

GEN-AQUA

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DISSATISFIED CONDITIONS

● ENVIRONMENT POLLUTION

- I Battery waste results in corrosive liquids which are toxic for the environment

II BATTERIES AND HEAVY METALS

- Typically used to store energy in solar powered systems which add to waste at the end of life

III FOSSIL FUELS

Finite amount available for energy generation

PROJECT GOAL

- Our goal is to produce an energy-efficient system that intakes excess solar energy and stores it as gravitational potential energy to be used later

NEEDS AND DEMANDS

- I AN ENVIRONMENTALLY SAFE MECHANISM
- II MORE EFFICIENT
- III COMPLETELY RENEWABLE
- IIII CHEAPER
- IIIII DEMAND WILL INCREASE ONCE IT HITS THE MARKET

The image features a teal background with a pattern of overlapping, wavy, organic shapes in various shades of teal. Centered on this background is the text "PROBLEM FORMULATION" in a bold, white, sans-serif font. The text is arranged in two lines: "PROBLEM" on the top line and "FORMULATION" on the bottom line.

PROBLEM FORMULATION

PROBLEM STATEMENT

GEN-AQUA

The Gen-Aqua provides user with a self-contained power generating system with an environmentally friendly method of storing solar energy for usage during hours of inadequate sunlight.

DESIGN REQUIREMENTS

- WEIGHT OF OUR FINAL “WATER WHEEL” PRODUCT SHOULD BE A LITTLE UNDER 10 POUNDS
- 5.5V SOLAR PANEL
- 12V WATER PUMP
- 2 WATER TANKS CAPABLE OF STORING 2-5 GALLONS OF WATER
- LED LIGHT
- WATER WHEEL TURBINE

CONSTRAINTS

WATER PUMP

- Making sure our water pump outputs the correct amount of water into the tanks

MINIATURE FEATURES

- Size of our potential model causes size constraints for our water pump and solar panels

OVERFLOW

- Water overflowing into the tank overnight

CAPACITY


- Limited water and energy storage capacity

WATER WHEEL

- Efficiency of a water wheel on a bigger scale

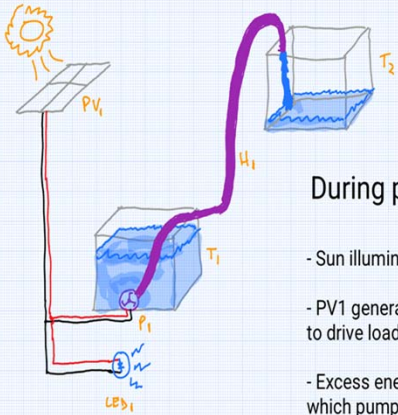
SCALABILITY

- Won't completely know how scaleable our product is

The image features a teal background with a pattern of overlapping, wavy, organic shapes in various shades of teal. Centered on this background is the text "SOLUTION GENERATION" in a bold, white, sans-serif font, arranged in two lines.

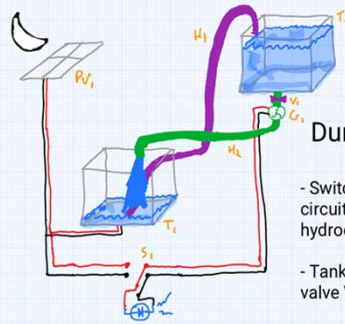
SOLUTION GENERATION

SOLUTION I



During periods of daylight

- Sun illuminated Photovoltaic cell PV1
- PV1 generates sufficient electrical energy to drive load LED D1.
- Excess energy drives aquarium pump P1, which pumps water from tank T1 through hose H1 to tank T2



During periods of no daylight

- Switch SW1 is positioned to open the circuit from PV1 and close the circuit from hydroelectric generator G1
- Tank T2 is drained into Tank T1, by opening valve V1.
- As water flows from T2 to T1 through hose H2, it turns the rotors of generator G1.
- G1 generates sufficient electrical power to drive load LED D1 during these periods of no sun.

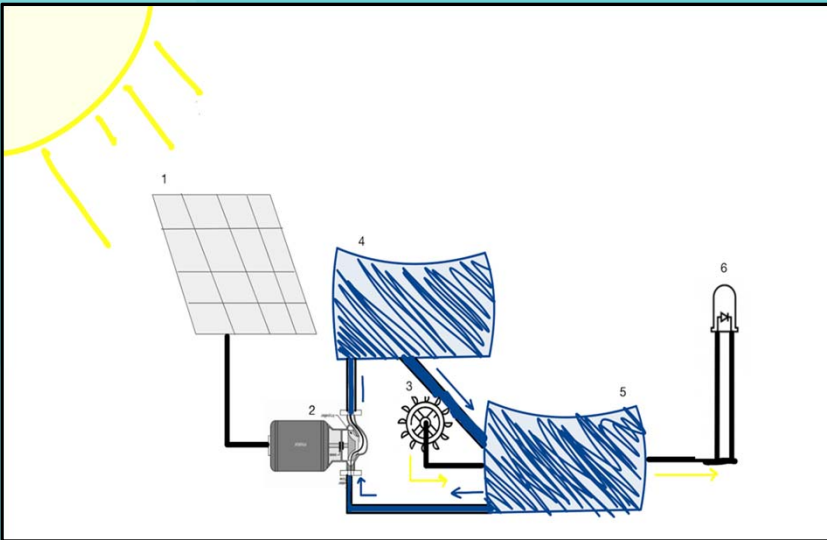
PROS:

- The uses of switches to open and close pv cells and hydro generator.
- Implementation of the sun illuminated photovoltaic cell

CONS:

- Use of switch may be too tedious, and an automatic switch seems to complex

SOLUTION 2



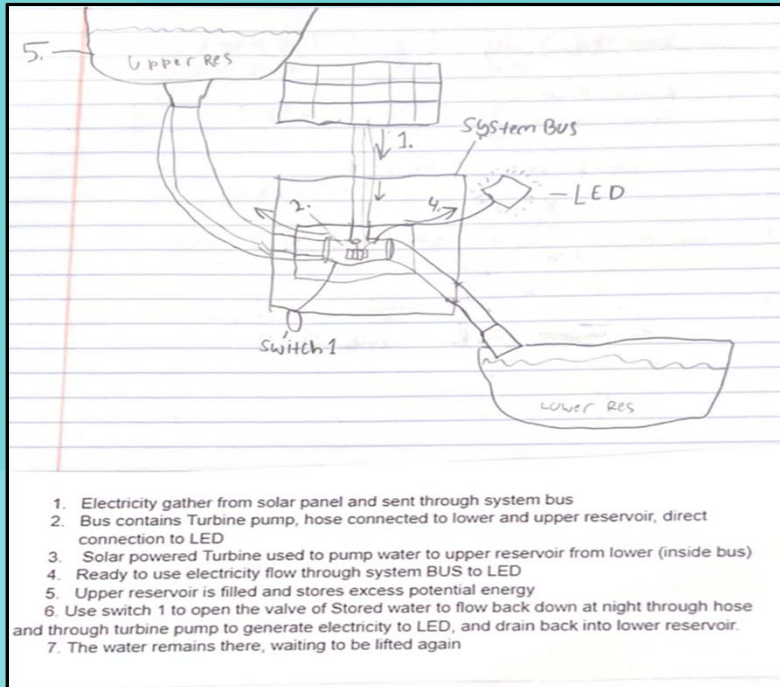
PROS:

- Water Wheel is a great energy devices.
- Water wheel is a good alternative to generate energy at the small scale we are trying to use.

