

# Wood Pellet Boiler Heating System



**10 Months Actual Experience  
Harney District Hospital  
Burns, Oregon**

It's a brand new hospital with 10 months operation experience and we've got 9 months of data to talk about what we've learned.

We're probably the reddest county in Oregon so we did this because it make such great economic sense.

# Agenda

- Why Wood?
- Why Pellets?
- Heating & Cooling a New Hospital/The Design
- Actual Operating Experience/Savings/Costs
- What We Would (Will) Do Differently
- Discussions/Questions
- Useful References/Contacts



## Why Wood?

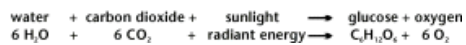
- The original biomass factory.



PHOTOSYNTHESIS



In the process of photosynthesis, plants convert radiant energy from the sun into chemical energy in the form of glucose - or sugar.



I'm a 3<sup>rd</sup> generation woods products guy out of Bend so I like trees and think that they're really useful. But its about the "Human vs. Hummer tradeoff".

Running a hospital is sort of a career diversion so I wasn't afraid of wood and neither were some of the board members who worked in the woods industry in the past. So it was just a matter of economic sense.

## Why Wood?

- It eats carbon dioxide.



## Why Wood?

- It is easy to convert to energy.



## Why Wood?

- It is not food (from a caucus state).



## Why Wood?

### Interesting Facts:

- 50% of Oregon land area is “forest land”.
- In 2003,
  - √ 8.3 billion board feet of growth
  - √ 4.1 billion board feet of harvest
  - √ Private ownership accounts for 24% of the timber but 85% of harvest
  - √ Public ownership accounts for 76% of timber and 15% of harvest

**Growth on public lands exceeds harvest levels by a factor of 15.**

## Why Wood?

- Left to itself, forests will oxidize
  - Rapidly, with forest fires.
  - Slowly, with bugs, death and rot.



## Why Wood?



Growing and processing trees is one thing  
Oregon is uniquely qualified to do.

- Largely public ownership of trees
- Widely dispersed
- Talented (but shrinking) work force

## Why Wood?

### ***The Butterfly Effect***

The significant reduction in harvest levels in the 1980's and 90's has consequences...

- Increased fires in unhealthy forests
- Vast destruction of forests world-wide to replace local wood products (orders of magnitude trade-offs)
- Loss of bi-products which are convertible to energy

## Why Wood?

One cord of wood has the same energy as:

- 5,000 kWh of electricity = \$350 value
- 200 gallons of propane = \$500 value
- 125 gallons of #2 oil = \$500 value

Converting the excess annual growth of Oregon trees to energy is equivalent to:

- ✓ the energy needs of six (6) Seattle, WA
- ✓ 2/3 of all energy produced by Bonneville Power

## Why Wood?

***“Think globally – Act locally”***

It may be worth considering the global benefit of rejuvenating a kinder, gentler wood products industry in Oregon to help solve:

- Energy shortages
- Food shortages
- Climate change
- Forest health
- High-value employment

***“Oregon: the Saudi Arabia of sawdust”***

## Why Pellets?

- Lower initial investment (\$250,000)
- Lower periodic maintenance costs
- More automated
- Automatically adjusts to a wide range of load demands



It's a 25 bed hospital, it's a critical care facility and consequently we're limited to 25 beds.

From my experience I didn't want to deal with sawdust, conveyers and all the maintenance issues that would could avoid by going with pellets.

## Why Pellets?

- Much smaller footprint  
(750 sq. ft.= 4 parking spaces)
- Clean & quiet
- Consistent fuel supply
- Commodity fuel – available from a number of sources



The boiler was shipped from Austria in a container, two guys took two days to set up the installation on a concrete pad, the whole foot print is very small. We use a bout 7 tons or about 2-3 truckloads.

## Why Pellets?

- Probable lower price inflation than wood chips
- Quick install: 2 day set-up
- Extremely low emissions
- Overall lower life cycle costs



We're working out a bulk delivery system with Bear Mountain, we've worked out a system, it takes about an hour to empty the truck.

We are comfortable with wood pellets in part because the costs are less volatile, we think, than chips for a variety of factors.

DEQ issued letter that found all their emissions are negligible.

## Heating & Cooling a New Hospital

- Hospital design developed with CTA during 2005
- Budget set in mid-2005 (Shocked to discover we were over-budget!!)
- Architect and contractor opposed to pellet boiler/no experience/unproven technology
- Fearing oil could go as high as **\$60/barrel** and wanting to support historic wood industry, Hospital Board insisted
- Boiler added to final bid documents in Dec. 2005, 45 days before groundbreaking
- Too late to apply for State Tax Credits

Initially there was resistance from the Architect and the Contractor, but the Board finally said we're going to do it damn it.

