# (Hybrid) Jean Pain style Wood Chip Compost Water Heater

## Proof of Concept: 2016

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# Benefits

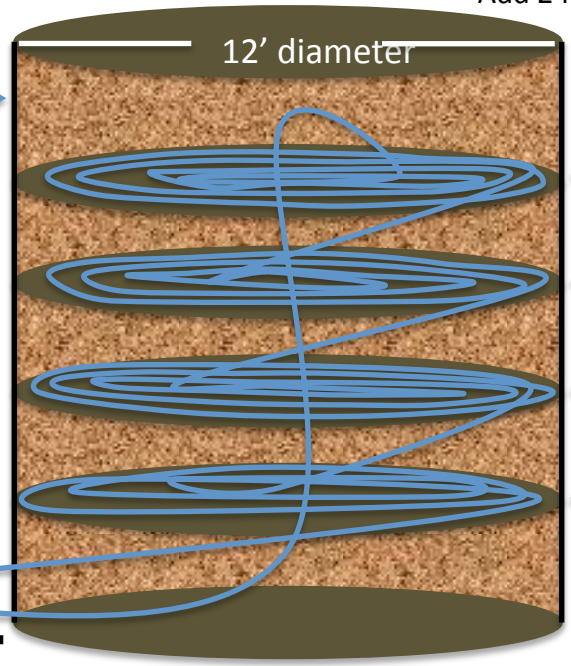
- Generates useable heat for 18 months
- Heat homes (radiant floor)
- Green houses
- Hot tubs
- Industrial applications
- Replaces propane
- Turns wood chips into organic compost
- Sequesters carbon in the soil once used as compost
- Turns a waste product into usable heat and main byproduct is soil fertility

# Wood Chip Compost Water Heater

Soak each chip fill layer with 200 gal water with hose wand

Add 2 feet of leaves or wet straw on top to reduce vapor loss

~ 6 feet tall




Concrete reinforcement
Wire holds up sides

> 18” chip fill

150’ of pipe in circles

> 10” chip fill

150’ of pipe in circles

> 10” chip fill

150’ of pipe in circles

> 10” chip fill

150’ of pipe in circles

> 18” chip fill for base

(50 F)
Cold in

Hot out
(140 F)

(At flow rate of 1gpm) consistently, 24/7 for 18 months

Contents of pile is 90% wood chips, 5% sawdust, 5% dried sheep manure

Entire pile is then surrounded with 2’ thick jacket of leaves for insulation, contained by lightweight plastic deer fence.

Final pile is then 16’ diameter including leaf jacket.

