Abstract: Science and Engineering Fair of Houston

1207

Finding the Optimal Generation Mix to Power Critical Home Loads During Extreme Weather Events

Anaya Tiwari

Fort Bend ISD /Quail Valley Middle School

Category:

Energy and Transportation

The purpose of this project is to test whether combining solar panels and a wind turbine provides more reliable backup power for critical home loads during extreme weather events. The problem investigated is whether a hybrid solar□wind system can keep electricity available longer than solar□only or wind□only setups. To test this, a small prototype was built with a solar panel, handmade wind turbine, and rechargeable battery pack connected to a light bulb. The battery was charged separately by solar only, wind only, and both together, and the run time of the light was measured with a timer and power meter. A mathematical model was also developed to calculate the optimal mix of solar and wind capacity needed to supply a 24□hour emergency load.

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[ ] Vertebrate animals [ ] microorganisms [ ] rDNA [ ] tissue

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Abstract: Science and Engineering Fair of Houston

1208

DIY Breeze

Naomi Harris

Charter/School of Science and Technology, Houston - MS

Category:

Energy and Transportation

I chose this project because I needed a new way to have airflow and thought of an electrical cardboard fan. What I hope to fix about my project is the way it looks. i want to make it more appealing and fix some electrical work. This project/fan can benefit society by how it uses recycled materials and a new learning aspect. This project can teach basic engineering making it a fun hands-on activity. My main goal for this project is to make a fan that is affordable and sustainable.

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Abstract: Science and Engineering Fair of Houston

1209

How does changing the fuel affect the amount of voltage the sterling engines produces

Hiroshi Valdez

Houston ISD/BCM Biotech Academy at Rusk - MS

Category:

Energy and Transportation

The Stirling engine is the best example of a real engine that we can make. It makes electricity when hooked up to a stater. The Stirling engine works by getting heat from the outside to warm up the piston, which then moves and makes the engine run. The starter motor works because there's a rod in the middle with wire wrapped around it, and it's lined with magnets that help generate electricity. This project is to find a alternate fuel other than gasoline fuels used to do this was methanol, kerosene, and vegetable oil,. Methanol is made from biomass, kerosene is made of hydrocarbons, and vegetable oil is made from the fat extracted from the plant .The research stated that methanol did better in lasting longer that the entire minute while kerosene made higher voltage. In the end I found two good fuels to use instead of gasoline.

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Abstract: Science and Engineering Fair of Houston

1210

Proximal Policy Optimization in Traffic Congestion

Category:

Energy and Transportation

Pranav Ramprasad, Nathan Feng

Conroe ISD /McCullough Junior High

Traffic signal optimization is a critical challenge for improving urban mobility and reducing congestion. This project evaluates the effectiveness of reinforcement learning (RL) using Proximal Policy Optimization (PPO) compared to traditional Fixed-Time traffic signal control. A traffic simulation was developed using SUMO to assess both approaches on a 4 way intersection network. The PPO agent was trained to optimize traffic flow by minimizing vehicle waiting times and queue lengths, while the Fixed-Time controller operated using pre-defined signal cycles. Experimental results show that the PPO-based controller consistently outperforms Fixed-Time control, achieving a less negative total reward across multiple trials (average PPO reward: −22,790.3 compared to −36,172.0 for Fixed-Time), indicating reduced congestion and improved traffic throughput. These findings highlight the potential of reinforcement learning–based traffic signal control as a scalable and adaptive solution for real-world urban traffic management.

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Abstract: Science and Engineering Fair of Houston

1211

Colored Roofs

Category:

Energy and Transportation

Naret Embil

Clear Creek ISD /Seabrook Intermediate School

Most might complain about the amount of money spent on electricity, especially throughout peak times such as winter and summer, whether trying to cool off their house or keeping it warm. To test the best roofing materials for an energy efficient house, this experiment evaluated the following hypothesis: if the color of the roofs is different, then the lighter the color of the roof tile is, the cooler the temperature inside the model home will be. First, the outside temperature was taken, then each of the model houses (with differently colored roofs) were put outside every day for a total of thirty minutes, then the temperatures inside of the house were taken and compared to the outside one. The darkest to lightest roof color went from 1-5. House number 1 being the one with the darkest (black) tiles was the house with the hottest temperatures, while house number 5 being the one with the lightest (white) roofing tiles was the coolest house. The data proved that the hypothesis was true, the lighter the color of the roof tile, the cooler the temperature inside the model home was and the darker the roof tiles, the greater the temperature difference between ambient temperature and temperature inside the model house.

