

# Abstract: Science and Engineering Fair of Houston

**1219**

## **Maglev Trains-Exploring the future of transportation**

Ayden Ynosencio

School of Science and Technology, Houston - MS

**Category**

**Energy and  
Transportation**

The first thing that I would do is give you a walk-through of the presentation, like what the purpose of the experiment is, and then I would give you the answer which would be to show how maglev trains would benefit us and the environment better than our average trains. I have researched the information in trusted sources and (just in case) researched the source to see if it really was reliable. The most important results that I have found are how fast it can travel, energy consumption, and CO2 emissions. In conclusion, this research is used to make us understand maglev technology and its implications for the future of transportation. By exploring the mechanics of magnetic levitation and searching for the advantages and challenges of maglev trains, this project aims to understand how this technology can help transportation be more efficient and have eco-friendly solutions. Ultimately, this project is ready to teach other people how advancements in magnetic technology can change the way we think about traveling.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1220**

## **Waste to Watts: Harnessing Organic Waste for Sustainable Energy Using Microbial Fuel Cells**

Rishaan Dave

THE HONOR ROLL SCHOOL - MS

**Category**

**Energy and  
Transportation**

Hurricane Beryl devastated Houston, leaving many residents without electricity for over a week during a scorching summer. This crisis inspired the exploration of sustainable energy solutions through microbial fuel cells (MFCs), which can transform organic materials into electricity. This project aims to determine which combination of organic substrates: organic cow dung, cow dung with cow urine, cow dung with homemade compost, or cow dung with backyard soil; produces the most electricity, comparing their performance to distilled water as the control. Five MFCs were set up: one with 100% distilled water as the control, one with 90% organic cow dung, one with 45% organic cow dung and 45% cow urine, one with 45% organic cow dung and 45% organic compost, and one with 45% organic cow dung and 45% organic soil, each mixed with 10% distilled water. Voltage and current measurements were taken to evaluate the energy output of each substrate. The results highlight the role of microbes in electricity generation and demonstrate how additives like cow urine, compost, and soil can enhance the process. This study showcases how waste materials can be repurposed into renewable energy sources, providing a sustainable pathway to address environmental challenges and improve energy resilience.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1221**

## **The Wind, the Blade, and the Energy**

Avery Nguyen

Clear Creek ISD /Westbrook Intermediate School

**Category**

**Energy and  
Transportation**

My project focuses on the efficiency of wind energy and the factors of it. I wanted to study this because it would help create a cleaner future, where humans could use efficiently produced green energy that is cheap and environmentally friendly. My engineering goal for this project was to design and build the most efficient blade shape that could create the most amount of electricity. I planned my experiment to accurately describe the amount of electricity each blade made: I tested each blade 3 times and took the average of the number of volts. I then compared the averages to each other to form my conclusion. After all the data had been collected and compared, the best blade shape was the biggest blade: the root-region blade. It had been able to create an average of 0.8 volts, while the other blades had made an average of 0.58 volts. My findings of this study had given me the knowledge of the most effective blade that could create electricity from the wind. This can help power homes, buildings, and other important places. The importance of clean energy is crucial on Earth to help stop climate change, and this study can help make wind energy better than it has been before. However, this project is not the end of the story. Wind energy can depend on angles of the blades, angles of the wind, direction of the wind, and so much more. This project is the first step in making a difference.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1222**

## **Underground Powerlines**

Emery Flores

Aziel Mercado-Cruz

Valerie Elizarraras

Aldine ISD /Hambrick MS

**Category**

**Energy and  
Transportation**

The purpose of this project is to protect Texans from power outages. Our idea to protect the powerlines is to put them underground and encase them in a PVC pipe. We conducted 3 separate trials with 3 separate intensities to make sure our idea would remain successful. All 3 tests resulted in the same voltage, meaning our experiment was successful.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

