CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Ikeoluwa F. Adeyemi

Project Number
J0201

Project Title
There Once Was a Hydrogen Fuel Cell

Abstract

Objectives/Goals
The objective of this project is to discover which form of oxygen a hydrogen fuel cell car would run more efficiently on- forced oxygen, forced air, or ambient air. I believe the car will run more efficiently on forced oxygen, which is 100% oxygen, while forced air and ambient air contain only 21% oxygen(19% at the least).

Methods/Materials
I used a fuel cell car to test how it ran on each oxygen source by changing a factor in the operation of the car depending on the source. I let the car run, while propped on blocks, and measured the voltage outputs every 10 seconds using a multi meter and stopwatch.

Results
The stopwatch showed that the car ran most efficiently on forced oxygen- it ran for more than 12 times the amount of time as forced and ambient air. On forced oxygen, the car ran for 434 seconds, but on forced air and ambient air, it ran for about 30 seconds. According to the multi meter, before stopping, the car was able to get down to a lower voltage on forced oxygen than on forced air or ambient. On forced oxygen, the fuel cell's voltage output got down to .039 befor stopping. On forced air, it stopped at .077 volts, and on ambient air, it stopped at .053 volts.

Conclusions/Discussion
In the short run, forced oxygen allows the fuel cell car to operate more efficiently, but when an unlimited supply of oxygen is needed for a more powerful fuel cell, ambient air would be the best choice.

Summary Statement
My project shows which source of oxygen would be most effective when operating a Proton Exchange Membrane Fuel Cell- an alternate source of energy.

Help Received
I used lab equipment at Loma Vista Middle School under the supervision of Mr. Cooper, who provided help and advice throughout the process of project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Julian E. Andrade

Project Number
J0202

Project Title
Solar Energy

Abstract

Objectives/Goals
The purpose of this experiment was to determine if the 2.5 inch solar panel would produce more electrical power to the rechargeable battery than the alkaline non-rechargeable AA, C, and D batteries.

Methods/Materials
Use one 2.5 solar panel, 4 Miniature screw-base lamp (2.47 volts) and 4 lamp holders. 3 battery holders. Measured the voltage on the 3 alkaline non-rechargeable batteries AA, C and D. and the AA rechargeable battery with a voltage meter. I Took the red (positive) and black (negative) electrical wire, from the battery holders and connected the positive and negative connections to the light bulb lamp holders to the non-rechargeable batteries. I repeated the same procedure with electrical wires from the solar panel to the AA rechargeable battery. The solar panel with rechargeable battery was placed to an exposed sunny area. The voltage of the batteries were checked with a voltage meter, the data was recorded and logged for 9 days.

Results
I recorded the voltage for each battery for 9 days. After 9 days of observation. By the 4 day AA non-rechargeable battery voltage dropped from 1.48 volts to .66 volts lost its potency. The C non-rechargeable dropped from 1.60 volts to 1.29 volts and 6 day dropped to .04 volts lost its potency. The D non-rechargeable dropped from 1.59 volts to .09 volts on the 9 day lost its potency. By the 9 day, the AA rechargeable battery with solar panel continue to have potency, varied from 1.23 volts to 0.96 volts. The AA rechargeable battery continue to recharged because the solar panel produce more electrical power to it while being exposed to daily direct sunlight.

Conclusions/Discussion
I accept my hypothesis that the 2.5 inch solar panel produced more electrical power to the rechargeable battery compared to the alkaline non-rechargeable AA, C, and D batteries. It is amazing and exciting to see how technology for using Solar Power Energy can help the world have a healthier environment. This experiment with Solar Energy can be related to the world because Solar Energy is recycling energy that comes from the sun's rays and is everywhere the sun shines. It is free, clean and quite. Why not go green and recycle with Solar Energy and save the earth from air pollution.

Summary Statement
My Science Projec is about Solar Energy and Batteries.

Help Received
My parents helped me with gathering all my materials, check my grammar and supervise. My science teacher review my project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Cannon M. Armistead

Project Number
J0203

Project Title
Blade Design: Energy for Generations

Abstract

Objectives/Goals
The purpose of my science fair project is to understand and demonstrate the creation of wind energy through the process of observing blade design variations on the energy production rate of a wind turbine. This project will include learning about the main components of a wind turbine and the basics of how a generator works and how it can turn physical work into electrical power.

Methods/Materials
After building my wind turbine, I used an 18" fan to simulate wind in a controlled setting. By changing blade materials, number of blades, and the angle of the turbine shaft, I was able to observe and record 99 different scenarios with an anemometer.

Anemometer, Multimeter, Alligator clips, Balsa wood (1/8", 1/16", and 1/32" thick), Cardboard, Super glue, Wooden dowels, Tape, Model wind turbine kit, Fan, Scissors, Wire strippers, LED light

Results
The heaviest material, balsa wood 1/8", was most productive and the lightest material, cardboard, was the least productive. The upright position of the turbine shaft was the most productive. Using three blades proved most productive.

Conclusions/Discussion
Many laws of physics came into play when my wind turbine was generating electricity. Two of these laws are inertia and drag. Inertia explains how objects in motion are resistant to change. Once the turbine blades are moving, they have a natural tendency to continue to rotate in the same manner and direction. Drag refers to the laws of physics that govern opposing forces to an object in motion. In this case, drag is a result of blade length beyond the area of wind exposure. As a result, the longer blades resided outside of the wind generation "tunnel" and therefore created drag, which decreased the rotational speed of the turbine and ultimately generated less electricity. Newton's third law is the driving force behind wind generation. By changing the angle of the blades, they are exposed to different amounts of wind. The most electricity is generated when the most wind is focused on the maximum surface area capable of the blade. Newton's third law is evident through the blades taking the force of the wind and transforming it into the inertia in the blades. This inertia drives gears of the motor and creates electrical energy through the generator. When the shaft is leaning forward or backward, the wind encounters the blades in a non-uniform fashion therefore causing it to be less productive.

Summary Statement
The purpose of my science fair project is to understand and demonstrate the creation of wind energy through the process of observing blade design variations on the energy production rate of a wind turbine.

Help Received
Mother helped glue materials on board; Father answered some of my questions

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Jonathan Berman; Benjamin Kotzubei; Austin Veseliza

Project Number

J0204

Project Title

The Solar Solution

Abstract

Objectives/Goals

The objective of our project is to create a three-dimensional solar collector that will be more efficient and versatile than the commonly used flat panel.

Methods/Materials

We performed a computer simulation using 3 software applications: called Autodesk Ecotect, Google SketchUp & Autodesk 3DStudio. We ran a three-dimensional virtual solar analysis on the shapes we modeled and measured for incident Wh/m2. We built a solar flat panel and a dome-shaped solar collector. We measured volts produced by each prototype. Materials used: 1 inch x 2 inch silicon photovoltaic cells, tabbing wire, solder, Plexiglas, glass & LEGO Technic parts. We used a Vernier LabPro multimeter & the Logger Pro application to measure & graph the volts produced by our prototype models.

Results

Through our south facing computer simulation tests, we determined the 3 best collectors were a flat panel at proper tilt, which collected 32,000, Wh/m2, a hemisphere/dome, which collected 20,500 Wh/m2, and a quarter sphere, which collected 26,000 Wh/m2. We ran more virtual tests with these best 3 shapes facing North, East, and West. The quarter sphere fluctuated greatly while facing different directions, and the dome data remained nearly identical in all directions. We discovered that the dome & flat panel were the most efficient shapes. South facing prototype tests were extremely close to Ecotect predictions that the panel would be approximately 59% more efficient than the dome. This was true on the first day of south testing. On the other three days the panel was 56%, 55%, and 55% more efficient than the dome. However, west facing test results differed from the computer simulation predictions. Ecotect stated that the dome was 273% more efficient than the flat panel when both were facing west; in the prototype test the panel was 1%-2% more efficient than the dome.

Conclusions/Discussion

After analyzing our data, our team determined that the solar dome is a viable replacement for the panel in instances where the panel is not able to face south at an optimal tilt. Unlike a flat panel, the solar dome can also be placed on moving vehicles, trains and ships to collect solar energy more efficiently than flat panels, as these moving conveyances do not always allow flat panels to face south at a proper latitude angle.

