CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Cameron M. Baab

Project Number

J0201

Project Title

The Effects of Various Extraction Methods of the Antioxidant EGCG on Biofuel Production in Nannocholoropsis Salina

Abstract

Objectives/Goals

The purpose of this project is to develop a cost effective method for increasing biofuel yields from algae by investigating how different extraction methods of the antioxidant Epigallocatechin Gallete (EGCG) from common green tea affect Biofuel(Fatty Acid) Production in Nannochloropis Salina. Recently, researchers at UC Davis discovered that EGCG can increase biofuel production by up to 85% using a pure form of EGCG at a cost of $1,200 per gram, making this technique uneconomical.

Methods/Materials

The Nannochloropsis was grown in five groups of 32 test tubes per group; 1) Control, 2) Ultrasonic, 3) Grinding, 4) Boiling, and 5) Microwave. The Control Group was made up of only sea water and algae. The other groups had an even amount of algae and green tea was placed into each tube at a per group concentration of 5.4 grams of green tea. The EGCG, was extracted using four methods:

1. Ultrasonic: Used ultrasonification to extract EGCG from green tea in an ultrasonic cleaner.
2. Grinding: Used a pestle and mortar to crush and grind the green tea leaves.
3. Boiling: Used a hot plate to boil the green tea.
4. Microwave: Heated the green tea in a microwave for three minutes.

The algae was cultivated for three weeks, exposed to grow lights 12 hours a day. The Fatty Acids were extracted using a centrifuge and ultrasonification

Results

Biofuel (Fatty Acid) Yields:

Control: 1.6 mL
Ultrasonic: 2.3 mL - increase of 43%
Grinding: 1.4 mL - decrease of 12.5%
Boiling: 1.6 mL - no increase
Microwave: 1.7 mL - increase of 6.3%

Conclusions/Discussion

Results showed algae has the highest biofuel production rate when in a medium with EGCG extracted by Ultrasonic-Assisted Extraction(UAE). This method achieved a 43% increase in biofuel production at a cost of $0.15 per liter vs. the UC Davis approach at a cost of $2.20 per liter. For equivalent biofuel production, using EGCG extracted from common green tea by UAE costs only 13.5% of the total cost as compared to the UC Davis pure form approach. This project shows that using EGCG from common green tea to increase biofuel should be used to improve algae's economic feasibility as a biofuel source.

Summary Statement

43% increase in Biofuel Production from Nannochloropsis Salina can be achieved when grown in a medium with EGCG extracted by Ultrasonic-Assisted Extraction from common green tea, resulting in a cost effective approach to algae biofuels.

Help Received

Father helped print out slides for board. Mother and Father proofread abstract

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Bethany J. Chen

Project Number
J0202

Project Title
Harvesting Wind on a Blustery Day

Abstract

Objectives/Goals
The objective of this experiment is to evaluate the impact of blade count on the electrical output of a Horizontal Axis Wind Turbine (H.A.W.T.) at a constant wind speed of 21 kilometers per hour, the wind speed typical of a residential area. A common hypothesis is that the wind turbine with the highest number of blades (eleven) will generate the most electricity because of a maximum windswept area.

Methods/Materials
A tower made from PVC plumbing pipes, a pre-manufactured nacelle, and an umbrella stand was placed in front of a large industrial house fan that was set up to generate a wind speed of 21 kilometers per hour. A voltmeter was used to measure the electrical output of five wooden turbines with three, five, seven, nine, and eleven blades. Each variation was tested five times.

Results
Contradicting the hypothesis, the turbine with nine blades generated the most power rather than the turbine with eleven blades. The trend of the average graph is represented by the quadratic equation y = -0.0029x^2 + 0.054x + 0.4609. In the equation, the x variable is the number of blades and the y variable is the voltage generated. By substituting the x variable for the values 8, 9, and 10, it can be proved that the turbine with nine blades will usually generate the highest voltage, for it is also the apex of the parabola.

Conclusions/Discussion
To a certain extent, the energy generated by a wind turbine does increase with the number of blades. However, when blade count reaches a critical number, wind turbine function destabilizes due to the weight of the turbine and impairment of airflow through the fan blades. In the future, residential wind turbines may be altered to achieve optimal performance. Energy generated from wind turbines is directly correlated with wind swept area until blade weight and airflow limitations become pernicious variables.

Summary Statement
The objective of this project is to find the ideal number of blades on a Horizontal Axis Wind Turbine in a residential area.

Help Received
Father helped shape the wood of the turbines; grandfather explained the mechanics of wind power.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Hagop J. Chinchinian

Project Number
J0203

Project Title
Micro-Electricity: The Effect of Various Microorganisms on the Output of a Microbial Fuel Cell

Abstract

Objectives/Goals
The purpose of the project was to improve the efficiency of a microbial fuel cell by using various microorganisms from different items. Additionally, the purpose was to see if household items containing microorganisms could be used in a microbial fuel cell.

Methods/Materials
I built three mediator-less microbial fuel cells at home. I also collected river mud which was used within 24 hours of collecting it. I also used organic potting mix with compost enhancer and organic potting mix alone in the microbial fuel cell. Each item contained microorganisms. I placed each in one of the three fuel cells, and did it three times for three trials.

Results
After doing the experiment, the organic potting mix produced the most electricity, followed by the river muck, and the organic potting mix with compost enhancer produced the least electricity. The organic potting mix produced on average 99.67 mV, the river muck produced 63 mV on average, and the organic potting mix with the compost enhancer produced on average 44.33 mV.

Conclusions/Discussion
After the experiment, I found out my hypothesis was proven wrong. Instead of the muck producing the most electricity and the organic potting mix producing the second most electricity as I hypothesized, the organic potting mix alone produced the most electricity because it contained microorganisms that worked the best in the microorganisms. I also found out that the river muck produced the second highest amount of electricity, while the organic potting mix with the compost enhancer produced the least electricity since the compost enhancer broke down the organic potting mix and altered the reactions that take place in the microbial fuel cell.
Other questions I had about the experiment were if the material of the electrode of the microbial fuel cell affected the output. Additionally, I wondered if the aquarium pump that provided oxygen to the microbial fuel cell would affect the output.

Summary Statement
The project's purpose is to help improve efficiency of a microbial fuel cell by using various microorganisms found in different items.

Help Received
My father helped me drill a hole in the microbial fuel cell. My mother helped glue items onto the board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Malena M. Clark

Project Number
J0204

Project Title
The Effects of Different Swell Generator Designs under Different Ocean Conditions on the Amount of Energy Generated

Abstract

Objectives/Goals
My project was to design an environmentally safe way to generate energy from ocean swell. I simulated different waves heights with different speeds on my Swell Generators at home and in the ocean to test how different swells push air through tubes into an electric turbine.

Methods/Materials
Two 3 inch diameter 10 ft. PVC pipes with end caps with 3/4 in hose were attached to the voltage generator. A voltmeter connected to the generator measured current generated when air turned the turbine. To simulate various wave conditions I constructed 4 inch diameter tubes filled with water. The 3 inch tubes travelled down simulating a swell.
I dropped the tubes into the water tubes at different speeds and heights individually and simultaneously; at different speeds, mimicking calm, moderate, and stormy days. The tubes were also attached at the Santa Cruz city wharf to test the generator under natural conditions.

Results
Wave Height: My data show that bigger swells generate more energy. When I simulated one-meter waves no voltage was generated. When I simulated a two-meter wave with two pounds of weight (slow waves) I generated 18 millivolts (mv) and 55mv for 2.5m waves and167mv and 235mv for faster waves. With large waves (2 and 2.5m) I generated 98 and 330mv using two tubes. Increasing the speed of the wave (4lb weights) generated 81mv for 1m, 600mv for 2m, and 624mv for 2.5m waves. Waves run sequentially generated 0mv for 1m, 19mv for 2m and 74mv for 2.5m waves. Wave Speed: By changing the speed of the wave (the force) I generated more energy per swell. A 2.5m wave generated 55mv at slow speed and 235mv at high speed, suggesting stronger/faster waves generate more energy.
Comparison of Generator Designs: I hypothesized that tubes run sequentially would generate more volts. My results show both tubes generated more energy at the same time.