human participants

potentially hazardous biological agents

vertebrate animals

microorganisms

rDNA

tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

yes

no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

yes

no

4. This project is a continuation of previous research.

yes

no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

yes

no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

yes

no



# Abstract: Science and Engineering Fair of Houston

**1223**

## Efficiency of Wind Turbines

Nathan Feng

Conroe ISD /McCullough Junior High

Category

Energy and  
Transportation

This project aims to investigate how changing the shape and sizes of blades can improve the efficiency of a wind turbine. After doing some research, a hypothesis was made; if we use an airplane blade design using three blades that are lightweight, flexible, and have a narrow tip, then there will be a 20% increase in efficiency for the wind turbine. Then, two wind turbines with different types of blades were built and tested for their voltage output under different wind conditions. The results were recorded and compared with each other. With three trials with the regular airplane blade and three trials with the innovative airplane blade, after comparing results, the innovative airplane blade had a 15% increase in electricity output than the regular airplane blade making our hypothesis partially true. Then using all of this information, a data table was created along with 2 graphs. One graph represents the average amount of electricity being produced while the other graph represents the maximum amount of electricity being produced(for both blades).

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1224

## How to prevent Containers from falling off of Container ships.

Brian Lemire  
Central Middle School

Category

Energy and  
Transportation

Have you ever wondered why containers fall off the ships and how is this impacting the environment? In my science project, I will explore ideas on how to prevent containers falling off the ships and how it affects the environment. The problem is, every year over 2000 containers are lost at sea, this amount of containers can affect the marine life in the area. I researched how many containers were lost at sea and the effects of containers being lost. When the containers get lost at sea, it can affect many different parties and could cause harm to the environment. Based on the completed research, and experiment, although the number of containers lost at sea has been decreasing year after year, those that still float or sink without a solution continue to negatively impact the environment

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1225

## Green Hydrogen Production from Splitting of Water by Electrolysis - Part 2

Vaishnavi Iyyamperumal

Clear Creek ISD /Westbrook Intermediate School

Category

Energy and  
Transportation

Hydrogen Production from Splitting of Water by Electrolysis benefits us because this experiment helps produce green(er) hydrogen which can be used as fuel to power several things. Last year, an electrolysis cell was created, and a number of catalysts were screened to identify most effective catalyst to produce more hydrogen. Magnesium chloride was found to be most effective among the catalysts. In continuation, this year the process conditions such as magnesium chloride and applied voltage levels were varied using electricity produced from a solar panel to make the entire process greener. At optimized conditions, 5g of magnesium chloride in 250 mL of water, produced about 17 mL of hydrogen at 20 v, while plain water only produced 0.5 mL. Further investigation found that a higher amount of catalyst and higher applied voltage increased hydrogen production in the span of two hours. To confirm the gas that was produced was hydrogen and wasn't caused by a failed experiment, a pop test was conducted. If the gas made a pop, it is proof that there is hydrogen present in the test tube. Using this approach, a portable hydrogen cell that continuously produces hydrogen was built.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1226

## Water Turbine Blades & Electricity

Maryam Fatima

AL-HADI SCHOOL OF ACCELERATIVE LEARNING

Category

Energy and  
Transportation

This project helps you understand the benefits of using a water turbine to generate electricity. Using a water turbine to generate electricity is an awesome way to stop pollution and greenhouse gas emissions. Water energy is more reliable than air and solar energy because it is continuously moving as long as the water is flowing. This report shows us the importance of hydropower and how it helps us to make our future brighter and the planet greener. My research question: Do different water turbine blades shape affect how much electricity is being generated? My Hypothesis: The bucket like blade or Pelton Turbine will generate more electricity than the flat blade or Francis turbine. My independent variable: The shape of the blade. My dependent variable: how much electricity is being generated. This experiment involves for testing my hypothesis that the Pelton blade generates more electricity than the Francis blade because of the shape of the blade, the bucket like shape design allows the incoming water be split into two halves and divert it at 180 degrees the design of this blade allows the blade to capture maximum amount of energy from the water pressure causing the water turbine wheel to rotate with high efficiency and fast enough to generate hydropower or kinetic energy. To test which type of blade generates more electricity, I measured the current and voltage from both of the blades' designs. The test data shows that the peloton blade produced more voltage (2.00v) and current (45.90 mA) than the flat or Francis blade voltage (1.90v) and current (43.23 mA). The pelton blade generates more electricity than the Francis blade which means that my hypothesis is correct. In this experiment I achieved my objective that the peloton blade generated more electricity than the Francis blade.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no





