Name(s)

Nathan G. Behrens

Project Number

J1001

Project Title

Using the Thermal Mass of a Building to Lighten the Load of an Air Conditioner

Abstract

Objectives/Goals

To determine if the efficiency of the air conditioner (AC) varies over a one-day cycle and if the thermal mass of a house in Bakersfield is sufficient to avoid running the air conditioner at peak daily electrical demand and non-efficient run times.

Methods/Materials

Two experiments were run. First, a three-week heat capacity test was run where data loggers recorded the internal, attic, garage and external temperature while the house was vacant. The vacant house transient data were then used to best fit the heat capacity by matching the calculated and observed internal daily temperature swings. The second experiment was to test if there is a more efficient run time for an air conditioner by recording data from loggers outside, in the attic, at the evaporator inlet and outlet, and at the inlet and outlet vents within the house. Humidity was also recorded at the inlet and outlet vents. The numerous data points recorded were culled down to 400,000 data points covering 22 days and 345 AC cycles. Data taken from the inlet and outlet vents within the house provided the delta H, or difference in enthalpy between the air before and after running through the air conditioner vents and evaporator. By comparing the delta H of air conditioner cycles at different attic temperatures, the most efficient run time can be determined.

Results

It was determined that the heat capacity of a house is large enough to avoid running the AC during the heat of the day in Bakersfield (which allows the AC to run at the coolest part of the day when it is most efficient as determined in the second experiment). With a livable interior temperature of 29°C (84°F), a well insulated house can use the AC only at night even with 35-40°C outside high temperatures. For outside temperatures greater than 27°C, the usable delta H of the AC drops from 4kJ/kg to 0kJ/kg when the attic temperature rises from 35°C to 50°C.

Conclusions/Discussion

It was discovered that a building#s thermal mass was great enough to avoid running the air conditioner if the house is cooled to 22°C by 6:00 A.M. and the maximum outdoor temperature never exceeds 35-40°C, the interior temperature would be 29°C. The air conditioner is most effective when run during the night which also avoids electrical demand peaks and associated high rates.

Summary Statement

The heat capacity of a house was measured and determined to be sufficient to carry the house through the daytime heat allowing the air-conditioning to be only run at night, which was determined to be more efficient.

Help Received

Dad wrote some VBA to pull out data as needed from the data logger output text files and dump it into Excel where I worked it.

Name(s)
Braeden C. Benedict

Project Number
J1002

Project Title
Optimization of the Water Flow Rate in a Clean Energy Electrostatic Power Generator

Abstract

Objectives/Goals
This experiment had two goals. The first goal was to optimize the water flow rate in a Kelvin electrostatic generator to allow the quickest buildup and discharge of charge. The second goal was to demonstrate the feasibility of using such a device to produce clean power for practical uses, such as lighting fluorescent light bulbs.

Methods/Materials
I built my Kelvin electrostatic generator using plumbing parts and other commonly found materials. To conduct my experiment, I set my flow valve to different positions, measuring the resulting flow rates, and measuring the time between discharges across my sparkers. I repeated this process for each flow rate I tested. Controlling unwanted variables such as the humidity and the gap between the sparkers helped eliminate experimental error.

Results
My results showed the higher the flow rate, the quicker the charge built up. An interesting portion of these results were that there seemed to be two separate phenomena occurring. For the flow rates that broke into drops below the inducer ring my graph showed a straight line with a low sensitivity to flow rate. For the flow rates that broke above the ring, the results formed a curve with high sensitivity to flow rate.

Conclusions/Discussion
According to my results, the higher the flow rate, the less time it takes the generator to spark. One of the objectives of this project was to demonstrate the feasibility of this generator to produce clean energy. This small scale electrostatic generator was able to light up a fluorescent light bulb every few seconds. A larger scale setup likely could produce much higher current, allowing it to provide a great deal amount more useable power. The results from this experiment could help in the design of a larger scale electrostatic generator.

Summary Statement
This project is a study of how different water flow rates affect the performance of a clean energy electrostatic generator.

Help Received
My dad operated a stopwatch and supervised my use of power tools. My science teacher taught me the scientific method and encouraged me throughout the project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Alexander W. Bissell

Project Number
J1003

Project Title
Shake Down

Abstract

Objectives/Goals

Shake Down is a project in which I plan to see if I can harness one of the world's most powerful natural forces, an earthquake. I am doing this project because I want to see it is possible to use a destructive force as a power source for house that has been hit by an earthquake.

I predict that my generator will only be able to have a limited amount of power due to the fact of how short earthquakes are but if I lengthen the earthquake's height I believe that there is a higher potential for more energy being produced.

Methods/Materials

Materials:
Balsa house, Electrical tape,10x10 wooden house board, 3½x2X2 wooden blocks, 25x12 wooden main base, brass elbow joints and screws, Shake flashlights, Rare earth magnetic discs, Copper wire and wire-cutter, Multifilament plastic covered wire and wire shredder, Soldering iron, Epoxy glue, Wood glue, Grain of wheat light bulb, Voltmeter, Metronome for timing
Method:
1.Assemble small house, leaving roof off and a small opening for wires to enter and exit. 2.Mark on 10" x 10" board location of generator and the house. 3.Screw down the house to the board. 4.Assemble generator by sawing off the front end of a shaky flashlight. Take the two copper wire ends from the flashlight and solder a covered wire extension to each of the original wires. 5.Glue the generator into place. 6.Solder the extensions to the small light and screw the light into the house and glue the roof on. 7.Attach two elbow joints to the side of the board. 8.Take two of the wooden blocks and attach the other part of the elbow joint to them. 9.Screw the blocks into the main board. 10.Attach voltmeter to the wires leading the house. 11.Set timer for 30 seconds and turn on volt meter. 12.Start timer and rock the upper board until the thirty seconds are up. 13.Observe the highest reading on the voltmeter. 14.Write down observation. 15.Reset timer, place blocks under each side of board to simulate an earthquake with smaller surface waves and shake again.

Results

My results were that electricity was produced from the the movement of the generator, and that the most electricity was produced from the shaking with the blocks.

Conclusions/Discussion

In conclusion it seems that my hypothesis was correct because the generator was able to produce more than one volt of power. One thing I noticed though is that no real earthquake could power the generator I

Summary Statement

My project is about producing emergency electrical power from earthquakes.

Help Received

Dad helped me build the base for my house, John Newby helped me attach my voltmeter, Mom helped glue things on my board.

Name(s)
Lindsay S. Brown

Project Number
J1004

Project Title
Watts Your Angle?

Abstract

Objectives/Goals
The goal of this project was to determine the best tilt angle for a solar panel to generate electrical power.

Methods/Materials
I aligned the solar panel at true south or the azimuth angle at 180 degrees. Testing was conducted between 11:30 AM to 12:30 PM when the sun was at its peak altitude. I increased the tilt angle by 5 degrees between 0 and 90 degrees. I recorded the voltage across the resistors using a multi-meter for each tilt angle. Then I converted the voltage into power for each tilt angle and plotted output power versus tilt angle.

Results
My results showed that the output power at 0 degrees tilt was on average 39% less than the maximum power observed. Once the power leveled off, little change occurred until 65 to 70 degrees tilt angle when output power declined at a much slower rate than the initial rise. The output power at 32 degrees was usually only 3 to 5% less than the maximum output power. The absolute best tilt angle was 55 degrees for the period of time I did these experiments. These times just happened to coincide with the time of the winter solstice.

Conclusions/Discussion
If I pick the right tilt angle for my solar panel I can get more power up to a certain point. Since the difference in output power between 47 and 55 degrees was only 0.2%, 47 degrees turns out to be a good compromise between 32 and 55 degrees during the winter months. I noticed that there was only a 3% difference between 32 and 55 degrees. Just laying a solar panel flat on the ground or at 0 degrees tilt angle has 37% less output power than the maximum at 55 degrees. I believe that investing in a mechanical tracking system for tilt angle would not be worth it. You can manually adjust the tilt angle of your solar panels but you would have to decide for yourself how often you really need to. It may even be acceptable to just leave your solar panels at 32 degrees all year long.

Summary Statement
The objective of this project was to determine the best tilt angle for a solar panel to generate electricity.

Help Received
Grandfather helped build tilt angle measuring device; Professor Rick Moyer answered questions about project; Mom bought materials; Dad helped with motivation.

Name(s)

John E. Carrion

Project Number

J1005

Project Title

A Comparison Between Angled Reflectors and Flat Reflectors on Solar Panel Voltage

Abstract

Objectives/Goals

The objective is to determine whether flat reflectors or angled reflectors produce more electricity in solar panel voltage output. Last year I tested flat reflectors, reflecting light on to a solar panel, to determine if it was an efficient way to produce electricity. That project made me wonder what would happen if I angled the reflectors instead of keeping them parallel to the face of the solar panel.

Methods/Materials

Two solar panels, a 1000 watt spot light, black foam board (control background), white poster board (white reflector), Foil, and two mirrors. I compared three different reflective surfaces shining light onto two solar panels back to back (one facing direct light, one facing the reflector) and measured the voltage output of the solar panels. I tested the panels with the light source starting at 90 degrees to the face of the solar panel, and then moved in ten degree increments, all the way down to 0 degrees (simulating the sun at the horizon).