Conclusions/Discussion
My results show that if the swell is large enough I can collect energy using my swell generators. I also learned that if the Swell Generator Tubes were aligned perpendicular to the swell I would collect more energy.
We have to find new and improved ways to collect energy without burning fossil fuels that emit CO2 and contribute to global warming. There are other ways to generate energy from the ocean, but I suggest that it is better to place generators on structures that are already there, like wharfs, instead of making new impacts to the ocean floor.

Summary Statement
The purpose of my project was to design an environmentally safe way to generate energy from an ocean swell.

Help Received
My father helped set up tubes

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Michael A. Connors

Project Number
J0205

Project Title
Electromagnetic Capture of the Energy of Wave Motion: Translational vs. Rotational Capturing Mechanisms

Abstract

Objectives/Goals
The purpose of my project is to try to find a cheap and efficient source of alternate energy. The objective of my project was to harness the motion of waves as a source of alternate energy. My experiment was to determine whether more energy can be captured from the translational motion of waves than the rotational motion of waves.

Methods/Materials
For the translational test, the waves moved a platform of styrofoam, aluminum, and weights up and down, that was connected to a wire, that was connected to a lever that amplified the total linear motion by almost 3 times. For the rotational test a blade rotated side to side with the motion of the waves and had a gear attached to it in order to translate the rotational motion to linear motion that could make the magnet go through the generator coil. The gear was connected to a wire connected to the lever. The other end of the lever had a wire that had a neodymium magnet attached to it, dangling inside of the generator coil with 3000 feet of copper insolated wire wrapped around it. It was connected by alligator clip wires to an electrical circuit on a breadboard consisting of conductors and semiconductors. The electrical circuit was connected to an arduino with a LCD that read out the accumulated charge.

Results
The translational mechanism captured on average about 11% more electricity than the rotational mechanism.

Conclusions/Discussion
The results that I gathered supported my hypothesis, that the translational motion of waves would capture more energy than the rotational motion of waves. In the future if I am going to try to capture energy from wave motion I know to use the translational motion of waves not the rotational motion of waves.

Summary Statement
My project was about finding an alternative source of energy from the motion of waves and determining whether the rotational motion of waves captured more energy than the translational motion of the waves.

Help Received
My uncle helped me with concepts and brainstorming design ideas.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Adrienne M. Corr

Project Number

J0206

Project Title

Some Like It Cold: How Does Temperature Affect a Solar Panel's Efficiency?

Abstract

Objectives/Goals

There is an increasing need for power sources that do not pollute the planet. Silicon based solar cells have a lot of promise, but are not very efficient. In this project the relative power output of three different sets of solar panels was examined under different load and temperature conditions.

Methods/Materials

Three different sets of solar panels: four 11.4 cm x 33 cm, solar panels, Junior Solar Sprint, Solarmade (3 volts @ 3 Watts), two 19.1 cm x 29.2 cm solar panels, LiteFuze, (20 volts @ 5 Watts) and four 6.35 cm x 12.7 cm solar panels, (6 volts @ 3 Watts) were tested. The panels were connected to various loads resistances (R): 33, 100, 200, 233, 300, 600 and 900 Ohm resistors at 10 Watts, to complete the electrical circuit. A halogen light (1000 Watts) was suspended at a fixed distance above the panel. The panels were placed in the kitchen freezer to cool to below freezing. Each panel was taken quickly to the garage and the temperature was taken across the panel. The voltage (V) at that temperature was recorded when the light was turned on repeatedly as the panel warmed. The power (P) was calculated using P=V^2/R.

Results

The panels were first tested for consistent temperature measurements at 3-6 points across each panel. The panels were then tested for the optimal load for power output. The Junior Solar Sprint panels (set A), the LiteFuze (set B) and the smaller panels (set C) were tested and had optimal loads of 33Ohm, 300Ohm and 233Ohm resistors respectively. The panels were tested across temperature gradients at 33Ohm (peak) and at 100Ohm (approximate load for about 50% peak power) for set A, 300Ohm (peak) and 900Ohm resistors for set B and 233Ohm (peak) and 600Ohm resistors for set C respectively. With load resistance at or above the optimum the power output decreased linearly with temperature. When the load resistance was below the optimum then the power output did not follow the linear curve.

Conclusions/Discussion

The relative efficiency of silicon based solar panels increases with lower temperatures. The temperature and power relationship was linear at or above the optimal load resistance. The load resistance is critical to the performance of these solar panels in predicting their efficiency under different temperatures.

Summary Statement

The power output of solar panels increases linearly with decreasing temperature only at or above optimal load resistances.

Help Received

My parents purchased the supplies and my father helped me take measurements. Mrs. Gillum reviewed the project and provided solar panels. They also reviewed the write up.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Tyler Cullen

Project Number
J0207

Project Title
Rain to Renewables: Harnessing the Power of Rain Water in Street Gutters

Abstract

Objectives/Goals
My objective for my project, Rain to Renewables, was to test various turbines and an aqueduct system to see if I could harness rainwater from a street gutter during a storm to create enough electricity to power an emergency communications device.

Methods/Materials
A 40 foot long aqueduct was constructed in order to channel rain water into a sono tube for temporary water collection. The sono tube was fitted with water resistant lining, a downspout and a large plastic end cap. Three turbines,a water wheel, an 8 ounce 13 spoon Pelton turbine and a 30 ounce 13 spoon Pelton turbine, were constructed. The downspout sprayed water at the each turbine, tested individually.

Results
The 8 ounce 13 spoon Pelton turbine generated the most electricity under 12 and 24 in. head, and the water wheel generated the most electricity under 36 in. head.

Conclusions/Discussion
My conclusion is that a light-weight Pelton turbine can generate enough electricity from rain water in a street gutter to power an emergency communications device. This engineering design shows that renewable energy geneators can be used during storms, rather than turning to fossil-fuel based generators.

Summary Statement
Rain water in street gutters can be harnessed to create renewable energy generators, reducing reliance on fossil fuel generators.

Help Received
I sought some advice about implementation of my device from my parents and their friends who work in climate and energy.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Benjamin Davidoff; Joshua Levine; Dylan Ross

Project Number

J0208

Project Title

The Revinoff

Abstract

Objectives/Goals

The objective of our project is to build an engine to power cars that runs on alternative energy sources. Through this eco-friendly engine we want to revolutionize the world of transportation. The engine runs on water and solar energy.

Methods/Materials

We used four car tires, a water pump, some PVC pipes, wires, a 12 volt led-acid battery, 52x55 solar panel, a drill, a valve, an axle, 3D printer, a water wheel and a plastic box. Many steps were required in order to build this engine. We needed to gather the materials and prep them for work. We then drilled all the holes into the plastic box. The wheels were attached to the bottom of the body, we used the 3D printer to print a water wheel and attach it to the axle. We attached the PVC pipes to the valve and the pump. The axle was attached to the box and so was the pump. We attached the gears and the chain to it. We then did all the wiring and attached the solar panel.

Results

We tested our pump's power on each of our energy sources using a flow rate sensor and logger pro. The test results show that that the solar panel produces more water, in a measurement of meters per second, than the battery produces.

Conclusions/Discussion

In conclusion, we partially accept our hypothesis. We were wrong about the charging time of the battery and the number of solar panels necessary. The battery takes about twelve hours to charge, and we only needed one solar panel. We accept our hypothesis in that our engine is a success and works perfectly.

Summary Statement

Using water and solar energy we have engineered an eco-friendly car engine, and it is designed to revolutionize the ever growing world of transportation.

Help Received

Director of operations at The Mirman School, Mr. Craig Fine helped with drilling, sawing and welding.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nicholas L. Finke

Project Number
J0209

Project Title
The Amazing Power of the Microbial Fuel Cell! Making Energy from Organic Waste

Abstract

Objectives/Goals
A microbial fuel cell can generate electricity from organic waste. Bacteria in the organic waste generate extra protons and electrons during their digestive process. The electrons move from anode to cathode to create an electrical circuit. My objective with this project is to build a working microbial fuel cell and measure how the energy it produces increases and decreases over time.
This project is important because it demonstrates how to make energy and fresh water from something that costs almost nothing and is widely available - organic waste. This can help disadvantaged people who live in underdeveloped countries.

