BIOMASS ENERGY: AVOIDING COMMON MISTAKES IN ENGINEERING AND CONSTRUCTION

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Our Mission

We outfit communities and businesses with state-of-the-art biomass energy systems that strengthen local economies, lower energy costs and promote environmental stewardship.

Technology in Service of Community and Environment
ABOUT WISEWOOD ENERGY

• **Project Development:** Project planning, project finance, fuel supply contracts, third-party owned thermal energy generation assets

• **Design/Build:** Biomass energy installations including complete system engineering, procurement and construction (EPC)

• **Technical Consulting:** Feasibility studies, financial modelling, and project management

• **Territory:** OR, WA, AK, CA, ID, MT, CO
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COMMON ENGINEERING MISTAKES
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• Oversized Boilers
• Fuel Quality / Fuel Handling / Combustion System Mismatch
• Improper Hydronic Design
• Inadequate Thermal Storage
• Poor Controls Integration/Intrusive Controls
Oversized Boilers

- Fossil fuel boilers typically grossly oversized for the heat load.
- Typically 2-5x or even 10x oversized
- Example Ketchikan Airport
  - Existing Boilers = 2 x 3,300 MBH
  - New Wood Pellet = 1 x 500 MBH
  - New Backup Oil = 1 x 1,000 MBH
  - 6,600 MBH replaced by 1,500 MBH
  - Original boilers ~ 4.4x oversized
OVERSIZED BOILERS

• Oil/Gas/Elec boilers react quickly so oversizing is not usually problematic
• Biomass boiler react very slowly
• Example Ketchikan Library
  – New built system with biomass boiler sized for 100% of load
  – In reality, after three years of operation boiler is 200% of load
EXISTING PELLET BOILER (500 MBH)
NEW PELLET BOILER (190 MBH)
FUEL QUALITY / COMBUSTION SYSTEM MISMATCH

• Fuel quality is defined by moisture content, particle size, ash and fines content
• Most boilers designed for a fairly narrow range of fuel types
• Problems arise when a project is designed around one fuel spec, but actual delivered fuel is different
• Can lead to combustion issues, fuel feeding problems, slagging and clinker formation
FUEL QUALITY - MOISTURE
FUEL QUALITY – PARTICLE SIZE
FUEL QUALITY – ASH CONTENT
HYDRONIC DESIGN

• **Elements of good hydronic design for biomass include:**
  – Buffer tanks between biomass boiler and load
    • Dampens fluctuation, decreases short cycling
  – Hydraulic separation
    • Via closely coupled Ts and Low loss headers
  – Modulation
    • VFD driven pumps
  – Thermal protection
    • Thermostatic mixing valves for boilers
CONTROL DESIGN/INTEGRATION

• **Elements of good control design for biomass include:**
  - Allow boiler vendor to control all systems up to the buffer tank
    • They should know best how to handle fuel feed, firing controls, tank loading
  - Balance of system should treat the buffer tank as the boiler
    • Buffer tank can respond to the load like a conventional boiler, allow biomass boiler “do its thing” without interference
Common Construction Mistakes

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COMMON CONSTRUCTION MISTAKES

• Over budget
• Insufficient Construction Management
• Inadequate Commissioning
• Insufficient Operator Training
OVERBUDGET

• **Poor Cost Estimates**
  – Need detail costs estimates with full labor and material breakdown, generally 50-100 line items

• **Alaska Factor?**
  – Precedent to choose local vendors even if it’s 4x more expensive or not as high quality

• **Solutions:**
  – Equipment Pre-Purchase when possible
  – Containerization
RL1600 Weigh Module
LIGHT TO MEDIUM CAPACITY MOUNT ASSEMBLY

Stainless Mount shown with RL7521M WHC load cell
ALASKA FACTOR

• Specified product was $8,000 in lower 48
• Product was purchased in Alaska for $20,000
• Important to get competitive bids for specialty items
• Some extra costs for remoteness are justified, but need to evaluate on case-by-case basis
EQUIPMENT PRE PURCHASE

• **Large ticket items can be purchased direct by project Owner to help contain costs**
  – Items that can work well to purchase direct:
    • Boilers
    • Tanks
    • PEX piping
  – These are relatively simple, yet high cost items
  – Contractor markup is usually not justified in relation to risk
  – Pre-purchase of long lead items can shorten schedules
CONTAINERIZATION

• Containerizing boilers for cost containment in remote locations
  – Site work generally suitable for local contractors
  – Complex mechanical work can take place in controlled environment
  – Containerized packages available from boiler vendors, limiting burden on local mech. firms with little experience with equipment
  – Allow MEP work to proceed in parallel with Site Work
  – Pre-purchase of container systems can allow lower overall project cost
MANAGEMENT AND TRAINING

• **Insufficient Construction Management**
  – Need on-site assistance for complex systems that local contractors are not familiar with
  – Typically should have site visits by Engineering firms at the kick-off of each new craft/discipline

• **Commissioning and Training**
  – Need multiple days/weeks at start-up
  – Need follow up in Fall of first heating system to work out kinks
THANK YOU!

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