CONS:

- Water wheel may not be as efficient as other options.

SOLUTION 3



PROS:

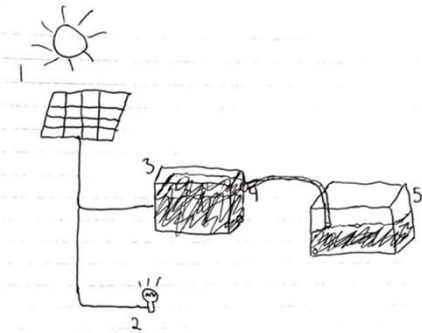
- System bus simplifies the design
- Solar powered turbine is a very efficient way of pumping water into tanks

CONS:

- No feasible Generator pump that design is incorporating
- Creating an efficient system bus may be to complex of a task.

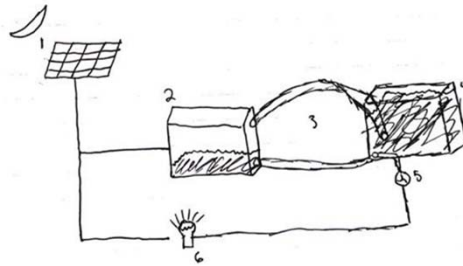
SOLUTION 4

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Senior Design 1
Diagram 1: During the day



1. Solar Panel generating electricity from Sun
2. LED light generating energy from panel
3. Pump that's powered with excess energy from panel pumping water through a valve in first tank
4. All excess water goes through valve 2 into tank 2
5. Extra water stored into tank 2

Diagram 2: At night



1. Solar panel stored with energy
2. After tank two is filled from the day the water is let back out to first tank
3. As the water transfers from tank 2 to tank 1, water will also flow through both valves which will create energy later for the generator
4. Tank 2 will be flowing water through both valves
5. Hydro Powered rotors from Generator will be creating energy from tank 2
6. Power from generator will light up the LED light when there's no sunlight

PROS:

- Very simple design flow

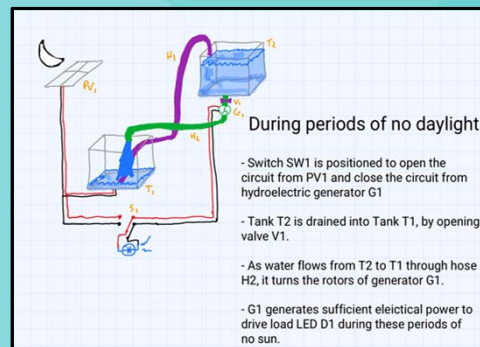
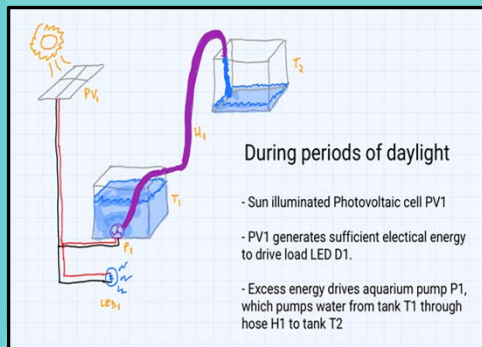
CONS:

- Both tanks being level brings into question how the potential energy will be stored.

TOP TWO SOLUTIONS

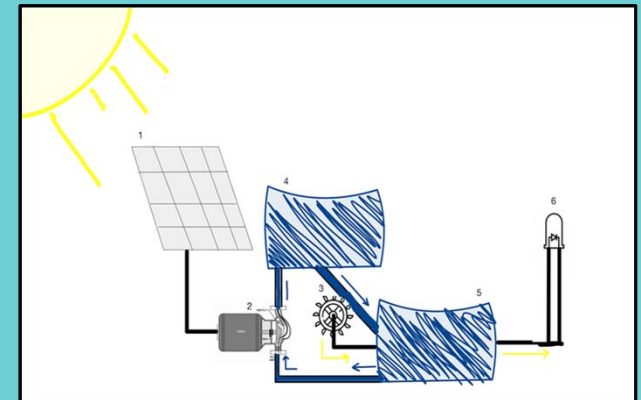
SOLUTION 1

- We loved the incorporation of the photovoltaic cells.
- We ultimately decided that the switches may be a necessary addition to the design
- Loved the organization and simplicity of the design




SOLUTION 2

- Wanted to incorporate water wheel into our design because we believe that it is a very functional tool.
- We also believe that the design will be fairly easy to create.



Design Decision Matrix

	Weight	Design 1	Score	Agg. Score	Design 2	Score	Agg. Score
Functionality	5	Hydroelectric Micro Generator	5	12	Water Wheel	5	18
Fabrication	3	System as a Whole	3	10	System as a Whole	3	11
Efficiency	3	Power Generation	3	9	Power Generation	3	7
Cost	1	Price of Materials	1	4	Price of Materials	1	4
Scalability	4	Model to Scale	4	15	Model to Scale		12
TOTAL				50			52

