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Hiding in Plain Sight; GHG Co-benefits of Woodstove Changeouts

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35-year History of Woodstove Changeouts

- Thousands of Ton of PM 2.5 reduced in U.S. and Canada
- Crested Butte, Seattle, Southern Indiana, Green Bay, Oakridge (Oregon), Spokane, Fairbanks, Ottawa, B.C. Provincial (multipole locations), Libby, Northern Minnesota, Rutland, Tribal (many)
- Focused on small towns, high heating costs, intermittent electric service,

_PM reductions from

Lower appliance emissions

Increased efficiently

Some fuel switching

<u>But there were also Reductions in Key GHG emissions</u>

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Methane Reductions for Changeouts

- Source – AP-42, Vol 1, CH1.10
  - All data is IN-SITU
  - Emission Factor – lbs/ton fuel
  - Methane - Conventional Stove - 30
  - 1990 Non-Catalytic 16
  - 1990 Catalytic 11.6
  - Average Reduction in Methane = 27%
  - Plus, decreased fuel use due to increased efficiency
  - Thousands of lbs of Methane reduce by woodstove changeouts

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Environment and Climate Change Canada
Impacts of Various Parameters on Woodstove Emission Factors

- **130** tests – varying Draft, Fuel Species and Moisture
- 7 Appliances,
  - Conventional Open Fireplace
  - Conventional Free-standing Woodstove
  - 2020 Certified Catalytic Woodstove
  - 2020 non-catalytic woodstove
  - 1990 Certified non-Catalytic Woodstove
  - Canadian Certified In-built non-catalytic heater
  - Certified Pellet stove
  - Cordwood Fueling Protocol - Polytechnic University of Milan, Italy.

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Test Stand – PFS-TECO Portland, OR

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Methane Reductions

- Emission Factors –G/kg dry fuel
- Average All Variable – Moisture, Fuel Type, Draft
- Conventional Stove -- 9.3
- 2020 Non-Catalytic-- 5.14 45% Reduction
- Older 1990 non-Catalytic -- 5.63 40% Reduction
- Pellet Stove --2.19 76% Reduction
- 2020 Catalytic Stove 10.5
  - (Cat Stove lowest PM 2.5 & 18% improvement in Eff)

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Conclusion

- Woodstove Changeouts have not only lowered PM 2.5 levels in disadvantage rural communities, but have also contributed to reductions in GHG – especially methane