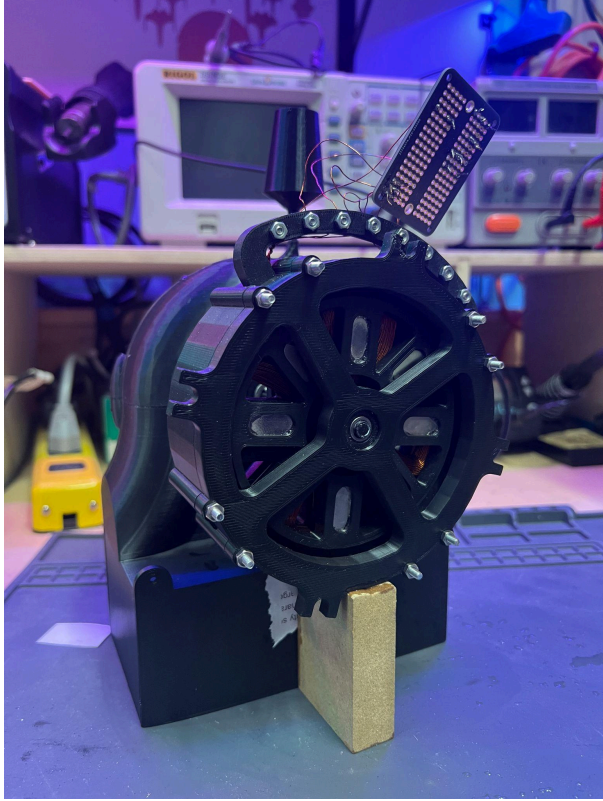
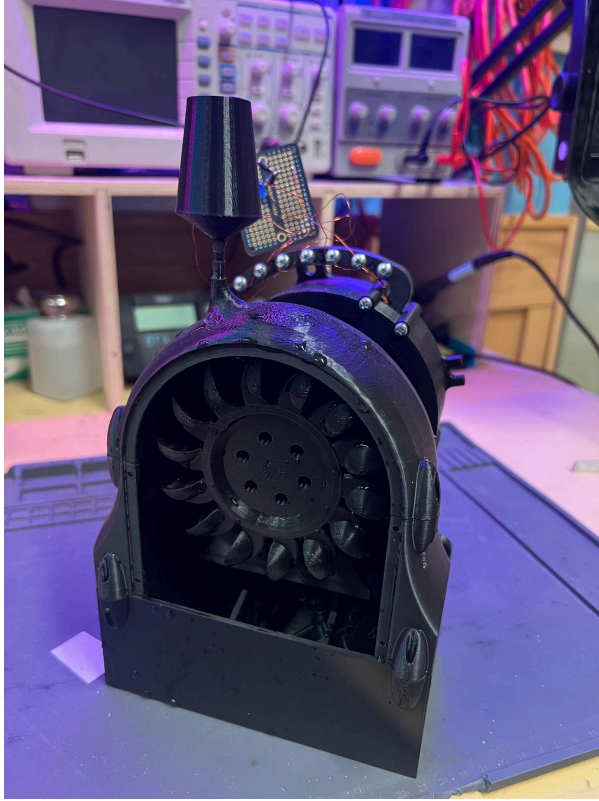


Water Wheel



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Project Description

To run any automated system, regardless of its robustness, power is required. In a post-apocalyptic world, acquiring power will not be easy, so one must be creative! By placing ourselves in that world, we can draw from our own experiences. Water is essential now, and especially vital in this theoretical scenario. Not only does it sustain life, but it also offers numerous opportunities for power generation. Focusing on one system, our group examined water wheels and their various form factors. The beauty of water wheels, we have discovered, lies in their ability to operate with dirty water. As long as the water is filtered of debris and non-dissolved solids, we can take advantage of it! This allows non-potable water to become an asset on its path to becoming drinkable. This inspired our integrated water wheel concept, driving us to make our design modular and compatible with the piping system of a gravity battery, enabling constant power generation. Modularity also allows intermediary water wheels and power generation to be integrated into multiple systems in future iterations. For instance, we can seamlessly collaborate with the distribution team without disrupting their system.

Overall, our design is quite simple and can be constructed with scavenged parts. It begins by intake from the top barrel of the gravity battery, funneling the water before directing it onto the wheel to increase pressure, then draining through the wheel's enclosure into the bottom barrel, ready to be pumped back to the top. The wheel's axle connects directly to the alternator's axle, causing it to spin in unison with the wheel. Here, we should elevate the alternator to both stabilize its axle and align it with that of the wheel. The alternator is then connected to a rectifier to regulate the generated alternating current, which is subsequently sent to our system's battery bank(s). It is important to note that the connection points of the water, both into and out of the wheel, are designed around our 1-inch piping, promoting future modularity given the established consistency within the plumbing of each of the other systems.

