Biomass: Wood as Energy

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Alaska's Forest Resources

Alaska has extensive forest resources:

* approximately 120 million acres of forest land
* approximately 3 million cords of wood grown annually
* wildfires average 1-2 million acres annually (range is 500,000 to 6.2 million; 2015 was 2nd worst @ 5+ million)

Alaskans burn approximately 100,000 cords annually for heat

Benefits of forest management:

* reduce risk and severity of wildfires
* utilize trees killed by insects, disease and fire
* enhance/restore wildlife habitat and forest health

Modern Woody Biomass

Sources:

- Forest thinnings
- Logging slash
- Sawmill residues
- Land clearing
- C&D, MSW, dunnage

Forms:

- Hog fuel
- Cordwood
- Fuel logs / briquettes
- Chips
- Pellets

Advantages and Disadvantages
of Woody Biomass Fuels and Boilers

Advantages

Renewable

Carbon neutral and sulfur free

Local in origin (supports local economy and creates jobs)

Low-grade or waste material

Price stability

Saves money

Disadvantages

Bulky; requires considerable on-site storage

More difficult to deliver & convey

Non-uniform, inconsistent (compared to oil, gas, electricity)

High system capital costs

Operational learning curve

Requires some attention daily, weekly

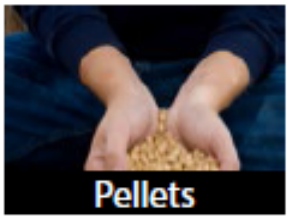
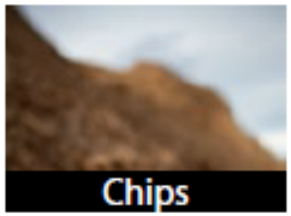
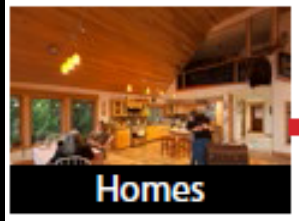
Not always well-suited for “shoulder” seasons or “peak” demand

HELE Woody biomass boiler systems reliably meet State and Federal clean air standards

Characteristics of Wood Fuels

	Advantages	Disadvantages
Cordwood **Slabwood**	Readily available Low cost (generally) Dry-able; Btu/lb variable	Requires manual fuel delivery & stoking
Pellets	Meter easily; easy to convey Dry; High Btu/lb	Limited availability High cost
Chips **Hog fuel**	Lowest cost (generally) Automated delivery possible	Availability ??? Wet; generally not dry-able Lowest Btu/lb

Sizing The Heating System

Building Type	Fuel Type			Heat Output	Wood Usage
	 Cordwood	 Pellets	 Chips		
 Homes	Wood Stoves	Pellet Stove		0.1 MMBtu/hr	1 Ton/year
 Small Buildings	Cordwood Boiler	Pellet Boiler		0.3 MMBtu/hr	10 Tons/year
 Large Buildings			Chip Boiler	1.0 MMBtu/hr 3.0 MMBtu/hr	100 Tons/year 1,000 Tons/year
 Large Districts	Photos by D. Bihn			30 MMBtu/hr	10,000 Tons/year

Major System Types

Type I. *Manual* Fuel Delivery

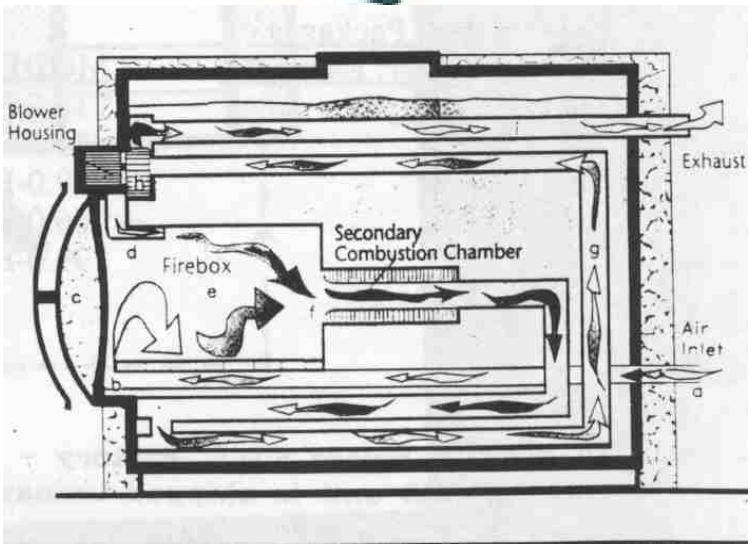
FUEL: Cordwood, slabwood, briquettes

COST: Lowest-Cost Option (usually)

APPLICATION: most suitable for medium-sized facilities; scalable to larger facilities; can also be used residentially