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TOP SOLUTION DESIGN

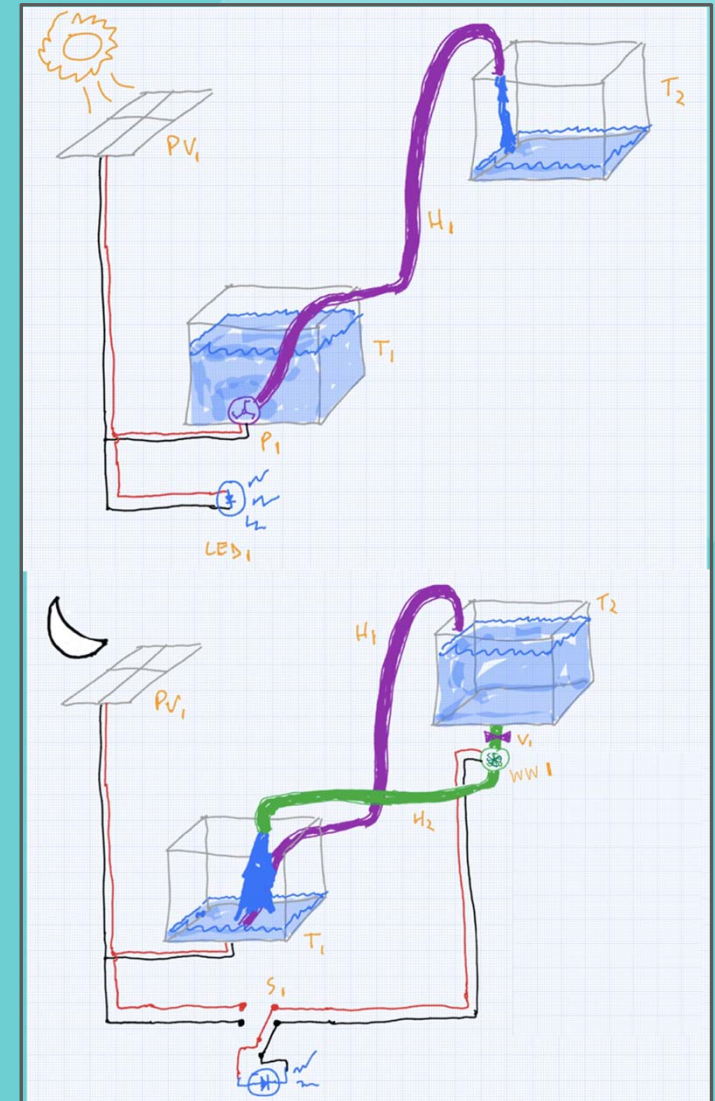
SOLUTION SCHEMATIC

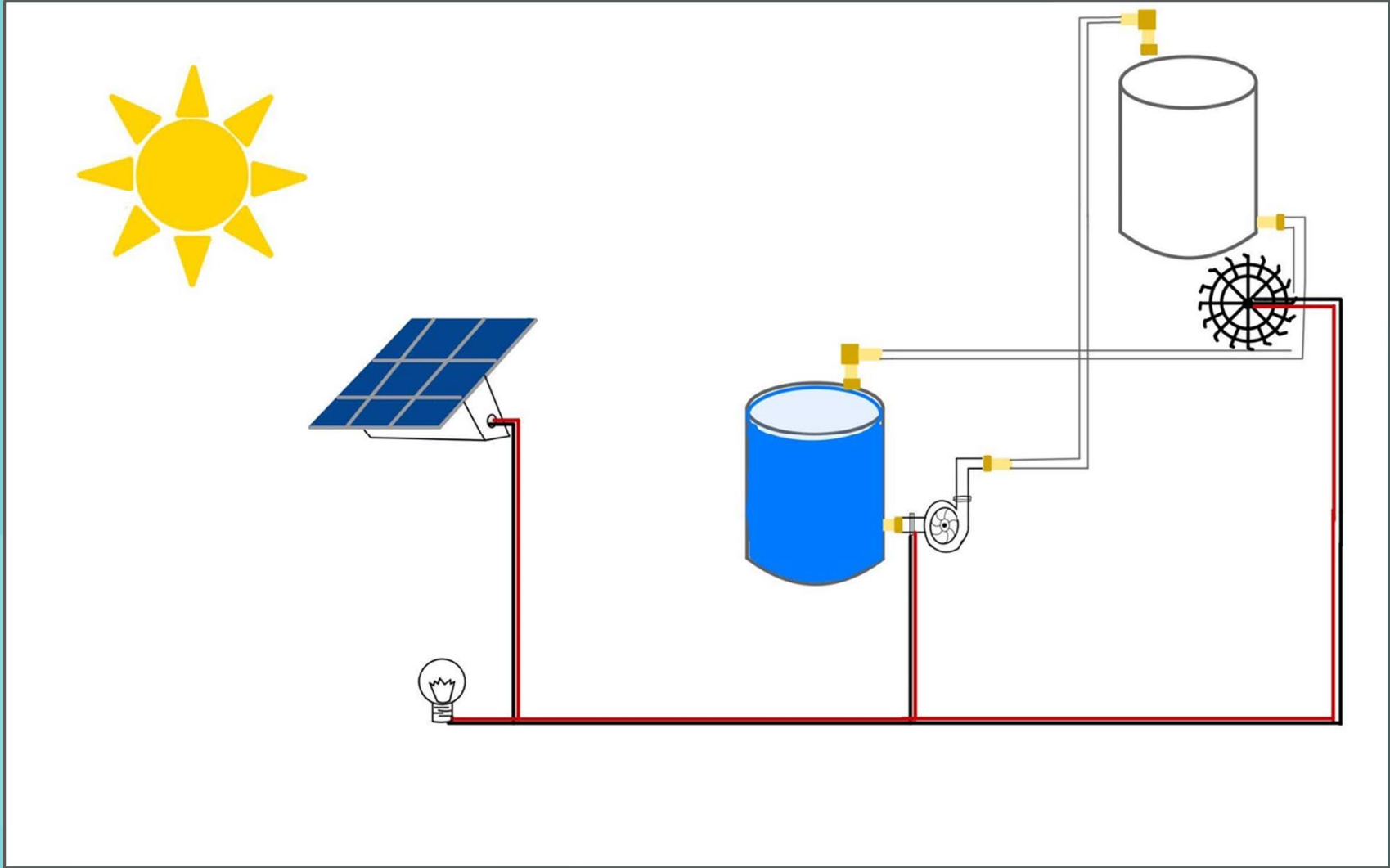
DAY:

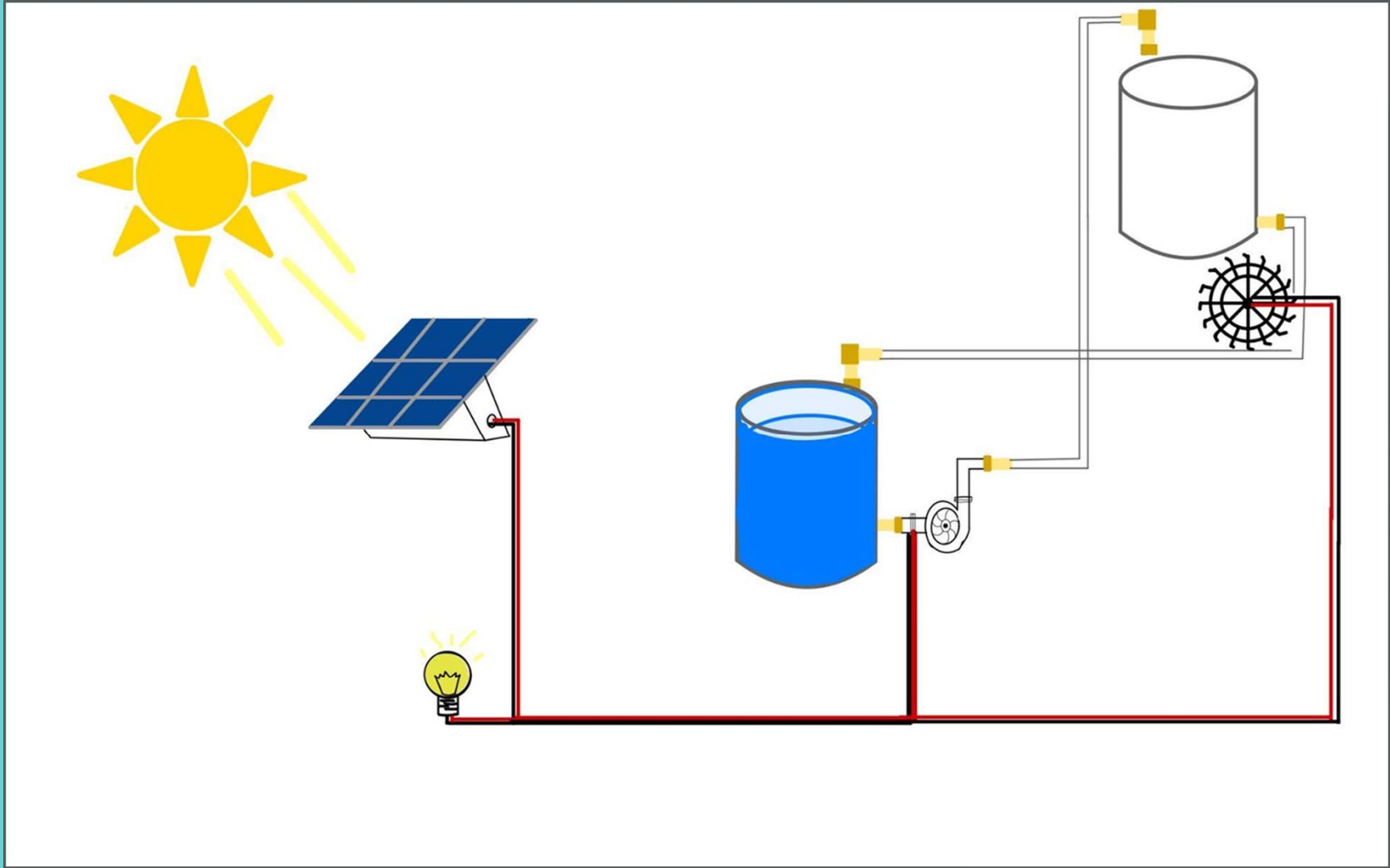
- Sun illuminates the photovoltaic cells (PV 1) to generate sufficient electrical energy needed to light an LED (LED1)
- The excess energy drives an aquarium micro pump which pumps water from the lower tank (T1) to the higher resting tank (T2).