# Abstract: Science and Engineering Fair of Houston

1227

## Better Together? VAWT Spacing Analysis

Logan Nagel

Clear Creek ISD /Brookside Intermediate School

Category

Energy and  
Transportation

Vertical axis wind turbines could support higher power generation per acre and potentially open up new opportunities for small footprint wind farms in electricity hungry urban locations which could support renewable power goals while minimizing impacts to natural ecosystems. Maximizing wind power generation per acre requires knowledge of optimal wind turbine spacing and wind turbine layout. What is the effect of vertical axis wind turbines placed at various distances from each other on the power output of each turbine? This experiment will analyze the impact of spacing on vertical axis wind turbines with drag 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. Testing in a wind tunnel showed that the first vertical axis wind turbine produced an average of about 1.808 V across all trials. At one rotor diameter spacing, neither downstream turbine produced any power (rotors stalled). At two rotor diameter spacing, the middle wind turbine stalled, and the third turbine produced 0.458 V during one of three trials (74.5% less than the voltage produced by the first wind turbine). At three rotor diameter spacing, the middle wind turbine produced no power, but the third wind turbine produced 0.668 V (63.1% less than the voltage produced by the first wind turbine). In conclusion, orienting vertical axis wind turbines in a straight line at close spacing intervals negatively impacts power output from the downstream turbines.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1228

## Bridge Wars: The Ultimate Strength Showdown!

Laisha Verma

Conroe ISD /Knox Junior High

Category

Energy and  
Transportation

Ever wondered why there are so many types of bridges and which one can hold the most weight or stand the longest? A researcher hypothesizes that a suspension bridge made from popsicle sticks and pencils will hold more weight than a Deck Warren Truss bridge made from popsicle sticks alone. They believe the suspension bridge benefits from the added support of threads and pencil towers, holding the load more effectively. Bridges are ubiquitous, used everywhere from spanning rivers to over road walkways, and their construction requires considering factors like location, purpose, and weight capacity. The goal of this experiment is to compare different bridge designs and materials to determine which can bear the most weight. The suspension bridge involves creating towers with pencils, installing thread holders, and threading the structure for stability. The truss bridge's base is made by gluing popsicle sticks, leveling the sides, creating support panels, and assembling the frame using a Deck Warren Truss pattern. Precise measurements and careful assembly ensure the structural integrity and strength of both bridges. The researcher noticed the deck truss had ample surface area for the load. The hypothesis was unsupported as the suspension bridge's cables snapped, leading to the base cracking. The truss bridge proved stronger, with its base supporting the load effectively. This experiment compares various bridge designs and materials to determine the strongest combination, helping engineers optimize bridge construction for strength and safety. This knowledge can improve engineering practices, and inspire innovative solutions for future infrastructure projects.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1229

## Higher Stakes, Bigger Spatters; Exploring Fake Blood Dynamics

Jordan Marie Escañan  
Dayla Guilarte-Bonifacio  
Alief ISD

Category

Energy and  
Transportation

When forensic scientists investigate crime scenes, details like the position the victim was in when dying are crucial to the case. You can figure these sorts of things out with the blood drops left. The size, position, amount of blood, etc., can tell forensic scientists much about what happened. We decided to do this experiment because we are both interested in forensics, crime-related events, and solving problems. For this experiment, fake blood was prepared to be dropped onto paper from varying heights. The diameter of each blood drop was then measured and compared. The results showed that the higher the "blood" was dropped, the bigger the splatter it created.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1230**

