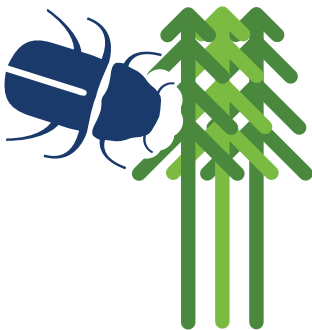


OPPORTUNITY

What are the benefits to using Biomass Boilers?

DRIVE USE OF LOCALLY SOURCED RENEWABLE ENERGY



TAKE ADVANTAGE OF WASTE WOOD

Pine-beetle infestation has killed 17.7 million acres of U.S. forest¹

TECHNOLOGY

How do Biomass Boilers work?

POWER HOT-WATER-HEATING SYSTEMS

with solid wood fuel

85%-90% EFFICIENCY RATING

M&V

Where did Measurement and Verification occur?

NATIONAL RENEWABLE ENERGY LABORATORY evaluated efficiency, cost-effectiveness, and operational functionality of a 1-million BTU biomass boiler provided by Advanced Climate Technologies at the Federal Building in Ketchikan, Alaska

RESULTS

How did Biomass Boilers perform in the M&V?

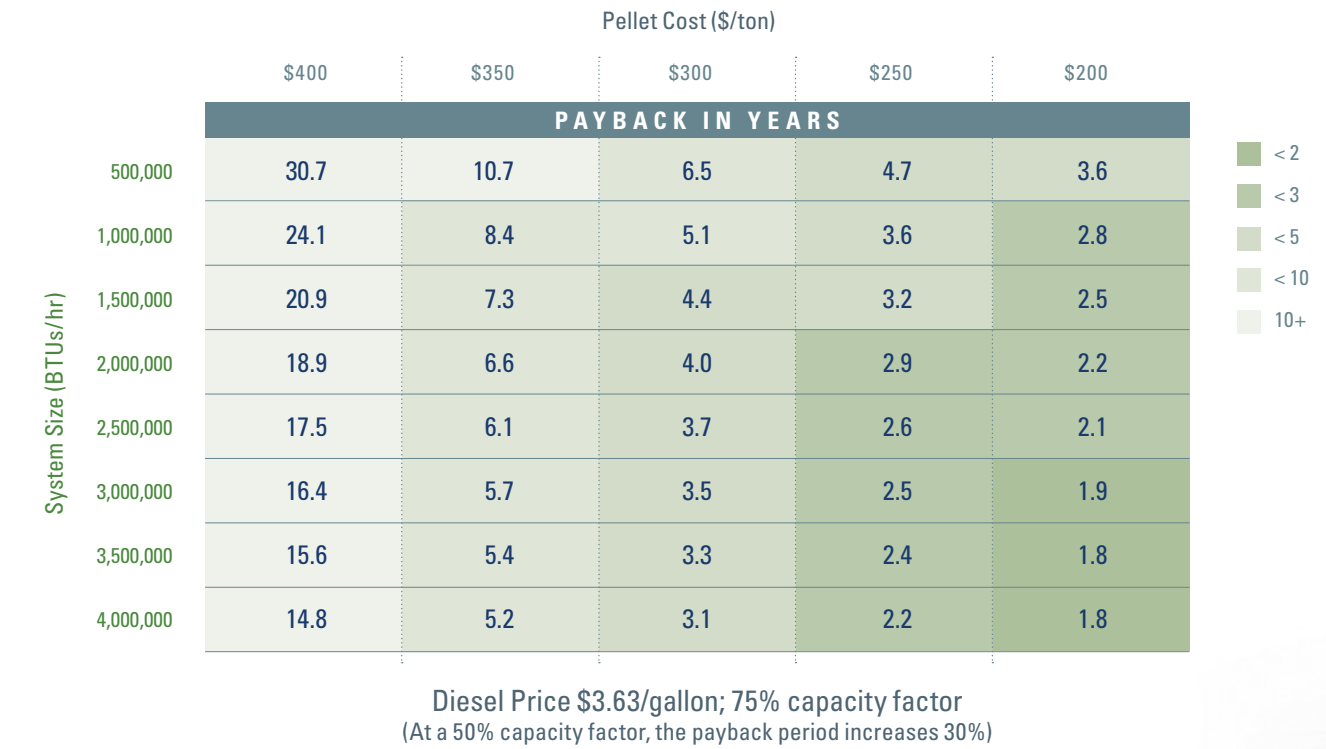
85.6% BOILER EFFICIENCY
at 45% partial load²; increased load will increase efficiency³

HIGH FUNCTIONALITY
low o&m costs⁴

<5 YEARS
Payback operating at 75% capacity with average pellet costs⁵

Payback Varies by System Size and Pellet Cost

Savings are greatest with larger systems and lower fuel costs



DEPLOYMENT

Where does M&V recommend deploying Biomass Boilers?

HOT-WATER HEATED FACILITIES USING FUEL OIL

Most cost-effective for buildings in cold northern climates within 50 miles of a biomass pellet mill

1US Forest Service, Western Bark Beetle Strategy, Human Safety, Recovery and Resiliency, 7/11/2011 2Wood-Pellet-Fired Biomass Boiler Project at the Ketchikan Federal Building. Gregg Tomberlin (NREL), June 2014, p3 3Ibid, p.12 4Ibid, p.23 5Ibid, p.29