

WaterPod Pico in a Bucket

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**Waterpod
Engr215
Student
Projects**

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Pico in a Bucket -

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Commander 9000 -

Soil-less Growing System - Composting Toilet - thewaterpod.org
(<http://thewaterpod.org/>)

Background

The WaterPod is New York based art project/exhibition of



Fig 1: A preliminary images of the WaterPod



Fig 2: Logo for P.I.E. Through Design

sustainable living and conservation. The project entails a barge showcasing a variety of

projects with the purpose of teaching the people of New York about sustainable living and

conservation. The barge will house several artists and travel to the five bouroughs of New York. The barge will then dock for two weeks at every borough allowing the public to board and learn about the showcased

techniques.

P.I.E. through Design is a team of four Humboldt State University engineering students. For Engineering 215, Intro to Design, the team selected the pico-hydro generation project, a method of generating small amount of electricity from a water source. The team consists of Eric Kilgore, Meghan Heintz, Mitchell Brown and Brandon Jones.

Problem Statement and Criteria

P.I.E. through Design's objective was to create an educational, water based, electrical generation system, to be featured on the WaterPod. The system uses the water sources available to achieve this goal. The project teaches

the possibilities of conservation and the use of renewable energy.

The following is a list of our criteria based on input from the client and the group's decisions.

- Aesthetics- The amount of the system that is readily visible, if the system is visually educational, looks professional, and how “nifty” it looks.
- Cost- The assumption that cheaper is better.
- Durability- The system needs to be able to work for all six months and the less maintenance the better.
- Educational Value- Our ability to use the system as a means of education.
- Effectiveness (Watt/Dollar)- The hypothesized mechanical effectiveness of the system.

- **Mobility-** The ability to move the system from side of the barge to another.
- **Use of Reclaimed Material-** The ability to construct the system from recycled materials.
- **Safety-** The less potential dangerous system the better.
- **Ship ability-** The ability to send the system to New York.
- **Simplicity-** The number of parts involved and the intricacy of the parts of the system.

Criteria	Weight
Aesthetics	5.75
Cost	8.25
Durability	7.5

Educational Value	9.75
Effectiveness Watt/\$	4.25
Mobility	8
Use of Reclaimed Material	6.25
Safety	7.75
Shipability	6.75
Simplicity	6.5

Description Of Final Project

The Pico-in-a-Bucket project takes the overflow from the WaterPod's water tower and uses its stored energy to generate electricity. The overflow from the tower is funneled into a PVC pipe which directs the water 12 feet down to a 5 gallon bucket. When the water leaves the

water tower and starts flowing down the PVC pipe the stored energy is converted into kinetic energy. The water is directed inside the 5 gallon bucket the water hits a turbine made of sliced 45 degree elbow PVC pieces. By making contact and spinning the turbine as the water drops down the kinetic energy of the water is converted to mechanical energy. Next the spinning turbine drives a permanent magnet motor generating electricity by converting the mechanical energy into electrical energy. That electricity then lights LED light bulbs around the bucket.