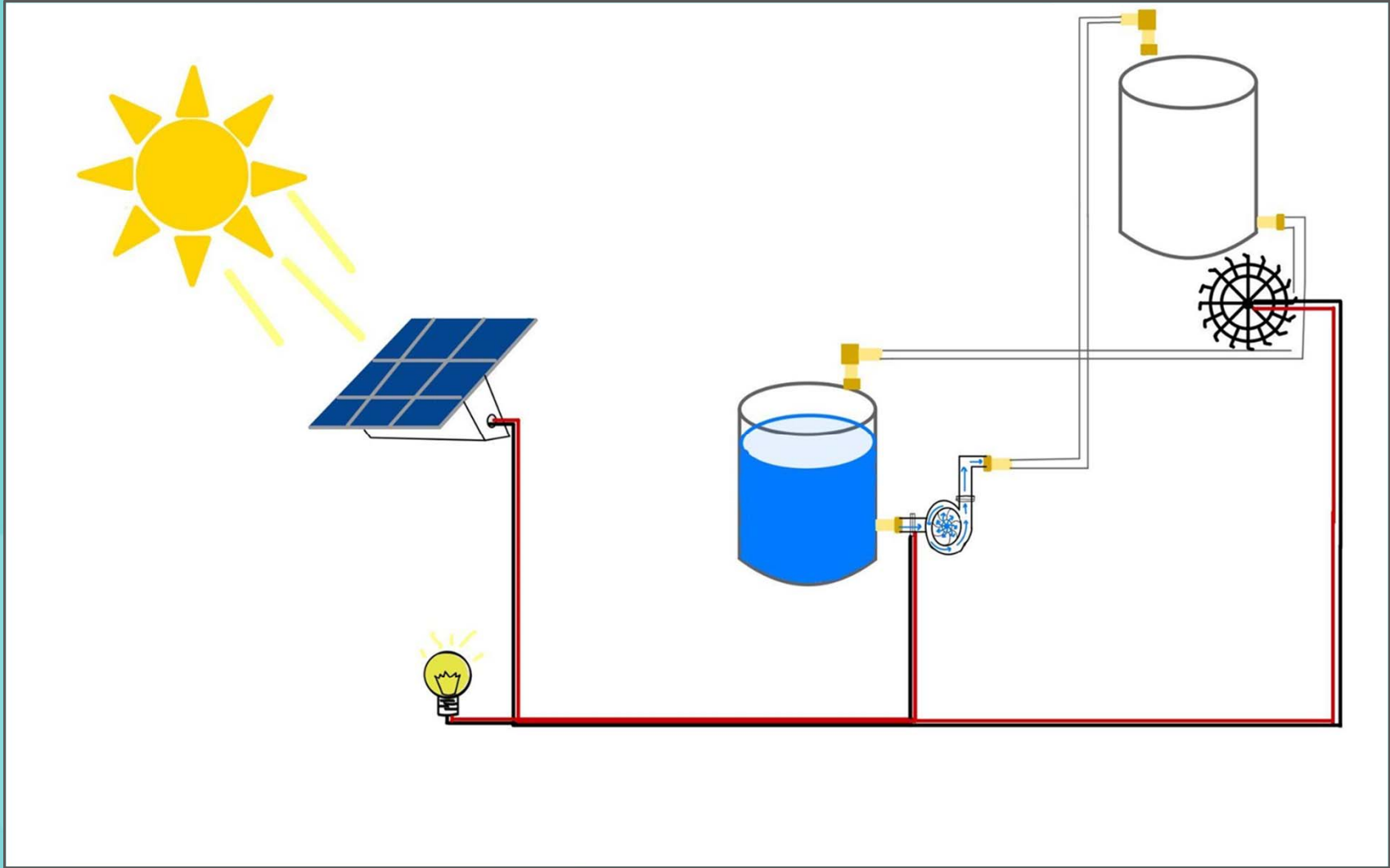
NIGHT:

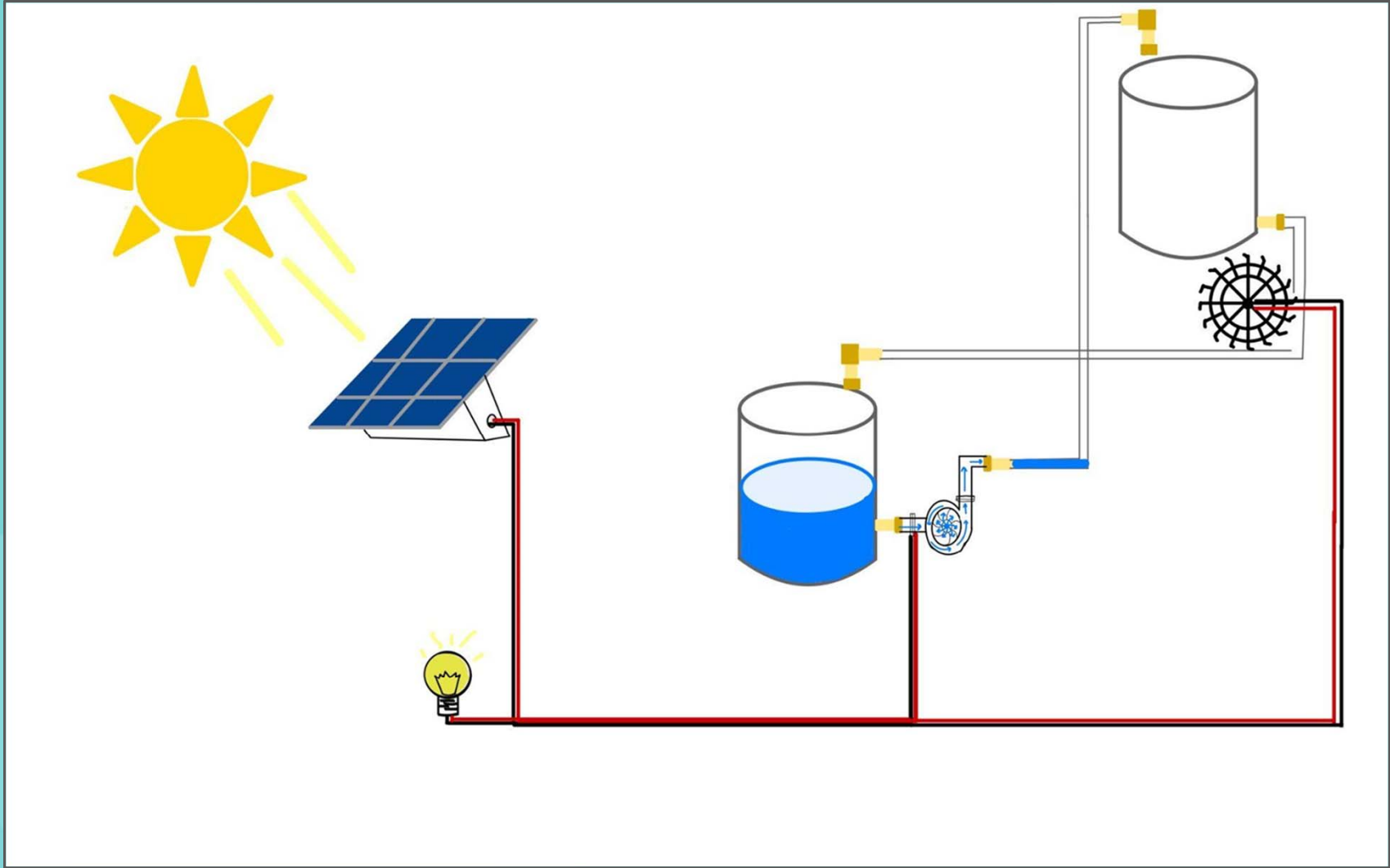
- When the system isn't receiving solar energy to power the LED, a switch opens the circuit from PV 1 and completes the circuit needed for the water wheel and a valve allows water to drain from T2 to T1.
- As the water drains from Tank 2, it turns the water wheel (WW1). The water wheel will generate the needed energy to illuminate the LED in the absence of solar power.