Results

Overall, white reflectors worked best. The mirrors were the best at 70 degrees but dropped off at all other angles because of the law of specular reflection. Foil was more like a muffled version of the mirrors.

Conclusions/Discussion

My conclusion, based on this two year project, is that white reflectors are the overall best reflector due to diffused reflection, regardless of whether they are flat or angled. Mirrors were the best at 70 degrees so if you could get the mirror to track the movement of the sun that would be ideal.This project proves that reflectors reflecting light onto a solar panel mounted back to back with another solar panel is an efficient way of using light to produce electricity.For places where space for solar panels are limited you could still have a good supply of energy being produced.

Summary Statement

My project proves that angled white reflectors produce electricity more consistantly and more efficiently than any other reflector at any angle.

Help Received

My dad helped build my display board and lended a hand when two hands were not enough.

Name(s)

D. Alex Carroll

Project Number

J1006

Project Title

Determining the Best Angle for Absorbing Photons

Abstract

Objectives/Goals

The objective of this lab was to determine at what angle solar cells produce the most electricity. I believe that if a solar cell is perpendicular to a light source then the solar cell will produce the most electricity, because the solar cell will absorb the most photons when the light source is directly above it.

Methods/Materials

The leads from a digital multimeter were attached to a solar cell module. Then the solar cell module and a skewer were attached parallel to the surface of a tilt mirror, and a protractor was attached perpendicular to the side of a tilt mirror. A lamp with a 150w incandescent light bulb was placed 4.5" above the solar cell module. The skewer was placed at 10° intervals on the protractor (90-180) and the amount of electricity produced at each interval was recorded. The experiment was repeated two more times.

Results

The average electrical output for the 3 trials ranged from 1082mV at 90° to 792mV at 180°. In each trial as the angle was increased by increments of 10°, the electrical output decreased.

Conclusions/Discussion

The lab showed that when the solar cell was perpendicular to the incandescent light source it generated the most electricity, because the solar cell absorbed the most photons when the light source was directly above it. Solar cells have many environmental benefits, so it is important to find out the best ways to make them efficient at producing electricity. Since solar cells are most efficient when perpendicular to the sun instead of having to move the solar cells so they follow the path of the sun, a way to improve the solar cell module may be to make it in a sphere shape so that photons are captured no matter what the angle of the sun.

Summary Statement

My project was about measuring the amount of electricity created when photons are absorbed by a solar cell module when it is placed at different angles to a light source.

Help Received

My science teacher and aunt inspired the idea for the project and reviewed my procedures. My mother provided help in getting my research and materials, and reviewed the layout of my board. My sister helped photograph the procedure.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Anshul B. Chandan

Project Number

J1007

Project Title

Solar: Saving the Earth One Panel at a Time

Abstract

Objectives/Goals

The objective of this experiment was to find how the angle and direction a solar panel faces affect the amount of electricity it generates. The goal was to find which angle and direction would be best for a solar panel to capture the most sunlight and, thus, generate more electricity in winter and spring. It is inferred that the panel facing south and has an angle of 45º will generate the most electricity because the equator is south of California and 45º is an angle where it will be able to get sunlight when the sun is both in the west and almost directly hitting the panel.

Methods/Materials

After placing the three five watt panels in a flat open area, the panels facing north and south were propped up to a 30º angle while the third was placed at 0º equidistant from the other two. Then, every other hour from 9 a.m. to 3 p.m. the milli-amps (mA) and voltage of each panel was recorded using a multimeter and alligator clips. This was repeated on three separate days all of about the same weather but changing the angle of the north and south panels to 45º and 60º. The experiment was conducted in winter and spring which allowed two sets of data to be collected.

Results

From the data collected it was concluded that, in the winter, the panel at 60º and faced south generated the most electricity at 410 mA at its peak. The data collected also showed that in the spring the panel at 45º generated the most electricity with 440 mA at its peak. The daily winter averages for the panel facing south were 248 mA for 30º, 244 mA for 45º, and 287 mA for 60º. The daily spring averages for the panel facing south were 363 mA for 30º, 370 mA for 45º, and 315 mA for 60º. The voltage of the panels was about 19.7, thus, making all the readings accurate. The panel at 0º stayed around 160 mA in winter and 323 mA in spring. Some days seemed to have few clouds or more sunlight than other days. The sun was pretty low in the sky during winter trials while it was pretty high in the spring.

Conclusions/Discussion

The hypothesis created was supported. The hypothesis that said that the 45º angle of the panel facing south would generate the most electricity was supported in the spring because it had the highest milli-amps compared to all the other panels. During the winter, however, the panel facing south with an angle of 60º generated the most electricity. The panel facing south always generated more electricity than the other two panels.

Summary Statement

The purpose of this project was to find the optimum angle and direction of a solar panel in order to generate the most electricty throughout the day.

Help Received

Dad helped set up experiment and helped make board; Mom helped print papers and get materials for board; Ms. Fisher corrected all information in the notebook; Mrs. Diaz read over annotated bibliography, bibliography, notes, and research report and corrected them.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Sara K. Davis

Project Number

J1008

Project Title

Nanocrystalline Dye-Sensitized Solar Energy II

Abstract

Objectives/Goals

This project is further to my 2009 science project. The objectives were: (1) to compare the photovoltaic energy generation capabilities of conductive glass-based and conductive polymer film-based Graetzel solar cells; (2) to determine if a polymer film solar cell generates more energy from exposure to sunlight than from lamplight; and (3) to see if a polymer film cell is capable of sustained energy generation over a several-day period.

Methods/Materials

I made several Graetzel solar cells from conductive polymer film, with filtered juice from dark red flower petals as the primary reactive agent. Then I conducted a series of experiments to measure photovoltaic energy generation from those cells when exposed to lamplight compared to sunlight. Next I compared the energy generation data from my 2009 science project (which involved conductive glass-based solar cells) with the results from this year's project (using conductive polymer film-based cells). Then I conducted a series of experiments over three consecutive days to see if conductive polymer film-based cells could sustainably generate photovoltaic energy.

Results

A conductive polymer film-based cell produced a stronger electric charge, when exposed to either lamplight (263% more energy) or sunlight (51% more energy), than a similar solar cell made with conductive glass. Polymer film cells produced from 18.1% to 47.5% more energy when exposed to sunlight than to lamplight. When three sets of polymer film cells were exposed to sunlight over several days there was an increase in energy generation by anywhere from 142% to 211% from day 1 to day 2, with those levels generally sustained through day 3.

Conclusions/Discussion

I learned: (1) that conductive polymer film-based Graetzel solar cells generate measurably more low-level electrical voltage than conductive glass-based photovoltaic cells when exposed to either artificial lamplight or natural sunlight; (2) that polymer film-based cells generate more energy when exposed to sunlight than to lamplight; and (3) that conductive polymer film cells, when exposed to sunlight, are able to generate energy on a sustainable basis for a minimum of several days. The results of this second project indicate that further, longer-term research into the comparative efficiency, durability, and sustainability of conductive polymer film cells versus conductive glass cells could be helpful and illuminating.

Summary Statement

Generation of electricity from simple conductive polymer film-based photovoltaic solar cells, using plant juice.

Help Received

Mother supervised experiments, and helped construct backboard; father proofread and edited logbook.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Paul A. Dennig, Jr.

Project Number

J1009

Project Title

Solar Concentrators for Battery Chargers

Abstract

Objectives/Goals

While many people in poor countries don't have electricity, the fuels in wealthy countries produce pollutants. Solar power is a clean alternative but is unreliable due to cloudy days or nighttime. We can solve this problem by storing solar energy in batteries. However, solar cells are still expensive, and the solar battery chargers below $80 are inefficient. I want to create efficient concentrators for solar battery chargers that can keep the cost down by reducing the area of solar cells. Eventually, I want to achieve a voltage >1.5V and a current >100mA under $15 for charging one AA battery.

Methods/Materials

My research question was: which design would be the cheapest and most efficient? First, I built 4 systems: (1) a control, (2) a big metal bowl with a suspended cube of solar cells, (3) lenses over solar cells, and (4) small mirrored cups with cells inside. They were put on a table at noon and aimed at the sun. Then, over 3 days from 9:00 AM to 4:00 PM, 3 repeated measurements of the current and voltage were taken each hour. Next, I tested the winner(s) by attaching an AA battery. My materials were: 24 of 1 x 1 sq cm 20 mA cells, a fruit container, spray paint, a metal bowl, Fresnel lenses, a multimeter, NiMH rechargeable batteries, 8 of 100 mA cells, and supplies.

Results

The control provided the highest energy output at 850 Joules a day and was the cheapest at $6.23. The bowl was the worst performer. The lenses produced a little more energy than the cups, but were twice as expensive as the cups. However, I could not put much charge in a battery with the control; the current and voltage dropped substantially when the battery was attached. Therefore, I decided to switch to larger 100 mA solar cells and learned that about 2 volts were needed to charge one AA battery. Furthermore, it took 8 solar cells to reach the maximum charging current of 100 mA, many more than I had expected.