## Super Sources

Liam Phan

SST - Champions College Prep - MS

**Category**

**Energy and  
Transportation**

A. This project demonstrates small-scale renewable energy setups, like solar, to inspire sustainable energy use. B. Steps: Connect solar panel to battery, battery to Uno R3, Uno R3 to breadboard with LEDs. Add resistors to LED negatives, jumper cables to positives. C. Data: Worked: 9V battery, R3 Uno (wall adapter), 12V solar panels (battery). Didn't Work: 5V solar panels (solar manager); water generator output too weak. D. The solar panel powered the LED but required a 3.7V battery for current storage.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1231**

## How To Make Clean Energy

Daniel Flores

Weis Middle School

**Category**

**Energy and  
Transportation**

for my project how to make clean energy is because I wanted to find a nother way to make clean energy and so I researched to see different ways and so I saw hydropower energy and it was unique and so I tried to see what I could do with that and so I decided to build a hydropower generator and in the end I found out that hydro powerd energy is energy

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1232

## Wind Powered Turbine

Aayat Bangash

AL-HADI SCHOOL OF ACCELERATIVE LEARNING

Category

Energy and  
Transportation

Abstract Save the Earth with Wind Energy The purpose of this science project is to make a model of an efficient windmill that can produce green energy. This model of energy generation is not only clean but also cheap if made on a larger scale. If the windmill is created efficiently with special focus on its wind blades we might be able to generate energy for the whole house and light all the bulbs at least. If people put one of the windmills in their backyard they will be able to light their house for free. This windmill model consists of wind blades that are sleek in shape. The hypothesis of this experiment is that oval shaped blades produce more electricity. To test the hypothesis I made 3 different wind blade shapes: pointed tip, round tip and square tip. The blow dryer was used as a wind source and I measured the electricity through a multimeter and recorded the reading in a table. According to the experiment wind blades with pointed tips generated more energy. Even though the results did not support my hypothesis, it helped us understand that the aerodynamics behind wind shapes is very important and even a small change can make a big difference.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1233

## Grass to Ethanol: The Process

Bruce Shu

Conroe ISD /McCullough Junior High

Category

Energy and  
Transportation

This project investigates the process of converting grass into ethanol. Ethanol is a biofuel found in most gasolines, and it essential to our modern world. My project focuses on the stages of biomass conversion that includes the preparation and fermentation of the grass. The primary goal is to evaluate the efficiency of grass in ethanol production and the effectiveness of various pre-treatment methods such as sulfuric acid hydrolysis. This project aims to highlight the potential of using grass, a widely available and fast-growing plant, as a sustainable ingredient for biofuel production. My results demonstrate that while grass-based ethanol production is certainly feasible, optimizing the pre-treatment and fermentation processes is essential to maximize ethanol yield, drive down costs, and make the approach commercially viable.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1234**

## Friction and Motion Investigation

Steven Truong  
Stafford STEM Magnet Academy

Category

Energy and  
Transportation

Friction and Motion is an important topic in Physics, and friction is a key force that affects how things move. In third-grade textbooks, we learn that the type of surface can change how far and fast a car can go. For example, a rough surface like carpet will slow the car down. I want to look at a slightly different situation. I did not see it had been done on the Internet/YouTube. When a car goes down a ramp, will it travel the same distance and speed in two different cases? In Case 1, the track is smooth for the first half and rough for the second half. In Case 2, the track is rough at first and then smooth. The result is significant. It can help self-driving vehicles to choose the best route to travel.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no