Summary Statement

To build a three dimensional solar collector panel that performs more efficiently and has fewer limitations than the commonly used flat panel.

Help Received

A mother helped us acquire the PV cells. Architect Eric Carbonnier taught us how to operate Ecotect software. A father taught us how to solder.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sneha S. Bhetanabhotla

Project Number
J0205

Project Title
A Study of Osmotic Energy

Abstract

Objectives/Goals
The objective of my research is to study the effect of different solute concentrations on osmosis, generate osmotic energy and compare its feasibility with other types of energy. My ultimate goal is to find a new source of clean, green and renewable energy to help solve the world#s energy problem.

Methods/Materials
I used NaCl and KCl as solutes and measured the rate of osmosis for different concentrations of these solutions. I also studied the rate of change of osmosis with time, and I calculated the amount of energy generated by osmosis.

My experimental set up contained of a large jar which held fresh water. A cellulose dialysis membrane tube 10ft long contained the solution with a solute in it and was connected to a 1 cm diameter plastic tube. The plastic tube is graduated and was secured in an upright position with a balsa wood stand. Each experimental run took 90 minutes where I measured the height of water in tube at different intervals of time. I repeated this experiment for several solutions of different concentrations. I plotted graphs with the data I got from each of these experiments and analyzed them.

Results
NaCl solutions have higher rates of osmosis than KCl solutions. Solutions with higher concentrations of NaCl produced higher rates of osmosis. The osmosis rate decreased with time and the amount of energy generated also decreased with time. The amount of osmotic energy generated is very small.

Conclusions/Discussion
Sodium Chloride is an effective solute which can produce high osmotic pressures. Large membranes are needed to generate feasible amounts of energy. Osmotic power plants can be located at river mouths to generate electricity using the fresh water and sea water. Osmotic power can also be generated wherever waste, dirty water is processed.

Summary Statement
My project is a study of osmotic energy as an alternate, clean, green and renewable energy.

Help Received
My father helped me in obtaining the needed materials and with the experimental setup.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Ethan H.F. Brier

Project Number
J0206

Project Title
How to Maximize the Ability of a Solar Thermal Fluid Heater

Abstract

Objectives/Goals
My objective was to learn how I could make the most efficient solar thermal fluid heater. I predicted that using Mylar, rubbing alcohol, and a copper tube would yield the best results.

Methods/Materials
I performed 24 tests (6 for each experiment) that were each two hours long. I measured these tests every 30 minutes, while rotating the device towards the sun every 15 minutes. These 4 experiments were the control group with water in the copper tube, rubbing alcohol in the copper tube, Mylar covering the mirrors with water in the copper tube, and water in a black tube. Lastly, while doing the tests, I measured outside temperature, how sunny it was, and how windy it was.

Results
I found out that rubbing alcohol worked better then water, the black tube worked better then the copper tube, and Mylar worked better then the mirrors. Also, I concluded that in a warm environment with lots of sun, long days and little wind works best when using a solar thermal device.

Conclusions/Discussion
I conclude that liquids with low boiling points heat up the best, good heat insulators warm up the fluids the fastest, and Mylar has extremely beneficial effects on solar thermal energy using devices.

Summary Statement
My project involved finding out how to most effectively reach a maximum temperature in the solar thermal device.

Help Received
Uncle helped build device; teacher helped get formula; teacher helped me come up with experiment

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Priya Choudhary

Project Number
J0207

Project Title
Biodiesel Fuel: How Viable?

Abstract

Objectives/Goals
Biodiesel can be used to lessen our dependence on fossil fuels and decrease our carbon footprint and carbon emissions. If all the cooking oil is converted to Biodiesel, it will meet 2% of our energy need and will have much less carbon emission in environment.
My objective is to produce biodiesel from vegetable, corn and see how effective they are as a fuel.

Methods/Materials
Materials used are Sodium Hydroxide, Methanol, 1 lit each of Soybean, Corn and Vegetable oil.
Accessories like glass containers, measuring cups, coffee filters, safety glass, latex gloves, thermometer, stopwatch, and funnel were used.
Method - 5 grams of sodium hydroxide(NaOH) and 220 mL of Methanol were mixed gently to make Methoxide Solution. Vegetable oil is heated to 130 F and mixed vigorously with Methoxide Solution. After 5-6 hours, a lighter layer at the top will appear, which is the biodiesel, and a darker layer, glycerol, at the bottom. Biodiesel is further cleaned with distilled water and coffee filters.
Repeat these steps, with Soybean and Corn Oil to produce Biodiesel from these sources.

Results
Biodiesel from Soybean oil shows the best results. It ignites quicker, is the clearest, and has the least viscosity. Soybean Biodiesel is not as good as Petro-diesel.

Conclusions/Discussion
I concluded that biodiesel is a completely viable and alternative energy source.
Its economical - 50 to 60 cents per gallon in bulk quantity.
Its environmentally friendly - 20 lbs. less CO_2 per gallon of Biodiesel.

Summary Statement
How viable is it to produce Bio-Diesel from cooking oil.

Help Received
Dad brought in some of the raw material for the project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Alexander D. Cowan

Project Number
J0208

Project Title
"Sea-ing" Solar: Floating Photovoltaic Electrical Generation System

Abstract

Objectives/Goals
Is it possible to build an offshore floating barge that supports a series of photovoltaic panels which generate electricity that is carried back to land through insulated wires? Does air temperature have an affect on electrical generation of a solar panel? What are the affects of corrosion on the floating barge over time? My hypothesis is that the offshore, floating photovoltaic barge will successfully float and generate the same amount of electricity as a similarly sized photovoltaic field on land, air temperature will not affect electrical output, and corrosion on the barge will be minimal.

Methods/Materials
Materials: 1. Floating photovoltaic barge, which I will construct; 2. Voltmeter; 3. Pool; 4. Plastic container filled with saltwater; 5. Computer.
Methods: 1. Build the floating solar barge. 2. Select dates for testing that will be cold or warm days. 3. Connect wires to Voltmeter. 4. Place in pool and test for a 25 minute period and record the voltage output in 5 minute intervals. 5. Place in salt-water filled container for 3-5 weeks. 6. Every 3 days observe/look for rust/corrosion.

Results
The solar barge successfully kept the solar film afloat and transmitted the electricity back to land through wires connected to a voltmeter. The voltage output was the same in both warm and cool air temperature environments. Temperature does not appear to have an effect on the electrical generation of solar panels. The corrosion test requires a long period of time for solid results#results will be finalized by late April.

Conclusions/Discussion
In conclusion, I learned a great deal about renewable energy, photovoltaic technology, and engineering. After the testing was complete, the results of my project showed that my hypothesis was correct. In addition, the results of my project were promising--the barge kept the solar film afloat and transmitted the electricity back to land. The Floating Photovoltaic Electrical Generation System (FPEGS) is a very effective method of delivering electricity to coastal urban communities because 40% of the world's population lives within 100 kilometers of the ocean. Thirdly, I discovered that solar radiation (watts/square meter) is greater over oceans and coastline than it is over land, which means that solar panels over the ocean are more efficient. Finally, the FPEGS would be a valuable tool for providing power after a natural disaster or other emergency.

Summary Statement
In this project, I built and tested the effectiveness of the Floating Photovoltaic Electrical Generation System (patent pending) in order to create a new method for capturing/delivering solar energy to coastal communities around the world.

Help Received
Father helped me solder wires together. Mother helped me edit my report and display board. Used pool at Sharon Redsun's House.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Ezra B. Creighton

Project Number
J0209

Project Title
Can I Make an Engine Run More Fuel-Efficient by Introducing Oxyhydrogen to the Air-Fuel Mixture?

Abstract

Objectives/Goals
I am doing this project to see if I can make an engine run more fuel-efficient with the addition of oxyhydrogen (Browns gas) to the air/fuel mixture. This project could lead to future money and fuel saving and have emissions more friendly to the environment.