Methods/Materials
I had to build an anode, cathode, electrodes, and proton exchange membrane, and assemble them into the fuel cell. For the anode, I collected a benthic mud sample from a nearby lake as a substitute for organic waste, and for the cathode I used a conductive salt solution made from the lake water. I used an aquarium filter to pump air into the cathode. For one month I measured the current and voltage produced by the fuel cell using a digital multimeter. I built 3 separate fuel cells to be able to compare the measurements between them, and to have backups in case one didn't work.

Results
The microbial fuel cell actually did produce electricity. The voltage output started out slowly increasing over a few days, made a steep upward incline, then leveled out reaching a peak of 470mV after 18 days, then finally started decreasing. The current also increased and decreased - it's graph had sort of a rainbow shape over the month.

Conclusions/Discussion
My hypothesis was that the energy produced by the microbial fuel cell would increase for about 4 days, then decrease to zero as the bacteria in the benthic mud sample died out. My hypothesis was partially correct. For example, the voltage increased for 18 days (not 4), and it never went all the way down to zero. It stopped at 175mV. I think this happened because the bacteria didn't completely die out, because they still had matter in the benthic mud to feed on. If I had let the fuel cell run for a longer time, then probably all the bacteria would die out and the voltage would have gone to zero.
Since I have demonstrated that the fuel cell works, I would like to build a huge one to generate energy for people who need it.

Summary Statement
A microbial fuel cell can generate energy and fresh water from organic waste!

Help Received
My dad helped me use a power drill to build to the fuel cells.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Lili N. Follett

Project Number
J0210

Project Title
Vortexes for Cheaper Solar Power

Abstract

Objectives/Goals
This project investigates whether a solar vortex can produce more energy than rising air without a vortex.

Methods/Materials
A vortex generator was built using a heating element at the bottom to simulate heat from concentrated sunlight and vertical slats to control airflow. A fan is at the top to convert air movement to electricity. The first step in the experiment is to heat up the air at the bottom of the vortex generator with an electric heater. Second, adjust slats so that incoming air swirls and measure the speed of the fan. Third, arrange the slats so the incoming air does not swirl, and measure the speed of the fan without the vortex. Fourth, chart the data and determine whether the swirling or non-swirling air produced the most energy. Investigate the effect of wind on the vortex by repeating steps one, two and four with wind simulated by an electric box fan. Finally, evaluate the cost of the system compared to a photovoltaic system with the same solar collection area.

Results
The vortex was able to spin the fan 48.5% faster than the no vortex case. The results were repeatable, since the fan speeds in all tests were within + / - 6.2% of the average for both the vortex and no vortex cases. The cost analysis shows that the solar vortex system costs 26.9% less compared to a photovoltaic system, for the same solar collection area.

Conclusions/Discussion
The hypothesis that a solar vortex will produce more energy than rising air without a vortex is true. The data was also repeatable. The cost analysis shows potential to be less expensive than a photovoltaic system. In the real world, this could be set up in deserts to create vortexes so solar power could be harnessed in a different way. Georgia Tech claims it can reduce the cost of energy by 65% over solar photovoltaic energy.

Summary Statement
This project investigates whether a solar vortex (or dust devil) can produce more energy than rising air without a vortex.

Help Received
My father mentored me and donated his garage space, and my family helped me assemble the rig by holding all the slats while I put the top on. My teacher, Ms. Ligeti, also provided guidance and encouragement.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Max A. Freedman

Project Number
J0211

Project Title
Power from Ocean Waves

Abstract

Objectives/Goals
Can ocean wave power be used generate electricity? Oceans have tremendous potential, but ocean energy is not widely used. Wave energy, from tides and ocean currents can be used to drive an Oscillating Water Column (OWC). This project builds a small scale OWC using a Wells turbine apparatus, to generate energy with ocean waves.

Methods/Materials
Methods: Prototype, test and refine systems and integrate systems into working OWC. Pipe System (Pneumatic): Task: Convert wave energy to pneumatic energy. Action: When waves ascend, air pushes out and when waves descend, air is pulled in. Turbine System (Mechanical): Task: Convert pneumatic to mechanical energy Action: Moving air spins turbine and turns the motor. Electrical System (Electrical): Task Convert mechanical energy to electrical energy Action: Electricity is generated by spinning motor and conducted to voltmeter. Integrated System (Wave, Pneumatic, Mechanical, Electrical): Task: Convert wave energy to pneumatic energy to mechanical energy to electrical energy Action Integrate all systems using waves to spin the turbine generating electricity.
Materials: 4# diameter 3D printed PVC Wells turbine and assembly, 2v DC motor with bell wires, ABS 4# pipe and fittings, 50 gal plastic garbage can

Results
Individual systems were prototyped tested and refined. Pneumatic System--Air Pressure Test: Is there enough air pressure to spin the turbine? Submerge in ocean waves, test the air pressure coming off the OWC in three trials using a weighted lid. The air pressure generated from the OWC was: 86.59 kPa. Turbine System--Intake vs. Outtake Test: Is the Wells Turbine effectively producing electricity in both directions? Testing the turbine with the blower, the Intake air direction generated higher voltages, however both directions produced voltage. Electrical System--Resistor Test: What is the power potential in the system? Testing the motor with 10k ohm, 1k ohm, 100 ohm resistors demonstrate the power generated by motor, 1.85, 20.16, 14.44 respectively. Integrated System--Integrated Systems Test: Will It Work? Integrating all systems did not generate electricity with ocean waves.

Conclusions/Discussion
This engineering project demonstrates a small-scale model of OWC and Wells turbine. Initial results from the integrated unit fail to generate electricity.

Summary Statement
This engineering project demonstrates a small-scale model of OWC and Wells turbine to generate electricity from ocean waves.

Help Received
My mom helped me with research and board. My dad helped me assemble my model and testing in the ocean

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Sierra G. Freitas

Project Number
J0212

Project Title
Looking for the Best Blend of Biofuels

Abstract

Objectives/Goals
My project "Looking for the Best Blend of Biofuels" is about testing and finding the best biofuel blend based on cost and performance while using alternative energy to produce biofuels. My hypothesis was that 50% cooking oil/50% petroleum diesel would be the best blend based on cost and performance.

Methods/Materials
I designed and built a solar and wind powered biofuels refinery in my yard in which I processed over 200 gallons of waste vegetable oil I collected from three restaurants in my city. I converted the used oil into clean, dewatered and filtered cooking oil using my home built solar heat exchanger, photovoltaic & wind powered pump through my three tanks, 20 micron and 1 micron filters. I blended cooking oil with defined amounts of petroleum diesel. I also converted separately, cooking oil into biodiesel and blended it with the same percentages of petroleum diesel. I tested the different blends in a diesel car and in my diesel generator connected to a 3000 watt load.

Biodiesel is very similar to cooking oil except it is processed with chemicals. I used many titration tests to see how much potassium hydroxide (catalyst) was needed in each batch to separate the glycerides from the oil. I used methanol to bond the glycerides and separate these free fatty acids from the oil. I tested the biodiesel for complete reaction with water tests. I poured hot water into the biodiesel and after an hour there was separation between the water and oil as long as there were no emulsions (compounds that allow water and oil to bond). I continued to do this three times until the separated water looked clear. I then dehumidified the biodiesel, blended it with petroleum diesel, and ran it in a car and in my diesel generator.

I ran multiple sets of tests with all 6 blends. On the diesel generator, I measured the voltage, amperage and time with all 6 blends to determine the watt hours which I equated to power density for my analysis. I also tested in a 2006 VW Jetta TDI with all 6 blends and measured mileage.

Results
The 50% cooking oil and the 50% petroleum diesel was the best blend based on cost and performance.

Conclusions/Discussion
My hypothesis was proven correct, the 50% petroleum diesel/50% cooking oil was the best blend. The 70% petroleum diesel/30% cooking oil blend had 4.1% more energy, however, the 50% petroleum diesel/50% cooking oil was 20% less expensive, therefore making it the best blend overall.

Summary Statement
Find the best biofuel blend based on cost and performance using alternative energy to produce it.