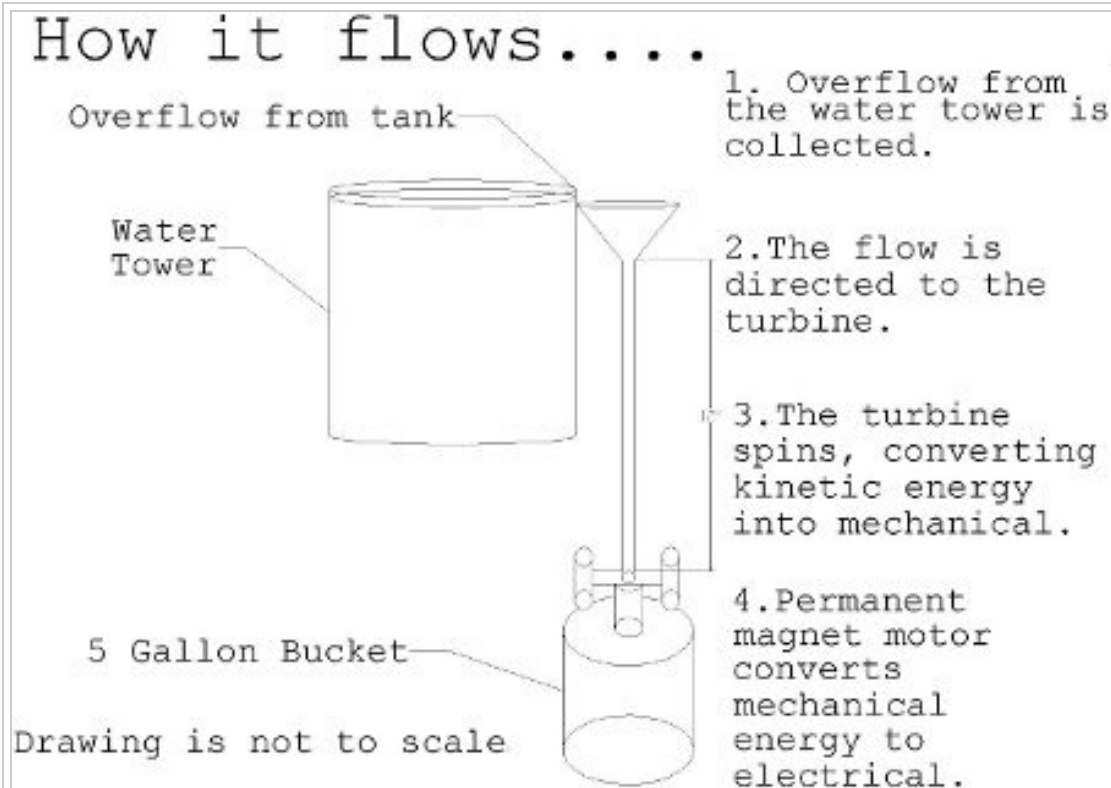


Figure 1: Overview Pico-in-a-Bucket. Stored Energy is turned into electrical energy.

