

# PROJECT



-ELECTRIC

JOANNA ROWE  
VIKTOR SHKRIVANI  
JACKSON HONNER  
HIROTO HOSOKAWA

HYDRO  
ELECTRIC  
GENERATOR

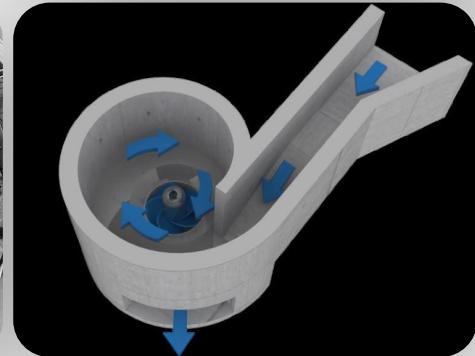
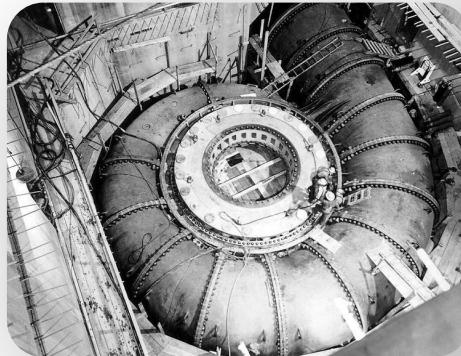
using a Francis-style turbine

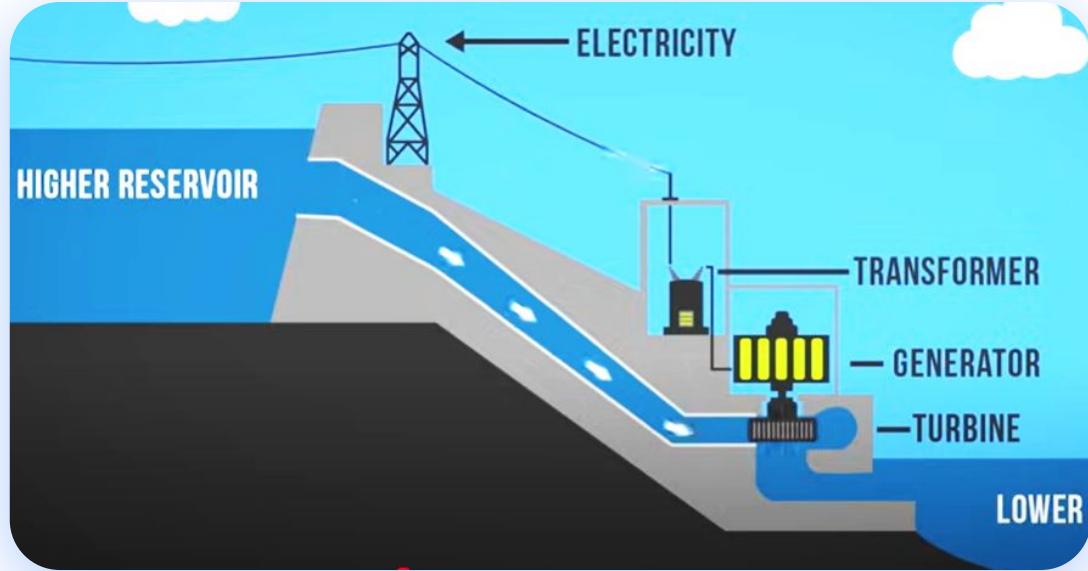
# TABLE OF CONTENTS

1	.....	Introduction
2	.....	Diagram & Design
3	.....	Generator
4	.....	Calculations
5	.....	Sources of Error
6	.....	Conclusion



# INTRODUCTION





# Hydroelectric Power Plants

Purpose

How many in the US?