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Abstract: Science and Engineering Fair of Houston

1212

How Does the Metal Combination Used in a Thermoelectric Generator Effect the Amount of Electricity Produced

Marion Connelly

Private/ST. JOHN'S SCHOOL

Category:

Energy and Transportation

This project investigates different materials when employed in a thermoelectric generator, also known as a Seebeck generator. A Seebeck generator uses two different materials joined at a central point to generate an electrical voltage due to the Seebeck difference of those two materials. At the beginning of this experiment I predicted that if I changed the type of metal used in a TEG, then the iron and constantan thermopile would generate the greatest amount of electricity because the Seebeck difference is greatest. I then made five Seebeck generators using different combinations of metal for each variation. I alternating heated or cooled each thermocouple and attached the ends of the thermopiles to a voltmeter and read the voltage produced. My hypothesis was rejected. The constantan and copper and and copper and galvanized steel both averaged the same amount of voltage produced. This likely is due to human error, and because I was not able to procure electric grade wires for any of these metals because of exorbitant prices and unavalability. This research is important to the future of our world and energy. Many materials have yet to be tested for viability in thermoelectric generators. TEGs have no moving parts and therefore last for long periods of time. These generators also let off no greenhouse gasses and are a viable replacement for fossil fuels. There simply has not been enough research in this field, as the current technology produces menial amounts of energy. More investigation must be done into clean energies and TEGs if we are to reach a clean, green future.

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Abstract: Science and Engineering Fair of Houston

1213

sun rays go away!

Parker Simms

Clear Creek ISD /Seabrook Intermediate School

Category:

Energy and Transportation

The purpose of this investigation was to see what sunshade type works the best at stopping heat form getting into a car. It was predicted that the sliver sunshade would do the best at stopping heat form getting into the car. The "car" was an acrylic box with a sunshade on the front. The "sun" was a heat lamp shining on the shaded side. During the experiment to get data the temperature was checked every 30 minutes over a 2-hour period; this was done for 3 trials for every sunshade type. The results showed that UV Film did the best at stopping the heat with an average of 32.3°C inside the "car" after two hours. The results also show that no sunshade did the worst at stopping heat with an average of 51.7°C inside the "car" after two hours. The hypothesis was incorrect because UV Film was the best at stopping the heat, but the hypothesis said that the sliver sunshade would do the best. Overall, the results demonstrate that sunshades stop heat from getting into a car and would be good for your car to protect it from the sun.

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Abstract: Science and Engineering Fair of Houston

1214

The Effects of Electrode Spacing on Voltage and Efficiency in MFCs

Jeffrey Liu

Conroe ISD /McCullough Junior High

Category:

Energy and Transportation

My project investigated the effects of electrode spacing on voltage and efficiency in MFCs, which are renewable energy sources that use microbes to produce electricity. Improving clean energy sources like MFCs is important, because it helps combat one of humanity's biggest problems; global warming. I expected an inversely proportional relationship between both distance and efficiency and distance and voltage with the lowest electrode spacing to produce the most voltage. To construct all 6 MFCs, I placed two graphite rods wrapped with wire in each jar, each with their respective distances. Then, over 72 hours, I periodically measured their voltages using a multimeter. The data suggested electrode distance, with physical limitations, did have a significant inverse relationship, with a correlation of -98%. However, there was no clear trend between electrode distance and efficiency. The order of most to least voltage was 2 cm, 4 cm, 6 cm. The performance graph of the MFCs showed when they might need maintenance or more moisture to produce electricity. However, some improvements to my project that could be made are better defining efficiency and measuring it, more electrode distance range, and more jars per distance. Applying the data in wastewater facilities, landfills, and sewage systems can help them serve a better purpose as electrical powerplants. MFCS aren't just scientific advancements, but they also show society how new technology can solve our biggest problems.