Help Received
Teacher helped with electrical system, uncle helped with chemistry, dad helped with construction, acquaintances helped with explaining the process, classmate's dad provided test car

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Shakson K. Isaac

Project Number
J0213

Project Title
Soil + Reused Coffee Grounds + Tech. = Novel Microbial Fuel Cell

Abstract

Objectives/Goals
The objective of this experiment was to see that if a different ratio of soil to coffee grounds and adding a capacitor or resistor would make the battery applicable to the alternative a renewable energy world.

Methods/Materials
In the experiment I had 1 control and 10 manipulating variables.The independent variable is the ratio of soil to coffee grounds. The dependent variable is the amount of voltage and ampere it produces. I had (100% soil,add 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% coffee ground and 100% coffee ground). Then I put these different ratios into eleven separate jars. I checked the moisture of each jar and checked to make sure if the moisture was the same level. I also checked the PH. of the eleven different jars. I then added zinc and copper electrodes into every jar and soldered wires onto the electrodes. I also made holes in the jar lids and put the copper wires through them. I then patched the holes with silicon and everyday checked the voltage and amperage using a multimeter and a galvanometer. Also I attached capacitors, resistors, LED lights, and a motor.

Results
The results were 90% soil: 10% coffee ground had the highest voltage overall and 100% coffee ground had the highest ampere overall. It shows that the 100% coffee ground the acidic battery was only high in amperage but the neutral 90% soil: 10% coffee ground battery had high voltage and adequate amperage.

Conclusions/Discussion
My data indicates that my first experiment is partially correct because most of the batteries in the 50% to 100% soil (50%-0% coffee ground) have a high voltage of over 0.9 and 1 volt but not all of these have high amperage. 100% coffee ground has the highest amperage. Based on what my data indicates my hypothesis is correct too because when I connected 3 soil bacteria batteries (MFC) that make 3 volts and 100 micro amps with the 3.3 farad super capacitor it charged for 22 hours. After the capacitor was fully charged I attached it with a motor. The motor spun for about 23 seconds. When it tried using NPN and MOSFET transistors it worked but didn#t increase the amperage very much. When I attached 2 or 3 90% soil 10% coffee ground batteries together with a resistor it lit up a LED, clock, and low wattage electrical items. My overall conclusion was that this project could be applicable in the future when new technology comes out that turns low amperage batteries to high amperage batteries.

Summary Statement
MFC and an application to renewable energy.

Help Received
Mother helped order capacitors. Father soldered copper wires to electrodes. Mr.Tyler answered questions I had. Starbucks Coffee gave me a lot of coffee grounds.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Alec R. Isaacman

Project Number
J0214

Project Title
Osmotic Power: The Impact of Water's Salinity Level on the Production of Osmotic Generated Power

Abstract

Objectives/Goals
The objective is to determine the impact of water's salinity level on the production of osmotic generated power?

Methods/Materials
Two chambers separated by an osmotic membrane were filled with equal amounts of water. One with fresh water and the other with salt water (with different salinity levels). The three most common ocean salinity levels [Polyhaline (18-29 parts per thousand), Mixoeuhaline (30-39 parts per thousand), and Metahaline (40-49 parts per thousand)] were tested to determine the rate of absorption of salt water as it pulls fresh water (pressurized with a bicycle pump) through an osmotic membrane over a 20 minute time span.
Key items in the construction of the testing tank: Flat sheet reverse osmosis membrane as the chamber divider; Plexiglas to support the membrane; purified and salt water.

Results
Polyhaline was tested first. Over 20 minutes the volume of water on the salt water side increased by an average of 32.0625 cu.in. The average increased to 34.4375 cu.in. for Mixoeuhaline (30-39 parts per thousand) was tested. This is an increase of 6.897% over the Polyhaline. The rate of absorption was the highest for Metahaline, which resulted in an average increase of 37.40625 cu.in. Metahaline salinity level absorbed 7.937% more than the Mixoeuhaline and 14.286% more than Ployhaline. The results show that the greater the level of sodium chloride in water, the more fresh water it will absorb through an osmotic membrane.

Conclusions/Discussion
Osmotic power has real world applications and is currently being used to create energy in Norway. This experiment sought to determine the best locations in the world to use osmotic generated power. By testing the impact of ocean's most common water salinity levels on the osmotic process, I could determine where in the world this type of power plant would be most efficient. From my research, I believed that because there are more sodium chloride(NaCl) molecules in the higher levels of salt water, the freshwater would be absorbed more quickly through the osmotic membrane. In fact, Metahaline ocean water had the highest efficiency rate most likely because it contains the highest salinity level. With an increased rate of absorption, a power plant would use less energy to generate power, making it more efficient when built near oceans with higher salinity levels.

Summary Statement
The salinity level of ocean water impacts the efficiency of osmotic generated power.

Help Received
Father help construct the testing tank and assemble the display.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kai Y. Kato

Project Number
J0215

Project Title
Climate vs. Energy Output: The Effect of Temperature on the Productivity of Solar Panels

Abstract

Objectives/Goals
The objective of this project was to find how temperature affects the power produced by solar panels. The purpose was to see if panels in different climates have varying results. For example, one could see whether it is smarter to place a solar array in the arctic versus the desert. Also, companies that provide solar for houses could more accurately calculate the number of panels needed to power homes in different climates. The hypothesis was that a cold panel would work best.

Methods/Materials
For this experiment, three photovoltaic panels were set up in three environments consisting of a plastic tub and an acrylic cover. One received heat from a heat gun, one was cooled by dry ice, and another was left alone to be tested as a control. The panels were left out in direct sunlight and results were tested for each panel by a multimeter in intervals of thirty minutes. The cold environment was kept at a temperature of 0 degrees Celsius, the hot one was constant at 40 degrees Celsius, and the normal was kept at 25 degrees Celsius.

Results
The average wattage for the cold panel was 0.2164 watts, the hot one was 0.1531 watts, and the control was 0.1751 watts. The P-value of these results was 0.014, making a definite difference in the amount of wattage produced by each panel. The cooled panel worked about 40% better than the heated panel.

Conclusions/Discussion
Through the experimentation the null hypothesis is rejected. Therefore, the results support the alternate hypothesis: the cooled panel works the best. The solar panels in a cold climate work the most efficiently.

Summary Statement
Solar panels produce different amounts of energy at different temperatures, and this information could lead to smarter placement and calculation of photovoltaic cells.

Help Received
Father helped design display.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Rei J. Landsberger

Project Number
J0216

Project Title
The Effects of Reflective Designs on Solar Cell Power Output

Abstract

Objectives/Goals
The goal is to determine if reflective material placed around a solar panel will help to increase its electrical power output, and to also determine which reflector geometry produces the most power.

Methods/Materials
Two reflector designs were fabricated, one using flat panels and one with conical geometry. Their performance was evaluated by placing them around a solar panel that drives a motor to raise a weight 2.3meters. Data was obtained on electrical power by using electrical meters to measure voltage and current coming from the solar panel to the motor. Mechanical power was calculated by finding the work done by the motor in raising the weight and then dividing by the time elapsed. This test was performed using a range of weights for each reflector design.

Results
The conical solar reflector produced an average of 6.5 watts of electrical power and the flat panel mirror design produced 5.9 watts, whereas the solar panel without a reflector produced 5.1 watts. This is a 27% increase in power production for the cone and a 15% increase in power for the flat panel design. The reflectors increased the temperature of the panel, and this high temperature gradually lowered the voltage and power output. The heat caused slight melting in one spot of the panel.

Conclusions/Discussion
Reflective collectors can increase the energy output of a solar panel, and the conical design is the most effective. A challenge comes along with this greater power: to apply the reflector in the field, where the sensitive solar cells are exposed to sunlight for many hours, it may be necessary to find a way to keep the panel cool.

Summary Statement
This study researched the performance of reflector designs surrounding a solar panel to boost power output.

Help Received
Father helped with building the solar cone and setting up the experiment on a ladder.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Anne M. Lillis

Project Number
J0217

Project Title
What Ingredients in Anaerobic Digestion Produce More Methane?

Abstract

Objectives/Goals
My objective was to determine what ingredients (oranges, carrots, or sweet potatoes) produced the most methane when put through the process of anaerobic digestion.

