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Hydroelectric Power

In this activity students will build and operate a small scale electric power plant. This activity will incorporate the mechanical, fluid, and electrical systems needed to produce and move electric current.

Equipment:

small generator, fan blade system, hose and nozzle, flashlight bulb with socket, lead wires, pressure gauge, ammeter, voltmeter, ruler, and vernier caliper, stopwatch and pail

Setting Up:

1. Attach fan blades to generator shaft
2. Attach lead wires to poles of generator
3. Complete circuit so as to have bulb and ammeter in series.
4. Place voltmeter in parallel across light bulb

Procedure:

1. Using Pressure gauge, measure pressure of water coming through nozzle at various settings and record this value in Table 1.

2. Measure 4 gallons of water in a pail and mark this. Now time how long it takes to reach 4 gallon mark using nozzle at various settings. Record in table 1.

3. Measure the diameter of the fan with a ruler. Divide this value by 2 to get radius Place this value in table 2.

4. Mark one blade of the fan in some manner.

5. Spray the nozzle at the blades and record the following in the correct tables. Use a 30 second time interval
   a) Revolutions of fan (Table 2)
   b) Ammeter reading (Table 3)
   c) Voltmeter reading (Table 3)

6. Complete the table using calculations similiar to text examples

Table 1: Fluid System

Trial #	Pressure (P)	Volume (V)	time (t)	Rate of flow	Work done
1					
2					
3					

Table 2: Mechanical System

Force of water on Fan (F)	Radius of Fan (R)	# of Revolutions	Circumference (2x 3.14x R)	Work done

Table 3: Electrical System

Current	Voltage	time	Work done

Calculations:

1) Efficiency between Fluid system and Mechanical System: _____ %

2) Efficiency between Mechanical and Electrical Systems: _____%

3) Efficiency between Fluid and Electrical Systems (Total Efficiency): _____ %

Questions

1) What effect does changing the following have on the system?

a) Fan size:

b) Water Pressure:

2) How would you rate the efficiency of this system?

3) Why are the quantities of water pressure, rate of flow, torque, current, and voltage important to technicians at hydroelectric power plants?