Methods/Materials
I started my testing with a four-stroke Robin engine, I removed the air filter and fully leaned the fuel screw on the carburetor. I put a ¼ in. tube from my oxyhydrogen source into the carburetor. I did not turn the source on for the control tests only the oxyhydrogen variable tests. For the oxyhydrogen variable tests I turned on the source to provide oxyhydrogen at a rate of 1.3 liters per minute. I put gasoline in the engine and started the engine to let it warm up for approx. 15 min. While the engine was running, I put 50 cc of gasoline into the engine and started a stopwatch. I waited for the engine to die because it ran out of gasoline, and then I stopped the stopwatch and recorded the run time. I alternated the control and oxyhydrogen tests to keep the possibility of outside variables (engine problems, temperatures, etc.) to a minimum.

Results
After I completed several tests, both the control and oxyhydrogen variable, the average of the control run time was 79.8 seconds and the oxyhydrogen variable had an average of 85.6 seconds. This is a 5.8 second difference. Thus, by adding oxyhydrogen, the engine ran 7.3% longer with a much smoother idle. The addition of oxyhydrogen caused the engines RPMs to stabilize and run more efficiently.

Conclusions/Discussion
My tests show that when I introduce oxyhydrogen to the air/fuel mixture it makes the engine run longer. The engine was more fuel-efficient with the oxyhydrogen. When I leaned the fuel, it took away some of the gasoline the engine needed to run smooth. When I introduced oxyhydrogen to the engine, the oxyhydrogen replaced the deficiency so the engine ran smoother. My hypothesis was correct. The engine ran 7.3% longer with oxyhydrogen and with a much smoother idle. If the world could achieve similar results with oxyhydrogen on automobiles or other machinery, we would save money on fuel! Using oxyhydrogen not only makes the engine run more fuel-efficient, it also helps the environment. Oxyhydrogen turns back into water (H2O) when it goes out the exhaust, the water replaces a little of the bad exhaust gases that would have been there if the oxyhydrogen had not replaced it.

Summary Statement
This project proves that a four stroke, 10 horsepower engine can be more fuel-efficient with the addition of oxyhydrogen to the air and fuel mixture.

Help Received
My brother-in-law and my dad suppied the materials and helped me with this project . My mom helped me get library books.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sara K. Davis

Project Number
J0210

Project Title
Nanocrystalline Dye-Sensitized Solar Energy III

Abstract

Objectives/Goals
The main objectives are to compare the photovoltaic energy generation capabilities of three different types of solar cells in brief (2-minute) tests; to compare the energy generation sustainability over a short period (3 days) of two different composite conductive polymer film/stainless steel solar cells and a polymer film cell; and to compare the long-term energy generating capability of an #unsealed# composite cell with that of a #sealed# composite cell.

Methods/Materials
My 2009 and 2010 projects involved two different types of Graetzel solar cells: one made of conductive glass, another made of conductive polymer film. This year#s project introduces sealed and unsealed variations of a composite cell made of an upper conductive polymer film slide and a lower stainless steel slide. All of these solar cells used filtered juice from dark red flower petals as the primary reactive agent. A series of experiments was conducted to satisfy the objectives above.

Results
In a series of 2-minute tests the unsealed composite cell out-performed both the polymer cell and the glass cell. In a 3-day test the sealed composite cell generated slightly more energy than the unsealed composite cell. However, the energy generated by the unsealed composite cell dropped significantly after the first day; meanwhile the energy generated by the sealed composite cell increased dramatically on day 2, then decreased significantly on day 3. Surprisingly, both of the composite cells were slightly less effective than the polymer cell in generating energy over a 3-day period. In a multi-day test the sealed composite cell slightly out-produced the unsealed composite cell; but neither of the composite cells was a reliable energy generator beyond the first several days of testing.

Conclusions/Discussion
Since the objective of this series of annual science projects is to develop a simple photovoltaic cell that can be easily and cheaply made---and that can generate electricity reliably---the results of this year#s project indicate that consideration should be given to conducting further experiments to see if a composite solar cell made of conductive glass and polymer film can out-perform the composite cells used in this project. Hopefully, such a solar cell can be developed to help solve some of the world#s energy supply and ecological problems, especially in poorer countries.

Summary Statement
Generation of electricity from simple solar cells, using plant juice

Help Received
Mother supervised experiments and helped construct backboard; father proofread and edited logbook

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Paul A. Dennig, Jr.

Project Number
J0211

Project Title
From Concentrator to Tracker: An Innovative Solution for Maximizing Electric Power from Solar Photovoltaic Cells

Abstract

Objectives/Goals
With the awful BP oil spill in the back of my mind, I feel a sense of urgency to make green energy accessible to all. Solar trackers can increase power output by close to 40%, but even a simple tracker for doing science fair experiments costs $100. My goal is to build an affordable tracker with real-world applications at half the cost. After 10 prototypes, I created three trackers and my research question was which design would be the cheapest and most efficient. My hypothesis was that my focal-point tracker would be superior in both cost and power output performance, because it does not use expensive circuitry and it is the only one that receives concentrated light.

Methods/Materials
The three trackers that I built are: (1) a shaded solar-powered tracker, (2) a micro-controlled servo tracker, and (3) the novel focal-point tracker. The first two trackers use electric motor drives to follow the sun at a rate of 15 degrees per hour. My focal-point tracker consists of a circular solar concentrator and a tubular collector that moves inside it along a path determined through simulation by ray tracing software. The collector is moved by a clock at 20 degrees per hour. A flexible 60 mm x 150 mm solar cell and a load resistor are attached to each setup and the control. On a large table outdoors, I oriented all four configurations perpendicular to the rays of sun during solar noon. Then I let them track the sun and measured the voltage of each setup's resistor with a digital multi-meter every 15 to 30 minutes for 5 to 7 hours a day over 8 days.

Results
I calculated the current (mA) and power (W) and estimated the future cost ($) for each tracker and the control. Among the trackers, the focal-point tracker was the cheapest one which can be made for about $27 and it always had the highest power output with about 55% more than the control, while the other two trackers outperformed the control only by roughly half.

Conclusions/Discussion
My hypothesis was correct! My focal-point tracker was the winner by having the lowest cost and highest output. I know I can greatly improve the novel tracker's performance. My ray-tracing simulation suggests I can boost the power output by around 7 times. The plastic solar cell can only make about 100 mA without a load and melts in intense heat. I will look for a more powerful one that won't melt.

Summary Statement
I designed and built three solar trackers and found that my novel concentrating-type design performed the best in making electricity from sunlight.

Help Received
Mom helped me with my writing. Dad introduced me to Arduino microcontroller and servo motor and showed me how to do difficult math.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kyle A. Douglas

Project Number
J0212

Project Title
Biofuel: A Home Run for the Environment

Abstract

Objectives/Goals
To determine if the biowaste from a sports stadium can produce enough energy to power the entire stadium.

Methods/Materials
Switch grass and sugar were controls for the experiment. Testing was performed on Bermuda grass and wild grass. 400 grams of each grass was chopped finely and hydrolyzed using Cellulase. The grass mixtures were fermented using yeast. A sugar mixture was also fermented. A hydrometer measured the specific gravity throughout fermentation. The mixtures were filtered to remove any residue leaving only ethyl alcohol. A still was built using a pressure cooker, copper tubing, a coffee can, ice and a collection bowl. The liquid was heated while ensuring the temperature of the mixture was kept below 200°F. The alcohol vaporized, went through the tubing, and was collected in a bowl. The volume of the collected alcohol was measured and recorded.

Results
20 mL of 100% alcohol was collected from the Bermuda grass. 110 mL was collected from the Switch grass. Bermuda grass was only 30% as effective at producing alcohol as Switch grass.

Conclusions/Discussion
Petco Park#s electricity consumption and waste production were determined. A San Diego Waste Study Report provided the percentage and type of biowaste. Energy conversion charts supplied the kilowatt-hours of electricity that ethanol can produce. The results from the experiment showed that 69% of the electricity consumption during a sporting event could be provided by the biowaste produced during the event.

Summary Statement
The project measured the amount of alcohol produced from grass clippings to determine if a sports stadium could use its own biowaste to provide the stadium#s power.

