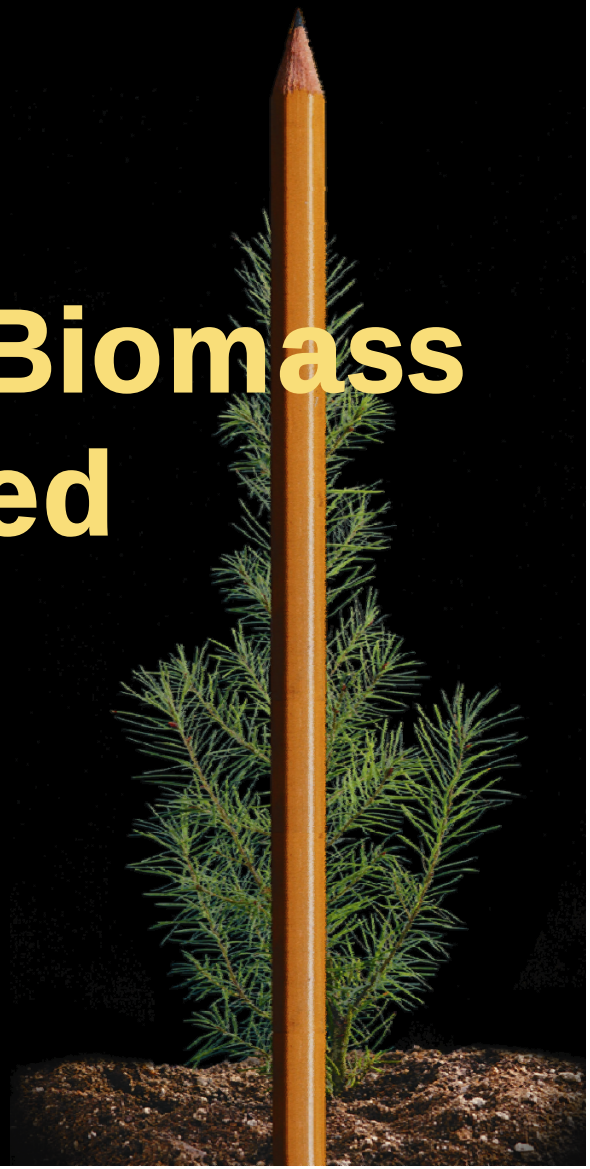
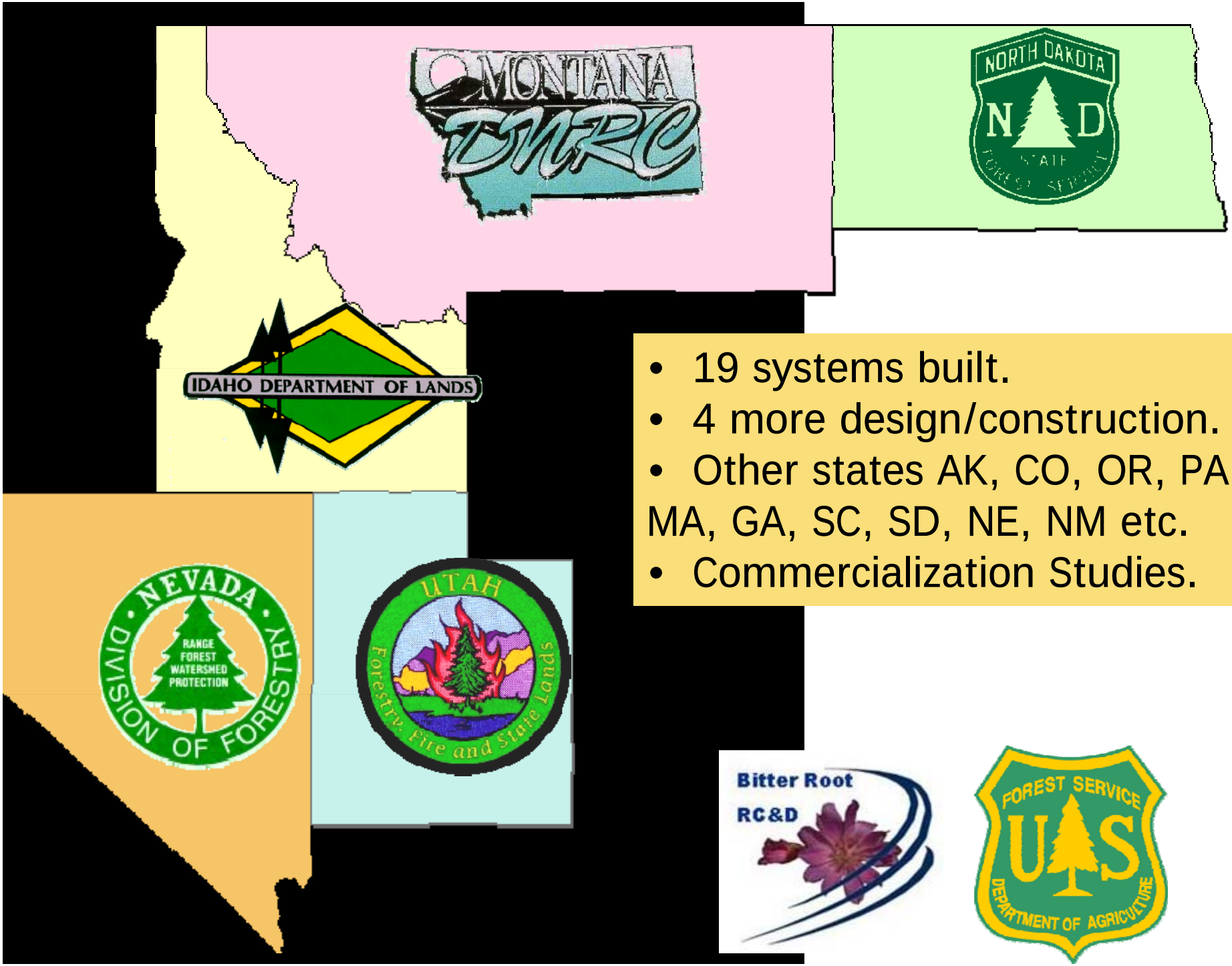
Fuels for Schools and Beyond