Methods/Materials
To do this project, I built three, identical anaerobic digesters, and put four pounds of oranges, sweet potatoes, and carrots separately into the anaerobic digesters, using 5-gallon buckets, tubes, caulking, etc. and let them sit for two weeks. I then measured the amount of methane that had built up inside of a balloon, recorded the data, and then repeated the process over again. In all, I did the experiment three times, recorded the data, and analyzed the results.

Results
The results showed that oranges produced the most methane.

Conclusions/Discussion
My results did and did not support my hypothesis. I thought that sweet potatoes would produce the most, carrots the least, and oranges in the middle. I was wrong where oranges produced more than sweet potatoes, but right in the fact that carrots produced the least.

Summary Statement
My project is about experimenting with different ingredients to determine which could be used as clean, renewable energy producers.

Help Received
Father helped with the construction of anaerobic digesters; mother gathered produce and helped with presentation board layout; brother helped get the lids off my anaerobic digesters; teacher, Mr. Scott, helped me along the way; and grandma provided a kitchen scale.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
W. Douglas Liu

Project Number
J0218

Project Title
Windmill Blade Efficiency

Abstract

Objectives/Goals
My objective is to determine which number of blades on a windmill would generate the most electricity. I will test the windmill with 2, 3, 4 blades.

Methods/Materials
Build a stand to support the homemade windmill heads of 2, 3, 4 blades respectively. Take the two blade head and put it on the stand. Connect the multimeter to the motor. Put a box fan 0.6 meters away from the stand. Set the speed on the fan to mode 3 and within five seconds record the highest voltage. Do the same to the 3 and 4 blades. Repeat the experiment three times.

Results
The 4 blade windmill generated the most electricity while the 2 blade windmill generated the least electricity.

Conclusions/Discussion
My conclusion is that the 4 blade windmill generates the most electricity because it catches the most wind. The number of blades can change the output of a windmill. In windy areas setting up a wind turbine would help generate electricity. Windmill uses wind power so it does not give out carbon dioxide and is Eco-friendly.

Summary Statement
My project is to test whether different number of blades on a windmill will affect the output of electricity using 2, 3, and 4 blades.

Help Received
My mother helped me buy the materials. Mr. Rowe helped me make the windmill stand. Ms. Zephyr pointed out some grammar mistakes

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nathan T. Loafman

Project Number
J0219

Project Title
The Natural Magnifier

Abstract

Objectives/Goals
The objective my project was to see if water would make light more intense to help a solar panel produce more electricity.

Methods/Materials
Two identical solar panels were placed approximately two inches apart. One with water on top the other without. At five o'clock I measured the voltage of each panel with the same multimeter.

Results
The solar panel with the water consistently produced the most electricity. The solar panel without water produces less electricity.

Conclusions/Discussion
My conclusion is that water does make light more intense to help a solar panel produce more electricity.

Summary Statement
My project is about using water to make light more intense to help a solar panel produce more electricity.

Help Received
Mother helped buy materials; teachers helped with grammar, where to place components, what to take out & what to put in.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Alicia C. McDaniel

Project Number
J0220

Project Title
Hydro-Power

Abstract

Objectives/Goals
The objective of the project Hydro-Power was to find the increase of voltage from three different water column heights, five feet, ten feet, and fifteen feet. The operational hypothesis was that the increase for every five foot interval would be 25%.

Methods/Materials
To conduct this experiment the following materials were used: a hydroelectric generator, a waterwheel, volt-meter,1 5-gallon bucket, 3 different length pipes: 5 feet, 10 feet, and 15 feet, couplings.
The experiment is set up by taking a 2-1/2 foot section of pipe and placing it inside a five gallon bucket. On the end o the pipe inside the bucket place a coupling and on the other end a 90 degree angled section of pipe. Place the 5 foot section of pipe on the end of the 90 degree angled pipe. Repeat with the 10 and 15 foot section of pipe when the test is run for those lengths. On the end of the pipe place a water spout. To collect data put a hose in a bucket and wait for water to stream down from the bucket via the pipe. Place a waterwheel in front of the stream of water so the generator spins due to its connection to the waterwheel. Tests last about one minute each. Perform several tests from each height to gather enough usable numbers for data.

Results
The results of data collected show that five feet had on average 2.82 volts, ten feet had an average of 4.93 volts an increase of 43%, and from fifteen feet there were 7.96 volts on average which was an increase of 38% from ten to fifteen feet.

Conclusions/Discussion
The data collected did not support the hypothesis. There was an increase of 43% from five to ten feet and an increase of 38% from ten to fifteen feet. Overall there was an increase of 155% from five to fifteen feet. This project is applicable because runoff from storm drains and household gutters could be used to spin larger versions of this type of hydroelectric generator and generate "clean" energy.

Summary Statement
Hydro-Power examines the increase in energy output when water is allowed to drop from varying water column heights and directed through a hydroelectric generator.

Help Received
Father helped build hydroelectic generator with 3D printer

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Brandon M. Moore

Project Number
J0221

Project Title
Which Type of Light Bulb Efficiently Generates the Most Electricity on a Solar Panel?

Abstract

Objectives/Goals
The purpose of this experiment is to determine which kind of light bulb (11W Incandescent, CFL, or LED) generates the most electricity on a solar panel in the most efficient fashion. I hypothesize that the CFL (compact fluorescent) bulb will do so.

Methods/Materials
To test the energy levels being produced by the panel, each bulb was tested in a specially-designed cardboard box, which was used to surround a 5W solar panel, the light bulb, and a Type A light bulb socket. This was done so that no exterior light or other factors could skew data. Energy levels (volts - V and Milliamperes - mA) were read off of a multi-meter, and the volts and the Milliamperes were multiplied together to find the Milliwatts (mW) produced by the panel. To test the efficiency component, a Celsius thermometer was put in the box, and the difference in temperature (before and after the trial) determined if extra energy was given off (see Discussion). Each light bulb was tested in 6 different trials for a total of 18 tests.

Results
The incandescent light bulb generated an average of 83.94 mW and had an average temperature gain of +0.35 degrees Celsius. The CFL bulb generated 69.67 mW with a temperature gain of +0.05 degrees Celsius. The LED bulb generated 67.20 mW with a temperature gain of +0.02 degrees Celsius.

Conclusions/Discussion
Solar panels respond to a frequency of light that carries a certain amount of energy, measured in electron volts (eV). A single-crystalline solar cell needs approximately 1.1 eV to create current for the cell in the form of an electron-hole pair, which corresponds to the infrared frequency of light (1,127 nm wavelength). A solar cell will give off any extra energy over the threshold of 1.1 eV off as heat. In essence, this project determines which type of light bulb gives off the most infrared light. The incandescent bulb generated the most electricity, but also had the highest temperature gain, which means it was not efficient. The LED bulb generated the least electricity, but had the least temperature gain. Therefore, the CFL bulb generated the most electricity on a solar panel in the most efficient fashion.

Summary Statement
This project tests which type of light bulb efficiently generates the most electricity on a photovoltaic (solar) cell.

Help Received
My father suggested ideas for the project and helped purchase supplies; my mother assisted with display board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Ronak Pai; Gino Prasad; Dhruv Shah

Project Number

J0222

Project Title

Use of the Piezoelectric Effect to Generate Electricity with a Trampoline

Abstract

Objectives/Goals

During a natural disaster many homes have severe power outages that can range from days to weeks. During this time people need to charge important devices such as a cell phone. The goal of this project is to create an alternative energy source that people can use to recharge small electronic devices in a natural disaster. The design criteria were that it should be compact enough to fit in a house, and generate enough electricity to charge a cell phone in an hour. It should also be easy and fun to generate electricity using this alternative energy source.

Methods/Materials

We looked at several alternatives for generating electricity at home. We decided on the approach of using piezoelectric disks attached to a trampoline as it met our design criteria. These piezoelectric disks generate electricity under pressure and are very convenient for generating electricity by using human body movement. The trampoline is a lot of fun to use, and using piezoelectric disks enable anyone to generate electricity simply by jumping on the trampoline.