Help Received
Jillian Blatti helped with research and hydrolysis. Kaitlin Rosichan helped by obtaining additional Switch grass and with distillation. Parents helped with materials and fermentation.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Corina Galvan

Project Number
J0213

Project Title
A Brighter Future Starts Here!

Abstract

Objectives/Goals
The objective is to determine if the PSI of steam affects the volts transferred into a 1.5 volt light bulb. I believe that the higher amount of steam stored in the pressure vessel will increase the voltage in the light bulb.

Methods/Materials
I conducted 120 trials, with varying levels of PSI from one to seven, and was able to determine the volts of electricity transferred into the light bulb using a voltmeter. To obtain the results needed, the following materials were connected: a pressure cooker with water stored inside, placed over a fifth burner, connected to a die-grinder, connected to a generator, connected to the light bulb and finally the voltmeter.

Results
The higher the PSI of steam, the more volts the light bulb has. Eventually the power was so strong, it blew out the light bulb, making seven PSI the maximum limit. The average volt with one PSI was .428, then .52 for two PSI, continuing on through six PSI and finally 1.494 for seven PSI. The volts produced continued to increase as the PSI of steam did.

Conclusions/Discussion
After comparing my hypothesis and results, I determined they were quite similar. The only significant difference was how the volts transferred did not stay a constant difference between each PSI level and how at eight PSI, the light bulb would become overwhelmed. I am able to conclude that the PSI of steam does affect the volt transferred into a 1.5 volt light bulb by increasing, up to the point of failure.

Summary Statement
Using household items to create a geothermal power plant model that utilizes wet steam to create energy needed to power a 1.5 volt light bulb.

Help Received
Father supervised the dangerous parts of building and testing.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Emily E. Gray

Project Number
J0214

Project Title
Here Comes the Sun: How to Maximize Electricity Generation from Photovoltaic Solar Cells

Abstract

Objectives/Goals
The objective of this experiment is to make solar cells more efficient by finding which wavelength produces the most electricity and how the electricity is most efficiently produced.

Methods/Materials
Red, yellow, and blue colored filters as well as 25% and 50% neutral density filters were put over 1.0v 100 mA and 1.5v 50 mA solar cells and the milliamps were recorded. Then, the solar cells were placed at various angles (45º, 90º, 135º, 180º, and 270º) facing north vs. south, and the milliamps were recorded. Finally, the milliamps were recorded from each solar cell at various times throughout the day (7:00 am, 9:30 am, 12:00 pm, 1:45 pm, 4:00 pm, and 9:00 pm.

Results
The tests resulted in surprising results. First, red, yellow, and blue colored filters caused the solar cells to produce similar results. The neutral density filters produced more than the hypothesized milliamps. Also, in the angle experiment, there was a pattern that in each trial, there was a peak at 180º, though it was not always the angle that caused the maximum results, and the solar cells at 360º produced the least amount of milliamps in every trial. Finally, maximum electricity generation took place at noon, and minimum electricity generation took place at 6:00 pm and 9:00 pm (at both times, the solar cells produced 0 milliamps in each trial).

Conclusions/Discussion
The 1.5v 5o mA and 1.0v 100 A solar cells that were used are not very sensitive to filters in the visible spectrum of light and they are only designed to block out a certain percent of light in specific regions. Also, the angle of solar cells that produces maximum electricity directly relates to the position of the sun in the sky. Finally, maximum electricity generation by photovoltaic solar cells occurs at 12:00 pm. For the most part, the entire hypothesis was proven incorrect.

Summary Statement
This project studied the efficiency of photovoltaic solar cells.

Help Received
Dr. Kevin Gray helped a lot as a mentor. Dr. Noufi also helped a lot by allowing to be interviewed. Finally, Mrs. Erin Schumacher provided a lot of useful information and help throughout this entire project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Roxanna Hashemi

Project Number
J0215

Project Title
The Effect of Different Material, Shape, Length, and Weight of Turbine on Maximizing Wind Energy

Abstract

Objectives/Goals
The objective of this project was to find the optimum turbine design that will result in maximum electricity using wind energy. Finding more efficient and ultimately cheaper way of generating electricity from wind will hopefully make this alternate energy source more widely used.

Methods/Materials
Different turbines were used in this experiment which varied in terms of their material, shape, length, and weight. The same motor, gear box, and wind energy source (hair dryer) were used as independent variables in all my experiments. For material I used plastic, wood, cardboard, and metal. The length experimented were 2#, 4#, and 6#. Different weight was obtained by changing the thickness of same length and width turbine. Thicknesses used were 2/32#, 3/32#, 4/32#, and 6/32#. For different turbine shape designs I used rectangular, oval, trapezoidal, and spoon shaped. The electrical output were measured and compared using LED bulb intensity as well as voltage generated by the motor.

Results
The spoon shape turbinewith2/32# thickness, and 4# long made out of plastic produced the brightest LED light as well as highest output voltage.

Conclusions/Discussion
My conclusion is the shape of the turbine is the most important design parameter followed by length, and weight. The material should only be chosen based on environmental impacts such as weather quality of a particular region.

Summary Statement
How to maximizing electrical energy output generated by wind through best turbine design?

Help Received
My dad helped me in some assembly and conducting experiment.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kaylyn M. Hedstrom

Project Number
J0216

Project Title
Electrostatic Power from Water

Abstract

Objectives/Goals
The objective of my project was to determine how the natural electric charge present in ordinary water can be used to generate static electricity.

Methods/Materials
I constructed a Kelvin electrostatic generator to be used as my testing apparatus. I tested 4 different water flow rates multiple times to determine if dropping the water at any of these rates would produce static electricity. By dropping the water, the friction against air changes its electric charge. Inducing the electrical charges to separate-they then can be used to generate static electricity.

Results
The tests on 3 of the 4 flow rates produced static electricity, which was confirmed by the spark between the electrodes on the Kelvin electrostatic generator. The 4th and slowest flow rate didn't produce a visible spark. Checking with a digital multimeter confirmed the presence of a charge. Using the Kelvin electrostatic generator demonstrated and confirmed my hypothesis.

Conclusions/Discussion
By using the Kelvin electrostatic generator I was able to achieve my objective and confirmed my hypothesis. I have concluded that it is possible to generate static electricity from the natural electric charge in ordinary water.

Summary Statement
Altering and separating the natural electric charge present in ordinary water with the use of a Kelvin electrostatic generator to generate static electricity.

Help Received
Mother helped type. Father helped construct apparatus. Family assisted with testing.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Alex P. Junge

Project Number
J0217

Project Title
Biogas

Abstract

Objectives/Goals
The purpose of the experiment was to determine which type of biomass created the most biogas. The experiment consisted 5 types of biomass, dead plant material,grass clippings, cow manure, chicken manure and food scraps.

Methods/Materials
Built 5 digesters using 20Lt collapsible water containers with miscellaneous fittings. Each digester was partially filled with biomass and water. the air was then removed to create anaerobic digestion.

Results
The Food scraps created the most biogas.

Conclusions/Discussion
The food scraps must have the most actice nutrients so to produce the greatest amount of biogas.

Summary Statement
The experiment is to test 5 diferent biomass materials to determine which produced the most biogas.

Help Received
Dad helped built digesters and supervise my measuring the biogas produced. He also helped burn off the biogas

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kriti Lall

Project Number
J0218

Project Title
A Study of Mutant Algae for Hydrogen Production

Abstract

Objectives/Goals

Last year, I tested 2 methods of producing H2 from the algae Chlamydomonas reinhardtii â## by sulfur(S)-deprivation and addition of different copper (Cu) concentrations to the algae media.

This year, I am continuing from last year and focusing on improving photosynthetic efficiency of this process. I am testing whether mutants with special properties improve the algae's light utilization efficiency, resulting in better H2 production. I chose 0.8 ppm Cu because it was the best medium from last year. This can help improve commercial H2 photobioreactors, making algal H2 economically viable.

I questioned: Are C. reinhardtii mutants better at producing H2 than the wild type in Cu-enriched or S-deprived media? I hypothesized that mutants with less chlorophyll will utilize light better, producing more H2. From last year, I hypothesized that on a continuous basis, the Cu- enriched media will produce H2 more effectively.