Small Scale Woody Biomass Lessons Learned

Dave Atkins

US Forest Service





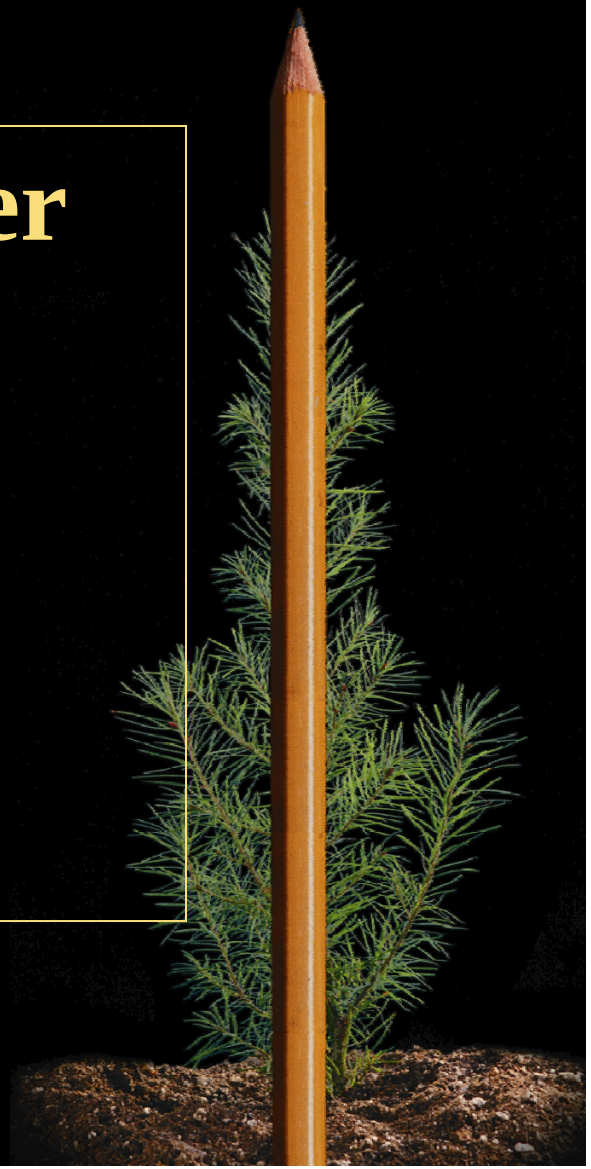
- 19 systems built.
- 4 more design/construction.
- Other states AK, CO, OR, PA, MA, GA, SC, SD, NE, NM etc.
- Commercialization Studies.