Conclusions/Discussion

I have learned how to achieve my objectives. Though the control performed the best, the cups are very promising. The cups' peak current was higher than the control's. The cups' poor performance at the end of the day was because the sun couldn't reach the cells well. I plan to improve the cups in the future. In addition, I learned the solar cell voltage must be quite a bit higher than the battery's for it to charge efficiently.

Summary Statement

My project is about how to use novel, low-cost solar concentrators to enhance the performance of solar cells when charging batteries.

Help Received

Dad taught me how to use Excel, a soldering iron, and some electrical equations. Mom helped with editing and taking photos. My science teachers Mrs. Amsden and Mrs. Sterne reviewed my notebook and application.

Name(s)

Michael H. Do

Project Number

J1010

Project Title

Harvesting Healthy Energy from Exercise

Abstract

Objectives/Goals

The objective is to calculate the efficiency of converting human exercise kinetic energy into electricity.

Methods/Materials

A voltmeter, generator, and digital oscilloscope were used to determine the frequency of the electrical current. Various equations were used to determine input energy and output energy. Lastly, the efficiency was calculated.

Results

The average efficiency of all of the voltages was equal to about 25%, which was very close to what was hypothesized. Not only that, but the efficiency gradually increased from 11% to 35% as the voltages increased. This is possibly due to the nonlinear characteristics of the electrical generator at low and high voltages. There was a tendency that the voltages would saturate at the higher end of the frequencies.

Conclusions/Discussion

Using a generator to convert kinetic energy into electricity is more efficient at high speeds. Using an industrial generator with more efficient materials used would be more efficient and therefore result in a higher efficiency.

Summary Statement

Exploring the efficiency and feasibility of converting human biomechanical energy into electricity,

Help Received

Dad helped learn about project; Mom helped make board; Teacher helped write reports.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Natalya Dreszer

Project Number

J1011

Project Title

Catching the Wave: Capturing the Wave Updraft for a Brighter Future

Abstract

Objectives/Goals

This experiment was about getting enough energy from an ocean wave in 24 hours to power a light bulb for a days use.

Methods/Materials

I used a tube 10cm in diameter fitted with a fan working as a wind turbine and recorded the volts and amps that a rising wave could produce.

Results

My calculations told me that 2,640 tubes would be needed to power a light bulb in a day. I also calculated that around 76.5 by 76.5 meters of ocean surface would be required to power a household.

Conclusions/Discussion

Even though it is improbable that a house will be powered by ocean waves any time soon, small lighthouses and warning buoys could definitely be powered with this technology today!

Summary Statement

I built a tube with a fan to measure how much energy I could get out of and ocean wave and I found out that I would need 2,640 tubes to get enough energy to power a light bulb for a days use in twenty-four hours.

Help Received

I would like to acknowledge my dad, who made sure I finished everything on time, and made sure I didn¡#t fall off the cliffs time and time again. ƒæ I would also like to thank my science teacher, Mr. Atchley, who read through countless reports and inspired us all.

Name(s)

Ellie F. Gifford

Project Number

J1012

Project Title

When It Rains, It Shines: Optimizing the Efficiency of Home Hydropower

Abstract

Objectives/Goals

The purpose of this experiment was to see how much electricity could be generated by connecting rain gutters to a Pelton wheel generator. This could complement home solar power which is popular but doesn't work when it is raining.

Methods/Materials

I made a Pelton wheel generator and tested this system with the water at two different heights, using four different water nozzles with different flow rates. For each of these conditions, I calculated the potential energy, kinetic energy, and electrical energy. Based on these numbers I then calculated the efficiency of the system. Finally, I calculated how much energy could be generated from rainfall on an average American home roof in a rainy area.

Results

I had a maximum of 1.08% overall efficiency. The highest generator efficiency was only 2.22%.

Conclusions/Discussion

I learned that each element of this system needs to be optimized and matched to the others to achieve high overall efficiency. I also calculated that even an efficient system would only generate a dime of electricity in an entire year, which is not a great investment.

Summary Statement

I studied whether it would be possible or practical to generate electricity from rainwater falling on the roof of a house.

Help Received

My dad helped me make the wheel and nozzles in his machine shop. He also helped me with my testing and calculations, as you have to take many measurements at the same time. My mom helped me with my display board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Sarah K. Hantke

Project Number

J1013

Project Title

Analyzing Solar Cell Efficiency When Using a Sun Tracker

Abstract

Objectives/Goals

The objective is to determine if a solar cell attached to a sun tracker is more efficient than a stationary solar cell perpendicular to the sun's rays at noon. The scientist believes that the sun tracking solar cell will be approximately 20% to 30% more efficient due to the fact that throughout the day the cell remains perpendicular to the sun's rays. Assuming the scientist's belief is accurate, a secondary objective is to determine the increased efficiency after considering the power required by the tracking apparatus.

Methods/Materials

A device that contained two solar cells was fabricated. The first cell was fixed in a position perpendicular to the sun's rays at noon. The second cell was attached perpendicular to a rotary table whose plane was parallel to the sun's rays. A tracking device rotated the table, thereby ensuring that the second cell directly faced the sun throughout the day. Each solar cell was attached to a 55 Ohm resistor and a data logger. Experiments were conducted over a ten day period. The data was then converted, through a series of equations, into power. In order to obtain meaningful results, measurements were made in different weather conditions. Separate measurements were also performed to determine the amount of power required by the tracking system.

Results

The results showed that the sun tracking solar cell was 76% more efficient than the stationary solar cell. When the power consumed by the tracking system was taken into consideration, the overall efficiency increase dropped to 54%.

Conclusions/Discussion

The scientist's hypothesis was supported by the results of the experiment. What was not anticipated was the degree to which the sun tracking cell's output improved. The scientist had expected an increase of about 20% to 30%. Solar energy production is already very popular. The results suggest that more emphasis might be appropriate for installing sun tracking solar arrays over the more commonly found fixed arrays. Additional research can determine if dual axis tracking systems yield even greater increases in efficiency.

Summary Statement

This project is designed to measure the increased efficiency of a solar cell mounted on a sun tracking turntable versus a fixed solar cell positioned perpendicular to the sun's rays at noon.

Help Received

Father supervised me soldering, using a lathe, and during the fabrication process; father explained some equations

Name(s)
Joanie M. Kalmbach

Project Number
J1014

Project Title
Solar Angle?

Abstract

Objectives/Goals
I wanted to test whether the power solar panels produce is affected by the angle at which they are mounted. I thought the angle that the solar panels are mounted play a significant role in the amount of power they produce, because the solar panels produce the most power when they are perpendicular to the sun. As the earth rotates, the path of sunlight constantly changes, therefore, causing the solar panels to produce different amounts of power at various times.

Methods/Materials
I had three different types of panels: monocrystalline, polycrystalline, and monocrystalline-hybrid. I chose four different angles to mount the panels at, and then used a volt meter to record the amount of power each panel produced at the different angles. To find the angle at which the panel would be perpendicular to the sun, I subtracted the suns altitude angle obtained from the U.S. Naval Observatory website from 90 degrees. On the first set of tests, this angle was 58.3 degrees (90 degrees-31.7 degrees). On the second set of tests, this angle was 59.7 degrees (90 degrees-30.3 degrees). The first set of tests took place at 1:45 p.m. The azimuth angle at this time was 206 degrees. The four angles I used on all of the panels, during the first set of tests, were 70 degrees, 58.3 degrees (this angle placed the panel perpendicular to the sun), 42 degrees, and 28 degrees. The second group of tests took place at 2:00 p.m. The azimuth angle at this time was 210 degrees. The four angles I used on all of the panels, during the second set of tests, were 70 degrees, 59.7 degrees(this angle placed the panel perpendicular to the sun), 42 degrees, and 28 degrees.

Results
According to the test averages, the monocrystalline-hybrid solar panel was least affected by the change in angle, and the polycrystalline was the most affected by the change in angle. This leads me to believe that the monocrystalline-hybrid would be the most productive because the earths rotation causes the sun angle to change constantly throughout the day.

Conclusions/Discussion
My hypothesis was supported because I thought that the angle the solar panel was mounted would affect the amount of power the panels produce. My data shows that all of the panels were affected by the change in angle; however, the monocrystalline-hybrid was the least affected, which means it would be the most productive throughout the day.

Summary Statement
My project determined how solar panels power production is affected by the angle at which they are mounted.

Help Received
performed experiments at home; dad helped set up solar panels

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

David Kayekjian

Project Number

J1015

Project Title

Biomass to Natural Gas: An Alternative Energy Solution

Abstract

Objectives/Goals

My objective was to determine what type of biomass: acidic, basic, or neutral mixed with cow manure will improve the production of biogas. I hypothesized that neutral biomass mixed with cow manure will improve the production of biogas.

Methods/Materials

I built 25 identical biogas generators using 2 liter soda bottles, Mylar balloons, corks, T-adapters, and vinyl tubing. Five of the generators were filled with cow manure + broccoli (pH 7.5 basic) + distilled water (test #1), five generators were filled with cow manure + cauliflower (pH 7.0 neutral) + distilled water (test #2), five generators were filled with cow manure + quince (pH 3.1 acidic) + distilled water (test #3), five were filled with cow manure + quince + broccoli + distilled water (test #4), and five were filled with cow manure + distilled water (control). I placed the biogas generators in a room with a constant temperature of 35 degrees C for 26 days. I measured the circumference of each balloon in cm every day and checked the flammability of the biogas produced by each generator.