Methods/Materials

I labeled 6 water bottles as CC-125 Cu, CC-125 S, CC-1101 Cu, CC-1101 S, CC-4170 Cu, and CC-4170 S. I added S-free and Cu 0.8 ppm solutions, and equal amounts of respective algae strains. I assembled an airtight apparatus for the algae environment to become anaerobic. I left it assembled for 5 days, after which I took it off, and fitted balloons onto the bottle spouts to collect the gas produced. After 12 days, I removed the gas-filled balloons and measured H2 using a graduated cylinder. At the beginning and end of the experiment, I measured the light intensity through each bottle with a light meter. Repeated experiment.

Results

CC-4170 S produced the most H2, followed by CC-4170 Cu, CC-125 S, CC-125 Cu, CC-1101 S, and CC-1101 Cu. Light intensity decreased as it passed through the bottles. The decrease was most for CC-125 Cu (78%) and least for CC-1101 S (58%). The H2 produced by CC-1101 was lower than expected.

Conclusions/Discussion

My hypothesis was supported. CC-4170, with less chlorophyll than CC-125 let more light pass through it and produced more H2 than CC-125. CC-1101 performed poorly. I think this is because it lacks an eyespot, which is needed for the algae to function properly. As expected, mutants in the S-deprived medium produced more H2; but by the end of the experiment, they began to die. The algae in the Cu-enriched medium produced less H2, but remained healthy at the end of the experiment.

Summary Statement

My projects investigates whether Chlamydomonas reinhardii mutants can improve the photosynthetic efficiency of hydrogen-producing process by better light utilization.

Help Received

Dad helped procure algae mutant strains

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Biyonka Liang

Project Number
J0219

Project Title
The Effect of Filtering Sunlight through Water on the Power Output of a Solar Panel with Fresnel Concentrator

Abstract

Objectives/Goals
The purpose of this project was to find a way to keep the efficiency of silicon solar panels by keeping it cool and at the same time to use the unused part of the spectrum of the sunlight to warm up water. I chose to experiment with placing water between a Fresnel lens concentrator and a silicon solar panel to filter the sunlight before it reaches the solar panel. My hypothesis was that placing water between a Fresnel lens concentrator and a silicon solar panel will increase the efficiency of the silicon solar panel and at the same time warm up the water.

Methods/Materials
Two identical solar panels (GP55x55-10B70 by Green Power Online), two multimeters, two 100 ohm resistors, two plastic fresnel lens on homemade wooden frame, an infrared thermometer, an oven thermometer, a clear glass container, water, and wires.

The voltage on the resistor is measured using a multimeter. The power output in Watt is calculated using the formula P = V^2/R. This formula is nice because it lets me compute power with only voltage measurement so I do not need more multimeters to measure currents. In each experiment, the direction of the Fresnel lens and the solar panel was adjusted to get the largest voltage from the solar panel.

Results
At the end of 22 minutes, the power produced by a solar panel with water-in-glass in front was 259.9mW. The solar panel without using a water-in-glass filter was producing only 194.4mW. The temperature of the solar panel with water-in-glass in front rose from 18.1A°C to 60.1A°C. The temperature of the solar panel without water-in-glass in front rose from 17.8A°C to 91.2A°C. The water temperature increased from 15.6A°C to 19.8A°C 22 minutes. It is 4.2A°C higher than without the Fresnel lens.

Conclusions/Discussion
Because the water-in-glass filtered out the lights that were not efficient in generating electricity and would heat up the solar panel, the solar panel heated up much slower and was able to make more electrical power over a longer time. That part of the energy was not wasted, it was used to heat up the water. My experiments should be studied more and it may help improve the efficiency of real silicon solar power systems and produce hot water at the same time.

Summary Statement
Use water to filter sunlight so the solar panel stay cool and produce more power and get warm water at the same time

Help Received
Father helped with buying parts from ebay and making the wood frames using power saw.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Maegan A. Lindsey

Project Number
J0220

Project Title
The Effects of Different Sealants on Titanium Dioxide Coated Solar Cells

Abstract

Objectives/Goals
My objective was to find out which sealant sealed a nanocrystalline dye sensitized solar cell the best.

Methods/Materials
I made eight solar cells from a solar cell kit with tin dioxide coated conductive glass, nitric acid, titanium dioxide powder, graphite, iodide electrolyte, and a blueberry juice solution. I sealed two of the solar cells with krazy glue, two with caulking, two with nail polish, and two control cells (no sealant). Using the same light source and volt meter for each test, I tested each solar cell for electrical output each week for 6 weeks. Each week I tested the electrical output of each solar cell three times and recorded the results in my log book.

Results
After six weeks, the solar cells sealed with krazy glue had the highest electrical output, next was caulking, then the control (no sealant), and nail polish did the worst.

Conclusions/Discussion
I think the krazy glue did better than the other solar cell sealants because it is strong, so if the cell tries to shift, it would prevent it from slipping and keep out the corrosive oxygen. I also think that since it was clear, it let more light in. Because the krazy glue went farther into the solar cell than the others, it prevented gaps or such on the sides of the cell. If I were to do this project again, I would lengthen the time period to see which sealant held up better over an even longer period of time.

Summary Statement
My project was to test different sealants on solar cells.

Help Received
My mother helped with cutting paper and preparing the backboard. My teacher, Mr. Scofield, and my dad helped me with the idea for this project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Madison H. Martin

Project Number
J0221

Project Title
Double or Triple Scoop: How Different Blade Sizes and Types Affect a Savonius Wind Turbine's Energy Output

Abstract

Objectives/Goals
I conducted this experiment to determine which size blade and type of blade would generate the most electricity in a Savonius wind turbine. My first hypothesis is if I build a wind turbine, then it will generate electricity to light the LED. My second hypothesis is if I use the 4-inch double blade, then it will generate more electricity than the 2-inch or 3-inch double blades. My third hypothesis is if I use the 3.5-inch triple blade, then it will generate more electricity than the 2.5-inch or 3-inch triple blades. My fourth hypothesis is if I use triple blades, then they will generate more electricity than double blades.

Methods/Materials
I built a Savonius wind turbine and tested six different blades. Each blade was made from plastic soda bottles and cardboard. The rotor for each blade consisted of sixteen rare earth magnets. The stator on the base consisted of eight coils of copper wire in a clockwise direction. I measured the voltage of each blade by setting the multimeter to 200 volts to light the LED.

Results
The 4-inch double blade produced a higher total average of 2.47 volts, compared to the 2-inch double blade total average of 1.99 volts and the 3-inch double blade total average of 2.31 volts. The 3.5-inch triple blade produced a higher total average of 2.76 volts, compared to the 2.5-inch triple blade total average of 2.07 volts and the 3-inch triple blade total average of 2.38 volts.

Conclusions/Discussion
My first hypothesis is true because each wind turbine produced various voltages to light the LED bulb. My second hypothesis is true because the 4-inch double blade had a greater total average than the 2-inch and 3-inch double blades. My third hypothesis is true because the 3.5-inch triple blade had a greater total average than the 2.5-inch and 3-inch triple blades. My fourth hypothesis is true because each triple blade had a total average greater than each double blade. The wind turbine with the 3.5-inch triple blade had the highest energy output compared to the other blades. Savonius wind turbines produce clean renewable energy and help slow the increase in greenhouse gases and pollution. Further work should be conducted outside to examine how different climates affect a Savonius wind turbine's energy output.

Summary Statement
I built a Savonius wind turbine and tested six different blades to determine which size blade and type of blade would generate the most electricity.

Help Received
My father and I shopped for project materials; My mother helped me untangle copper wire.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kieran S. Mital

Project Number
J0222

Project Title
The Effect of Various Colored Natural Dyes on Energy Output of Home-Made Dye-Sensitized Nanocrystalline Solar Cells

Abstract

Objectives/Goals

1) Build 14 home-made dye-sensitized nano-crystalline solar cells and test their output using natural dyes of different colors.
2) Hypotheses:
a) Green, as the most prevalent natural plant color will be the most efficient at absorbing light and will produce the highest electrical output.
b) Leaf dyes will work better than fruit dyes.