For our project, the equipment we used were:
4 piezoelectric disks
1 mini trampoline
4 pairs of 140 centimeter long wire
1 Multimeter
1 wire 9 centimeters long

We attached the disks to the top of the trampoline, and connected them to a multimeter to record the voltage and current, and also connected it to a battery for storing generated electricity for use in charging a cell phone.

Results

Using one piezoelectric disk, the electricity generated was 32.83 micro watts, and the amount of electricity generated for four piezoelectric disks was 4,949.25 microwatts.

Conclusions/Discussion

Using the data on the amount of electricity that is generated, we used a regression chart to plot the amount of jumps it would take to charge an iPhone for 1 hour with 10 piezoelectric disks. The required number of jumps on the trampoline was 127 jumps, which is a reasonable number.

Summary Statement

Use of the Piezoelectric Materials with a Trampoline to Convert Human Kinetic Energy to Electricity for Charging Mobile Devices

Help Received

Parents and team mate's parents helped guide us and point us in the right direction

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Saaketh Pakanati

Project Number
J0223

Project Title
How Much Energy Can You Produce from Dirt Using a Microbial Fuel Cell?

Abstract

Objectives/Goals
My project is to determine if we can produce lot of energy from dirt using a microbial fuel cell.
My hypothesis was that if measured and calculated properly the MFC will produce around 100 milliwatts which can power household items such as an alarm clock or a LED light.

Methods/Materials
Topsoil from our backyard was obtained. An MFC kit (microbial fuel cell) was assembled according to instructions provided. Topsoil was mixed with water and placed in the MFC. Dirt was left untouched in order to grow required bacteria for about 10 days. Then the amount of energy generated in milliwatts over a period of time was measured using a voltmeter.

Results
Around 130 milliwatts of energy was produced with the topsoil .Right conditions yielded in development of bacteria. The energy produced was sufficient to power a small LED light.

Conclusions/Discussion
My hypothesis was that if measured and calculated properly the MFC will produce around 100 milliwatts and my experiment proves that it went over what was predicted. My experiment turned out in this particular way because of how the MFC was handled. When MFC was not moved, the bacteria growth increased steadily. The surrounding temperature also impacted the growth of bacteria. Using different types of dirt to study energy would also be an interesting study.
Overall, this experiment can help people in the real world to use MFCs in order to power small everyday appliances. MFC energy can even be considered a renewable source of energy. All you need to make energy is dirt!

Summary Statement
My experiment was to measure how much energy can be produced from dirt.

Help Received
Parents helped me get all the materials for the project and to put the display board together. Ms. Ligeti provided guidance and support.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Garrett K. Pedvin

Project Number
J0224

Project Title
Solar: Weather or Not

Abstract

Objectives/Goals
This experiment examined whether or not weather conditions such as smog or fog affect the overall performance of a solar cell. The hypothesis stated that the weather conditions will have an effect on the solar cell because these weather conditions block out light that the solar cell can use, resulting in a decreased energy output.

Methods/Materials
This experiment tested how much energy was generated by a solar cell and how much UV light there was in each individual weather condition after two minutes and thirty seconds of the weather condition being present. The solar cell and UV Light Meter would be wrapped in plastic wrap before each test to ensure that no damage would be done to the solar cell or UV light meter. After the two minutes and thirty seconds, the data would be collected and the weather simulation would be reset. There were ten trials where I set an incense holder into the aquarium and deposited two incense sticks into the holder. Next, the two incense sticks were burned in a controlled environment. This simulated smog. There were ten trials where I measured 26 g of dry ice and deposited it into 300 mL of water, which simulated fog. As well, there were another ten trials where I tested the solar cell and UV Light Meter without any weather condition present, simulating clear weather.

Results
When the weather was clear, on average, the solar cell produced 39.85 AC volts of energy and the UV light meter read 50 µW per square centimeter. When smog was present, on average, 37.95 AC volts and 44 µW per square centimeter were generated. The fog scenario yielded, on average, 37.65 AC volts and 35.1 µW per square centimeter. Though both the smog and the fog had similar energy outputs via the solar cell, there were much less UV Rays passing through the environment in the fog weather condition rather than in the smog.

Conclusions/Discussion
Overall, the data the experiment yielded supported the hypothesis, as the weather conditions clearly affected the energy output of the solar cell, while the fog scenario created less energy. Even though solar cells can be a reliable source of energy, one should consider how effective a solar cell can be if they are in an environment that will affect its output. In San Francisco, where there is a lot of fog, you may want to reconsider solar because it can impact its efficiency.

Summary Statement
This project is about how weather conditions such as fog and smog affect the performance of a solar cell.

Help Received
Mother and Father helped type report and collect materials, Ms. Fisher helped collect materials and supervised testing.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Jonathan F. Petty

Project Number
J0225

Project Title
Temperature's Effect on Solar Panel Energy Output

Abstract

Objectives/Goals
The objective of this experiment was to find out if the energy output of a photovoltaic solar panel is affected by its temperature. The hypothesis was that they are and that colder temperatures would increase a solar panel's voltage output.

Methods/Materials
Two small solar panels were used to compare a heated panel with a cooled one. Heat lamps were used to heat the panels and a cooling system was built for one. This was done by taking apart the panel and weaving aluminum tubing inside that cold water could be pumped through. The surface temperature was measured with a digital thermometer and the voltage with a volt meter.

The temperature and voltage output of the panels were first measured at room temperature for each of the three trials making sure they were the same. The heat lamps were turned on and the temperature and output measured at 5, 10, and 15 minutes. Next, the small pump was turned on to begin pumping cold water through one panel and the temperature and outputs on that panel were measured again every five minutes for 15 minutes.

Results
The results of this experiment showed that as the surface temperature of the solar panels increased, the voltage output steadily declined and as the temperature decreased, the voltage output steadily climbed. The surface temperature started at 71°F with an output of 13.5V and after 15 minutes was up to 80° with a decreased output of 11.6V. Then when the panel was cooled, dropping to 45° after 15 minutes, it was generating 17.6V, an incredible 152% jump in output. Once the heat lamp was turned off, it was observed that the first panel cooled and increased its output back to the baseline very slowly comparatively.

Conclusions/Discussion
The surface temperature of a solar panel does affect its energy output and actually quite significantly as shown, confirming the hypothesis that cooler surface temperature of the panels would produce higher voltage output than hotter ones.
We expect solar panels to perform better as their exposure to sunlight increases, but many may not realize that their performance starts to decline rapidly if they start getting hot as well. So especially in very hot regions, it would be highly beneficial to have a cooling mechanism in place to keep from losing efficiency.

Summary Statement
The purpose of this project is to determine the effect of solar panel surface temperature on its energy output.

Help Received
Dad helped build the experiment apparatus and mom helped by proofreading my written work for errors.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Matthew B. Prata; Thomas J. Prata

Project Number
J0226

Project Title
It's So Hot It's Electric

Abstract

Objectives/Goals
Can you charge a phone with geothermal electricity? Our hypothesis was that we can generate a decent amount of electricity from a portable heat cell.

Methods/Materials
We looked for a portable geothermal conducted and we found Peltier tiles. Next, I had to conjoin the peltier tiles to the heat sink. We did this by using geothermic glue which is safe to use with heat. Next, we tested our project by placing the heat sink over a flame to produce heat, while a fan was going on at the top to cool it down. These opposing energies produces a reaction through the magnets that is called the Thomson effect, which is an effect that produces electricity. We tested the volts it was conducting. For this project we used a candle, Peltier tiles, thermometer, phone, phone charger, and gloves.

Results
We got 2 volts from the Peltier tile. This still charged the phone but it wasn't enough to make the phone indicate that it was charging.

Conclusions/Discussion
Our hypothesis was correct; it is possible to charge a phone with a portable heat device.

Summary Statement
Our hypothesis was that we can generate an adequate amount of electricity from a portable heat cell, particularly Peltier tiles.

Help Received
Mom helped prepare heat sink.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kaushik Shivakumar

Project Number
J0227

Project Title
Factors Influencing the Conversion of the Kinetic Energy of a Landing Airplane into Useful Electrical Energy

Abstract

Objectives/Goals
The purpose of this project is to explore the conversion of an airplane's kinetic energy during landing into useful electrical energy. The hypothesis, based on Faraday's and Lenz's laws is: When an airplane fitted with electromagnets lands on a runway, underneath which lie coils of wire within which magnets can slide, the landing kinetic energy will be converted into useful electrical energy, and will in turn slow the airplane.

