PRODUCING ENERGY WITH THE LEAST EXPENSE

INTRODUCTION

Wind Turbines and Solar Panels are both types of energy producing technology that are both good for the environment and sustainable due to the fact that the energy produced by these structures is regarded as 'renewable'. However, both forms of energy production can be quite expensive. The cost efficiency of these structures will be tested using the STELR energy kit.

AIM

The aim of this experiment is to find the most cost effective way of producing using wind turbines or solar panels.

BACKGROUND

Wind turbines use wind energy in order to create electrical energy. The energy transformations that occur in a wind turbine are as follows: kinetic energy à mechanical energy à electrical energy. The kinetic energy is the energy captured from the wind. This energy is then transformed into mechanical energy to force the wind turbine's blades move, which in then further transformed into electrical energy to be used in households. They require high levels of maintenance to keep them fully functioning and can also be relatively expensive to install and manufacture.

Solar panels are made up of solar cells that use light energy retained from the sun to produce electrical energy. The energy transformation that occurs within a solar cell is as follows: light energy à electrical energy. The light energy is obtained from the suns UV light that shines onto the earth's surface. This light is directly transformed into electrical energy, which can be used to make electrical appliances and devices work. Solar panels can be relatively expensive to both manufacture and install. Despite this, solar panels require little maintenance to keep in order.

SUMMARY OF PREVIOUS RESEARCH

Primary research was undertaken before the experiment was undertaken to gain a better understanding on how to maximise the energy production of solar panels and wind turbines. The following information was found:

EXPERIMENT	RESULTS TO GAIN MAXIMUM ENERGY PRODUCTION:
Angle of wind turbine blades	20-degree angle
Different sizes of wind turbine blades	Smallest blade
Number of wind turbine blades	4
Number of solar cells	4 (Most solar cells as possible)
Type of electrical circuit connecting to solar panels	Series circuit
Angle of light source	90/120 degree angle

Table One: The results obtained during the previous research

VARIABLES

Independant Variables:

Design One: Wind turbine- 3 blades at 20-degree angle, connected in series circuit
Design Two: Wind turbine- 6 small blades positioned at 20 degrees, connected in a series circuit
Design Three: Solar panel- 4 cells positioned at 90 degrees, connected to load in series circuit

Dependant Variable:

Energy output of the three designs

Controlled Variables:

- The same multimeter from STELR kit 8 was used for all three designs to ensure all three designs were measured with the same resistance.
- The same load panel from STELR kit 8 was used throughout all three designs in attempt to have a consistent resistance throughout all three designs.
- The same load, being the buzzer, off the load panel was used when testing the voltage and current throughout all three designs.
- The same wires from STELR kit 8 were used for all three designs, again, to create a levelled balance of resistance throughout all three of the designs.

METHOD

1. The first design was built using the appropriate materials and positioned 15cm away from the fan.
2. The structure was connected to the multimeter and the load panel using wires as a connecting path.
3. A photograph was taken of the structure and set-up.
4. The fan was turned on at the setting high (design one and two) OR the 3 lights set to 12 volts each and turned on (design three).
5. The voltage and current was measured and taken note of.
6. The overall power output of design was calculated and noted.
7. The building cost of the structure was calculated and noted.
8. The power output of the design was divided by the cost of the structure to show the cost efficiency of the design. This result was taken note of.
9. Steps from 1 – 8 were repeated to the appropriate measure for the remaining designs.

RESULTS

RESULTS (DESIGN ONE):

Table Two: The results obtained throughout testing Design One

Current	Voltage	Power Output	Sample Cost calculations	Power output/ dollar
17.7 amps	2.58 volts	45.67 watts	$140	0.33 watts per dollar

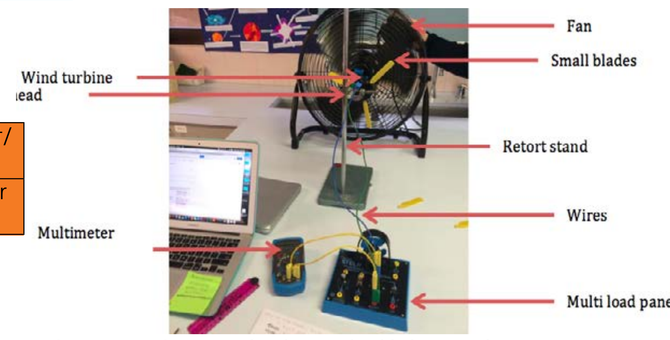


Figure One: Design One - Wind turbine with 3 blades at 20 degrees in series circuit

RESULTS (DESIGN TWO):

Table Three: The results obtained throughout testing Design Two

Current	Voltage	Power Output	Sample Cost calculations	Power output/ dollar
15.7 amps	2.68 volts	42.08 watts	$200	0.21 watts per dollar