Methods/Materials

Materials:
Conductive glass slides, TiO_2 powder, Potassium Iodide solution, vinegar, fruit and leaf juices, clear detergent, Petri dishes, beakers, pipettes, multi-meter, halogen lamp, precision scale, binder clips, alligator clamps, denatured alcohol, burner, mortar & pestle and various colored fruits and leaves.
Procedure:
Prepare titanium dioxide suspension. Place a drop on glass slide and roll it with a glass rod creating a thin film. Anneal the film by heating the slide at 400°C for 10 mins. After cooling, let the slide soak in plant dye for 15 min. Coat second slide with graphite using a pencil. Place the 2 slides together and clamp with binder clip. Insert a drop of KI electrolyte. Take voltage and current readings using multi-meter.

Results

A.Leaf dyes produced 77% more power than fruit dyes under sunlight & 43% more under halogen light.
B.Red dyes produced 284% more power than green under sunlight and 572% more under halogen light.
C.Red leaf produced 92% more power than red fruit.
D.Red dyes performed disproportionately better in sunlight than artificial light.

Conclusions/Discussion

The color red and not green was best which disproved the first part of the hypothesis. Red dyes probably absorb more light due to their highest wavelength. Leaf dyes, in general, performed better than fruit dyes with the exception of blackberry juice. Also, red leaves performed better than red fruit. Thus chlorophyll, in general, is better at absorbing light than anthocyanin so the second part of the hypothesis was proved.

These cells hold a promising future in our quest to find cost-effective, clean and renewable solutions to our growing energy needs but much work is still needed in readying this technology for heavy duty commercial uses.

Summary Statement

Test the output of various plant based dyes in home-made dye sensitized nanocrystalline solar cells as a possible cost-effective, clean, renewable energy source in the future for mankind's growing energy needs.

Help Received

Dad helped with experimental process and Mom helped with the board; Mr. Hobbs (science teacher) provided some of the equipment and general guidance.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Dominic J. Pletcher

Project Number
J0223

Project Title
Go Solar

Abstract

Objectives/Goals
Solar energy has always been an extreme fascination of mine. Even as a child, I#ve always wanted to find alternative ways to doing things. Last year in 7th grade, I built an Aquaponics system, and this year I wanted to extend the use of alternative sources of energy, and build solar panels that would solely power my Aquaponics system. My main objective was to build the solar panels, and then test whether connecting them in series of parallel would produce energy more efficiently to power the system.

Methods/Materials
I first used a soldering method to solder solar cells together, and silicone to glue the cells down onto a piece of Peg Board. I also cut Plexiglass using a table saw and glued it onto the frame I built for the panel using clear silicone. After all of the soldering, screwing, and gluing, I connected the panels together with wires. I stripped wires, soldered + and - wires onto Bus Wires of the panel, and screwed them into terminal boards. For series, I connected both panels into a + to - formation , and in parallel I joined both + and - wires together into a second terminal board. Finally, I connected the wires to the battery and recorded DC Volts and Amps.

Results
After connecting the solar panels into series and parallel, parallel turned out to work more efficiently. In series, both panels produced 18 Volts which combined to make 36. Since I was using a 12-Volt battery, 36 Volts was far too much for the battery to handle. Yet, in parallel, since both panels come together instead of flowing into one another, the voltage stayed at 18 volts, and the amperage tripled from 2 Amps, to 5.5 Amps. Also, the solar panels were able to power the system during the day, but the battery was not able to power the heater at night because of the heater's high demand of 300 Watts.

Conclusions/Discussion
According to my results, my hypothesis was proven correct. Parallel powered the Aquaponics system much more efficiently because it kept the voltage at a reasonable amount, and nearly tripled the amount of Amperage. Though the heater was not able to last the whole night hooked up to the battery, the system as a whole was able to run properly. Overall, there were many things that I would do differently such as making sure that no condensation occurs inside the Plexiglass from the sun, but the results helped me better understand what my specific panels and Aquaponics system need electricity wise.

Summary Statement
My project is the powering of my Aquaponics system using solar energy from PV-cell panels that I built.

Help Received
Father helped wire the panels together and hook them up to the Aquaponics system; Father also gave tips on how to solder properly.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Hunter E. Reusche

Project Number
J0224

Project Title
Green Powered Cars

Abstract

Objectives/Goals
To construct and operate a solar and wind power vehicle.

Methods/Materials
The material used for the first vehicle body was aluminum with caster wheels, a solar panel and small electric motor. The material used for the second vehicle was a lightweight wooden body with plastic pinewood derby wheels, a small solar panel, battery housing,two rechargeable batteries, toggle switches, and a small electric engine connected to one wheel. A mock windmill was attached to the car for display purposes only.

Results
The first vehicle was too large and heavy to be powered by the small electric motor and the caster wheels had too much friction. The second vehicle functioned well using the electric motor powered by rechargeable batteries. The first toggle switch turned on and off the solar panel connected to the batteries and the second turned on and off the electric motor on the circuit to the batteries. When the vehicle was not moving the toggle switch was turned on to recharge the batteries with the solar panel. A mock windmill was installed that was designed to be functional at night when no solar charging was available.

Conclusions/Discussion
Due to the size of the sample vehicle, a windmill for night charging was not practical because of the weight of a small generator. The electric motor functioned well and demonstrated good use of green solar power using solar rechargeable batteries and a solar panel to keep the batteries charged.
I feel that the use of solar is functional in ultra lightweight vehicles and I feel a larger vehicle with the same design could allow for a night functioning windmill for an extremely green vehicle.

Summary Statement
My project determines the practicality of using both wind and solar to operate a vehicle.

Help Received
My dad taught me how to use a soldering gun to wire the connections and toggles on the vehicle together.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Michael S. Roach

Project Number
J0225

Project Title
Energy

Abstract

Objectives/Goals
The objective is to determine which battery and motor combination will be the most efficient.

Methods/Materials
In my project, I tested five batteries and four motors. I did all my tests on the dynamometer that I built which recorded the volts l, watts, speed, and the distance run. The batteries I tested were; one 7.2 volt NICD-1800 mAh, one 8.4 volt NIMH-5000 mAh, one 7.2 volt NIMH-4200 mAh, one 7.2 volt NIMH-5000 mAh, and one 7.4 volt LIPO-5200 mAh. Two of the motors that I tested were 12 and 14 turn brush type motors. The other two motors were 8.5 and 5.5 turn brushless motors. I repeated each test five times with each battery and motor combination. I also ran a five-volt test to determine how long the different combinations would run until drained down to five volts.

Results
The LIPO-5200 mAh battery with the 5.5 brushless motor was the most efficient because it drained less volts, watts, and went the furthest compared to all the other motor and battery combinations.

Conclusions/Discussion
The LIPO battery was the strongest, and the most efficient. It used less energy with the least amount of voltage, and watts drained. The brushless motors ran cooler at the end of all the tests. The brushless motors ran more evenly with less variation during each test.

Summary Statement
My project is about finding the most efficient battery and motor combination.

Help Received
Dad helped time tests and supervised the building of my dynamometer.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Anish Seshadri

Project Number
J0226

Project Title
Dye Sensitized Solar Cells and Everyday Foods

Abstract

Objectives/Goals
The purpose of this experiment is to find less expensive and more efficient organic dyes in everyday foods that can be used to build a solar cell. These easy to build solar cells could in future replace fossil fuels.

Methods/Materials
To create the nanocrystalline solar cell, a suspension of nanometer size particles of titanium dioxide is distributed uniformly on a glass plate which has previously been coated with a thin conductive layer of indium tin-oxide. The TiO2 film is dried and then heated on the glass to form a porous, high surface area TiO2 film. The TiO2 film on the glass plate is soaked with a few drops of natural food dye such as fresh raspberry juice. Many natural dyes can be utilized, but they must possess a chemical group that can attach to the TiO2 surface, and they must have energy levels at the proper position necessary for electron injection and sensitization. A single layer of dye molecules adsorbs to each particle of the TiO2 and acts as an absorber of light. To complete the device, a drop of liquid electrolyte containing potassium tri-iodide is placed on the film to enter into the pores of the film. A counter electrode layer of carbon is placed on top, and the sandwich is illuminated with bright sunlight through the TiO2 side.