Results

My control, with cow manure only, produced the most amount of biogas and the gas produced was flammable. Test #2 (neutral) was second and the gas produced was flammable. Test #3 (acidic) was third and the gas produced was not flammable. Test #4 (basic + acidic)was forth and the gas produced was not flammable. Test #1 (basic) was last and the gas produced was flammable. My control, test #1 and test #2 were successful because the pH level of the slurries were not too basic or acidic. Test #3 and test #4 were not successful because the slurries were too acidic.

Conclusions/Discussion

Acidity is a major factor in anaerobic decomposition. If the mixture of the slurry is too basic or acidic the fermentation slows down. Test #3, cow manure + quince, and test #4, cow manure + broccoli + quince stopped producing biogas during the second week because the high acidity stopped the methane producing bacteria from producing methane and the gas produced was mainly carbon dioxide. Anaerobic decomposition is a two stage process. In the first stage, acidic bacteria dismantle the complex molecules into simpler compounds and mainly carbon dioxide is produced. In the second stage methane producing bacteria convert simpler compounds into methane. My control, test #1, and test #2 were successful because they produced biogas throughout the 26 days and the gas produced was flammable.

Summary Statement

Organic materials from animals and plants, through an anaerobic decompostion, can be trasnformed into useful energy (methane gas) that can be usesd for cooking and heating.

Help Received

My father helped me build my biogas generators. Paul Harris from the University of Adelaide helped me with some complications that I had.

Name(s)
Khush M. Kharidia

Project Number
J1016

Project Title
Power Your Gadgets Using a Green Outlet All the Time

Abstract

Objectives/Goals
Climate change and controlling greenhouse emissions has become a major issue. The U.S. has a goal of getting 25% of the country's energy from renewable resources by 2025. Energy usage in households has increased 15% due to the exponential growth of electronic gadgets. I am motivated to address the energy issue by providing a low cost solution for generating clean energy for every household. My project demonstrates that you can charge and operate electronic gadgets used in a household without using an electric outlet.

Methods/Materials
I used a 10W solar panel, a 5W wind mill, and a 1W human powered bicycle to convert renewable energy and store it in the battery. I used a two battery system. The energy from renewable resources is stored in one battery while the other battery is used to charge and operate the electronic gadgets. Each battery's function is switched daily. The two battery system allows an uninterrupted operation under all weather conditions. The regulator converts the battery voltage into 3V-8V needed by the appliances.

Results
The daily power required to operate the electronic gadgets in my house is 8 Wh. The average daily power generated using solar, wind, and human power is 22.5 Wh. This shows that the power from renewable resources is sufficient to operate the electronic gadgets and keep the backup battery charged. I charged and operated all 3V-9V electronic gadgets for two weeks using the clean energy adapter. The time it took to charge the electronic gadgets using the green outlet was similar to the time it took to charge them using an electric outlet.

Conclusions/Discussion
I was able to charge my electronic gadgets using the clean energy adapter under all weather conditions. If every household in the U.S. uses the green outlet, 2,750 mega watts of energy can be saved every day. More importantly, a different electric adapter for each gadget is no longer needed. My adapter design has multiple terminals which allow simultaneous charging of multiple gadgets. I learned about the parameters that can affect wind power and about series and parallel connections.

Summary Statement
Operating all electronic gadgets using renewable energy generated at home at a low cost.

Help Received
Father helped get material and make adapter; Mrs. Castagna and Mrs. Makhijani helped correct papers

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Ankush R.K Khemani

Project Number

J1017

Project Title

The Effect of Dust on the Performance of Photovoltaic Solar Cells

Abstract

Objectives/Goals

My objective is to find the effect of dust on the performance of Photovoltaic Solar Cells. My goal is to demonstrate that increasing dust particles will decrease the ability of photovoltaic cells to convert light (sun, lamp) into electricity.

Methods/Materials

Materials:

1.Photovoltaic Solar Panel; 2.Multi-meter; 3.Six identical large Glass Jars filled with clean water; 4.Talcum Powder; 5.250W Halogen Lamp; 6.Digital scale and a 1L Graduated Cylinder.

Methods:

1.Measure the output of the photovoltaic solar panel by recording the milliAmp (mA) in sunlight by placing a clear Glass Jar filled with clean water between the PV Solar Panel and the Sunlight. 2.Add a half teaspoon of talcum powder to a 2nd clear Glass Jar filled with water, shake vigorously to disperse the talc, and measure the PV Solar panel's mA output with the Multi-meter. Take readings three times for each experiment and record the average mA in the data table. 3.Using a separate Glass Jar for each experiment, continue to increase the amount of talcum powder suspended in water by half a teaspoon each time until it reaches two and a half teaspoons, and record the PV Solar panel mA output similarly as described in step-2. 4.Calculate the parts per million (ppm) of talcum powder in each jar. 5.Repeat steps one through four using a Halogen Lamp as the light source instead of Sunlight.

Results

1.As seen from graphs, increasing the amount of dust from zero to 2067 ppm resulted in a steady decline of the mA output of the PV Solar Panel. I also found that the light was almost completely blocked out at the dust concentration of 2067 ppm.

2.The mA output of the PV Solar Panel in uninterrupted sunlight and uninterrupted halogen light is higher than the mA output of the clean water-filled glass jar experiments. This shows that even clear water does not let 100% of the light from going through the jar, and therefore suggests that a high moisture concentration in the atmosphere would also reduce the mA output of a PV Solar Panel.

Conclusions/Discussion

1.Increasing concentrations of dust in the atmosphere can reduce the amount of electricity being generated by a Photovoltaic Solar Cell.

2.A dust concentration of about 2067 ppm in the atmosphere will block the sunlight and be almost the same as having a PV Solar Cell in the shade.

Summary Statement

My Project is about finding the effect of dust pollution in the atmosphere on the energy capture efficiency of a Photovoltaic Solar Panel.

Help Received

Father helped with shopping for materials and putting the posterboard together.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Annie M. Kingman

Project Number

J1018

Project Title

Wave Rider

Abstract

Objectives/Goals

The goal of my project was to find out if a buoy could be 'tuned' to a wave in order to maximize energy output. If this was possible, wave energy devices could be altered in order to get the most energy out of each wave.

Methods/Materials

I used a wave 'tub' with a buoy apparatus which was filmed and evaluated to collect data. The waves were made with consistent strokes of a board every second for 60 seconds. When the buoy floated up and down on the water a needle lifted the end of a dashpot (the resistance or work the wave is doing.) There was three different dashpots tested: air, water and oil. The end of the needle moved up and down next to a ruler which was filmed. Afterwards, I looked frame by frame on the movie and evaluated the average hight and depth of the needle. I changed the depth of the buoy by adding different amounts of weights to it, and perhaps 'tuning' the buoy to the wave.

Results

The prime number of weights for each dashpot were: one weight to the air dashpot, two weights to the water dashpot, and three weights to the air dashpot. Contrary to my previous belief, no weights with the air dashpot was not the best. The reason was because the farther down the buoy was in the water, the more it sprung back up. After the waves got into a rhythm, the weighted buoy would spring back up higher and higher.

Conclusions/Discussion

In conclusion, the one weight to air dashpot was the best. The reason was because the buoy started to spring up and down harder and harder as the waves and buoy became rhythmic. It is possible to tune a buoy to a wave, and it can help improve the amount of energy collected. Therefore, wave energy devices could be altered in depth to get the most energy out of each swell. The best location for a device like this would be further off shore because the waves are more consistent and repetitive.

Summary Statement

Tuning a buoy to a wave to maximize energy output.

Help Received

Engineer at Dad's work helped with dashpot, Dad helped with powertools

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Kelley J. Kramer

Project Number

J1019

Project Title

Solar Cells in Motion

Abstract

Objectives/Goals

The objective is to determine how the angle of the suns affects the ability of a solar cell to collect energy.

Methods/Materials

A solar landscape light was used as a solar cell and placed six inches from a 100 watt UV light bulb that represented the sun. An amperage meter was connected to the solar cell to measure the current at the solar cell. The light bulb could be moved from 0° to 90° at 15° intervals.

Results

Five trials were conducted at each interval (0°, 15°, 30°, 45°, 60°, 75°, and 90°) and the current was measured for each angle. The average of the five trials was recorded. The results showed that when the light source was at a 0° angle from the solar cell, the current measured 3.71mA. As the angle increased the current decreased to .02mA at 90°.

Conclusions/Discussion

As the angle of the sun to the solar cell increases, the ability of the solar cell to collect the sun's energy decreases. Once the light is at an angle greater than 45° then the energy at the solar cell is reduced by 37%.

If the solar cell cannot track the sun, then at what angle/reduction is a fixed solar cell a viable option for producing electricity?

Summary Statement

My project is to investigate how the angle of the sun affects the ability of a solar cell to collect energy.