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Abstract: Science and Engineering Fair of Houston

1215

Gearing Up for Green Energy

Rohan Maudgalya

Conroe ISD /Knox Junior High

Category:

Energy and Transportation

The core question behind this project was pretty straightforward: Does a bigger windmill make more power? I hypothesized that the answer was yes, longer blades would logically catch more wind and generate more electricity. To really put that idea to the test, I tested 5 different blade lengths using a windmill sized down to about 4 feet where I connected the different blade lengths The results confirmed our hypothesis: windmills with longer blades consistently produced higher power outputs. Measurements indicated that both rotational speed and torque increased with blade length, leading to a noticeable rise in overall energy generation. Additionally, the experiment highlighted practical considerations in windmill design, such as the balance between blade length and structural stability, and the diminishing returns observed beyond a certain size. These findings support the idea that blade length is a major factor in wind energy efficiency and provide a basis for optimizing small-scale wind turbines. Future studies could extend this work by testing additional blade shapes, materials, or environmental conditions to further refine performance predictions.

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Abstract: Science and Engineering Fair of Houston

1216

How Does the Angle of A Solar Panel Affect Energy Absorption?

Raeleigh Rhea, Sneha Vijayakumar

Harmony Public Schools - South District/Harmony Science Academy - Beaumont

Category:

Energy and Transportation

I always wondered how solar panels worked They were so cool I decided to do an experiment to see if I could make them more cool. So it was because of that I thought of this experiment. I figured that if I could get the solar panel to just move to a certain angle, it would work very awesomely. I wanted to see at which angle that the solar panel would work.

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APPROVED 2026 sefh SCIENTIFIC REVIEW COMMITTEE

Abstract: Science and Engineering Fair of Houston

1217

VAWTs the Journey Continues

Logan Nagel

Clear Creek ISD /Brookside Intermediate School

Category:

Energy and Transportation

Vertical axis wind turbines (VAWTs) could support higher power generation per acre and potentially open up new opportunities for small footprint wind farms in urban locations. Maximizing wind power generation requires knowledge of optimal wind turbine spacing and wind turbine layout. If Darrius type vertical axis wind turbines are placed in an array the downstream wind turbines will be negatively affected and less power will be produced. This experiment will analyze the impact of spacing on VAWTs with lift blades in controlled conditions using a wind tunnel. Testing is conducted at one rotor diameter, two rotor diameter, and three rotor diameter space between three wind turbines with a ~10 cm rotor diameter. At one diameter spacing downstream turbines spun slower than upstream turbines. The same results were recorded at two/three diameter spacings, turbine A averaged a voltage of around 4.2V during each trial listed above, turbine B produced around 2V max, turbine C produced around 3V at two/three diameter spacing while at one diameter it averaged 2.2V. For turbines offset to the right, the turbines performed poorly, turbine B did not spin, turbine C spun slowly. For offset to the left trials, the downstream turbines performed better than the upstream turbines, turbine C averaging 4.691V. In conclusion, orienting vertical axis wind turbines in a straight line or to the right at close spacing intervals negatively impacts power output for the downstream turbines, while an offset to the left increases power output for the downstream turbines.

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Abstract: Science and Engineering Fair of Houston

1218

Experimental And Economic Evaluation Of Algal Biofuels

Jayden Liu

Conroe ISD /McCullough Junior High

Category:

Energy and Transportation

The increasing impacts of climate change and the limited availability of fossil fuel resources have created an urgent need for sustainable energy alternatives. Biofuels provide a renewable option with the potential to reduce greenhouse gas emissions, and algal biofuels are especially promising due to their rapid growth rates, high lipid content, and minimal competition with food crops or arable land. As global energy demand continues to increase, identifying environmentally sustainable and practical biofuel solutions is critical. This project evaluated algal biofuels through both experimental testing and economic analysis. Algal lipids were extracted using a freezing-based separation method and combusted in a controlled experimental setup. Their thermal performance was compared directly to canola oil by measuring water temperature change and burn duration under identical conditions across multiple trials. Results showed that algal lipids produced a greater temperature increase and comparable or longer burn durations than canola oil, indicating strong energy performance. A cost and emissions analysis comparing algal biofuels to gasoline, diesel, and corn ethanol found that algal biofuels have lower carbon intensity, despite producing slightly less energy than traditional fossil fuels. Overall, this science fair project demonstrates that algal biofuels are a feasible and environmentally favorable energy source. They offer a practical transitional option for fossil-fuel-dependent countries through fuel blending, while serving as a sustainable replacement for crop-based biofuels in countries that already utilize renewable fuels.