Existing Technologies

- **Heat or Cooling or Power**

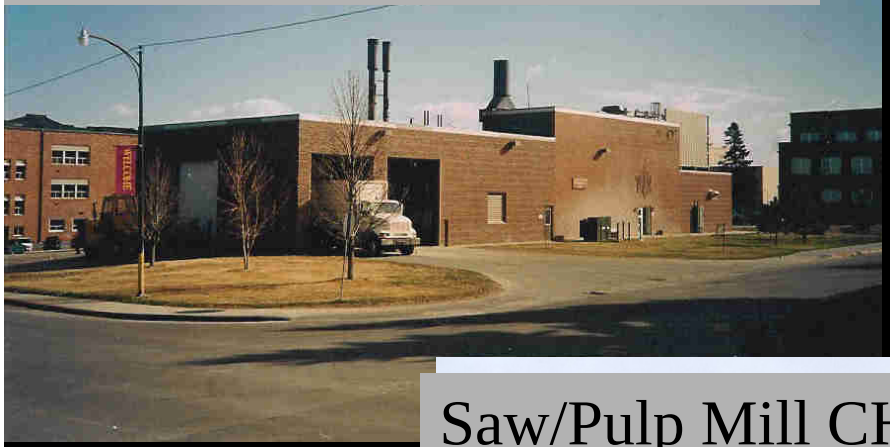
Or combinations

- **Ground wood**
- **Chipped wood**
- **Pellets**
- **Chunkwood**



Existing Systems

Chadron State College – 17 yr



University of Idaho -25 yr

Saw/Pulp Mill CHP- decades

Darby, MT K-12 - 8 yr

District Energy

Industry – Wood Products, Potatoes, Beer

Institutional &

Automated Facility

Darby, MT

3 schools

3.3 mill btu/hr
Messersmith

Darby, MT

$850k retrofit

Offset Fuel Oil –
52k gal/yr @ $3/gal

800 tons wood chips
@ $42/green ton

Saved $100-140k/yr
for past 4 years

Pellet Systems

- Solagen
- Replaced Fuel Oil
- 750k btu/hr
- Utility grade pellets

Harney Co. Hospital – Burns, OR

CTA Group

- 55k sq ft
- KOB 500k btu/hr
  ~$300k installed
- 100 tons/yr
  ~$17,000/yr
- Boiler – “plug and play”
- Offsets Propane
  ~$36,000/yr

Case Study: New Facility: Wood Pellets

Springerville USDA-Forest Service Office
Forest Energy Systems
270,000 BTU hot water boiler (Tarm USA)

Grant County Regional Airport

John Day, Oregon

A3 engineering and Bear Mountain Forest Products

Grant County Regional Airport

John Day, Oregon

- **Capacity: 750kbtu/hr Pellet Boiler: KÖB-Viessmann**
- **150 tons of pellets /yr replacing ~27,000 gal of propane**
- **Heats USFS Airbase and Grant County Airport**
- **Installed in 7 days (on-site)**

Troy, MT School

- 500k btu/hr Decton - $300k
- 90 tons/yr
- Offset fuel oil
- 35 ton storage

Case Study: Wood Pellet Boiler

Eager Town Hall, AZ
Forest Energy Systems
300,000 BTU hot water boiler


Blue Mountain Hospital
John Day, Oregon
A3 & Bear Mountain
Capacity: 1800 kbtu/hr Pellet Boiler: KÖB-Viessmann Pyrot
400 tons of pellets /yr $68k
~72,000 gal of propane $144k
$428,000 project cost
Installation set for March 2011

District Energy

- **Universities**
  - U of Idaho
  - Northwestern Missouri State
  - Chadron State College, NE
  - U of So. Carolina
  - UM Western, Dillon MT
  - Middlebury College
- **Communities**
  - St. Paul, MN – 80+% wood fired
    - 31 mill sq ft heat
    - 21 mill sq ft of cooling
    - 25 MW of electricity
  - Seattle, WA District Energy
- **Hospitals, Prisons, Shopping Centers, resorts, new development;**

St. Maries, ID

- 600 k btu/hr Solagen
- Oil to pellets ~$32k/yr saving
- $500k convert
- Boiler, cyclone & silo <$100k
- Integration

New Construction
Glacier High School

Integrated wood during design system cost ½ freestanding

Wood system meets ½ peak load 95% annual.

Offset natural gas saving $100k/yr – 6 mill btu/hr

Project cost: $550k

What are the Opportunities?