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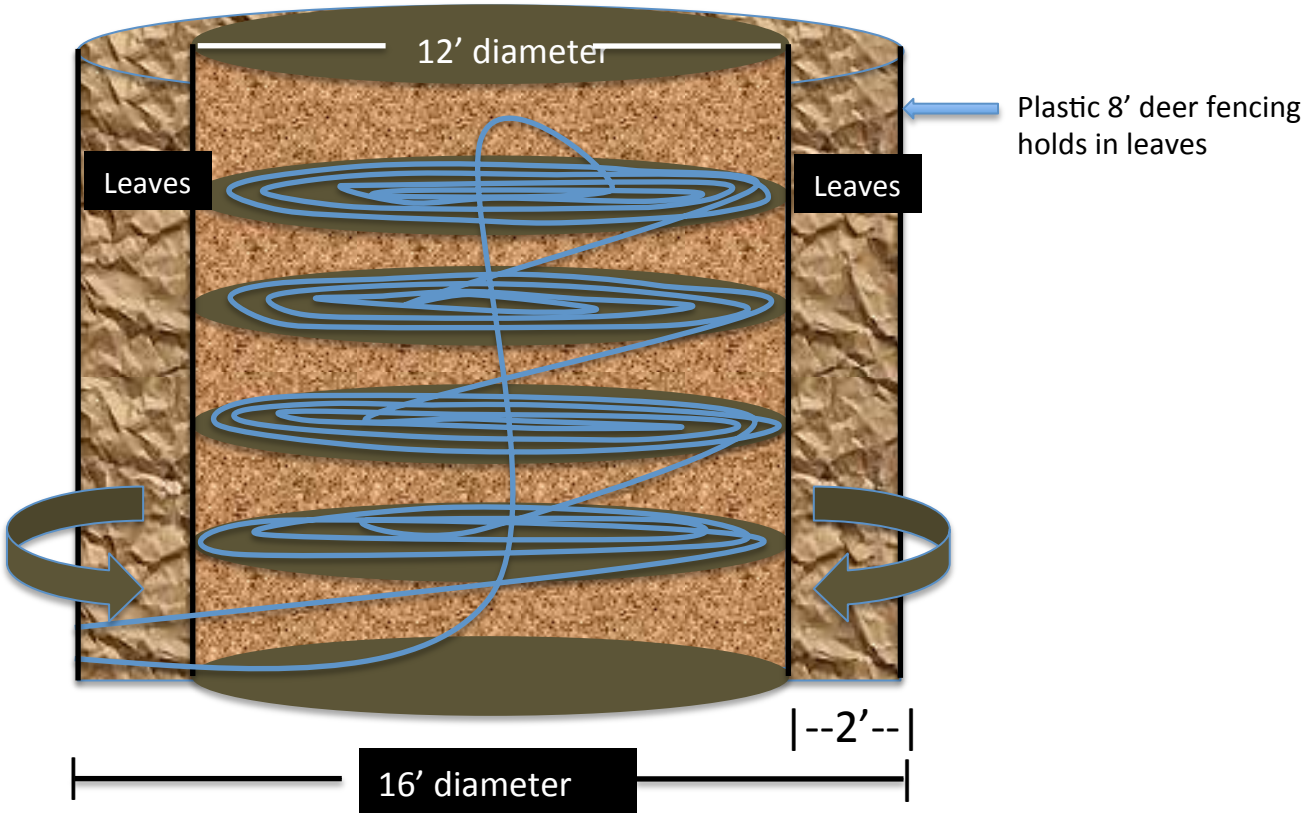

Best heat is from small diameter Branches, bushes, or bark. Deciduous species are best. Avoid Cedar, Doug Fir or anything that Doesn’t rot easily.

Vertical sides produce more heat overall, since top is same diameter. Optional 2’ jacket of leaves can be added for higher temps in winter. Fence for chips is concrete reinforcement wire.

Be sure to stake the return flow pipe first as it will connect to supply near top of finished pile
And then exit out the bottom. This is the vertical pipe you see here in center.

Rocks are used to keep consistent spacing for the poly pipe. Keep as close to 10” spacing as possible. If you are insulating the sides with leaves, you can take pipe most of the way to edges with little heat loss. I connected (3) rolls of 300’ poly with snake bites like the one in the photo. Heat wrapped the coupling to avoid leaks. Your worst nightmare is to have a leak In the midst of the pile and you need to dismantle everything to find it. None so far (6 mths)

I used 900 feet of drinking-water-certified polyethelene pipe. I coiled it in six layers inside the pile at 10” vertical intervals. Once the pipe and pile heated up, I ran it for a day or two to off-gas the inside of the pipe. It smelled for a bit, but then cleared out and no problem for past 6 months running. Pile has no smell whatsoever.

Tub was initially placed on 8-10” of chips to insulate from ground temps. The tub proved to be well insulated over first winter. Very little heat loss between nightly re-circulations. Mostly due to having sides wrapped in straw bales stacked vertically, and cinched tight with cam straps.

I added a tarp in winter to reduce evaporative loss and keep too much snow from melting down into the pile. This avoided a drop in temp inside the pile.




Temperatures even on outside edge of pile have commonly been from 125-140. Center of pile about 6’ in have been consistently between 130-140.