CTA stepped up and did a great job once the decision was made.

We ran the project economics based without any credits or subsidies.

## The Design

- Boiler heats domestic hot water & feeds 64 water-source heat pumps



We didn't want to have to deal with the regulations required with steam boiler.

## The Design

- Backed up by propane boilers





We are hoping to eventually get ride of the propane in the future.

## The Design

- Cooling supplied by evaporative cooler feeding the same 64 heat pumps
- (The old hospital had no central air conditioning at all)



## The Design

- Not enough time/budget to use hot water for other needs:
  - √ Heated sidewalks
  - √ Pre-heated air intakes
  - √ Heated ambulance garage
  - √ Heated HVAC areas



It was so late in the project design when the decision was made there wasn't enough time to connect the system to other areas that use heat.

We're hoping to add some heat exchangers in the future and replace the propane heaters in a year or two.

## Old vs. New Hospital Comparison

- 9 months actual
- 33,000 sq. ft. replaced by 54,133 sq. ft. (+64%)
- Very high tech, with wireless networks, electronic patient records, new MRI & CT, prox card security – all adding to electrical demand
- Added laundry, central A/C and heated ambulance garage

The old hospital was really inefficient so the cost difference isn't a direct comparison.

## Usage Per Energy Source

|                   | <u>33,000 sq ft</u> | <u>54,133 sq ft</u> |
|-------------------|---------------------|---------------------|
| Propane (gal)     | 19,344              | 12,000              |
| Electricity (kWh) | 652,381             | 1,200,000           |
| Heating Oil (gal) | 16,511              | -----               |
| Pellets (ton)     | -----               | 70                  |
| <u>MMBTU</u>      | <u>6282</u>         | <u>6356</u>         |



## Dollar Savings

- Propane (\$18,360)
- Electricity +\$36,241
- Heating Oil (\$65,879)
- Pellets +\$10,500

**Total Savings**

**\$37,498/year**

## Calculated Savings for 64% Footage Increase

- MMBTU: +3460 55% savings
- Dollars: \$58,590 37% savings

**Roughly 5-year payback on Pellet Boiler**

The original payback was 18 years, now - even without the tax credit - its down to 5 years!

## Operating Experience

- 2 day installation
- 2-3 truck deliveries per year
- Empty ash every 2 months; virtually total combustion
- Clean combustion chamber & tubes every 2 months = 3 hour job
- Otherwise, gravity feed of pellets to auger. Auto controls that respond to changes in heat demand
- Auto switchover to propane backup in case of failure
- 50% capacity used in January (15 below zero)

It puts out enough ash every couple months to fill an average sized trash can and folks take it home as a soil amendment.

