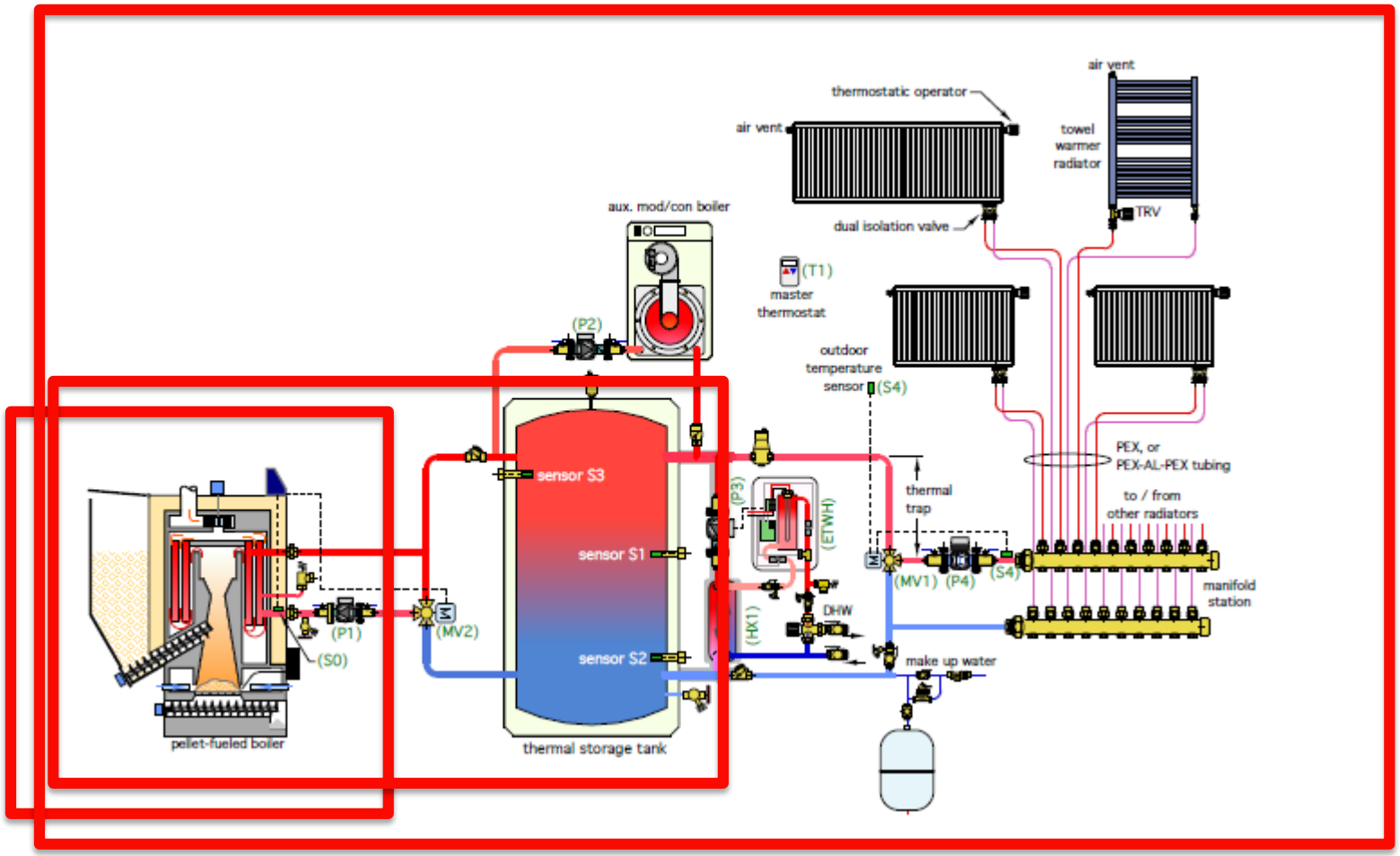
Program Eligibility Requirements

- Minimum Efficiency requirements
- Maximum PM emission limits
- Thermal storage requirements
- Boiler sizing
- Installer trainings
- Application review

Moisture Content Impact on Energy Value



Installed System Performance



Installed Heating System Performance