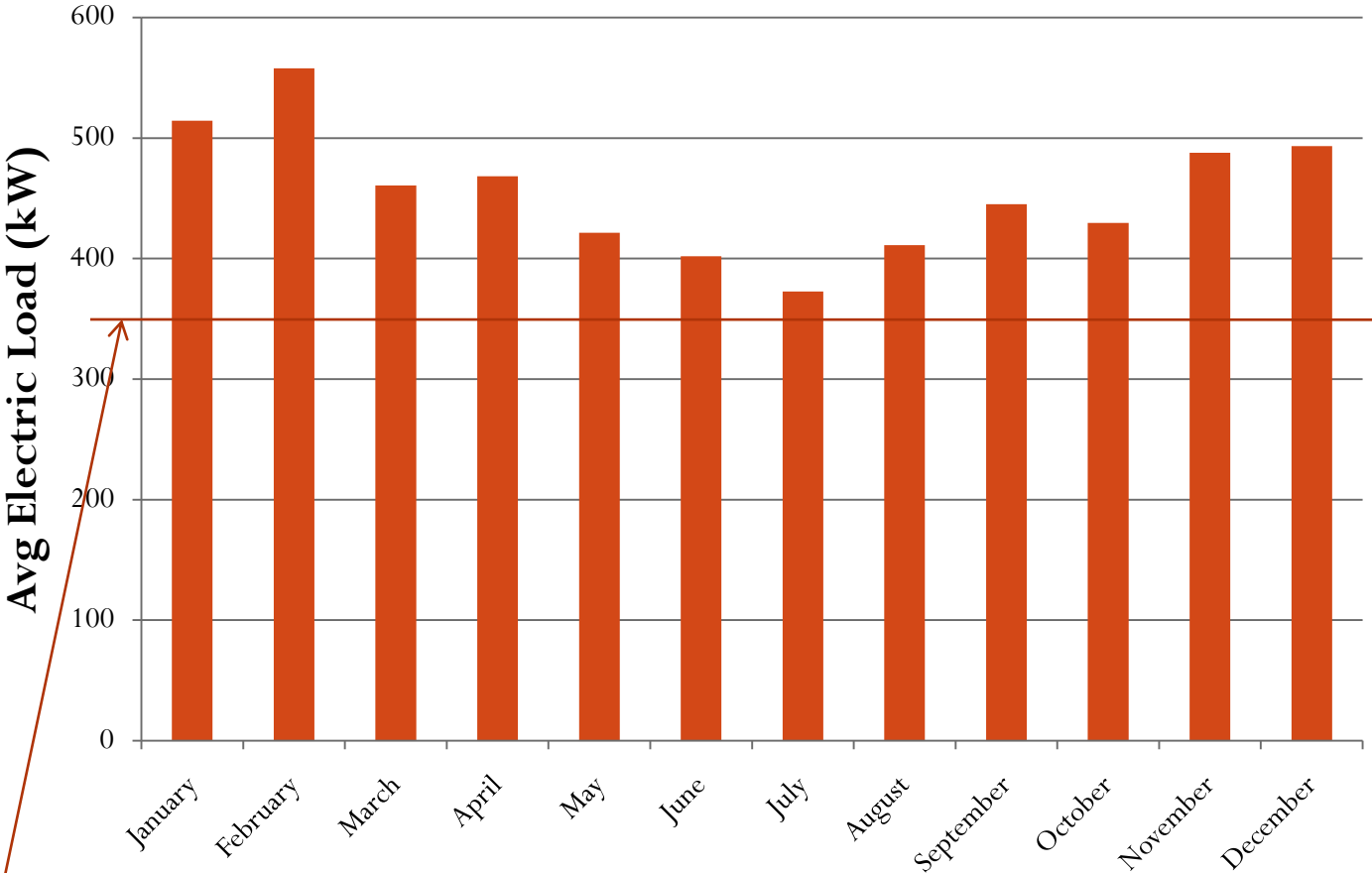


# Unalakleet Case Study

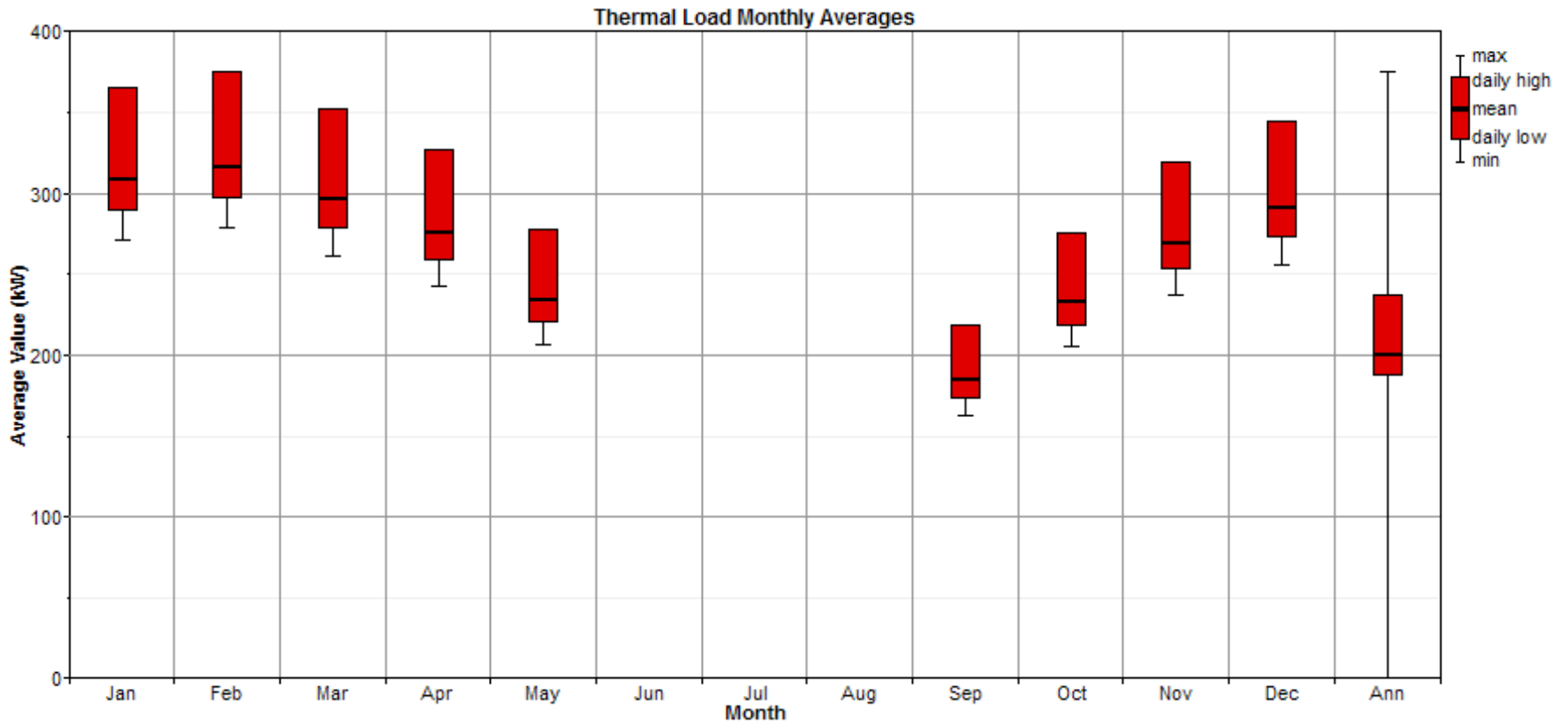
Waste Heat Applications: ORC vs Space Heating

# Unalakleet Electrical Load



Assume a base load of 350 kW

# Unalakleet Thermal Load



Assume a 300kW Thermal Load for 9 Months per year

# Available Waste Heat CAT 3456 @350 kW Base Load

- Heat Rejected to Jacket Water = 427 MBTU/hr
- Exhaust Heat Recovered to 350°F = 519 MBTU/hr
- Exhaust Gas Flow Rate = 2500 CFM @ 800°F

## Additional Assumptions

- Boiler with 75% efficiency provides ~ 100 MBTU/gal
- 75% of Recovered Heat can be delivered as space heat
- Electratherm's performance numbers are accurate

# Stack Heat for Thermal Load

$$(519 \text{ MBTU/hr}) \div (100 \text{ MBTU/gal}) \times 75\% = 3.9 \text{ gal/hr}$$

$$(3.9 \text{ gal/hr}) \times (8760 \text{ hr/yr}) \times (9/12) \times (\$3.36/\text{gal}) = \mathbf{\$86,000 /yr}$$

Fuel savings results in rapid payback (heat exchanger costs \$50,000)

Note: Stack and Jacket Water Heat Recovery could serve 200kW of Unalakleet's 300 kW thermal load

# Stack Heat Recovery for ORC

- The exhaust flow rate and temp work for Electratherm's 20 kW unit
  - have 2500 CFM @ 800°F need 2274 CFM @ 800°F
- $(20\text{kW-hr}) \times (8760 \text{ hr}) \div (15.5 \text{ kW-hr/gal}) \times \$3.36/\text{gal} = \mathbf{\$38,000/\text{yr}}$
- Assume: \$65k for ORC unit; \$50k for Heat Exchanger; \$75k for design, shipping and installation; O&M of \$1275/yr
- Simple Payback of **5.1 years**