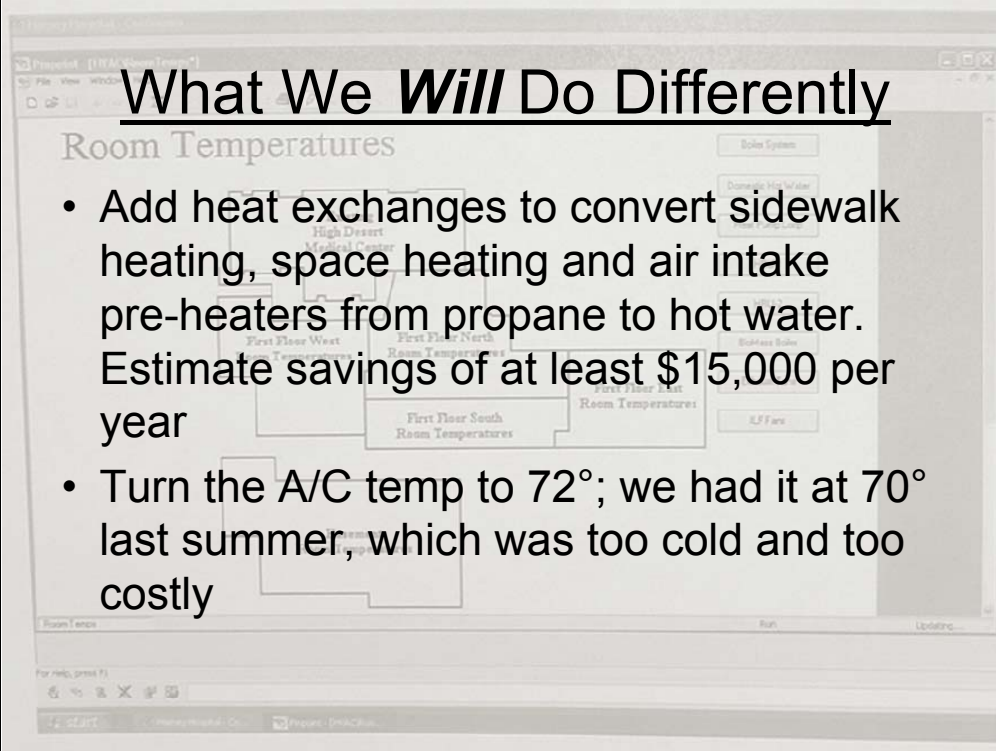
## What We *Would* Do Differently

- 40 ton silo instead of 30 ton
- Gauge or window to indicate pellet volume
- Far earlier planning to incorporate in design
- Apply for tax credits earlier (\*although we did receive a state tax credit for this project)



If we had to do it over again, having a bigger silo would make it easier to know that you've got the capacity to empty the truck when a new load shows up.

## What We *Will* Do Differently



The screenshot shows a software interface for managing room temperatures. The title bar reads 'Room Temperatures'. The main area displays a floor plan with several rooms labeled: 'High Desert', 'First Floor West', 'First Floor North', 'First Floor East', and 'First Floor South'. Each room has a 'Room Temperature:' label. There are several control buttons: 'Scale System', 'Control Hot Water', 'Control Air Flow', and 'KFF Air'. The interface also includes a 'Run' button and an 'Updating...' status indicator. At the bottom, there is a taskbar with a 'For help, press F1' message and a system tray showing the time as 1:41 PM and the date as 11/11/2014.

- Add heat exchanges to convert sidewalk heating, space heating and air intake pre-heaters from propane to hot water. Estimate savings of at least \$15,000 per year
- Turn the A/C temp to 72°; we had it at 70° last summer, which was too cold and too costly

Once we get better and adjusting the AC for optimum comfort, we'll be able to reduce electricity costs further.

## Useful Contacts

1. "Guidebook: Wood Pellet Heating" – Mass Division of Energy Resources ([www.mass.gov/Eoca/docs/doer/pub\\_info/doer\\_pellet](http://www.mass.gov/Eoca/docs/doer/pub_info/doer_pellet))
2. <http://www.finkmachine.com/englishversionshort2a.pdf>
3. "A Comparison of Low Cost Biomass Heating Options" – Biomass Energy Resource Center for USDA-FS ([www.biomasscenter.org](http://www.biomasscenter.org))
4. "Oregon's Forest Products Industry & Timber Harvest, 2003" (USDA PNW-GTR-681)
5. Bear Mountain Forest Products, Cascade Locks, OR ([www.bmfp.com](http://www.bmfp.com))
6. CTA Architects Engineers ([www.ctagroup.com](http://www.ctagroup.com)) (Harney listed under Projects/Healthcare)
7. Blue Mountain Lumber Products, Pendleton, OR (pellet supplier)

## Questions/Comments

Jim Bishop, CEO  
Harney District Hospital  
(541) 573-8329  
[jbishop@harneydh.com](mailto:jbishop@harneydh.com)

Q: How is the boiler different than a steam boiler?

A: The Kob boiler is manufactured to a EU standard which is not compatible with US standards for steam boiler, they came up with a vent to the atmosphere that means that it is not a boiler, but since then KOB has come up with systems that meet US standards.

Q: Did you do any calculations to determine how much carbon you reduced?

A: No, I just tell people we're really green. I think in Harney County people really appreciate that we're saving money and using wood.

## Questions/Comments - 1

Q: Do you have any problems with storage? fire problems? do you have to turn or mix the pellets?

A: You need to make sure they stay dry, but , its not a problem, the Silo is build for that. We had some down time once with the pellets bridging – basically getting stuck - but that's such a rare, random event and its really easy to fix.

Q: Can you do a bulk delivery of the lower grade and use them in the boiler? could it be recalibrated?

A: Yes, believe it will work and in fact, may adjust automatically with a lower grade pellets. Its going to increase some ash, it'll reduce some costs, but probably too little to be worth it.

## Questions/Comments - 2

Q: What is the height of the stack?

Q: About 30 ft. and includes both combustion gas exhaust and vent for the "tea Kettle" You most often can't see it (exhaust).

Q: Does wind cause down draft?

A: We haven't noticed a problem?

Q: Do you every worry about not being able to get pellets?

A; No, we're using such a small fraction of Bear Mountain's total production and there are other pellet mills in the state. and another thing is that we're the type of users that pellet mills really like because we're using it year round opposed to residential users who only use it in the winter.

Q: Do you have run it in the summer and do you have problems running at reduced capacity?

A: Yes, we use it to heat hot water, its running at 5%-10%, but the modern pellet boilers can be tuned to still be efficient. We run it at 50%