Help Received

Father helped with construction of board; Mr. Spandikow (science teacher) helped with inspiration.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Lamby C. Kreeger

Project Number

J1020

Project Title

Solar Cells: Will They Sprout in the New Green Economy?

Abstract

Objectives/Goals

As global warming concerns grow, a source of power which does not add to global warming becomes more and more important. Solar power is an obvious candidate to replace things such as coal and gas for creating electricity. However, it must make economic sense before solar power can replace existing sources of power. I investigated exactly how important the amount of sunlight was to a solar cell's ability to produce electricity. If a little less sunlight results in only a little less electricity being created, then the solar cell might be economical under less than perfect conditions. If I was to take away a little amount of light and a big amount of the solar cells electricity went away then the solar cell would not be economical or practical. For my project I tested solar cells with different light intensities and recorded the amount of electricity that the solar cells gave off.

Methods/Materials

To do this I built a box that I placed the light bulb and the solar cell in. Using different size bulbs, I would measure the amount of electricity the solar cell gave for a given light intensity. I measured the light intensity of each bulb with a light meter.

Results

I found that as the light intensity went down, the amount of electricity produced by the solar cells went down by about the same percentage. This was very clear because the graph of light intensity vs. solar cell output was linear.

Conclusions/Discussion

This means you may be able to place a solar plant at a place that is cheaper or easier to build at but has less light than a more expensive place. I believe that solar power is great for the environment and the economy and people should start using it more to get one step closer to a healthier planet.

Summary Statement

I investigated the efficiency of solar cells relative to the amount of light they receive in order to determine if solar energy can be economically feasible in places with less sunlight.

Help Received

My dad helped me build and put together the box and he helped me with soldering the solar cells to the wires. He also helped me with the wording of some of my papers for the display board. My mom took pictures of me doing the project for me to put on my board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
David G. Mariscal

Project Number
J1021

Project Title
Using Passive Solar Design to Cool and Heat a House

Abstract

Objectives/Goals
My project is about passive solar design,and how it uses the sun position in the sky during winter and summer, to heat and cool a building without an A.C. or heater. For this project I conducted a series of four experiments that simulate the sun position during summer and winter. The purpose of these experiments is to demonstrate how a model home using passive solar design can collect heat during the winter and reject heat during the summer.Because they rely on the sun, a renewable resource, passive solar homes and buildings can lower their energy bills and greatly reduce green house gases that contribute to global warming.

Methods/Materials
I determined the sun position for summer(68 degrees)and winter(22 degrees)at latitude 45 degrees. I made a cardboard triangle to help position a heat lamp(the sun)and measure how far away to place the model house. For Experiments 1 and 2(summer cooling)I used a heat lamp at 68 degrees and marked the temperature in and out of the model home at 30 second intervals for 5 minutes. For Experiment 2, I placed two trees in front of model house. For Experiments 3 and 4(winter heating)I used a heat lamp at 22 degrees and marked the temperature at 30 second intervals for 5 minutes. I turned off the heat lamp and measured the temperature at 30 second intervals for another 5 minutes. For Experiment 4, I used a clear glass dish with 4 ounces of water as a thermal mass storage device.

Results
Experiments 1 and 2 showed that a home using passive solar design can reject heat during summer. I was surprised by the temperature differences between the inside of the house compared to the outside during the summer especially with shady trees. Experiments 3 and 4 showed that a home using passive solar design can retain heat during winter. The thermal mass storage made a difference in storing the heat and keeping the inside temperature even for a longer period of time.

Conclusions/Discussion
I believe my project proves that passive solar design can reduce energy demands for winter heating and summer cooling. The best part about using the sun for heating and cooling buildings is that solar energy is free. Buildings that use passive solar design can cut their energy bills significantly. By using less electricity to run air conditioners or natural gas to fire furnaces, passive solar design can also help reduce green house gas emissions and global warming.

Summary Statement
My project is about passive solar design, and how it uses the sun#s position in the sky during winter and summer, to heat and cool a building without an A.C. or heater.

Help Received
My father helped me build the model house, My mother advised me on the design of the board.

Name(s)

Christie S. Mathews

Project Number

J1022

Project Title

Future Fuel

Abstract

Objectives/Goals

In 2008 alone the US used 23% of the world's oil consumption i.e., more than 7.14 billion barrels of petroluem. This number grows drastically each year. The world's oil wells are running dry. Not only is petroleum nonrenewable, it is also hazardous to the environment. Prolonged exposure to gasoline is hazardous to health and spills can cause much biological loss. We need an alternative fuel source which is renewable and safe for the environment.

The purpose of my project was to see if a biofuel such as ethanol has the potential to sustain the world with a renewable and environmentally safe fuel. I tested gasoline and ethanol for the energy content and the particulate matter emitted when the fuel was burned. I had hypothesized that gasoline would have a higher energy content than ethanol, but ethanol would produce far less particulate matter than gasoline.

Results

Ethanol overall had more calories per gram than gasoline while emitting far less particulate matter than gasoline. Ethanol produced an average of 741.55 calories per gram, while gasoline produced an average of 512.87 calories per gram of energy. The average mass of the particulate emission of ethanol was 1.28725 micrograms of particles per cubic centimeter while the particulate emission of gasoline was 635,667 micrograms of particles per cubic centimeter. My control group which was normal air had an average mass of 0.85063 micrograms of particles per cubic centimeter.

Conclusions/Discussion

The mass growing and selling of corn for ethanol could cause economic and pollution problems. One possible answer to this problem is something called cellulosic ethanol. Cellulosic ethanol is made from nonfood sources such as wood chips, switch grass, and cornstalks. If the ethanol industry develops into a large enough producer then cellulosic ethanol could be a real low cost solution in the ethanol versus gasoline debate. More research needs to be conducted to find new and cheaper sources of ethanol.

Summary Statement

Can ethanol replace gasoline as the fuel of the Future?

Help Received

Used lab equipment at University of California, Riverside under supervision of Dr. Paul Ziemann, Professor of Air Pollution.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Austin I. Miller

Project Number

J1023

Project Title

Pull the Plug on Wasted Energy

Abstract

Objectives/Goals

The purpose of this experiment was to determine if common household devices that remain plugged in during the time they are not being used would consume a significant amount of electricity. I believed that appliances would vary greatly in the amount of energy they consumed while 'off', but still plugged into an outlet.

Methods/Materials

In this experiment, 16 different household electrical appliances were tested using two 'Kill a watt' power meters, which measure the kilowatt hours used by an appliance. Each device was tested in its 'on' state for 30 minutes. The devices were also tested in their 'off' state for 5 hours; measurements were recorded at the end of the time interval.

Results

After 100 hours of testing, my results showed the computer (CPU) consumed the greatest amount of electricity when it was in its 'off' state. The computerized washing machine consumed the second greatest amount of electricity in its 'off' state, and the next greatest was the computer monitor. Assuming a 15 cent per kWh cost, this electrical consumption would amount to approximately $130 a year. While $130 might not seem like a great deal of money, this money also represents wasted energy. It was also noted that one of the appliances that was tested had lights on during its 'off' state, but the 'Kill a watt' meter did not register any electricity being used. A more sensitive, expensive metering device may be required to detect some of the lower, steady consumers of electricity.

Conclusions/Discussion

While each individual device may not use a great quantity of electricity in its 'off' state, having many appliances plugged in over time may amount to a significant waste of electrical energy. If every household across America wastes energy needlessly in this manner, it can add up.

Summary Statement

The purpose of this experiment was to determine if common household devices that remain plugged in during the time they are not being used would consume a significant amount of electricity.

Help Received

Thanks to my science teacher who game me guidance and encouragement. Thanks to my parents for supervising my testing.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Jacob Ryan Moe

Project Number

J1024

Project Title

Gas of the Future

Abstract

Objectives/Goals

The objective of this project was to determine which kind of wood could produce the greatest volume of wood gas in the fastest time during gasification? My hypothesis was: Almond wood will produce the greatest volume of wood gas during gasification in the quickest time.

Methods/Materials

Three types of wood were tested, almond, cedar, and redwood. They were tested five times each using a volume of 30 grams of wood each time. The gases were collected and measured by filling a 9 inch balloon that was attached to the end of the exhaust hose leading out of the gasifier. As soon as the heat was applied to the bottom of the gasifier, the stop watch was started. It was then stopped once the balloon reached 5 inches in diameter measured by the calipers. After each test, I also weighed the wood samples again to compare any differences in beginning and ending weights of the wood samples.

Results

The almond wood samples produced wood gas the quickest, filling the balloon in an average time of 40 seconds with a 4 gram loss in sample weight. Redwood was the second fastest, filling the balloon in an average time of 41 seconds with a 4 gram loss in sample weight. Cedar came in last, filling the balloon in an average time of 46 seconds with a loss of 5 grams.

Conclusions/Discussion

The results of my experiment supported my hypothesis. Almond wood did produce the greatest amount of wood gas in the quickest time when gasified. It also had less weight loss than cedar wood.

Summary Statement

The object of this project was to find out which type of wood would produce the greatest volume of wood gas in the quickest time when gasified..