Video Links

Water Wheel Video <https://bit.ly/waterwheelalternator>

Bill of Materials

Tools
Soldering Iron

Power Drill
0.5mm Drill Bit
Screw Driver
Needle Nose Pliers

Parts	Links	Quantity
PLA 3D printer Filament	http://bit.ly/4d6KqNr	1
36 AWG Copper Magnet Wire	https://amzn.to/3S6M0oy	2
Neodymium Magnets (20x10x3mm)	https://a.co/d/7Ms1ioz	32
Ball Bearing (6mm x 19mm x 6mm)	https://a.co/d/1mx97yx	2
Shoe Goo: Shoe Glue (3.7 fl oz)	https://a.co/d/5F52nRr	1
ElectroCookie Mini PCB	https://a.co/d/dCK1LDZ	1
1N5817 Schottky Diodes	https://a.co/d/hNkC3tp	4
Solderless Breadboard	https://a.co/d/cdDJotC	1
Jumper Wires	https://a.co/d/60slicl	NA
22 AWG Solid Core Wire	https://a.co/d/hqfW2OA	1
Rosin Core Solder Wire	https://a.co/d/b0DqgFN	1
Super Glue	https://a.co/d/c8Dd2EA	1
Twist Ties	https://a.co/d/1gbWRwN	16+
Ball Bearing, 10mm Bore, 30mm Dia	https://a.co/d/fK0QCdp	1
M3 length 50mm bolts		6
M3 length 12mm bolts		8
M3 length 8mm bolts		5
M3 length 10mm bolts		7
M3 length 6mm bolts		6

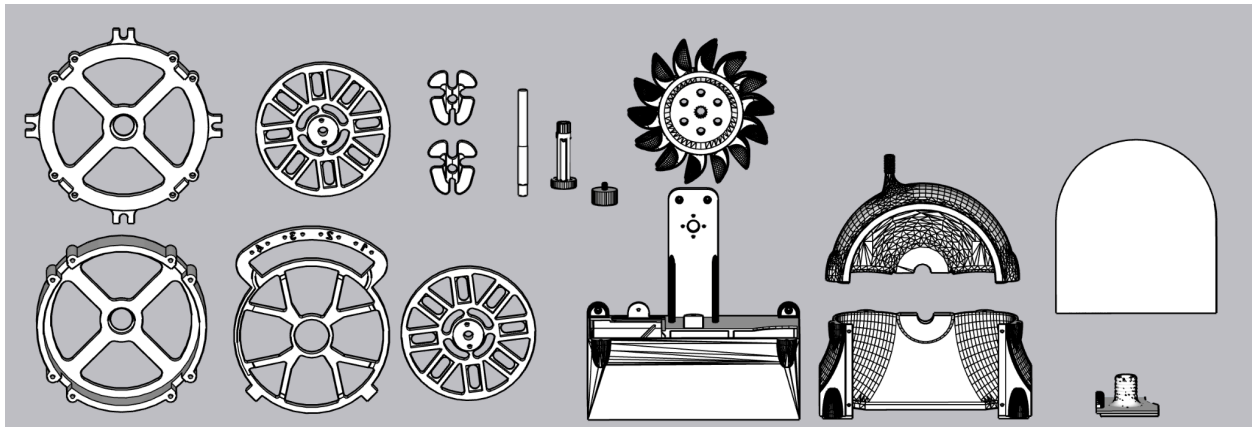
3M Thin Hex Nut		12
M4 length 3mm bolts		4
M4 Thin Hex Nut		4

 **CAD Files** <https://bit.ly/3ER26j5>

 **Water Wheel** <https://bit.ly/3GxFtRj>

Assembly Instructions, step-by-step, w/ Images

- 1) Acquire all necessary materials and parts
- 2) Print 3D models [Turbine, Turbine Housing, Turbine Axle, Alternator Axle, Axle Adapter, Alternator Housing, Magnetic Rotors, Coil Stator, and Coil Jigs]



- 3) Starting with the alternator, to create the copper coils, assemble the coil jig by securing the two pieces together with a 1/4-20 bolt, and then insert the bolt into a drill chuck.
- 4) Wind copper wire around the jig spoke, then begin spinning the drill until the coil reaches approximately 33 mm in width.
- 5) Use twist ties to hold the coil together and remove it from the jig.



- 6) After removing, leave twist ties on and secure the coil with super glue.