- Boiler databases by state
- MT – 6700 boilers
- UT – 12,000+
- MI – 65,000 boilers
  - 38k <750k btu/hr – 58%
  - 15k .75-2.5 mill btu/hr – 23%
  - 3k 2.5-5 mill btu/hr
- OR – 10,700 boilers
- NEW vs Retrofit

e used. Similar to the overall database, almost 90% of the boi
ars use natural gas as their fuel source.

Number of boilers installed in Montana in the last 10 yea

Fuel Source	Number of Boilers
natural gas	2,365
propane	241
other	134
oil	44
electric	32
wood	2
coal	7

This is in a state with less than 1 million people.

Table 1. Oregon Boiler Size and Age

Size in MM BTU	**< .750**	**.75 - 2.5**	**2.5 - 5**	**5 - 20**	**20+**
Manuf. date:					
0-1950	586	42	16	10	28
1950-1970	1523	234	130	69	67
1970-1980	875	223	60	46	39
1980-1990	1359	539	90	41	46
1990-2002+	2901	1239	289	130	108
Total:	**7244**	**2277**	**585**	**296**	**288**

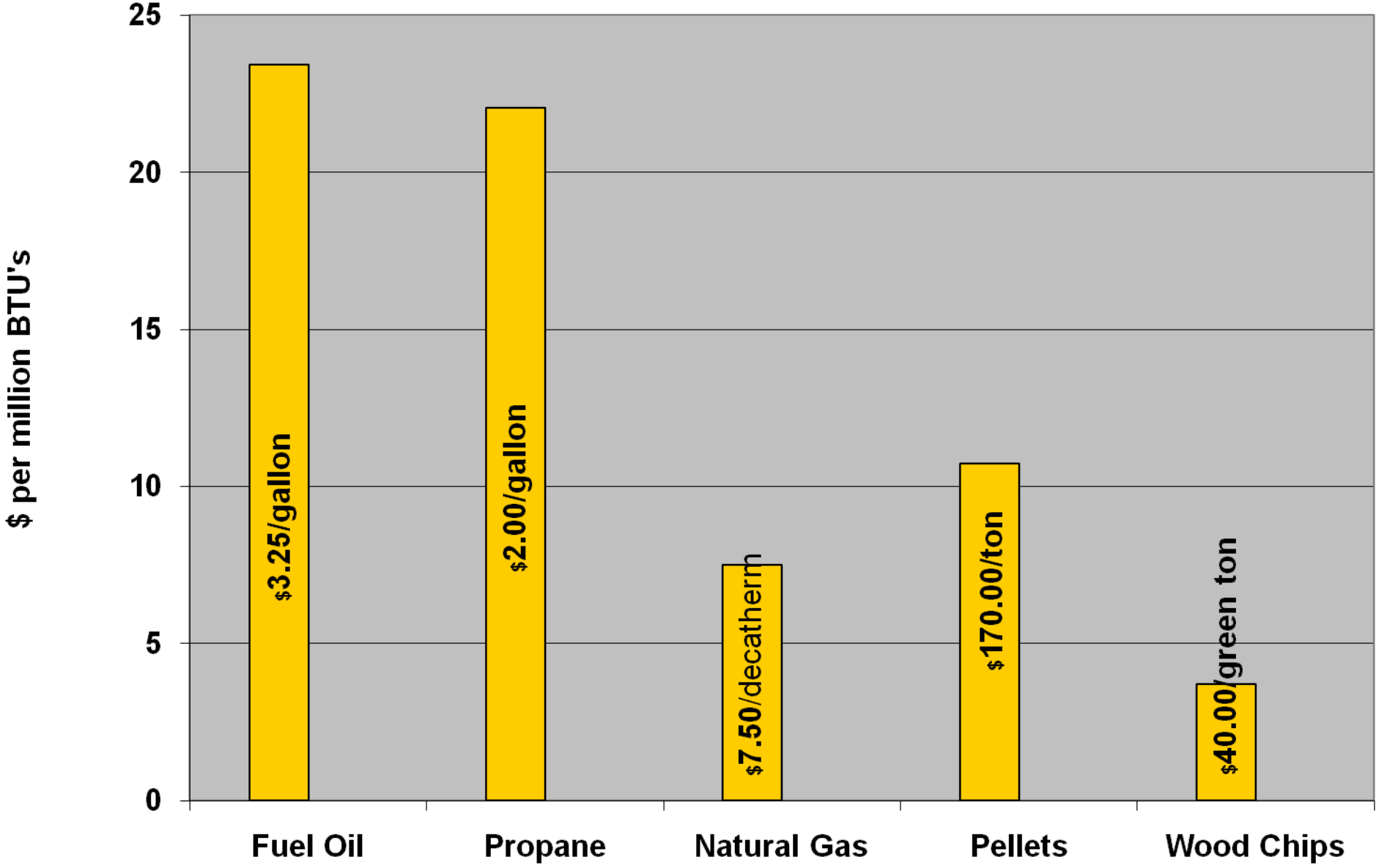
When Pellets vs. Chips? Finding the Sweet Spot