First test on the line out of the pile. 142 F. Highest temp recorded was in center of pile when I took the tub offline for three days. Center of pile spiked to 149F. Turned tub back on and it equalized at 146. I usually ran flow rates of .25-1 gpm for a few hours each night to keep tub at between 104-108. Later in spring, I only needed to run the pump for an hour each night to keep tub at same temps.


Electrical draw for the pump and a 6' piece of heat tape on the pipe between pile and tub ran from a high of $3.27 / mth. In the winter (running 24 hrs/day) to a low of 30 cents per day in summer. (running less than 1 hr/day  I'm on solar, so it was free anyway, but that's about how much electric cost is involved in running it with standard market electric.

Very inviting on a cold winter morning. Night temps were in single digits, but the tub stayed around 105F.

Rough Data on experimental wood chip hot tub 2016, Durango Colorado, Elev. 6512'

Chip pile has kept 275 gallons of water between 102F – 108F (24-7) for over six months (so far) from Dec 8th to June 8th, 2016. Winter ambient temps were commonly in single digits.

Tub is single wall poly stock tank, only insulation is straw bales around it, floating ¼" floating foam cover and and foam top

Chip pile heat internally averaged around 125F in winter while sending heat to outside tub for first four months, then hovered around 130 in spring/summer.

Avg tub temperature of 104 modulated by manual valve on intake, average flow of ¼-1 GPM.

Turned off pump for 4 days, pile peaked at 149.4F and then settled back to 146F

Has continuously worked from Dec 8th, 2015 through present (June 9th, 2016) 6 months and Running strong. Pile temp today is 132..

# Main Materials for Wood Chip Compost Heater

90 % chips
- -Best if shredded, not just big chips,
- -Bark is good
- -Smaller branches shredded is best
- -living fresh material (nitrogen)
- -deciduous species best, use less than 10% pine
- -no Cedar, Doug Fir, Hemlock or other species that rot slowly

5 % sawdust

5 % coffee grounds/ manure/ other nitrogen

All material is soaked to consistency of wrung out sponge.

# Main Materials for Wood Chip Compost Heater

Polyurethane pipe

1” high pressure (250 PSI) HDPE pipe (polyethelene)
Drops to half pressure at 125F so roughly 125 psi.
(3) 300’ lengths

Pipe Placement:
-10” from outside edge of pile is widest ring.
-7 concentric circles on each layer, 6” between each ring
-10” of chips vertically between each layer pipe
-Hot water return line is placed in center of pile first
Moving vertically to extend out top as pile is constructed.
-One 90 degree elbow on top as pipe connects to hot water out.

Electrical consumption: circulation pump and pipe tape on 24/7

Load is .44 amps and 52 watts total for both

(in winter) X  24 hrs = 1248 watt- hours per day
/1000 = 1.248 kWh per day
X 30 days = 37.44 kWh per month
@ .10/kWh total cost would be about $3.74/ mth but we have full PV so its “free”.

Summer only running pump for .5-1 hr per day, cost is about 30 cents/month.

After 18 months of heat production, temperatures will start to decline as compost becomes mature.

Market value of remaining finished organic compost is between $700-$1200 on open market.

30 yards of compost can cover 3000 square feet of garden beds with 1” of material, or 1500 square feet with 2” of material.

Material cost of original pile was $600, mostly in quality pipe cost and pump. So heat is free, and material cost is covered in first year in value of finished compost. Each year after, heat and compost are free, since you re-use same pump and pipe and for years.

Tips: 1

Don’t over compress pile during construction, leads to compaction, less O2
This is Aerobic compost.

Cow fencing for verticals

Plastic elk fence for leaves

Stay straight on walls so pile doesn’t cone on top layer, where more heat can
Be gained.

RESOURCES:

I started general research with these two sources:

Website: Compostpower.org
Book: “The Compost Powered Water Heater” by Gaelan Brown

Any questions?
email Tom Bartels
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