Results
I had hypothesized that Anthocyanin-rich foods like blackberries, blueberries, red raspberries, red grapes and red cherries will produce more powerful solar cells than Other Flavonoid-rich foods like tea and fresh parsley when used as dye on titanium dioxide solar cells. The reasoning behind this hypothesis is based on the fact that anthocyanins have the ability to absorb light and convert it into electrons. This ability is not present in other flavonoids. The results prove that my hypothesis was correct.

Conclusions/Discussion
A very important conclusion drawn from this experiment is that the higher the Anthocyanin content of the food dye used for making the dye sensitized solar cell, higher is the average voltage measured between the positive and negative electrodes of the solar cell when exposed to bright sunlight. It should be noted that the efficiency of these solar cells can be greatly improved by improving the nature of the dye as well as using a chemical other than titanium dioxide as a coating on the indium tin-oxide glass.

Summary Statement
While making a dye sensitized solar cell based on Titanium dioxide, this experiment compares the efficiency of solar cells produced when Anthocyanin-rich foods and other flavanoid-rich foods with very low Anthocyanic content are used as dye

Help Received
I would like to acknowledge Ms. Aditi Risbud of the Molecular Foundry, a Department of Energy (DOE) user facility for interdisciplinary research at the nanoscale supported by the DOE office of Science. Ms. Risbud helped me by lending me the Indium tin-oxide coated glass and nanocrystalline Titanium dioxide

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Aakash N. Shah

Project Number
J0227

Project Title
Microbial Fuel Cell

Abstract

Objectives/Goals
In this project my goal is to build a microbial fuel cell using a mud sample from a stream and determine if this device can harvest the electrons that the anaerobic bacteria create. Secondly, I am also measuring the amount of electricity harvested.

Methods/Materials
Compression Fitting; Sandpaper; Acrylic Cement; Nickel Epoxy; Copper Wire; Electrical Tape; PVC Pipe; Nylon Rope; Safety Goggles; Ruler; Permanent Marker; Drill or Drill Press; Scissors; Wire Stripper; Plastic Wrap; Aluminum Foil; Measuring Cups; Pot; Stirrer for Solution; Plastic Spoon; Stove; Table Salt; Refrigerator; Plastic Bag; Buckets; Plastic Jug; Top Soil; Shovel; Tap Water; Distilled Water; Digital Kitchen Scale; Aquarium Air Pump; Tubing; Acrylic; Storage Containers; Carbon Cloth; Digital Multimeter; Alligator Cables ; Petri Dish; Agar # 30 grams

Results
Hour: 0.02W-0.05W
Day: 0.48W-1.2W
Week: 3.36W-8.4W
Month: 14.4W-36W
Year: 172.8W-432W

Conclusions/Discussion
My result was that the microbial fuel cell did in fact harvest the electrons that the anaerobic bacterias create. As said previously, I also measured the amount of electricity the microbial fuel cell can produce. I came across the fact that it produced a different amount every hour. The results are the following: I measured the amount of voltage and current my microbial cell generated. The microbial fuel cell I built generates ~0.02-0.05 watts per hour. Though this is small, over time it creates quite an amount of energy; for example, the microbial fuel cell produces 0.48-1.2 watts per day, 3.36-8.4 watts a week, 14.4-36 watts per month, and even 172.8-432 watts a year! Furthermore, if you increased the size, the amount of energy harvest increases; for instance, a cubic meter large microbial fuel cell can produce as much as 50 watts per hour! This little machine could power a light bulb and much more with these methods. And if purification centers used the fuel cell over time, the numbers would just keep multiplying. My experiment was a success but could have been improved. Some of the areas I would like to have explored more are: (a) what can impact the efficiency of electricity generation of my cell and (b) does temperature or pressure have effect on the amount of electricity being harvested. Overall, this project was a great learning experience

Summary Statement
My goal is to build a functioning microbial fuel cell.

Help Received
Parents bought materials; Dad helped dig mud; Parents escorted me to places;

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Margaux Shraiman

Project Number
J0228

Project Title
Going Green Has Never Been So Hot: The Peltier Effect and Geothermal Energy

Abstract

Objectives/Goals
This is my idea for a new and hopefully more efficient geothermal power plant. It is based on using the Peltier effect in reverse to convert temperature difference into electric power.

Methods/Materials
-Ice
- Copper Wires
- Metal Blocks
- Heater
- Thermal Compound
- Peltier Element
- Voltage Meter
- Thermometer
- Water

First, I heated the thermal blocks to a certain temperature. Then, I used a box full of ice to cool a shallow dish, which I'd filled with water. Next, I connected the Peltier element to the voltage meter and placed it in the water. When the blocks were the right temperature, I put a little bit of thermal compound on the top of the element and placed the block on top of it. After that, I calculated the voltage (volts) and current(amp) and recorded it. Then I started over, but heated the blocks to different temperatures.

Results
Based on the results of my experiment, I can conclude that increasing the temperature difference does in fact raise the amount of electricity produced.

Conclusions/Discussion
The bigger the temperature difference, the more voltage you create. My experiment is important because it could be the first step leading to the invention of a new kind of geothermal power plant. In the future I am hoping scientists will take my research to the next step, and experiment with better equipment so as to reach higher temperatures and get more accurate results as well as potentially inventing the blueprint for an entirely new kind of geothermal power plant.

Summary Statement
Converting geothermal energy into electricity by using the Peltier element.

Help Received
Used lab equipment at UCSB under the supervision of Dr. Boris Shraiman and Dr. Pierre Neveu

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Daniel Y. Suh

Project Number
J0229

Project Title
Converting Waste into Fuel?

Abstract

Objectives/Goals
My objectives were to see if cellulase can break down seaweed and find the optimum conditions for the cellulase to work efficiently. The ultimate goal is to convert the seaweed into ethanol as an alternative fuel source.

Methods/Materials
For each test, I degraded seaweed using cellulase, with a mixture of seaweed, water, and enzyme for two hours. Then I would calculate the weight decrease and make a percentage. I also tested other areas such as temperature, time, concentration of enzyme, and type of enzyme.

Results
I found that cellulase could degrade seaweed, where the percentage of the weight decrease was 11%. Cellulase from Aspergillus sp. was found to be the best enzyme, where it led to a weight decrease of 14%. 40 C is the optimum temperature because the weight decrease percentage was 19%. I found that when the concentration of enzyme was increased, the weight of the seaweed dropped. Finally, 2 hours is the optimum time for the enzyme to work, for the percentage of the weight decrease was 39%.

Conclusions/Discussion
My conclusions are that cellulase can degrade seaweed, 40 C is the optimum temperature, and cellulase from Aspergillus sp. is the best enzyme. Also, as the concentration increases, the weight of the seaweed drops, and 2 hours is the optimum working time.

Summary Statement
My project is to find the optimum conditions where seaweed can be broken down by cellulase to increase the amount of ethanol produced.

Help Received
Mother for helping me gather materials; Father for continuous support.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Mirra N. Tubiolo

Project Number
J0230

Project Title
How Much Light Energy Do Certain Materials Reflect?

Abstract

Objectives/Goals
The purpose of this experiment was to see if certain materials are good at reflecting the sun#s light. The hypothesis of this experiment was that the mirror would reflect the most light energy.

Methods/Materials
Information was collected from tests done over a series of several days. Glass, a mirror, aluminum foil and laminated paper were compared for how much light energy they reflected. A solar panel was set up to measure this reflected energy in a controlled location. A DCV voltage meter was used to collect data.

Results
The mirror indeed reflected the most light, and therefore the most energy, but on cloudy days when there was no light, the foil reflected the most light energy. The two other materials reflected a very close amount of light to each other, but laminated paper was more reflective than glass. So the very reflective color of the white paper was more reflective than glass# sheen and transparency.

Conclusions/Discussion
This data suggests that mirrors reflect more light energy than many common substances. Aluminum foil reflects more light energy, however, if clouds block direct sunlight.

