Wind 4 Water

Tess Bowling Kenny Wine Alex Roeca Dan Kim Hannah Thomas

The Problem

Water is essential for life.

In third-world countries, water can be miles away.

Electricity for pumping water is hard to come by in these nations.

People can't get out of poverty while having to worry about water.

Theory Calculations

Betz' Law: Power = (1/2)(Area Swept)(Air Density)(Velocity^3)

Predicts the amount of power at 100% efficiency

Maximum power turbine can generate:

1,072 watts

Bill of Materials

Parts	Price
Adapters	$30.99
Rods	$17.44
Fasteners	$60.9
Pipes	$10.41
Wood	$24
Adhesive	$31.18
Bearings	$5
Water Pump	$97
Storage Shed Door	$15
Bucket	$2.78
Strut	$5
I-Beam	$20
Sheet Metal	$17.96
Poster Material	$12.16

$340

Turbine Types

Savonius

- Drag
- Match Wind Speed
- Self-Starting

Darrieus

- Lift
- Faster than Wind

Horizontal

- Must Match Wind Direction

Calculations

Force = (Area)(Air Pressure)(Drag Coefficient)

Area: 3.75 ft^2

Air Pressure: (.00256)(Velocity^2)

Drag Coefficient: 2 for flat plates, 1.5 for curved

Torque = Force x "Radius"

Max Torque = 3.84 lb-ft

Min Torque = 0.24 lb-ft

Problems Faced

Notching the Blades

Bent Wheels

Wobbly

Costs

Chain Tension

Top-Heavy

Blade Material

Base Structure

Drive Train System

Attaching the Pump

Nuts, Bolts, and Rods

Water Pump Types

Rotary

Easy to pump

Diaphragm

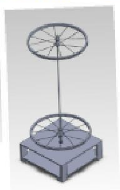
Creates the most pressure

Piston

Most Popular

Initial Design

- Savonius Blades
- Recycled Parts
- Pump Water



The Final Product

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Max Force — Min Force

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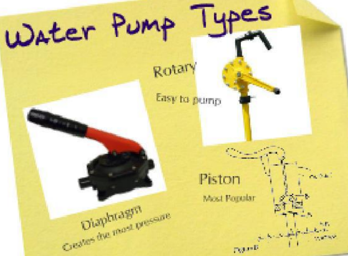
Water Pump Types



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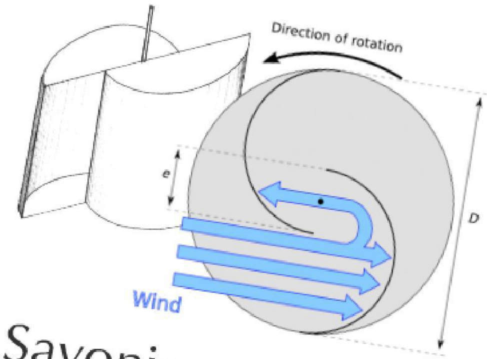

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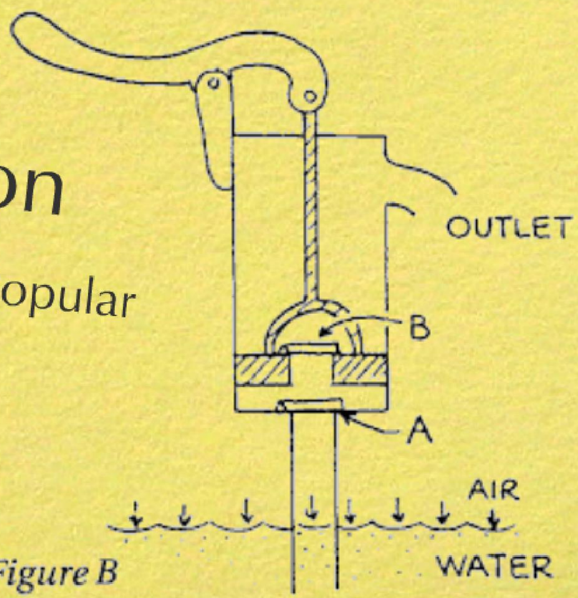

Figure B

Theory Calculations

Betz' Law: Power = (1/2)(Area Swept)(Air Density)(Velocity^3)

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Calculations

Force = (Area)(Air Pressure)(Drag Coefficient)

3.75 ft^2

(.00256)($Velocity^2$)

2 for flat plates
1.5 for curved

Velocity (mph)	Force on Flat Plate (lbs)
2	0.077
5	0.48
8	1.23
10	1.92
12	2.76
15	4.32
20	7.68

Max Force

Velocity (mph)	Force on Curved Plate (lbs)
2	0.0576
5	0.36
8	0.92
10	1.44
12	2.07
15	3.24
20	5.76

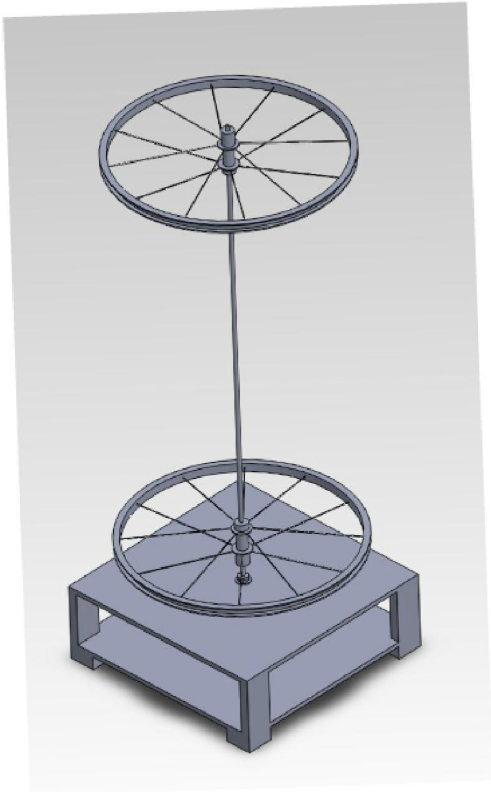
Min Force

Torque = Force x "Radius"

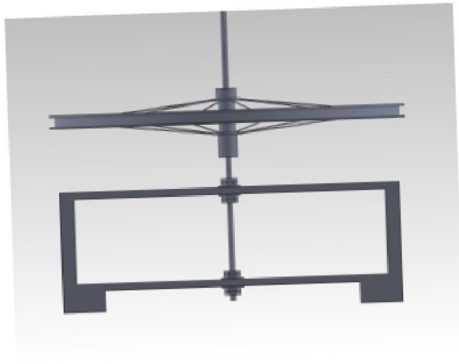
Max Torque = 3.84 lb-ft

Min Torque = 0.24 lb-ft

Initial Design



- Savonius Blades
- Recycled Parts
- Pump Water



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