Help Received

My mom and dad supervised my project. I also received advice in designing/building the gasifier and how to accurately measure the gases produced from two chemical engineers, Mr. Kurt Koehler and Mr. Chris Ecker.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Robert L. Mummery

Project Number

J1025

Project Title

Shedding Light on Produce: Comparing the Electrical Output of Organic Cells to That of a Solar Cell

Abstract

Objectives/Goals

The objective of my science project was to determine how many lemons, oranges, or potatoes would be required to make an electric battery that would match a small solar cell's voltage and current in a circuit with an LED. My hypothesis was that the lemons and oranges would make equally more effective cells than the potatoes. I thought this because lemons and oranges are more acidic than potatoes.

Methods/Materials

My control circuit contained a solar cell, bar conductors, a 10KU resistor, a switch, and a red LED. I used a digital multimeter for my measurements. I assembled the circuit, then measured the voltage across the solar cell, and then measured the current through the circuit. Then, I replaced the solar cell with cells made from first oranges, then lemons, and then potatoes, using copper and zinc rods as electrodes, and alligator clip leads. I placed the fruit or vegetable cells in a circuit in series and parallel until there was enough current and voltage to match that of the solar cell.

Results

The lemons proved to be the most effective battery. All my test fruits and vegetables, by themselves, produced between nine tenths and one volt of electricity. The lemons required between two and four cells to produce enough current (0.02 mA) and voltage (1.765 V) to match the solar cell's output. The oranges required four to six cells; the potatoes required six to eight.

Conclusions/Discussion

Although my hypothesis was only partially supported by my data, my results were better than expected, because I had thought that I would need up to twenty of each kind of cell. Theoretically, one could use fruits or vegetables to replace chemicals in powering smaller light bulbs, but widespread use is absurd.

Summary Statement

The focus of my project was to create an effective organic battery using lemons, oranges, or potatoes.

Help Received

My dad taught me AutoCad and supervised my experiment, and my mom tested my procedure for user-friendliness.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Samantha M. Nishimura

Project Number

J1026

Project Title

Desalination Using Solar Power

Abstract

Objectives/Goals

The goal of my project is to test whether the use of black paint or aluminum foil will facilitate solar desalination. My hypothesis was that the aluminum foil desalinators would be the most effective because they would reflect the sunlight back into the water.

Methods/Materials

Methods

I built 9 identical solar desalinators. I covered the bottom on 3 of them with aluminum foil, and painted the bottom of 3 others black. The last 3 served as my control group, so I left them plain. I filled the desalinators with 2 cups of ocean water and left them outside undisturbed, from 8 am to 2 pm. Every 2 hours I recorded the temperature of the ocean water inside the desalinators and also the temperature of the day. At the end of the day, I measured the amount and salinity of the collected condensate. I re-tested all the desalinators on 2 more days, which showed that regardless of the weather, the black desalinators are the most effective in solar desalination.

Materials

Nine 1- gallon jugs; Nine ½ -liter water bottles with caps; Nine flexible straws; Ocean water samples; Aluminum foil; Black paint; Saran wrap; Tape; Scissors/utility knife; Awl; Propane torch; Eyedropper; Thermometer; Glue; Hand held salinity refractometer; Nine small measuring cups; 10 ml syringe.

Results

Results

Contrary to my hypothesis, the aluminum foil desalinators produced the least amount of condensate. The black desalinators generally had the highest temperatures throughout the day, which accounts for the high amount of condensate collected, compared to the plain and aluminum foil desalinators. All of my readings were zero salinity which shows that solar power does effectively desalinate ocean water.

Conclusions/Discussion

Conclusion

The results of this experiment disagreed with my initial hypothesis. The black desalinators were the most effective and had the highest temperatures over the aluminum foil and plain desalinators. Air pockets between the aluminum foil and the sides of the jug may have acted as insulating zones which slowed the heat transfer. Black surfaces act as "thermal collectors" by absorbing light and generating heat. This experiment also shows that the air temperature is directly proportional to the amount of condensate

Summary Statement

My project consisted of building nine desalinators and testing whether the use of black paint or aluminum foil would be the most effective in ocean water desalination using solar power.

Help Received

My father helped me with the power tools in cutting the 1 gallon water jugs.

Name(s)
Peter D. Oliver

Project Number
J1027

Project Title
From Mud to Electricity: Using Microbial Fuel Cells

Abstract

Objectives/Goals
My project was to determine whether a microbial fuel cell produced more electricity with mud from a stream bed or mud made from commercially sold topsoil and distilled water. I hypothesized that the mud from the stream had more organic material and would produce more electricity.

Methods/Materials
Microbial fuel cells are a fairly new type of renewable energy which uses the bacteria in the mud in a process to generate electricity. Using plastic containers, piping, and various types of glues I built six cells made up of four major parts: the anode, the cathode, the PEM or salt bridge, and the external circuit. As the variable I used two different types of mud in the cells, mud from the bottom of a stream and mud made from commercially sold topsoil and distilled water. I filled three of the cells with river mud and river water, and the other three with topsoil mud and salt water. I started up the cells by giving them a regular oxygen supply and tested them for voltage twice a day over a thirty-day period.

Results
The fuel cells containing the river mud immediately shot up to about 400 millivolts in the first few days of testing while the cells with the topsoil mud produced less than 50 millivolts early on. Every cell rose in voltage slowly but steadily until their final standings were with the river mud cells around 450 millivolts and the topsoil mud cells around 300 millivolts. During the last 20 days the rate of change in the topsoil mud was greater than in the river mud.

Conclusions/Discussion
The more organic river material offered a better environment for the bacteria to produce electrons. Since the bacteria in the microbial fuel cells use the organic material in the mud to produce electrons, the river mud performed better than the commercial topsoil.

There was not a great amount of electricity produced in my fuel cells, but this technology can be used in places that lack proper sanitation and electricity because the process of generating electricity in these fuel cells also purifies the water. In this way microbial fuel cells may be helpful, but I can not see them becoming one of our leading power sources in the near future.

Summary Statement
In this project I tested two types of mud for electricity production in microbial fuel cells.

Help Received
Father purchased materials and monitored safety during construction; Mother proofread final copy and helped organize the backboard display.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Roger K. Romani

Project Number

J1028

Project Title

A Thermo-Mechanical Sunflower: Developing a Passive Concentrator/Tracker for Photovoltaic Panels

Abstract

Objectives/Goals

My goal is to find a robust, low-cost method (or methods) of increasing the power output of solar panels.

Methods/Materials

In this two-part project, I first investigated the effect of reflection angle on power generation in a system of non-parabolic light concentrators. I then constructed example reflectors and tested the designs by measuring the power generated vs. a control panel without reflectors.

To be effective, reflectors must track the Sun, so I developed a novel, simple and cost-effective solar tracker based on bimetallic coils. Four coils mounted on a rod formed a differential thermometer. Shades were arranged so when the Sun was located to one side of the tracker, two of the bimetallic coils heated up and turned the panel towards the Sun. During the development, I constructed and tested seven prototypes. I tested the final prototype by measuring the power output of a tracking solar panel in relation to a static panel over a series of days, using a data logger.

Results

In tests, the panels with reflectors generated 2.25x the power generated by a control panel (where the theoretical gain was 3x).

The final tracker prototype (prototype 7) tracked up to 40 towards the sun, and gave 13% more power than a control panel (theoretical limit 30%).

Conclusions/Discussion

The tracker I designed is inexpensive, simple and needs no electricity. I have demonstrated a 13% power gain for my tracker, with up to 30% gain possible. Combining the tracker and reflectors (the sunflower configuration), projected gains of 3.9x could be achieved. My tracker and reflectors design could help generate power in third world applications, in remote sensing stations, and in space, with potential to help developing economies and the environment.

Summary Statement

I created a novel tracker and low-cost reflectors which improved PV panel power output by 13% and 2.25x respectively.

Help Received

My father helped me with trigonometry in the reflectors section and using power tools, and my mother helped edit my report. Laura Hood of Crest co. and Mike Helbig of Hood co. donated bimetallic coils for use in my tracker.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Mateo Rudich

Project Number

J1029

Project Title

Juice It with Juice

Abstract

Objectives/Goals

My objective was to find out which juice (blackberry, cherry, pomegranate, or raspberry) makes the most power in a nanocrystalline dye sensitized solar cell.

Methods/Materials

I made four nanocrystalline dye sensitized solar cells using tin dioxide coated conductive glass, titanium dioxide powder, nitric acid, graphite, and iodide electrolyte with each of the four juices. Using an overhead projector for a steady source of light, I tested each solar cell for volts and amperes. I then multiplied the volts and amperes of each solar cell to find out the power in watts.

Results

The nanocrystalline dye sensitized solar cell made with the blackberry juice made the most power with 0.875 watts. The solar cell with the pomegranate juice came second. It made 0.3 watts.Next was the solar cell with the raspberry juice making 0.16 watts. The solar cell that made the least power was the one made with cherry juice. This one made only 0.02 watts.

Conclusions/Discussion

I found that the nanocrystalline dye sensitized solar cell made with the blackberry juice made the most power. Whether the results were because of the color or some other reason, I'm not sure. To make the results more accurate, next time I would make more solar cells.

Summary Statement

My project was to figure out which juice (blackberry, cherry, pomegranate, or raspberry) makes the most power in a nanocrystalline dye sensitized solar cell.

