PicoHydro Electric Generator

Why and where it is useful as an alternative power source

The steep incised rivers and streams in The Oregon Coast Range make it challenging to get materials, supplies, and frankly people to various field locations. Because of the difficulties involved with traveling to our research site, an attempt was made to find ways to make data collection more self-sufficient. The first thought was solar power, but the long gloomy winters and steep relief make it challenging to receive enough light to make solar a viable option. Instead, we chose to use a first order perennial stream that feeds into our study reach, as a power source.

We began by building a "5 gallon bucket generator" seen here (https://www.youtube.com/watch?v=1tXgvoo6v10), which worked okay but not great. After exploring some options and looking into how we could make a more efficient generator we came up with the design seen above. Some things that make the design slightly better than the bucket style are adjustable jets (these allow for the control of the water flow so we can increase or decrease the flow based on the available supply, also we can better calibrate the jet velocity to better fit the turbine curve which is optimal at jet velocities twice the turbine velocity(Cobb, 2012)), next we limited the restrictions in the pipe (this is done a few ways, first we replaced the pipe reducers with tapered reducers (see examples on the next page), second instead of multiple bends to connect to the jet, like the 5 gallon bucket style, instead we used a poly pipe called Pex and made one long sweep to each jet), third we made it possible to adjust the jet position (this is nice because you can calibrate them on site with the flow your site is using), last we went with a machined turbine (this is more efficient in dissipating water and generating energy then the handmade one).

With the new design we went from 0.7 amps at 12 volts to 1.5 amps at 12 volts, doubling our power. We could have made more power by running a higher voltage (we approached ~45 watts when we stacked batteries to 48 volts), and we could have opened up the jets, but running the jets wide open at our site put too much strain on our stilling pond causing the pond to eventually drain which resulted in air coming of the jets.

Oregon State University
College of Earth Ocean
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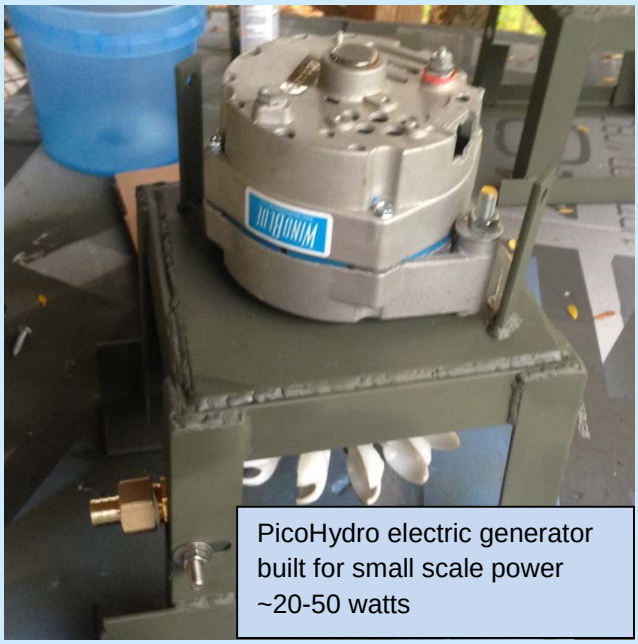


PicoHydro electric generator built for small scale power ~20-50 watts

Parts List with Vendors

Parts used include:

• Turbine, for this application I used the larger turbine (http://peltonwaterturbine.com/tema1/produts11.asp)

• Alternator (http://www.windbluepower.com/Permanent_Magnet_Alternator_Wind_Blue_Low_Wind_p/dc-440.htm)

• Adjustable Jets
SBCG — for 0.17 to 0.47 inch (4.3 to 12 mm) cord diameters, Type 4X (IP66) rated, ½-inch (15-mm) NPT threads (http://www.orenco.com/)

• Pipe Fittings (purchased from Home Depot)

1. (2)3/4 in. x 1/2 in. Brass Barb x Male Threaded Adapter
2. (2) 3/4 in. Brass Barb x Female Swivel Adapter
3. (2) 3/4 in. x 1/2 in. Lead-Free Brass MIP x FIP Hex Bushing