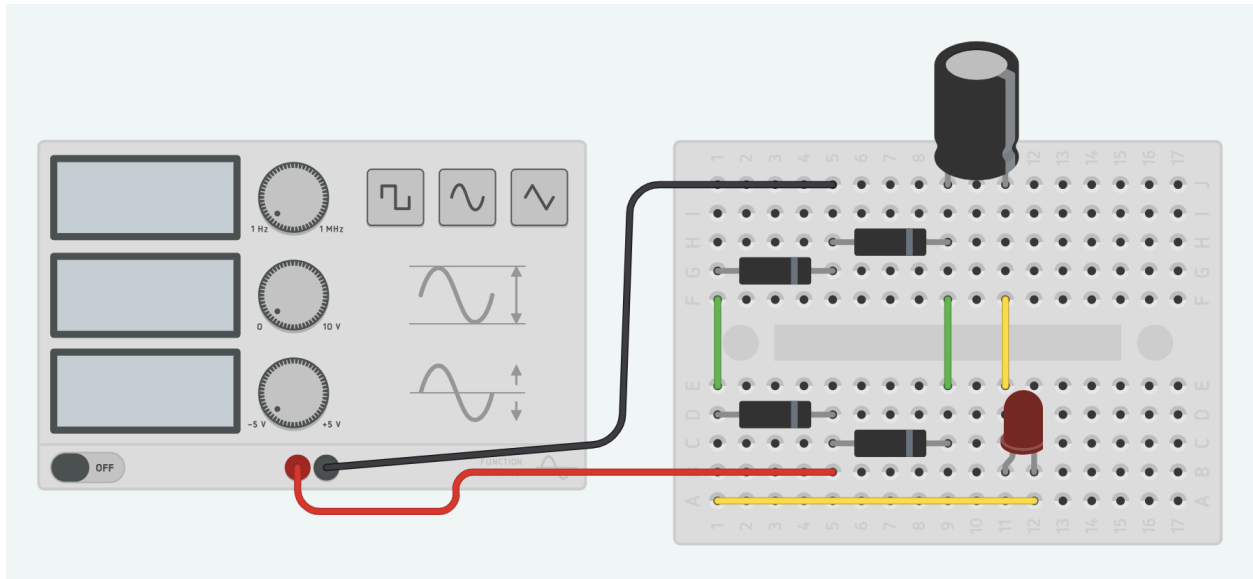
- 7) After multiple rounds of super gluing, remove the twist ties from the coils and place them in stator.



- 8) Once the coils are inserted into the stator, secure them in place using Shoe Goo glue.
9) Flag each wire with tape, labeling which coil it is and the side it's on (ex. the left wire on coil one will be L1)
10) Using the connection bridge, link neighboring coil wires (e.g., L1 -> R2, L2 -> R3, L3 -> R4). The two wires that are unconnected will be linked directly to the rectifier.



- 11) Now that the stator is complete, build the magnetic rotors by gluing the magnets in with alternating polarities.
12) Afterwards, apply pressure to press the bearing into the alternating housing elements.
13) Complete the alternator construction by installing the axle to the back housing, sliding the stator sandwiched between the magnetic rotors over the axle, and then covering it with the outer housing and bolting it together.
14) To build the rectifier, refer to the diagram below; the positive and negative wires shown will be replaced with the two unlinked wires from the alternator.



- 15) Now that the alternator and rectifier are complete, we will begin the turbine assembly by either gluing or bolting the lower and middle housing together.
- 16) After you drill a hole in the alternator mounting point on the back of the lower housing to allow the alternator axle to pass through.
- 17) Mount the alternator to the backside of the turbine's lower housing using glue and supporting materials.
- 18) Slide the 30mm bearing over the turbine axle, and then press the turbine onto the axle.
- 19) Place the 30mm bearing in the designated slot on the middle housing while simultaneously connecting the turbine axle to the alternator axle using the axle adapter.
- 20) Once the axle parts are aligned and spinning properly, use glue or set screws to hold them in place.
- 21) Afterward, bolt or glue the upper turbine housing to the middle turbine housing.
- 22) Lastly, bolt or glue the turbine housing face to seal the opening (you can use a 3D printed face or laser-cut acrylic if you'd like to see into the turbine).
- 23) Attach a unique adapter or $\frac{1}{8}$ inch hose to the inline nozzle to connect the generator to the water source.



Operation Instructions

Operation is simple. Once everything is connected appropriately—in this case, to the piping from the top barrel and directly into the bottom barrel—it functions independently. To reiterate, water flows down, spinning the wheel whose axle is connected directly to the axle of the alternator, allowing it to spin and generate alternating current for the rectifier to control and pass along to our battery bank(s).

Future Development:

In the future, we will focus on attempting to build this system with readily available, scavenged parts, as one would have to in a real post-apocalyptic scenario. Similarly, it is important to think about the materials used, as 3D-printed plastic is far from strong enough to handle hundreds of pounds of water pressure. On this same note, it is essential to consider attachment points, especially with modularity in mind. When dealing with flow rates and high water pressure, it is imperative that they are watertight. Finally, a significant but easy-to-make mistake that needs to be avoided in the future is ensuring that the magnets opposing one another on each side of the copper coils are of opposite polarity; otherwise, no power will be generated.

References:

1.  Rain Gutter POWER #2 - 3D Printed Alternator, BEST Explanation of a Rectifier E...
2.  3D printed hydroelectric power plant model for demonstration of physical laws
3. QuintBUILDs. "Rain Power Generator." Instructables, www.instructables.com/Rain-Power-Generator/. Accessed 29 Apr. 2025.
4. <https://grabcad.com/library/micro-hydro-generator-1>
5. Matic Markovič. "3D Printed Hydroelectric Power Plant Model." Hackaday.io, hackaday.io/project/171863-3d-printed-hydroelectric-power-plant-model. Accessed 29 Apr. 2025.