Methods/Materials
Hot wheels tracks were placed on top of solenoid(s) fitted with a clear lubricated polycarbonate tube containing cylindrical N48 neodymium magnets that could freely slide inside the tube. A car with N48 neodymium magnets was rolled down the track and an oscilloscope recorded the voltage. The circuit resistance measured by a multimeter along with the voltage was used to compute the electrical energy produced.

Results
With one solenoid, the electrical energy generated increased with greater kinetic energy of the vehicle. Although the electrical energy generated was greater for higher kinetic energies, the conversion efficiency was lower. By experimenting with two solenoids, with each wired separately, a higher percentage of energy could be converted. I also tested the effect of magnetic flux on the conversion of energy and observed that adding more magnets increased the peak voltage produced up to a certain point, beyond which the inertia of the increased weight of the magnet offset the increased magnetic flux.

Conclusions/Discussion
A significant percentage of an airplane's kinetic energy at landing can be converted to electrical energy. Multiple solenoids increases energy conversion efficiency. There is an optimum point for the size of magnets used for the amount of electrical energy generated. Based on our observations of a 30% energy conversion efficiency, this system can provide a constant supply of electricity of over 200 kilowatts at a busy airport like London's Heathrow.

Summary Statement
The goal of my project was to demonstrate the feasibility of converting the landing kinetic energy of an airplane into useful electrical energy using the principles of electromagnetism.

Help Received
My parents guided me in my research and provided feedback on my presentation.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Colin S. Snyder

Project Number
J0228

Project Title
From Waste to Energy- Cellulosic Ethanol Production from Chaparral: Comparison of Two Pretreatment Conditions

Abstract

Objectives/Goals
The objective of this experiment was to create a process that converts chaparral, a plant that is currently being removed under the California Fire Mitigation Plan, into ethanol, a biofuel. The objective was also to compare overall results between samples that were pretreated under room temperatures and samples that were pretreated in a greenhouse.

Methods/Materials
5 grams of chaparral were pretreated in a 2 percent sodium hydroxide 12 percent urea, 100ml solution. Half of the tests were pretreated in the greenhouse and half of them were pretreated at room temperature. After the solution was rinsed and buffered, the solution was raised to 200ml and treated with 0.5mL cellulase and 0.5mL of cellobiase. Each day of the 6-7 day cellulase treatment the glucose concentrations were measured with a glucometer. At the end of cellulase treatment, glucose was measured twice in a 150 ml solution. Then, 1 mL of Saccharomyces, 1mL of Brettanomyces, both of which are yeasts, and 0.2 grams of yeast nutrient were added. The fermentation process occurred for seven days.

Results
The results showed that on average, nearly 44.1mg of glucose per gram of chaparral under room temperature conditions was produced during this experiment, and about 50.5mg of glucose per gram of chaparral under greenhouse conditions. However, the difference in glucose measurements between the two categories was shown to be not statistically significant.

Conclusions/Discussion
The results showed the hypothesis was incorrect, as the amount of glucose produced was not the same as predicted. Also, even though there was more glucose production in the greenhouse condition, that was not statistically significant, and therefore no conclusions can be made from those differences. However, this experiment still showed the process to be possible, and therefore may be viable in industry.

Summary Statement
This experiment studied the conversion of chaparral, a potential waste product, into ethanol.

Help Received
Father handled Sodium Hydroxide and Hydrochloric Acid; teacher provided some equipment; Chris Takeuchi, PhD, answered questions.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Michael B. Stegeman

Project Number
J0229

Project Title
The Effects of Water Temperature on a Fuel Cell's Efficiency

Abstract

Objectives/Goals
The objective of my experiment was to determine if water temperature affects a Fuel Cells efficiency. This experiment is to offer data that can determine at which temperature will Fuel Cells work best at.

Methods/Materials
To conduct this experiment, I had to insert water of varying temperatures(cold temp. 1.67 deg. Celsius, room temp. 18.3 deg. Celsius, or warm temp. 29.4 deg. Celsius) into the Fuel Cell (FC). My testing was conducted inside a testing box, which was the same temperature as the water. The water would be electrolyzed until about 15 mL of Hydrogen was produced. I measured the amount of volts/amperes going into the FC to electrolyze the water so I could calculate the Input Power (Watts). After a 5-minute waiting period I started to measure the amount of volts/amperes being produced by the FC in a 4 min. operating time to get the Output Power. I then calculated the efficiency for each water temperature using the Input/Output Energy.

Results
My data showed that the cold water temp. was 39% efficient, room temp. was 19% efficient, warm temp. was 24.6% efficient. Cold water temp. was more efficient than warm water temp. by 13.4% and nearly two times efficient as room temp. water.

Conclusions/Discussion
I hypothesized that the warmer the water temperature the more efficient the fuel cell would be. As of now, my data does not support my hypothesis. The colder the water temp. the more efficient it is. More testing will have to be conducted to get more constituent and conclusive results.

Summary Statement
My experiment measured the input/output voltage and amperes to calculate the efficiency of a fuel cell with different water of different temperatures inserted.

Help Received
Forrest & Debi Csulak helped with improving on my project. Lisa & Josh Arreola also helped with improving on my project. My father supervised while I conducted my testing.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Colin S. Takeda

Project Number
J0230

Project Title
Sushi Power: Making Solar Cells from Seaweed and Squid Ink

Abstract

Objectives/Goals
Different types of solar cells, like nano crystalline dye-sensitized solar cells (DSSC), have become the subject of intense interest and research. The use of anthocyanin derived from various fruit has been the standard dye used in DSSCs. The purpose of my experiment is to compare anthocyanin-sensitized solar cells with solar cells constructed using novel sources of photosensitive dyes including phycoerythrin from red algae and melanin from squid ink. I hypothesized that if a natural dye pigment is photosensitive, then it will generate electricity when used in a DSSC.

Methods/Materials
In my experiment, I assemble 15 solar cells in the Grätzel style of DSSC - 5 for each dye tested. The conductive side of a tin oxide coated piece of glass is coated with titanium dioxide. Raspberries, nori (dried red algae), and squid ink are liquefied and treated with ethanol. The liquid derived after straining is used to soak the titanium dioxide. The conductive side of another piece of glass is covered with carbon by exposing it to a flame. Then the two pieces of glass are stacked in an off set fashion with the conductive sides facing each other. An electrolyte solution of potassium iodide is added between the slides. The solar cell is exposed to a controlled amount of light from a lamp that produces natural sunlight. Using a multimeter, the voltage generated is measured and the results are averaged.

Results
All three types of solar cells produced instantaneous current when exposed to light. For all three types, there was a rapid drop in voltage followed by a slower increase. In my tests, the phycoerythrin-sensitized solar cell (red algae) outperformed the anthocyanin-sensitized solar cell (raspberries) in both maximum voltage and average voltage over the test period. The maximum and average voltage for the melanin-sensitized solar cell (squid ink) was less but the slope of its voltage increase was greater than both the other groups.

Conclusions/Discussion
Based on my experiments, if a natural dye pigment is photosensitive, then it will produce electricity when used in a DSSC. In fact, a novel source of photosensitive pigment, red algae, proved to be as effective as the standard fruit-derived anthocyanin-sensitized solar cell. In addition, my experiments show that an animal-derived photosensitive pigment, melanin, can also be used in a DSSC.

Summary Statement
This project compares the phycoerythrin and melanin to anthocyanin as photosensitive dyes in nano crystalline dye-sensitized solar cell.

Help Received
My Mother help me with some of the cutting for my display board and my father taught me how to use Adobe Photoshop. My teacher, Ms. Cohen answered my questions and proof-read my work.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Andrew W. Troxell

Project Number
J0231

Project Title
Are Solar Angles Important? Analyzing Solar Panel Efficiency Related to the Angle of the Sun

Abstract

Objectives/Goals
The sun produces enough solar energy on earth to make almost every household in the world energy independent. Current solar panels have inefficiencies present which causes the panel to be less effective. Solar inefficiencies are more prominent due to the rotation and orbit of the earth. To understand how this occurs, one must understand how to extrapolate the angle of the sun and how to derive solar noon. My science project objective is to determine at which angle of the sun, relative to earth, will a solar panel be most efficient.