Summary Statement
how much light energy is reflected by certain materials

Help Received
Mother helped organize supplies and project board; Neighbors helped explain certain scientific concepts

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Elisabeth R. White

Project Number
J0231

Project Title
Novel Techniques and Materials for Dye Sensitized Solar Cells

Abstract

Objectives/Goals
This project explores new materials and techniques for the production of dye sensitized solar cells (DSSC). The objective is to find the combination of materials and preparation techniques that will provide the best performing photovoltaic cell.

Methods/Materials
Most of the research done in this field over the last twenty years has been based on cells made using thin films of nanocrystalline TiO2. For this work, I chose to study both ZnO and TiO2 because this would allow me to compare the performance something new (ZnO) to a material that has been well studied (TiO2). Another avenue to explore is the possibility of forming a working cell starting with ordinary, industrial grade chemicals rather than specially prepared nanocrystals. Industrial grade chemicals may offer an advantage since they are cheaper and easier to handle than nanocrystals. While researching this project, I came across the use of ultrasonic liquid processing or sonication. A sonicator is a machine that has a small tip which vibrates at 20,000 times per second. Sonicators are commonly used in biology to disrupt cell membranes for the extraction of genetic material. I remembered how tedious it was to grind the TiO2 powder for the recommended thirty minutes with a mortar and pestle for my project last year. I wondered if sonication could be used to prepare the semiconducting material for a DSSC and if it would prove better than hand grinding.

Results
It was found that that working cells can be made using the semiconductor ZnO. Furthermore, working cells can be made using industrial grade samples of both TiO2 and ZnO. Sonication proved to work as well as or better than hand grinding in all cases. Surprisingly, films that were prepared from material that had been hand ground for thirty minutes and then sonicated performed poorly.

Conclusions/Discussion
The cell made using nanocrystals of TiO2, sonicated for thirty minutes, and sintered at 500 oC outperformed all others. It was found that the best TiO2 cell outperformed the best ZnO cell by a factor of 15 times. In the cells made from TiO2, the best nanocrystalline cell outperformed the best industrial grade cell by 28 times. In the case of ZnO, the industrial grade cells outperformed the cells made with nanocrystals by 16 times.

Summary Statement
This work seeks to find the materials and techniques that will produce the best performing dye sensitized solar cell.

Help Received
My Grandmother let me set up a laboratory in her garage. My Dad helped me find a sonicator and lab furnace on ebay. He also helped me hook up my meters.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Justin W. Winslow

Project Number
J0232

Project Title
Microbial Fuel Cells: An Alternative Electricity Source from Mud?

Abstract

Objectives/Goals
Objective/Goals:
To design a microbial fuel cell using decomposing anerobic organic sediment and test which of two sources of sediment, fresh water or salt-water, can generate more microbial fuel cell electric current.

Methods/Materials
Methods/Material:
Sediment microbial fuel cells were designed by first showing that the electrodes, electric circuit and detection system worked in a microbial fuel cell kit positive control. Deep fresh water sediments from 3 sites, and salt-water sediments from 2 sites, were collected as was the water above each sediment. Using 14 cm x 14cm x 22cm plastic jars, sediment was placed in half the jar, with a carbon fiber electrode as the anode placed in the middle of the sediment. A similar piece as the cathode was placed in water from the same source above the sediment. An electrical circuit was set up, and current and voltage was measured every 8 hours for five days using a multimeter.

Results
Results:
Current (uA) and voltage increased over 3-4 days following setting up of each microbial fuel cell and then leveled off during days 4-5. Greater final current (uA) was observed from the 2 salt water sediment microbial fuel cells and water than from 3 made from fresh water sediment. The voltage was higher in fresh water sediment fuel cells. A negative control made by killing the bacteria by boiling the sediment had lower current and voltage, suggesting that the fuel cell electricity was produced by microbes.

Conclusions/Discussion
Conclusions/Discussion:
The data I collected was different than my hypothesis as I thought the fresh water sediment would have richer anerobic nutrients and generate more bacteria and electrical current, but salt-water sediment produced more current. This may be useful as an electrical source in the ocean and for organic sediment recycling. Although the current was low (~200mA), it appears to be biologically generated as the current increased with time, and the current was greatly reduced in a negative control fuel cell made with boiled sediment.

Summary Statement
My project tested whether an alternative electrical source can be generated by sediment bacteria, and which sediment produced the most electricity.

Help Received
My science teacher and dad discussed parts of my project; A scientist advised me on one of the challenges that arose- filters for colloidal supspension and background current; Dad drove/helped pay for supplies.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Emily M. Wong

Project Number
J0233

Project Title
Blown Away: How Altitude Affects Electricity Production

Abstract

Objectives/Goals
My objective is to test if altitude affects the amount of energy (in watts) a windmill creates. If my experiment works properly, I believe we may be able to create more windmills in the areas that create more efficient electricity, and produce cleaner energy.

Methods/Materials
To test if altitude affects the amount of electricity a windmill creates, I got a fan and a windmill model. The model was connected to a multimeter, which measured the amperes and volts, which could be multiplied to get watts. I measured the watts at two, four and eight inches away from the fan. I also measured the wind speed with an anemometer at those distances. I tested this at four different elevations: 0 feet, 1500 feet, 4000 feet and 7500 feet. I graphed and charted the results.

Results
I observed that energy produced in watts at 0 feet elevation was 28% higher than at 7500 feet, although 4000 feet was different than expected, possibly due to a mistake in my operation. Results were similar regardless of distance from the fan.

Conclusions/Discussion
I can therefore support the idea that all things being equal, windmills will create more electricity at lower elevations rather than higher ones.

Summary Statement
My project tests how elevation affects the amount of electricity a windmill creates.

Help Received
Parents helped type report, drive me to places, and encouraged me.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Richard Xu

Project Number
J0234

Project Title
Thermal Piling Power

Abstract

Objectives/Goals
The objective was to find out whether thermopiles could be made more effective through type change, temperature change, and number change.

Methods/Materials
Thermopiles (Thermocouples Type K and Type E), solder/soldering iron, oven, voltage meter.

Results
The test resulted in larger numbers of thermocouples reducing the voltage output. The E type produced more electricity than that of type K, but declined more as well. Type E produced almost 4 times more electricity than type K, but electricity drop was higher. The Type K thermopile had a fairly straight growth in electricity output, while the type E thermopile had a varying range in tests that involved higher temperatures. This means that probably Type E is not as well suited to hot environments as Type K.

Conclusions/Discussion
The project ended up differently than what was hypothesized. It was hypothesized that the electricity would grow with more thermocouples and temperature, because they would form a chain and pick up more heat. Both types of thermocouples showed signs of decline instead of increase.

Summary Statement
More heat/numbers means less electricity proportionally for all types of thermocouples.

Help Received
Father assisted in building thermopiles, Mother helped in building thermopiles. General Atomics allowed use of hot plate.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Rebecca Y. Zheng

Project Number
J0235

Project Title
Energizing Alternatives

Abstract

Objectives/Goals
The objective of my experiment was to compare power generated from a solar cell and wind turbine to determine which is the better alternative for the use in my community, given our unique weather conditions.

Methods/Materials
The experimental method involved designing and building the solar cell and the wind turbine apparatuses, researching weather conditions over the course of a year, interviewing subject matter experts, collecting current and voltage data, calculating power and energy, and finally drawing conclusions on which power source would be better given local sun and wind conditions.

The materials we used were photovoltaic cells, 2 dc motors, wire, PVC pipes, fan blades, multimeter, and wood and mounting materials.

Results
The total annual energy generated from the solar apparatus would be 132.48 watt-hours per year, verses 377.04 watt-hours generated per year from the wind apparatus. Based solely on my data, wind is the better alternative for my community.

Conclusions/Discussion
When only looking at the data, wind power is the better alternative for my community due in large part to the number of hours per day that power can be generated and the fact that voltage and current increased with greater wind speed. However, when I factor in expert opinion from my interviews I conducted, my conclusion is broader, indicating that a mix of alternative energy resources is actually optimal. This takes into account economic factors and timing of a typical energy consumption.

Summary Statement
"Energizing Alternatives" is about comparing solar and wind power for my commmunity to determine which would be the better alternative source of energy.

Help Received
Father helped brainstorm project idea with me,and built apparatus together.