• Extension shaft and Jet holder (fabricated at OSU by Ben Russel email brussell@coas.oregonstate.edu)

1. Cobb, B. (2012). Experimental study of impulse turbines and permanent magnet alternators for pico-hydropower generation (masters dissertation). Retrieved from Oregon State University Library. (http://hdl.handle.net/1957/22665)

Item Images, Examples, and Notes

Tapered

http://www.sears.com

Not tapered

http://www.thefind.com

Adjustable Jets

http://www.orenco.com

Pex Poly Pipe

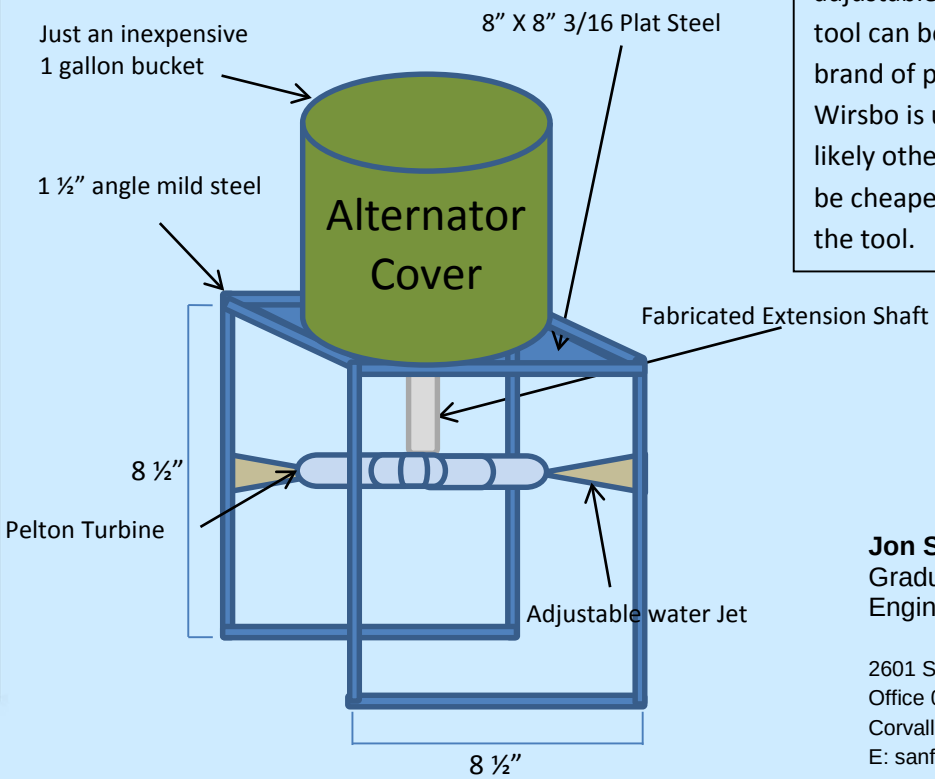
http://www.redlinepex.com

Notes:

The Wind Blue Alternator is a permanent magnet alternator that is remanufactured from an ACDelco alternator; ACDelco uses a propitiatory thread pattern for the output shaft (this means you can't find a nut for the main shaft at your local hardware store). I went to a local auto wrecking yard and found deeper main shaft nuts that could be machined and pressed into an extension tube to make my extension.

The Jets were a lucky find at a local Ferguson's Plumbing Store, before I found them I intended to use a bulkhead fitting, but they also have a propitiatory thread pattern. The jets from Orenco are half inch pipe thread so they will screw into any half inch pipe fitting (this makes hooking it to the Pex pipe as easy as getting a female ½" Pex fitting)

Pex Poly Pipe uses a special crimp tool to compress rings over the pipe that connect it to the barbed fitting which then connects to the adjustable jet and tapered pipe fitting. The Pex tool can be as much as $70. There is another brand of poly pipe called Wirsbo, but the tool for Wirsbo is usually more expensive. There are likely other options for this connection that may be cheaper or you may be able to borrow or rent the tool.



Conceptual design of PicoHyro generator

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