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Abstract: Science and Engineering Fair of Houston

1219

Fuel Cells

Category:

Energy and Transportation

Levi Johnson

Conroe ISD /McCullough Junior High

This project investigated how proton exchange membrane (PEM) fuel cells perform against the effects of electrolysis time and temperature. A PEM fuel cell works by using electricity to split water into oxygen and hydrogen (electrolysis). Then separating the gasses into different tubes where they build up. Once the electrolysis process is complete, the fuel cell pulls the gasses back in. Hydrogen comes in on the cathode side while the oxygen comes in on the anode side. Hydrogen reacts with the platinum catalyst, splitting the hydrogen into positively charged hydrogen ions and negatively charged electrons. In the middle of the fuel cell there is a Polymer Electrolyte Membrane that only allows protons to pass through. On the other hand the electrons have to travel through an external circuit, creating an electric current. In the cathode the oxygen combines with the hydrogen ions when they come through the membrane, then merges with the electrons to recreate water and a tiny amount of heat. My setup is a tiny bit different from your average PEM fuel cell set up. Mine has the fuel cell and the two electrolyzer tubes that hold the gasses. But I connect the tubes not only to the main fuel cell, I connect the tubes to a 3 stack fuel cell that continuously makes electricity by recombining hydrogen ions, electrons, and oxygen.

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Abstract: Science and Engineering Fair of Houston

1220

What is a dirty puddle to a STAR

Ethan Thomas

Stafford SMSD/Stafford STEM Magnet Academy

Category:

Energy and Transportation

The purpose of this project is to test out how far a light source has to be in order for energy to reach the solar panels. This experiment would show how humanity would be able to access the power of the sun by putting solar panels in space that would orbit the sun because it would show how far they would have to put it in order to gain the most energy.

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Abstract: Science and Engineering Fair of Houston

1221

Spinergy

Dax Stanforth

Clear Creek ISD /Seabrook Intermediate School

Category:

Energy and Transportation

The purpose of this project was to find out which wind turbine design-horizontal-axis or vertical-axis-produced more energy in a controlled environment. This question was important because wind energy is a major renewable resource, and improving turbine design could increase energy production. The problem investigated was which turbine type generated the most energy when tested under the same conditions. The hypothesis stated that the vertical turbine would produce more energy than the traditional horizontal turbine. To test this, two different turbines were built using the same blade materials, motors, and base components. Each turbine was placed 20 centimeters from a fan set to a constant speed. The motor wires were connected to a multimeter to measure voltage and current. Each turbine was tested for 30 seconds per trial, with 25 trials completed for each turbine type. The data showed that the vertical turbine consistently produced far higher voltage than the horizontal turbine. The vertical turbine spun smoothly during every trial, while the horizontal turbine rarely made full rotations and often produced almost no voltage. The lowest vertical reading was still higher than the highest horizontal reading, showing a clear difference in performance. The results supported the hypothesis. The vertical turbine produced more energy under the controlled testing conditions. These findings suggested that vertical turbines could be very useful for small homes or businesses. It was recommended that future testing compare different blade shapes and motor types to further explore ways to increase energy output.

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Abstract: Science and Engineering Fair of Houston

1222

Harness the Storm

Mahdi Dhanji

Private/AL-HADI SCHOOL OF ACCELERATIVE LEARNING

Category:

Energy and Transportation

The purpose of this engineering design project was to build a wind turbine that could generate energy during a storm using the Magnus effect. The Magnus effect occurs when a spinning object in moving air creates lift, which is used to help the turbine blades rotate. The turbine was designed and built using simple materials and tested in strong wind conditions to see how well it performed. During testing, the turbine was able to spin and somewhat demonstrate how the Magnus effect works, but the Magnus effect was not effective at extremely high-speed winds. The spin of the turbine was affected by changing wind speed. The results indicate that future designs should use stronger construction so the turbine can withstand extremely high-speed winds.

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Abstract: Science and Engineering Fair of Houston

1223

Ecological oil lamp

Anthony Tovar

Houston ISD/BCM Biotech Academy at Rusk - MS

Category:

Energy and Transportation

In my project I created an ecological oil lamp from scratch and found out the duration of burning for different oils and their compatibility. This is important because this lamp is easy to make with things that we all have at our disposal and it can help hundreds of people worldwide during power outages and hurricanes, which are very common here during hurricane season and the winter. Paired with the best lasting oil one can make a lamp that is efficient, made with low cost materials. and just overall helpful to many people around the globe.

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