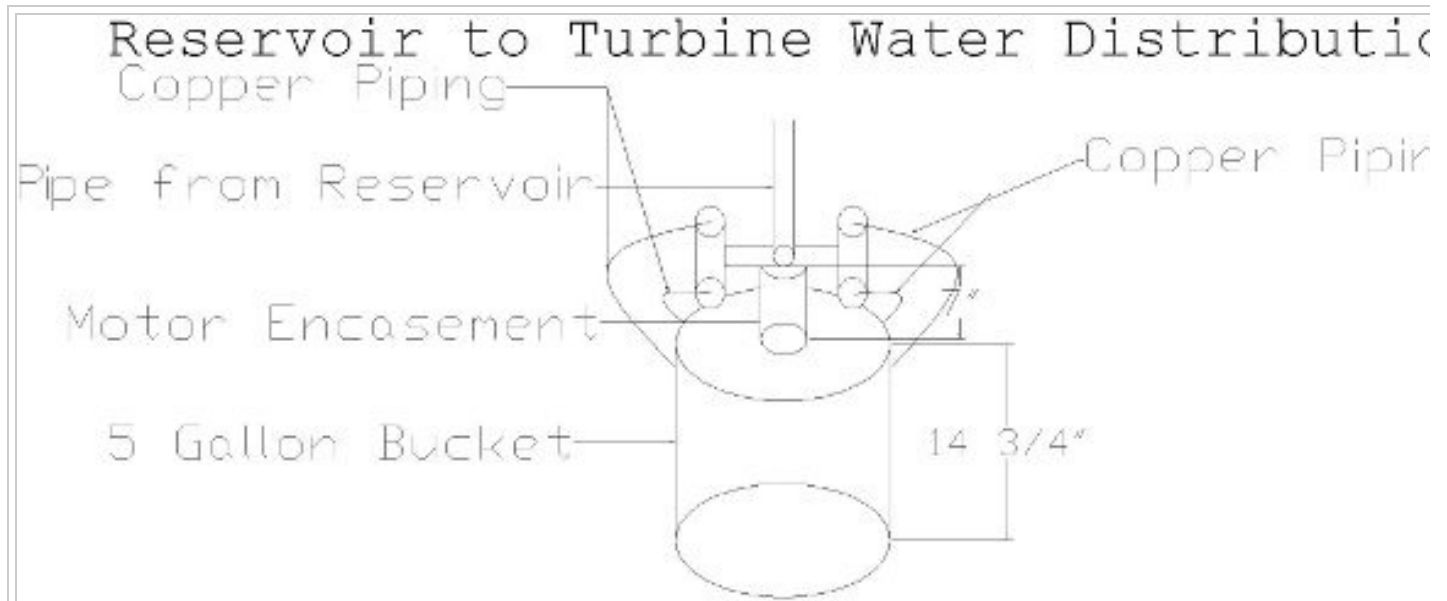


Fig 2: Overview of the water distribution to turbine

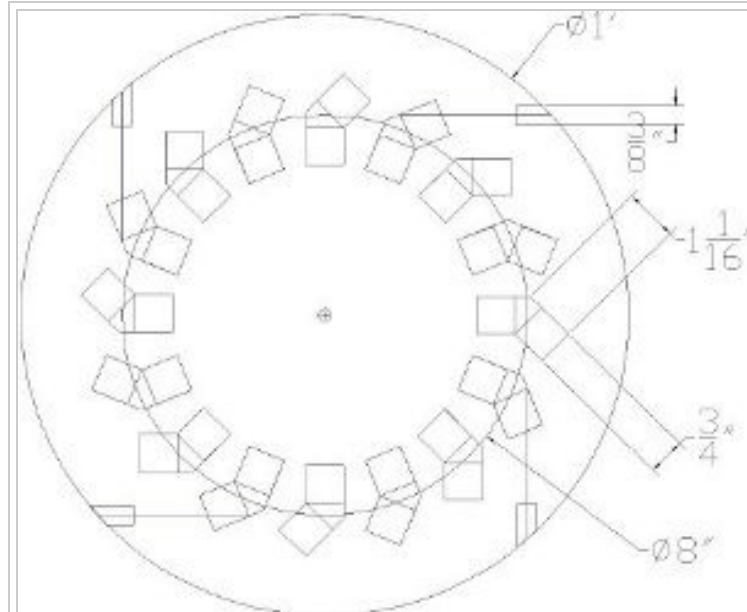


Fig 3: Turbine made of acrylic plate and PVC slates

Abstract

The WaterPod (thewaterpod.org) is an upcoming art project/exhibition on sustainable living and conservation. For the exhibition artists will be living on a barge on the Hudson River in a manner that embodies "self-sufficiency and resourcefulness, learning and curiosity, human expression and creative exploration." (quote taken from thewaterpod.org.) To achieve this feat the WaterPod contacted Humboldt State's Intro to Design class to help design systems that would sustain the artists on the barge for six months. P.I.E. through Design, a team created for Humboldt State University's Intro to Design class, selected the task to create a pico-hydro system as an exhibit on the barge. The Pico-In-A-Bucket is the result of this assignment. The Pico-In-A-Bucket consists of a 5 gallon

bucket encasing a turbine and a permanent magnet motor. The system will harness the kinetic energy of the falling water from the overflow of the WaterPod's water tower.

Costs

The Pico-In-A-Bucket project included two constraints that effected the cost of the project. One of those was cost, the cheaper the better. And the other was percentage of recycled materials used, the more reclaimed materials the less waste produced by the construction of the project. Recycled materials were cheaper so a higher percentage of recycled materials helped fulfill both criteria. The actual dollar amount spent is documented in the table below.

Material

Item	Quantity	Retail Cost	Actual Cost	New/Reclaimed
Electrical & Motor Encasement				
24 Volt Permanent Magnet Motor	1	\$49.77	\$49.77	Reclaimed
Plexi Glass Cap (\$/sheet)	1	\$58.31	Donated	Reclaimed
Plexi Glass Tubing (\$/ft.)	1	\$6.42	Donated	Reclaimed
Five Gallon Bucket	1	\$14.99	\$1.00	Reclaimed
6\ Wire (\$/ft)	1	\$2.40	\$14.40	New

PVC Pipe and Fittings

Elbow 90 1/2\"	4	\$0.49	\$2.14	New
Elbow 45 1/2\"	8	\$0.79	\$6.96	New
8 ft. 2\" pipe	1	\$4.19	\$2.00	Reclaimed
8 ft. 3/4\" pipe	1	\$4.19	\$2.00	Reclaimed
PVC Male Adapter	2	\$1.20	\$2.40	New
PVC Female Adapter	2	\$1.04	\$2.08	New
3/4\" Cap Slip	4	\$0.49	\$1.96	New
Comp Connector	4	\$3.49	\$13.96	New
Copper Tube	5	\$1.59	\$7.95	New
3/4\" T-Joints	2	\$0.80	\$1.60	New

Nuts & Bolts

Screws	12	\$0.11	\$1.44	New
Nuts & Bolts	16	\$0.09	\$7.79	New
Total		181.26	\$117.45	

Discussion and Next Steps

The project will remain on the WaterPod for the next six months. It will serve as a educational tool aboard the vessel. P.I.E. through Design learned from the project that the pipes were losing too much pressure at the bottom of the 15 feet drop. The water pressure was lost when it got to the small copper tubing. If this project were to be created again the small copper tubing would be replaced with larger PVC pipes with small spouts at the end. This would increase the pressure of water right before it hits

the turbine increasing the voltage produced.

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Categories

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