Locations

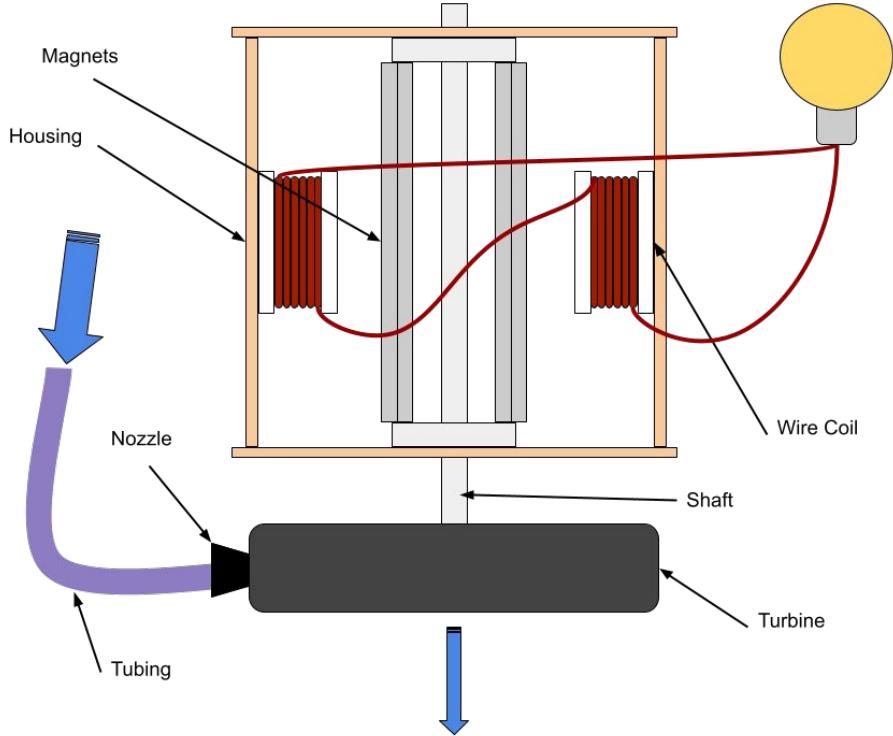
Efficiency

# Hydroelectric Plants

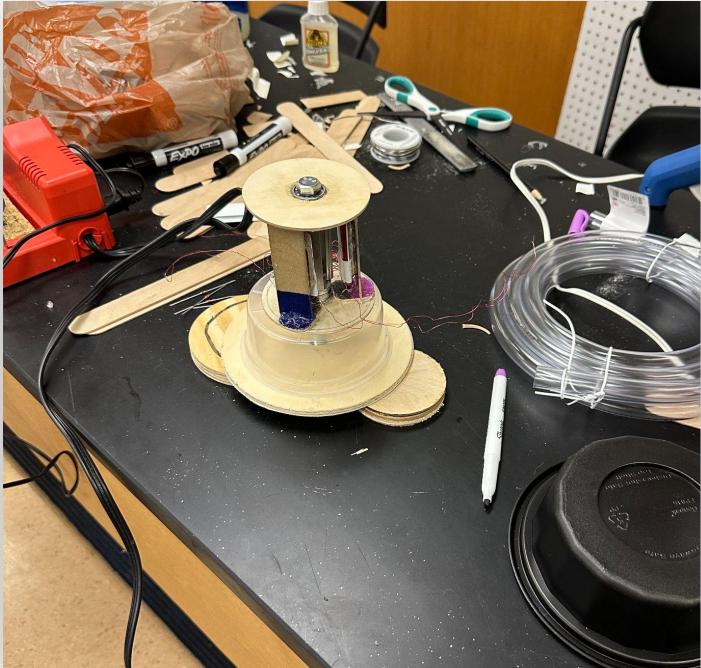
in the United States



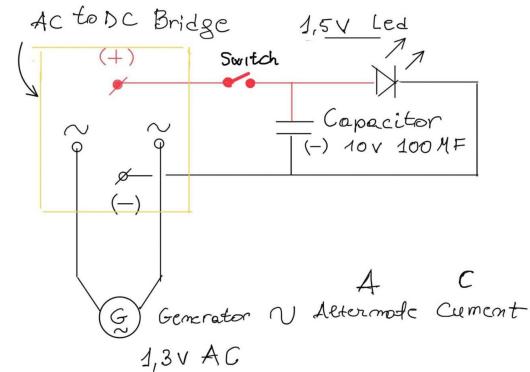
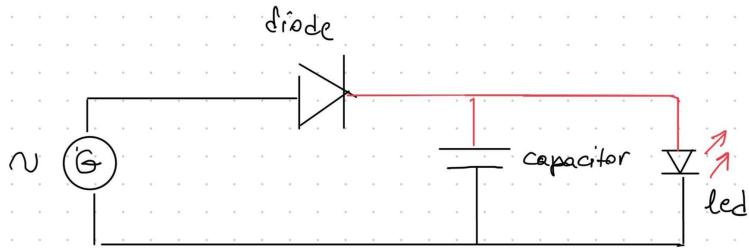
# DIAGRAM & DESIGN