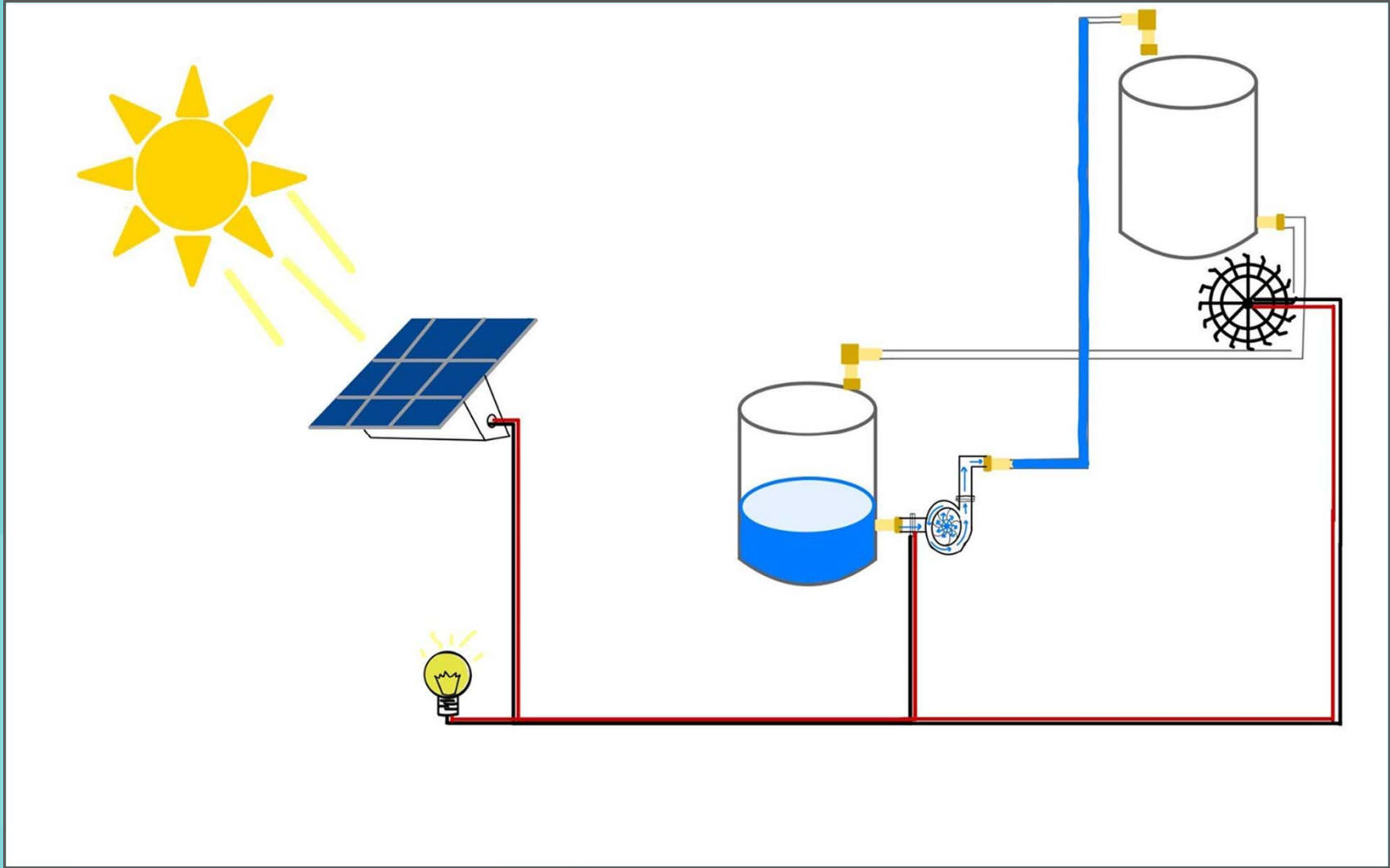


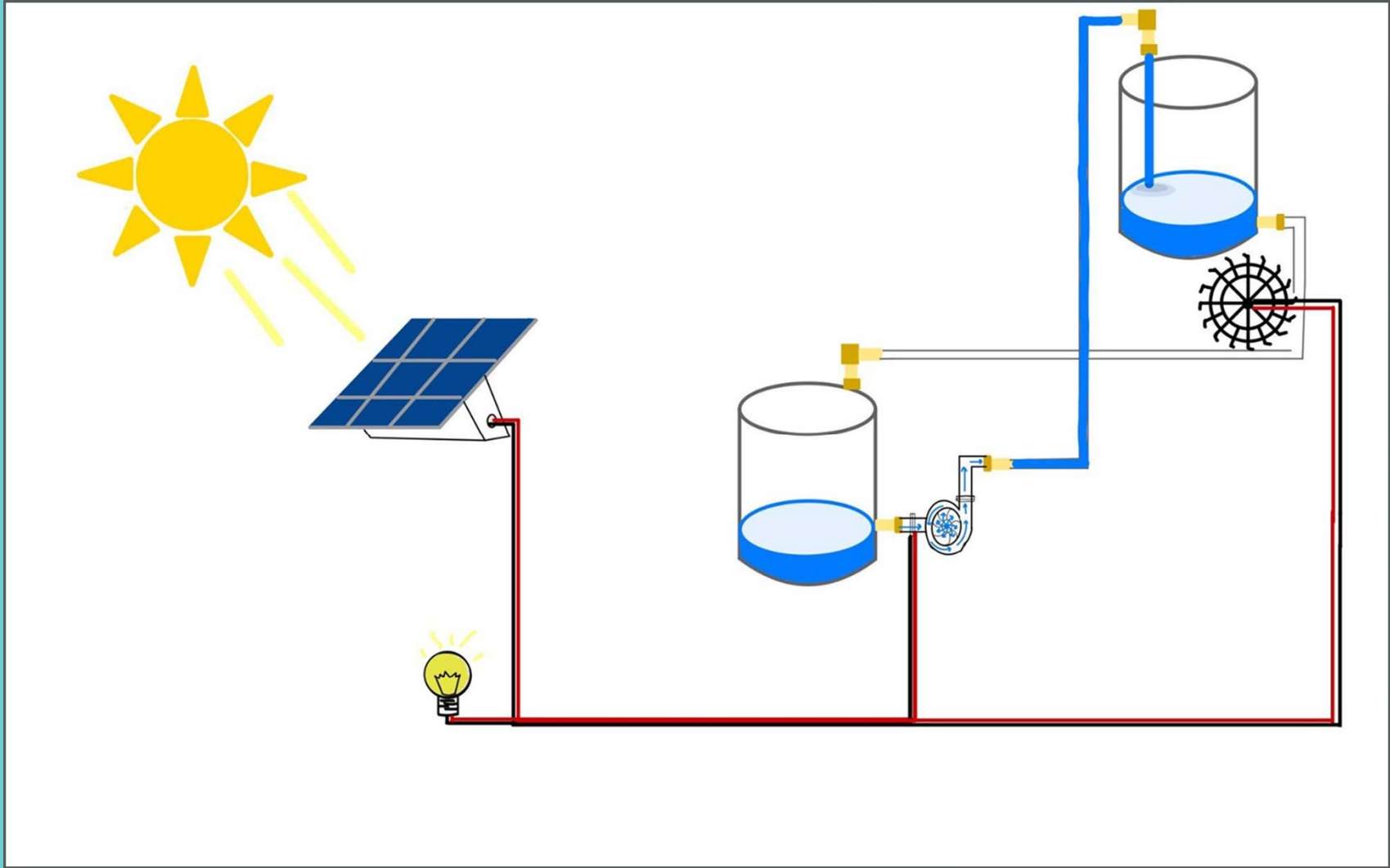


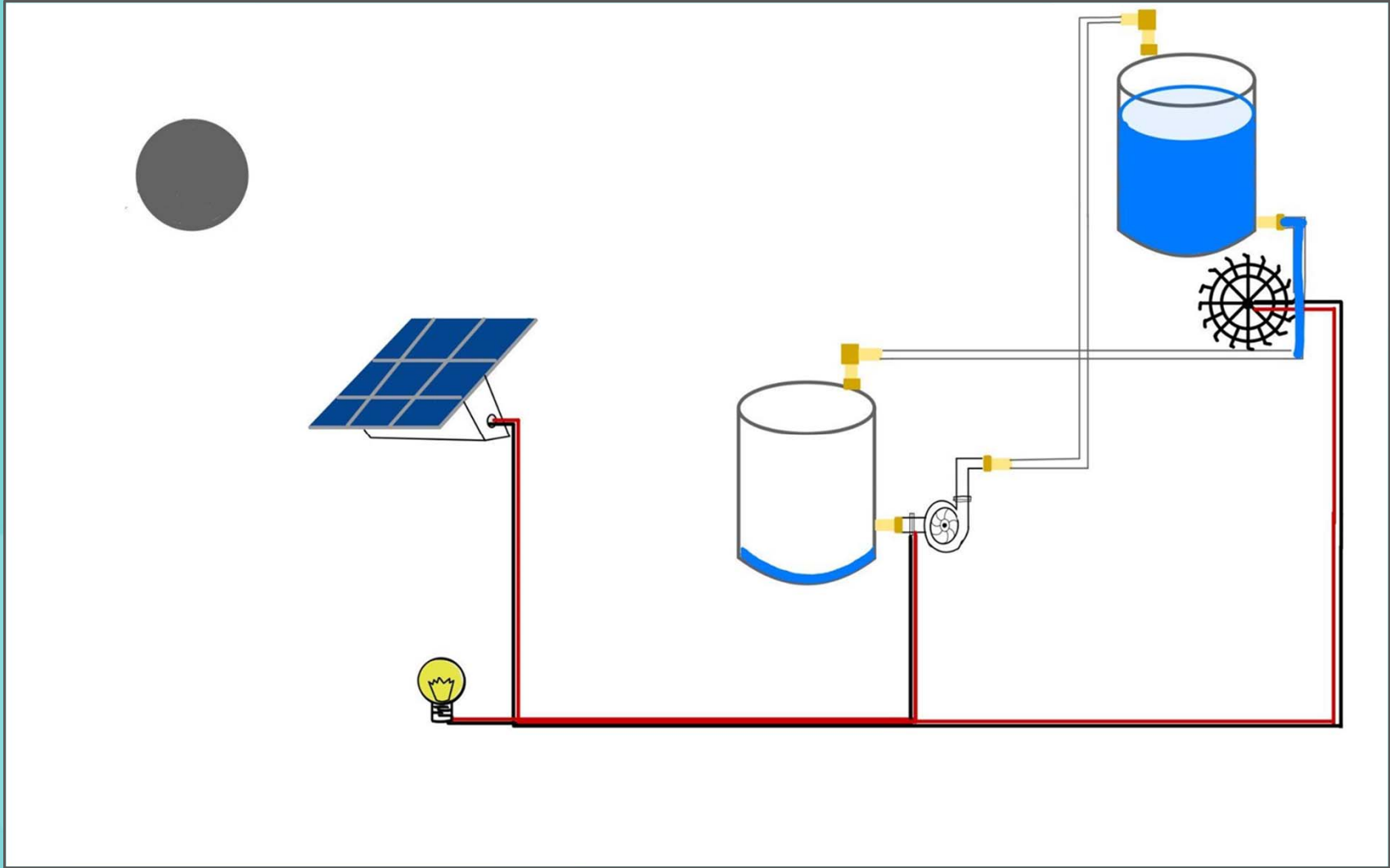


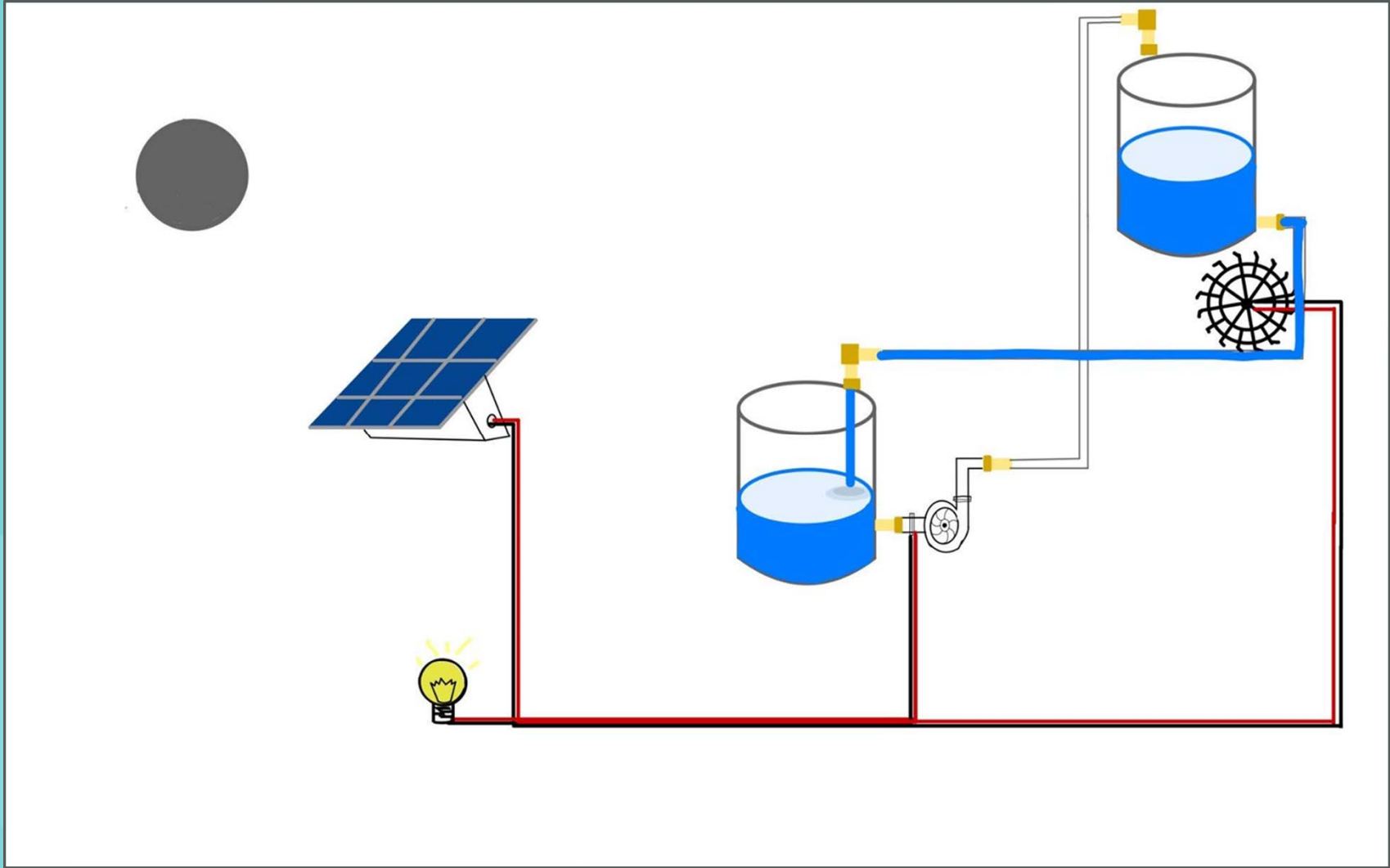


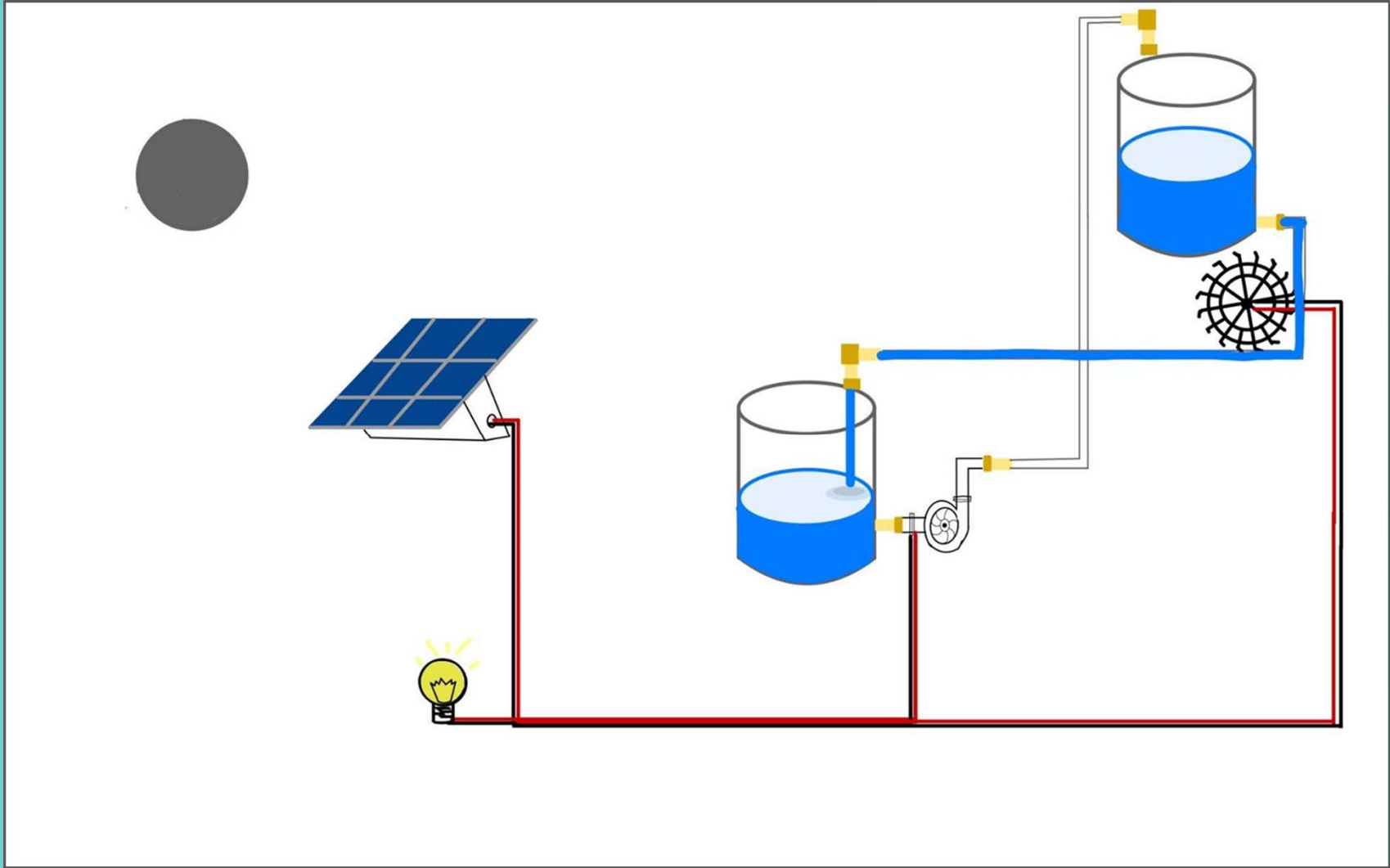