- Space to put a system in;
- Heat load 2 mill btu/hr breakpoint?
- Initial cost vs. fuel cost;
- Fuel consistency/energy density
- Ease of operation and maintenance
- Distance to supply;

What are the Barriers? Real of Percieved?

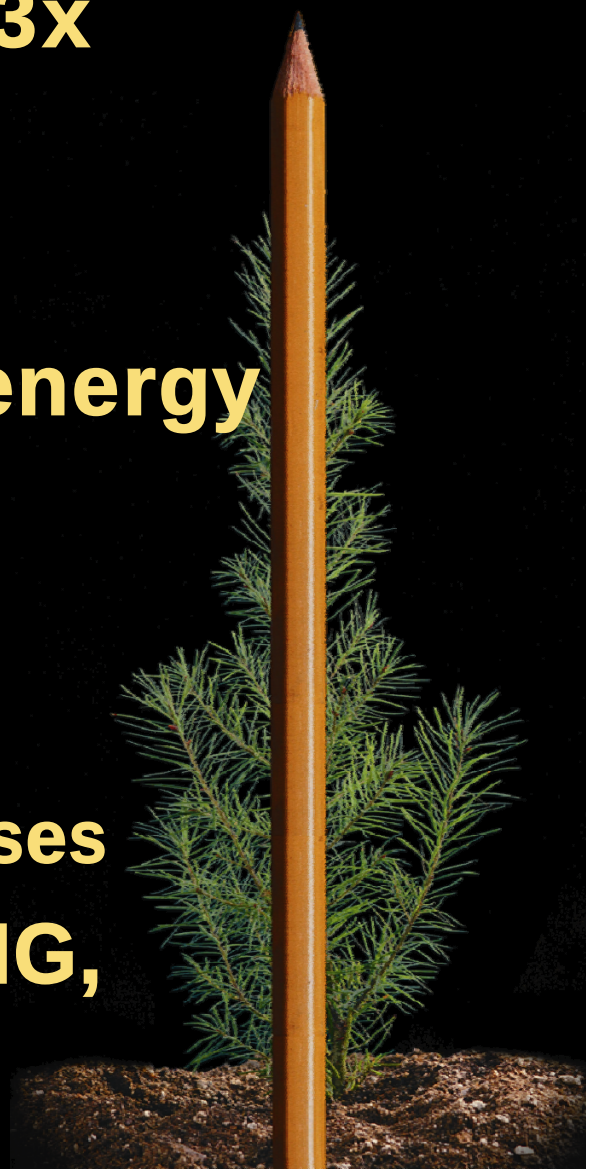
- Who will deliver?
- Reliability?
- Architects, HVAC, Contractors
- Price compared to other fuels
- Financing projects
- Air emissions – EPA new rules

Fuel Cost Comparison



Benefits Beyond Owner

- Local economy - $ circulate 3x
- Domestic Jobs
- National trade debt – ½ oil
- National Security – foreign energy
- Forest Management
  - Reduced Fire severity - Safety
  - Water – Denver example
  - Forest Health – beetles, diseases
- Climate Change – reduce GHG, resilient forests



Storage

- Do you need it?
- Where to put it?
- Moisture management

Grinders, Chippers

Cost Initial vs maintenance

Size and production

Pellets / Briquets

- Refined fuel
- Consistent low fuel moisture
- Flowability
- Higher energy density higher cost

Take Home Messages

- **Renewable – "If you don't grow it, you mine it!"**
- **Developing a new Energy Sector – production, distribution, consumption**
- **Opportunity save $$ & Reduce fossil C**
- **Fuel Factors**
  - **Quality vs annual cost directly related**
  - **Upfront investment vs. annual cost**
  - **Operation and Maintenance**
- **Sustainable – Forests are green!**