Methods/Materials
The solar racer was built following step by step instructions provided. A race track was marked off on a clean, smooth surface at a distance of four meters going North to South and East to West. Solar car trials were completed every hour starting at 9:00am through 2:00pm. The angle of the sun was measured before each test by using a meter stick, string, and a large protractor. The time was recorded, in seconds, for the car to travel 4 meters. Four trials were completed for each different angle of the sun/ time of day, and in each of the two directions. The trials information was collected and data was extrapolated.

Results
The data collected from each trial demonstrates which angle of the sun produces maximum solar energy. The output of solar energy was clearly most productive when the sun was located at a 45º angle relative to a solar panel maintained at 0º. Because the earth is always moving, the 45º angle of the sun can occur at different times of the day. It was well worth noting that the direction the solar car traveled was relative to the optimal solar energy output. This is verified by how fast the solar car traveled during the trials going West to East and North to South.

Conclusions/Discussion
The conclusion reached is that the angle of the sun does affect the amount of energy produced by a solar panel. My hypothesis was correct. The solar panel generated 59% more speed at 33-45º of the sun's angle to the earth's surface compared to the other angles at different times of the day. One can conclude the faster speed indicates improved energy output.

Summary Statement
"Are solar angles important?" The goal of this project is to determine the angle of the sun and time of day where a solar panel produces the best output of energy.

Help Received
My teachers helped by exploring ideas and allowing to borrow some materials such as a chalkboard protractor. My family helped me with typing and the graphs.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kyra M. van Kreuningen

Project Number
J0232

Project Title
Photovoltaic Solar Plant

Abstract

Objectives/Goals
The purpose of my project is to create and engineer effective solar cells into a solar array with a plant-like appearance. I chose this project because I feel it has marketable potential and it would help me further develop my engineering skills. I also chose this project as a way to express my creativity while adhering to the rules and restrictions of the Science Fair. The purpose of my Solar Plant is to produce usable electrical energy using the power of the sun.

Methods/Materials
I used readily available materials to create an attractive and functional photovoltaic solar array. The main materials used are copper plate, copper wire, acrylic sheeting, acrylic adhesive, water, PVC piping, and PVC fittings.

Results
I ended up creating two solar plants. Using my test data on conductive fluids, I decided to fill the first plant with a water/baking soda mixture. In sunlight, this plant produced about 100mv from 19 small solar cells, but I used silicon adhesive in assembling the cells and the cells were messy and prone to leaking. I then constructed a second, superior plant using larger cells held together with acrylic adhesive. Individual Test cells using this method did not leak and produced over 50mv in sunlight. The entire plant should produce just under 1000mv.

Conclusions/Discussion
I successfully blended science, engineering, and art to create an attractive and functional solar array. I knew when I started this project that the energy produced by the simple copper solar cells would be minimal, but I was hoping for more than it ended up producing. I plan to create a next generation plant using the skills I have learned and a superior cell technology.

Summary Statement
To create a functional and attractive Photovoltaic Solar Plant

Help Received
Father taught me to solder and safely use power tools. Mother helped in typing some of the report.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Simon T. Way

Project Number
J0233

Project Title
What's Better: Vertical or Horizontal Axis Wind Turbines?

Abstract

Objectives/Goals
Energy independence and environmental concerns have grown the interest in wind turbines exponentially. The purpose of this experiment was to determine which variation of the wind turbine design, vertical or horizontal is more effective in durability, power output, and cost to build. My hypothesis was that the horizontal axis turbine would be more effective.

Methods/Materials
Readily available parts were purchased for both turbines. I built and tested a vertical axis turbine using a rain barrel cut in half and offset on an axis. This design used a treadmill motor. I built the horizontal axis turbine using metal parts and prefabricated blades. This design uses an alternator. I used wind speed and a multimeter to study both designs, tracking wind speeds and corresponding power output.

Results
My hypothesis was that the horizontal design would perform greater but would be more expensive to build. The experiment results supported my hypothesis and showed the horizontal turbine produced much higher power outputs. Using mathematical ratios even swapping motors, the horizontal axis performed better.

Conclusions/Discussion
My Data tracking and calculations showed that even given the increase in costs, when durability and power output are considered, the horizontal design remains superior.

Summary Statement
This is a comparison of vertical and horizontal axis turbines built and engineered by the student.

Help Received
The blades were purchased from Missouri Wind and Solar. My parents supervised power tool usage.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Bryan M. Wong

Project Number
J0234

Project Title
We've Got the Power!

Abstract

Objectives/Goals
The objective is to determine if hydroelectric power would be the most efficient renewable energy compared to wind power and solar power.

Methods/Materials
Measured water power by duct-taping the apparatus so that Motor #1 was resting on a platform and the water wheel was hanging off it under where the fountain would run water, simulating a stream. Steadied it with a clothespin that has a hole between its teeth large enough to let the water wheel spin freely.
Measured wind power by building a miniature wind turbine out of PVC pipe and balsa wood and setting in the general direction of the wind for the day.
Measured solar power by leaving a solar turbine out in the sun.
Wired multimeters to each generator, and recorded the voltage generated every five minutes for one hour over seven days.
Each generator's efficiency in voltage output was found by taking the percentage of the voltage that was generated to the maximum voltage each generator was able to output.

Results
Solar power was the most efficient renewable energy and wind power was the most efficient. Solar power was the most efficient in energy output at 95.1%, hydroelectric power had 16.3% efficiency, and wind power had 0.4% efficiency.

Conclusions/Discussion
My hypothesis that hydroelectric power would be the most efficient renewable energy was not supported. Though it was shown that water power had 16.3% energy efficiency, solar power was the most efficient in its voltage output, with 95.1% energy efficiency. This shows that the most efficient renewable energy source that should be utilized in our geographical location is solar power.

Summary Statement
The goal is to determine if hydroelectric power is the most efficient renewable energy compared to wind and solar power by using self-built miniature generators.

Help Received
Mother helped supply tools and equipment; Father helped cut PVC pipe; Mr. Gavin Gladding helped find blueprints of a miniature wind turbine

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
David Zhang

Project Number
J0235

Project Title
Optimizing Solar Panel Efficiency: Comparing Energy Efficiency of a Solar Tracker and Stationary Solar Panels

Abstract

Objectives/Goals
The objective of my project is to determine if a solar tracker that is designed to rotate the solar panel throughout the day to follow the sun will generate more energy than the stationary solar panel system.

Methods/Materials
Two types of solar panel systems were built in this experiment: a solar tracker that used a light sensor and a DC motor to rotate the solar panel to track the sun, and a stationary solar panel built with a solar panel identical to the one used in the solar tracker. There are three testing units for the stationary solar panel systems by changing the direction of the solar panel: a stationary solar panel facing the east (Stationary East), a stationary solar panel facing the west (Stationary West), and a stationary solar panel laying flat on the ground (Stationary Flat). Seven days of data was recorded for the four testing units. Each day, twelve data points were recorded from 7:30 am to 6:30 pm by one hour intervals to record the power output of each testing unit. The final analysis only used five days of data by taking out the largest and smallest days in terms of average daily power output.

Results
The Solar Tracker consistently generated higher power output than all the other stationary testing units because it always had a direct beam of sunlight hitting it to produce the optimal power output of the solar panel. The Stationary Flat produced more power than the other two stationary units because it always had a beam of sunlight hitting it through the day although it is not at an optimal angle. The Stationary East and Stationary West generated similar level of daily power output, and the only difference is one generated power in the morning and the other one generated power in the afternoon.

Conclusions/Discussion
In conclusion, the angle of a beam of sunlight hitting the solar panel does affect the power output of the solar panel. Therefore, using a solar tracker will help to optimize the solar panel efficiency by generating more power.

Summary Statement
My project is about optimizing solar panel efficiency using a solar tracker.

Help Received
Participant in the Avid Academy Science Research Summer Camp; Mother helped check the format of my display board.