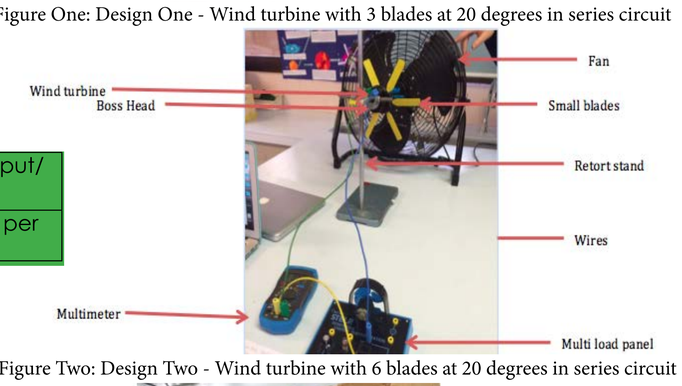


Figure Two: Design Two - Wind turbine with 6 blades at 20 degrees in series circuit

RESULTS (DESIGN THREE):

Table Four: The results obtained throughout testing Design Three

Current	Voltage	Power Output	Sample Cost calculations	Power output/ dollar
14.55 amps	1.88 volts	27.35 watts	$270	0.11 watts per dollar

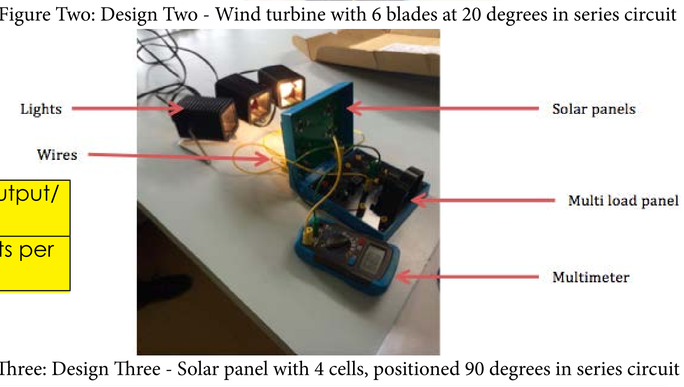
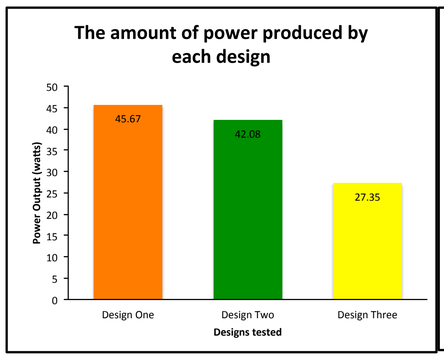
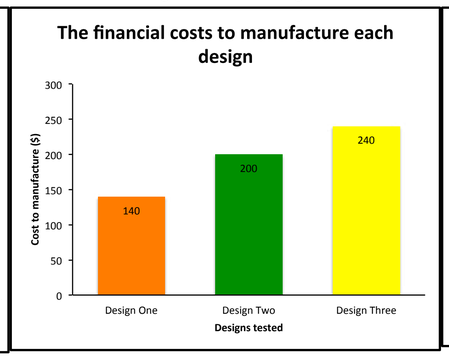
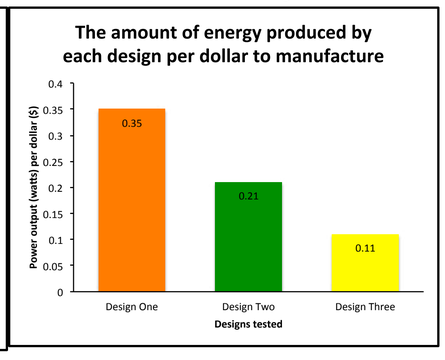


Figure Three: Design Three - Solar panel with 4 cells, positioned 90 degrees in series circuit







DISCUSSION AND CONCLUSION

Data Summary

From the results it can be seen that design one was the most cost effective design. Design one produced 45.666 watts of energy, whilst design two only produced 27.354 watts and design three only produced 42.076 watts of electrical power. There was not a great deal of difference between the amount of electrical power produced by designs one and three, however design three was almost double the cost of design one.

Conclusion

The first design was seen to be the most energy efficient as it produced the most electrical power. It was also the least expensive design as it used very little equipment that did not cost a large sum of money. If one were to choose one of the designs to manufacture, it would most certainly be recommended that they choose the first design due to its results. To further expand on the knowledge gained from undertaking this experiment, one may investigate how wind turbines may be built from less expensive building materials to bring down the extensive cost of the machinery. In doing this investigation, it must be made sure that the wind turbine is still producing similar, if not more, energy than what they already do produce otherwise the there would be no point.

ERRORS

Systematic Error

The amount of voltage was so small that the voltmeter could not pick up a reading, especially when testing with solar panels. This meant that extra time had to be given to the testing time of the solar panels.

Random Error

The voltage and current data being recorded on the multimeter kept on jumping around and could never seem to settle on a number for a long period of time. We came to the conclusion that we would just settle on the largest voltage/current reading shown.

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