FUELS FOR MANUAL SYSTEMS

High efficiency, low emission (HELE)
Manual, stick-wood boiler systems



Major System Types

Type II. *Automatic* Fuel Delivery

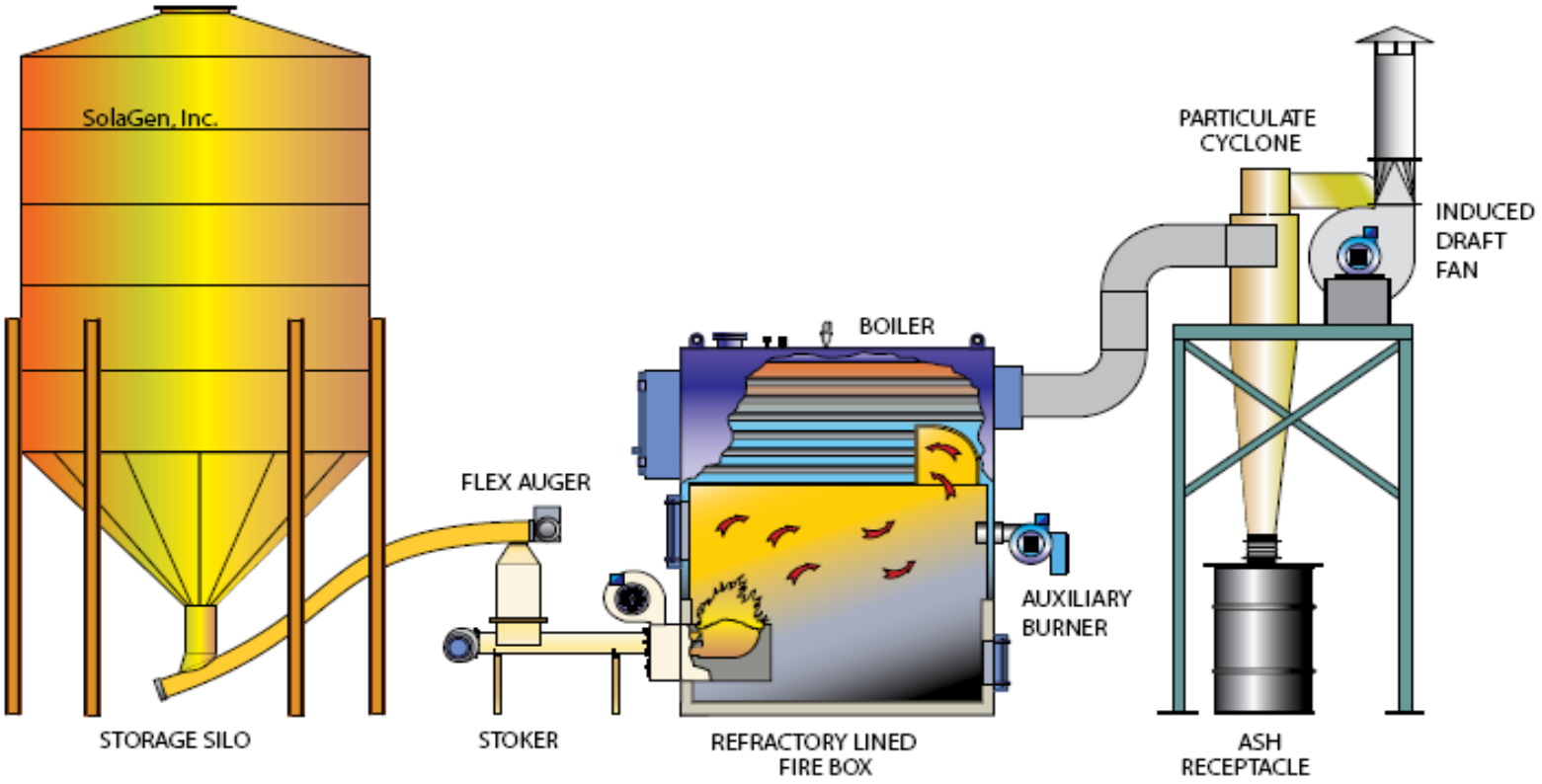
FUEL: "Meter-able" fuels (pellets, chips, hog fuel, cubes, pucks)

COST: Higher/Highest initial investment cost

APPLICATION: Suitable for residential (pellets), medium and large facilities

FUELS FOR AUTOMATIC SYSTEMS

Meter-able fuel systems generally consist of a fuel storage bunker or silo, fuel conveyances (augers, conveyor belts), metering bin (not labeled), fire-box, boiler, and exhaust system. Very large systems may incorporate automatic ash removal capabilities and particulate emissions controls.



This schematic diagram of a wood pellet system shows the components of a typical biomass boiler system including a place to store the fuel, equipment to move it to the boiler and equipment to manage the byproducts — ash and combustion gases.

courtesy SolaGen Inc.

Pellets are typically delivered like fuel oil and are stored in silos.

Chips and hog fuel are generally delivered by dump trucks or walking-floor trailers

Fuel is stored in bunkers, bins or silos and moved to the firebox *automatically* by augers and/or belt conveyors

Semi-automatic systems achieve some cost savings by using on-grade fuel storage (instead of below grade), and . . .

. . . typically use a small front-end loader, tractor or skid-steer (Bobcat) to load a day's worth of fuel into a "day bin."

There is a trade off between initial investment cost and annual operating cost.

Chip- and hog fuel-fired systems are more expensive to build and install than pellet-fired systems, and are most appropriate in larger applications. Relatively speaking, the fuel is generally lowest in cost. And while dry fuel is better than wet fuel, chips and hog fuel will not physically deteriorate if they get wet, as do pellets.

Economics 101

"**Simple Payback Period** (SPP)" is a Simple Measure of Cost Effectiveness

(PV, NPV, IRR, and LCCA are more detailed financial analysis tools)

$$\text{Simple Payback} = \frac{\text{Total Project Cost}}{\text{Annual Fuel Cost Savings}}$$

"No-Brainer"	SPP -- 5 years or less
Highly feasible	SPP -- 5 to 10 years
Medium Payback	SPP -- 10 to 15 years
Long-term investment	SPP -- 15+ years

Most facilities realize a 25 to 50% reduction in annual fuel costs


QUESTIONS ???

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