Help Received

Mother helped cut paper; Used equipement from Willits Charter School under the supervision of Erin Vaccaro.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Trey Schoenwetter

Project Number

J1030

Project Title

The Effect of Light Wavelength on the Output of Photovoltaic Cells

Abstract

Objectives/Goals

The objective is to determine the effect of light wavelength on the electrical output of photovoltaic cells with the goal of improving the efficiency of solar panels.

Methods/Materials

1.5 watt and 5 watt solar panels were exposed to seven different light wavelengths using colored light filters. The modules were first observed using sunlight as the light source. After exposure to each light wavelength, the electrical output of each panel was recorded in volts using a direct current digital voltmeter. Both panels were then re-tested using a halogen lamp with two 500W bulbs as the light source. Each of the four treatments was replicated three times to improve accuracy of results.

Results

Of the seven wavelengths tested, the yellow wavelength produced the most electrical energy with both panels and light sources. The electrical output of the other six wavelengths varied depending on the light source. White light outperformed all seven wavelengths. Surprisingly, the effect of wavelength on the solar panels did not produce a linear result. The size of the light wavelength did not directly affect the electrical output of the photovoltaic cells.

Conclusions/Discussion

Different wavelengths do affect the electrical output of photovoltaic cells. While there was no single wavelength in the visible spectrum that was more productive than full sunlight, the differences in productivity of each wavelength suggests that there may be a way to tune a solar panel so it can more efficiently collect the most productive wavelengths, visible or non-visible, of the electromagnetic spectrum.

Summary Statement

This project seeks to determine if exposure to specific light wavelength can improve the efficiency of photovoltaic cells.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Aakash N. Shah

Project Number
J1031

Project Title
Zap! Where Did It Go?

Abstract

Objectives/Goals
How much Standby Power is wasted in typical household electronic devices per hour?

Methods/Materials
Kill-A-Watt (instrument to measure power)
Camera, Laptop, Desktop Computer, P.S.P. Console, Wii Console
Pencil, Logbook
An outlet
Table/free space

Results
Trial 1: 14 W
Trial 2: 16.5 W
Trial 3: 18.1 W

Conclusions/Discussion
My project was "How much standby power is wasted in typical household electronic devices?" I chose this topic because I've always wondered how much un-necessary energy is being wasted. Additionally, while I would be putting away my charger/adapter, it would be warm. So I asked my dad why do they stay "warm" and he said, it was due to standby power. I went to Intel Corporation to meet my dad and his colleagues to understand more about this standby power concept. There I used the 'Kill-A-Watt' instrument to test and measure various devices. I recorded all the data, observations and graphed the results. My hypothesis was that 32W - 35W (Watts) of standby power is wasted in typical household devices per hour. The average standby power from my three trials was 16.2 Watts. On an average, each device consumed the following amount of standby power:
Laptop - 1.03W,
Desktop Computer - 8.33W,
PSP Console - 2W,
Wii Console - 3.67W.
Therefore, my results DO NOT support my hypothesis. I think my hypothesis was wrong because originally I over-estimated that standby power in all these devices. Initially, in this experiment, I did not know how to measure standby power correctly. I did not have a good understanding of exactly what is standby power. Later, I corrected my mistakes and gained correct knowledge and achieved valid results.

Summary Statement
My project is about the amount of standby power being wasted in typical household electronic devices.

Help Received
My Science teacher Ms. Linsley answered questions; Dad and his colleagues made me understand the concept of standby power.

Name(s)
Kian A. Shakerin

Project Number
J1032

Project Title
Power House

Abstract

Objectives/Goals
The objective of my project was to discover if it is possible to generate sustainable electricity using a hydroelectric generator placed in a house water main. I hypothesize that a hydroelectric generator placed in a house water main will not create sustainable energy.

Methods/Materials
A testing device was built and hooked up to a hose in my backyard. Tests were run in two separate categories. A one gallon category and a five gallon category. I tested each category with different water flow amounts to determine which water flow amount generated the highest voltage. The tests were run several times to validate the results. All results were reviewed and compared to each other to determine the correlation of data.

Results
The results proved my hypothesis. The data showed that only 1.61 volts of electricity was generated at most (this occurred during the one gallon tests). Math was performed based on water consumption per gallon of an average four-person home. The results showed that the electricity generated was enough to power eleven 200-watt light bulbs. The electricity generated under the best circumstances, as noted before, is not enough to sustain an average four-person house. The electricity however, could be stored in a backup battery or other storage device. The stored electricity would be very useful if a blackout or a natural disaster occurred.

Conclusions/Discussion
Conclusion:
My conclusion is that a hydroelectric generator placed in a house water main will not produce sustainable energy. The main reason it is not sustainable is because water is not constantly flowing into a house. Water only comes into a house when needed. This inconsistency in water flow prohibits constant energy generation.

Discussion:
The concept of an inline generator could be implemented on a larger scale like at the out flowing pipe of a city water tower. People are constantly using water all over a city; which means that water is almost continually flowing from the water tower. The near consistent water flow, larger pipe size, and higher pressures allows a higher consistent rate of energy generation.

Summary Statement
My project is about generating electricity by placing a hydroelectric generator in a house water main.

Help Received
Dad and mom drove me around and bought supplies with me; Friends dad let me use his tools and workspace to build device; Dad wrote down data I told him

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)	Project Number
Jonathan M. Summers	J1033

Project Title

Solar Air Heater

Abstract

Objectives/Goals

I think that on a sunny day there will be more heat produced from the solar air heater, than on a cloudy day, because the sun's energy has nothing blocking its way.

Methods/Materials

Materials:

Compass/Tape measure/Large piece of cardboard/Duct tape/White gesso paint/Flat black acrylic paint/Paintbrush (3-inch)/Plastic disposable plates(2)/Scissors/Exacto knife/Ruler/Thumbtacks(18)/Thin cotton string, 12-foot long piece cut in two equal lengths/Plastic wrap/Masking tape/Lab thermometer/Lab notebook/Timer

Methods:

I took temperature measurements on two different days, a cloudy day, and a sunny day. Both days I had to wake up at 7:00 a.m. and take masurements until 6:00 p.m. I recorded my measurements in my lab notebook.

On the cloudy day I woke up at 6:45 a.m. to prepare to take my 7:00 a.m. measurements. Each hour I had to take 6 measurements, three intakes and three outputs. Then I had to find the average temperatures for the intake and output temperatures. My last measurement was at 6:00 p.m.

On the sunny day I woke up at 6:45 a.m. to prepare to take my 7:00 a.m. measurements. Each hour I had to take 6 measurements, three intakes and three outputs. Then I had to find the average temperatures for the intake and output temperatures. My last measurement was at 6:00 p.m.

Results

The solar air heater produced more heat on a sunny day than on a cloudy day.

Conclusions/Discussion

The results of my experience show that my hypothesis was correct.

I learned that solar air heaters produce more heat in a sunny place. In a cloudy place the solar air heaters produce some heat, but not as much heat as in a sunny place.

Summary Statement

Solar air heaters produce more heat on a sunny day than on a cloudy day.

Help Received

My parents helped me built the solar air heater and put it in the window.

Name(s)

Steve J. Vargas

Project Number

J1034

Project Title

Saving Energy

Abstract

Objectives/Goals

The goal for my project is to inform people that they're ways to decrease one's energy bills by simply using a solar water heater in order to heat up water .

Methods/Materials

For my experimentation I needed a bucket, 1 1/4 gallons of water, laser and analog thermometer and a model made of the following items: 22 1/2 x 19 3/4 of plexiglass, 22 1/2 x 19 3/4 of plywood, 88 inches of pinewood 1 x 3, 6 16 x 1 1/2 diameter ABS pipe, 5 1 1/2 diameter x 180 degrees, 2 reductions 1 1/2 x 3/4, 10 inches of PVC 3/4, 2 valves of PVC 3/4, 2 PVC male adapters, 22 screws, 88 inches of double face tape, 100% silicon, ABS & PVC glue and black paper. First, I had to pour 1 1/4 gallons of water in a tub and would take the temperature of the water using an analog thermometer. I would then take and record the temperature of the environment at the time. Next, open both valves of the model and pour the water into one of the valves. Having that done, I'll have the model sit at an angle facing south for 60 minutes. With a laser thermometer take the temperature of the inside of he model and the tubing sticking out of the model, record the data. Then, dump the water out of the model and into the tub and take and record the temperature of the heated water. Repeat these steps according to the table.A model with better detail consisted of the following items: 1 13 1/2 x 1/2 copper tube, 1 12 x 1/2 copper tube, 8 7 1/2 x 1/2 copper tube, 9 1/2 x 90 degrees Ftg x C copper elbows, 8 1/2 x 90 degrees C x C copper elbows, 2 copper straps, 2 copper male adapters, 2 washing machine valves, 1lb. silver solder, 1lb. solder paste, ABS tube 2in. x 2 ft., 2 2in. ABS cups, 50in. double face tape, 14 in. x 11in. plywood, 14in. x 11in. plexiglass, 50in. 1 x 3/4 pinewood, 2 6 x 16 aluminum plate, prime paint spray can, high temperature spray can-black, 36 6 x 12.6mm screws and 48 1in. nails.