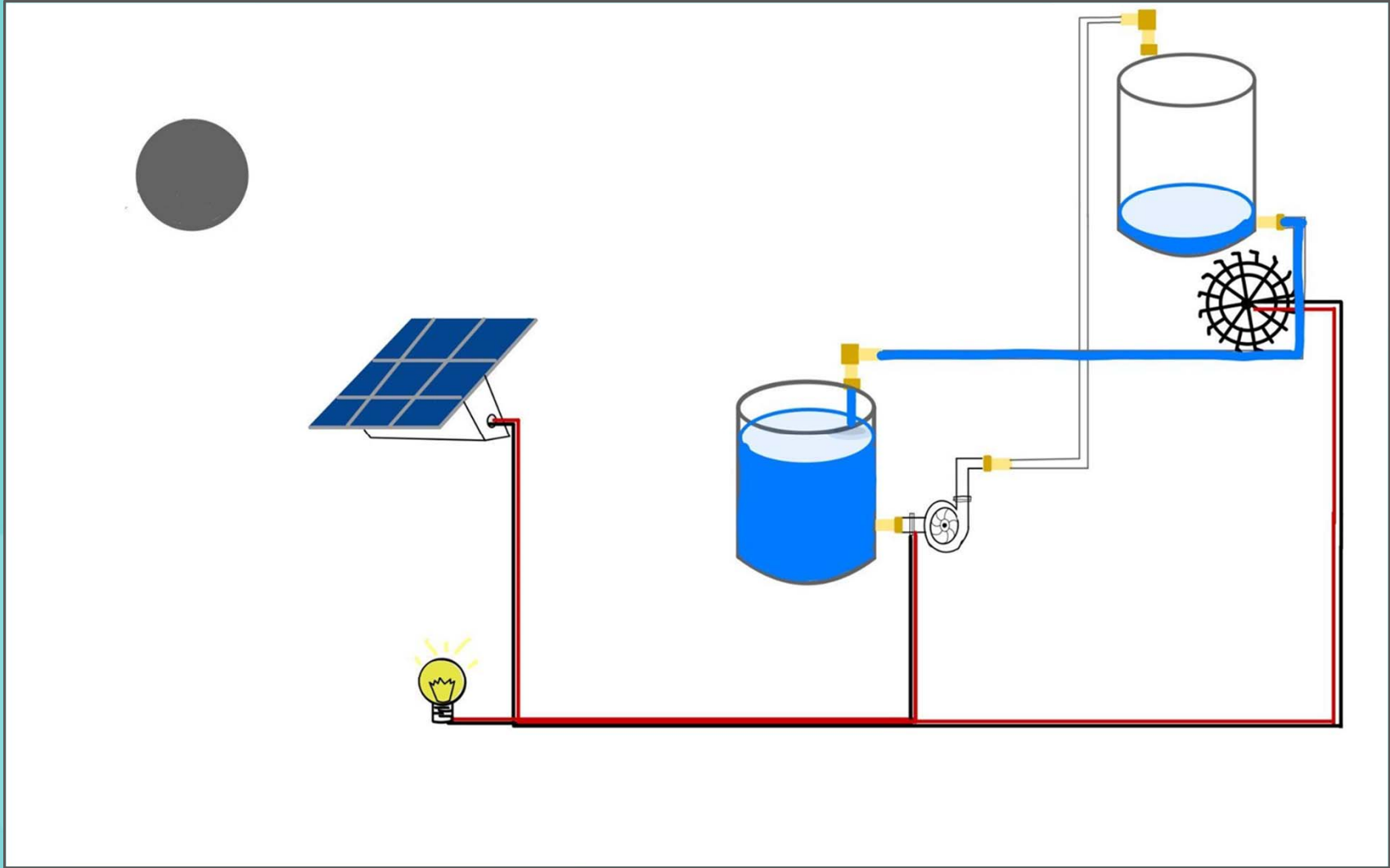


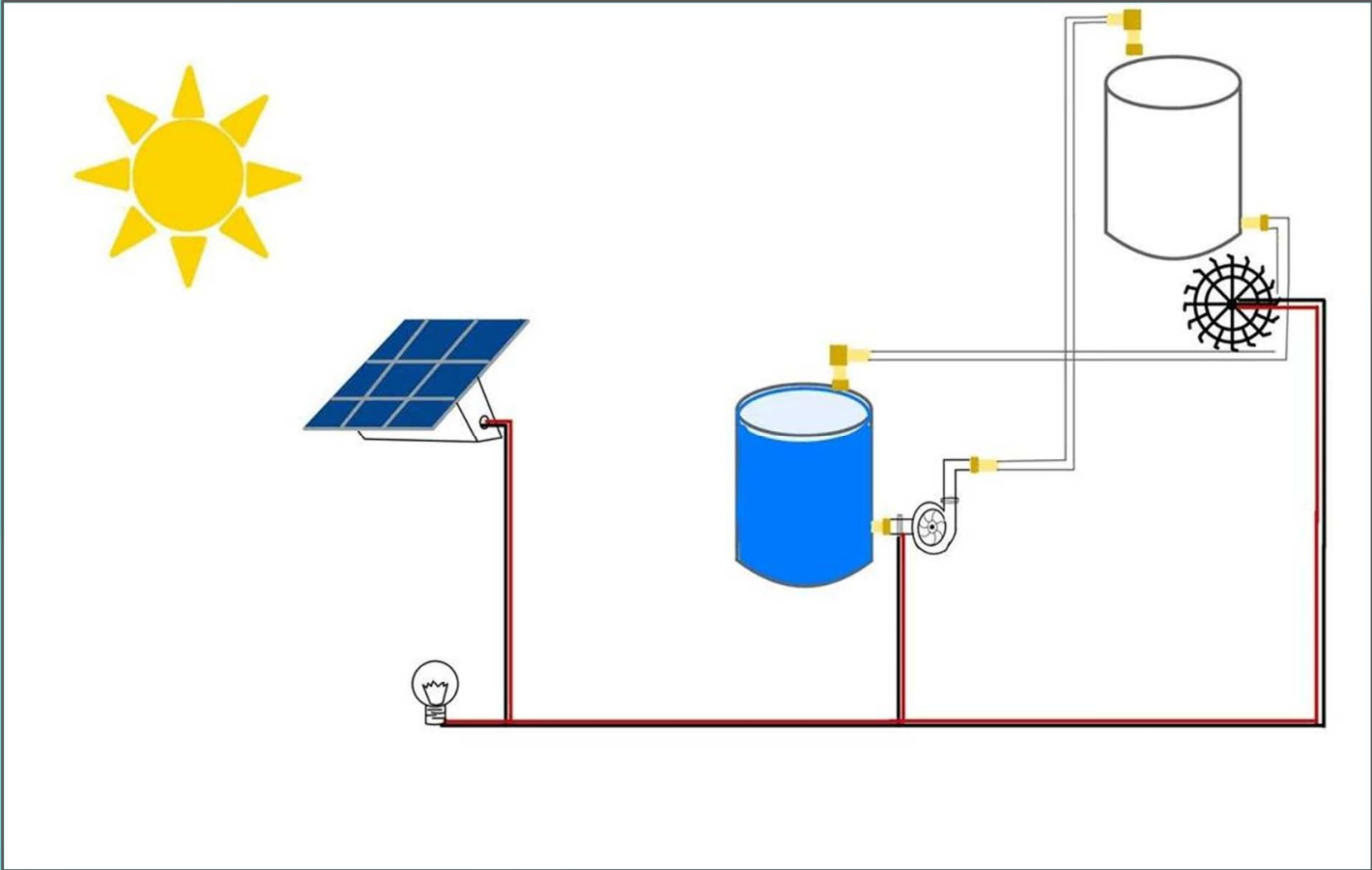












FUTURE WORKS

- **CREATE A WATER WHEEL POWERED MODEL OF OUR DESIGN**
- **TRULY CLEAN AND AFFORDABLE POWER SOURCE FOR UNDER RESOURCED COMMUNITIES**
- **DELIVER A SELF CONTAINED POWER GENERATING SYSTEM THAT DOESN'T USE BATTERIES TO STORE EXCESS ENERGY**

CONCLUSION

There is a need to store electrical energy harnessed from the sun in a manner which is least disruptive to our ecosystem. This design meets this goal by utilizing the gravitational potential energy of water as an energy storage medium instead of heavy metal batteries.

Q&A

Thank you for listening!

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