# THE MESS ...



# SCHEMAS



# GENERATOR

The generator consists of a central shaft which rotates inside a stationary housing.

Three bar magnets are attached to the shaft, and three coils of copper wire are attached to the housing.

The emf produced by the generator can be calculated with the following measurements.



The peak magnetic field strength on a coil.

$$B_{peak} \approx 1mT$$

The area of a coil.

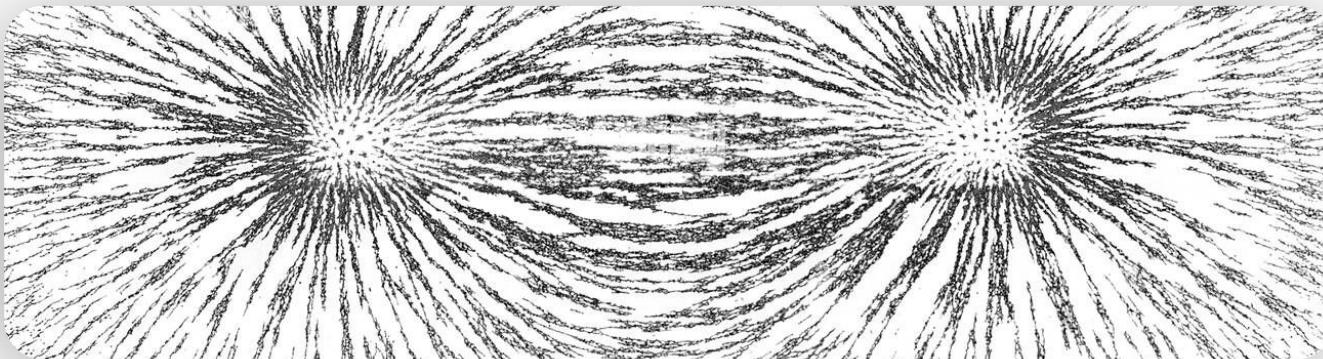
$$A_{coil} \approx 9.75cm^2$$

The number of turns in a coil.

$$N_{turns} = 200$$

demonstration

# CALCULATION



Faraday's Law can be used to calculate the emf produced by the generator.

$$emf = -N_{turns} \frac{\Delta\Phi_B}{\Delta t}$$

Calculating the actual change in flux through the coils would be difficult, so it must be approximated.

$$\Delta\Phi_B \approx (B_{peak} - B_{min})A$$

The shaft has three separate magnets, so.

$$\Delta t = \frac{1}{3 \cdot rps} \text{ where } rps \equiv \text{rotations per second}$$

Additionally, there are 3 coils on the housing, meaning the final equation is

$$|emf| = 3 \cdot 200 \frac{9.75 \times 10^{-2} \cdot 1 \times 10^{-3}}{\frac{1}{3 \cdot rps}}$$

# EXPERIMENTAL VALUES

The generator was tested by rotating the shaft with an electric drill at 450 rpm or 7.5 rps. This should produce

$$|emf_{pred}| = 3 \cdot 3 \cdot 7.5 \cdot 200 \cdot 9.75 \times 10^{-5} = 1.316V$$

When tested and measured with a voltmeter, the actual value was

$$|emf_{exp}| = 1.21V$$

This is a percent-difference of 8.055% below than expected



# SOURCES OF **ERRRRRR**

Resistance in the connections between coils.

Operator error when measuring the peak B-field.

The minimum B-field on a coil is assumed to be zero. Since the magnets on the shaft are very close together, the B-field on a coil may never reach zero.

**THANK YOU,**  
and enjoy the rest of your summer!



<< THIS IS US ☺