Results

As a result, I discovered that the water was able to double its heat using a solar water heater that consisting of the best solar water collector ideas. The water reached 2 major temperatures of 49 degrees Celsius and -2 degrees Celsius.

Conclusions/Discussion

In conclusion, solar water heaters could really benefit anyone who is trying to decrease their gas & electric bills or just someone who is thinking Eco-friendly. These devices could decrease your energy bills up to 75%.

Summary Statement

My project has to do with solar water heaters and the benefits one could acquire without using any source of energy besides the sun's rays.

Help Received

Dad helped build the model; Science Teacher helped improve project idea; Friends helped put board together

Name(s)
Samantha I. Wathugala

Project Number
J1035

Project Title
Sunny Money: Weighing Variables in Solar Water Heating Systems to Improve Cost-Effectiveness

Abstract

Objectives/Goals
Modern society needs alternative energy. Solar water heating systems (SWHS) can provide 8-18% of a home's energy usage. To aid SWHS, this study will determine how much each variable (insulation, color, and the presence and type of a metal conductor) affects the rate and amount that water heats. This in turn will improve the cost-effectiveness of SWHS. Insulation is expected to make the most effect and metal grid the least. The white grids were hypothesized to have a negative effect because of their color.

Methods/Materials
Two methods were performed, each twice, on four different mornings during which several pans, with adjustments that represented the variables, were measured for temperature for several hours. Each method examined pan color and mesh color, while the first tested mesh spacing and the second insulation.

Results
Insulation made an average of 0.90ºC effect in Method #2 Test #2 and color 3.03ºC. Grids' trends were inconsistent and difference from control was seldom over one degree, often arbitrarily dipping below the control, and within the experimental uncertainty.

Conclusions/Discussion
As expected, color and insulation had significant positive effects. However, contrary to the hypothesis, color made a larger and more distinct effect than insulation. Despite extensive testing, the grids' results were inconclusive, being within the experimental uncertainty. Future experimentation includes retesting the mesh, this time the variable being amount in the belief that mesh eventually affects heating.

Summary Statement
My project investigates which of the variables in solar water heating systems -insulation, color, or metal- absorbs the most heat energy from solar radiation by building and testing models.

Help Received
My teacher, Mrs. Acres, helped with the report, and my father acted as an advisor.

Name(s)

Scott D. Weismann

Project Number

J1036

Project Title

How Does Shading Affect the Power Output of Different Solar Panel Technologies?

Abstract

Objectives/Goals

My objective was to determine how shading affects the power output of two different kinds of photovoltaic solar panel technologies.

Methods/Materials

I tested two kinds of solar panels, monocrystalline and amorphous. I did three tests for each panel, one without shade, one shaded lengthwise, and one shaded widthwise. Each panel had to be at the same angle facing the sun, and I used a power meter, with which for each test I measured the volts and amps to find the wattage, or power output. I then analyzed the data by comparing the results of the two shading tests to the test without shade to find how much power had been retained when shaded.

Results

For shading lengthwise, both panels retained about 8% of their total power output without shade. For shading widthwise, amorphous retained 58% and monocrystalline a mere 14% of the total power output without shade.

Conclusions/Discussion

I concluded that the amorphous panel was more efficient when shaded than the monocrystalline, since amorphous technology is made without a definitive cell structure, as opposed to monocrystalline, which is made with precise cuts to create a more efficient cell structure. With this knowledge, people now know more about what panel type they should buy for their own house depending on where they live. If they live in a place with overhanging trees that may block sunlight, amorphous panels would be better. If they live in an open area, they should consider the monocrystalline technology, since monocrystalline is about twice as efficient in direct sunlight than amorphous.

Summary Statement

My project is about whether an amorphous or monocrystalline panel is more efficient when shaded.

Help Received

My dad helped me understand how a solar cell worked.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Timothy W. Whitaker

Project Number

J1037

Project Title

Finding the Optimal Wave Height for Maximizing Voltage Generation of the OWC Method for Capturing Ocean Wave Energy

Abstract

Objectives/Goals

The purpose of my experiment is to find the optimal wave height for maximizing voltage generation of the oscillating water column (OWC) method for capturing ocean wave energy.

Methods/Materials

In my experiment, I simulated the OWC by using a marked-off water bottle and plunger to turn a pinwheel connected to a small motor, and measuring the voltage generated using a multimeter.

Results

The resulting data shows that the average voltage generated increased as the plunger depth increased. I concluded that the higher wave heights resulted in higher voltage generation and the shorter wave heights resulted in lower voltage generation.

Conclusions/Discussion

I learned that the ocean is a great source of power and that environmentalists and scientists are developing new and efficient ways of producing clean energy. My investigation demonstrates in a simulated format that ocean wave energy generation is a practical way to create power. Ocean wave energy generation is pollution-free, is relatively inexpensive, and does not harm the environment the way other modern forms of energy generation do, such as nuclear power plants and the use of coal.

Summary Statement

My project measures the voltage generation of a model of an ocean wave energy capturing device.

Help Received

Father helped put together board; father's friend, a doctoral candidate in electrical engineering from UCLA, helped with the design of my experiment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Elisabeth R. White

Project Number

J1038

Project Title

The Effect of Various Plant Dyes on the Efficiency of a Dye Sensitized Solar Cell and Comparison to a Silicon Solar Cell

Abstract

Objectives/Goals

The purpose of this work was to produce several dye sensitized solar cells and to measure their output power density as a function of the incident irradiance. Comparison was made to a conventional photovoltaic cell. The main objective was to determine which type of dye would produce the cell with the highest output power density.

Methods/Materials

To produce the dye sensitized solar cells for this work, plant dye was extracted from beets, red cabbage, blueberries, pomegranates, and blackberries. Nanocrystalline films, measuring 2 x 2 cm, were prepared for each cell, on electrically conducting glass slides. These films were dyed and the cells assembled. A test stand with a 100 Watt lamp was used to insure that each cell would be tested under identical conditions. Measurements of the open circuit voltage and short circuit current were made for each cell as a function of the incident irradiance.

Results

All of the dye sensitized solar cells constructed for this project produced open circuit voltages in the millivolt range and short circuit currents in the microamp range. The highest output came from the beet cell, followed by blueberry, pomegranate, blackberry, and red cabbage. All of the dye sensitized solar cells had power densities far below the silicon photovoltaic cell.

Conclusions/Discussion

Although all of the dye sensitized solar cells made for this project did produce voltages in the millivolt range, as expected, the current readings were lower than expected. For a dye sensitized solar cell of this size made with fruit dye, current readings in the few milliamp range have been reported. One possible way to improve the performance of the cells would be to change the procedure used in preparing the TiO_2 suspension. While hand grinding was used for this project, a better method might be to use a magnetic stirring device or a sonicator.

Summary Statement

I wanted to find out which type of plant dye would produce the best dye sensitized solar cell.

Help Received

I borrowed some equipment from Dr. Pei-Chun Ho at Fresno State. I performed the work at home.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Kaitlyn N. Wilde Wantz

Project Number

J1039

Project Title

Generating Power Using Micro-Hydroelectric Generators

Abstract

Objectives/Goals

I attempted to see if it was possible to make a micro-hydro generator more efficient by using more blades in the turbine. I hypothesized that it wouldn't matter, as long as the speed of the water was consistent.

Methods/Materials

I built two generators (one with four blades, one with eight). I connected them to a multi-meter one at a time, tested them each 50 times using a hose, and recorded the voltage. The independent variable in my test was how many blades on each generator. The dependent variable was the amount of electricity produced.

Results

The number of blades does effect the amount of electricity. Generator A, which had eight blades, produced an average of 49.6 VCA, while Generator B, which had four blades produced an average of 44.2 VCA.

My hypothesis was proven wrong, but if I think about it, if the turbine only had one blade, it wouldn't spin very well, would it?

Conclusions/Discussion

During this project I have learned so much including how to build a micro-hydro generator, at least a very basic one. I learned about alternative fuels and how hydroelectricity works during the research phase. When testing I learned how to use a micro-hydro system and how to be specific. It is best to hold the generator at a downward angle so the water will hit the turbine correctly. I also learned something about my hypotheses. My hypotheseis was proven incorrect, however, it turns out that the amount of electricity each system generated varied slightly. Generator A, with (eight blades) produced an average of 49.6 VCA, while Generator B (four blades)produced an average of 44.2 VCA. My hypothesis was definitely weakened. However, this has caused me to form a new hypothesis that if you increase the number of blades, the amount of electricity will increase slightly.

My actual numbers were pretty easy to gather once I figured out how to use a multi-meter. My numbers didn't vary too much. My only outlier was a 47 VCA for Generator B, for which the range was typically 43 to 45 and not much above or below. I think my test was fair, my conclusions and numbers were correct and reliable. I'm confident in the construction of my generators, and I think I did this project to the best of my abilities. My parents are proud and I feel a sense of accomplishment.

Summary Statement

How the number of blades inside the turbine affect how much electricity a micro-hydro system will produce.

Help Received

My dad helped me pick a subject. My grandma is helping me type this application.