# Abstract: Science and Engineering Fair of Houston

1235

## Emergency Kit Crank-held Electricity Generator

Karthik Muvva

Houston ISD /T. H. Rogers MS

Category

Energy and  
Transportation

The emergency kit crank-held electricity generator project aims to create a portable and sustainable energy solution for emergencies and off-grid scenarios. This research focuses on designing a user-friendly device that converts mechanical energy into electricity using a crank mechanism. The generator is intended to provide reliable power for small electronic devices, addressing the need for eco-friendly alternatives during power outages, disasters, or in remote locations. By exploring the integration of efficient energy conversion components and ergonomic design, the project seeks to optimize usability and performance while minimizing environmental impact. Additionally, the project investigates how adapting the crank mechanism to other setups, such as treadmills or bicycles, can improve power stability and reduce user fatigue. The generator was constructed using permanent magnets, copper wire coils, and a hand-crank system to induce electricity through electromagnetic induction. A rectifier and voltage regulator were added to stabilize the output, while a durable housing ensured portability. Tests revealed that the generator could reliably charge small devices, with peak efficiency achieved by optimizing the magnet and coil arrangement. Incorporating a flywheel or adapting the crank to a bike significantly improved power stability, allowing for smoother and less tiring operation. These findings demonstrate the feasibility of the generator as a practical energy solution for disaster preparedness, outdoor activities, and educational purposes. Future research could focus on enhancing energy storage, further improving ergonomics, and scaling the device for larger power needs. This project underscores the importance of sustainable and innovative approaches to energy generation.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1236

## Sodium in Water Electrolysis

Katherine Mei

Conroe ISD /McCullough Junior High

Category

Energy and  
Transportation

Dependence on nonrenewable energy is dangerous, especially when energy sources are near depletion. The introduction of hydrogen fuel as a renewable, clean energy source offers a way to combat this reliance. Electrolysis is the process of separating hydrogen and oxygen atoms from water using a direct electrical current. In other words, it is an electrical current that flows through a liquid. The hydrogen produced from this process can be used for energy as hydrogen fuel. In this research, a solar panel powered an electrolyzer containing water. Because pure water cannot conduct electricity, salt (sodium chloride) and baking soda (sodium bicarbonate) were used to carry current. Different combinations of sodium chloride and sodium bicarbonate (made with 5-gram increments) were tested to determine the optimal amount of each compound. Hydrogen was collected over water. Due to the saturation points of sodium chloride and sodium bicarbonate at specific temperatures, larger amounts of salt and baking soda did not necessarily equal a faster process. However, the general trend was that more sodium in water directly corresponded to faster hydrogen production. Ultimately, the combination of 25 grams of sodium chloride and 25 grams of sodium bicarbonate (the largest amount of sodium tested in this experiment) resulted in the least time necessary for the process. This research demonstrates a form of clean energy production that relieves unnecessary dependence on non-renewable energy sources. While not the most efficient choice of energy production, electrolysis provides an alternative for the energy industry.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1237

## Exploring the future of Solar Energy - Are Organic Photovoltaics the next best?

Anshi Parekh

Beckendorff Junior High school

Category

Energy and  
Transportation

Solar energy, a renewable source of power, is a creative way of generating electricity to meet increasing demands and reduce greenhouse gas emissions; solar cells are helpful but are the current cells environmental-friendly, lightweight, and cost-effective? Silicon based solar panels are proven, successfully deployed and commercially used in different applications. Other materials such as Perovskite, quantum-dots, thin film, are all good alternatives, but all have major drawbacks. This project is to build the next generation solar technology. I want to find the best kind of solar panel that is lightweight, flexible, cost-effective, efficient, and most importantly, sustainable and environmentally friendly. During my research, I came across organic photovoltaic cells (OPVs) that have all the desired features. Therefore, I chose to find out for myself; 'Are OPVs The Next Best': And if not-how can I make them? This study discusses how OPVs could and should replace current silicon based solar panels. In order to do this, an experiment is conducted using an OPV, a monocrystalline solar panel (most efficient panel today), and a multimeter to measure the output. OPVs are not yet available in the market, so they are homemade. The OPV is made with anthocyanin dye as the medium or converter, which is a carbon compound that absorbs the blue and green light from the visible light spectrum of the sun. According to an online simulation platform with a virtual OPV, I was able to create multi-layer cells. With both the experiments, I tested and compared the quality of an OPV vs a traditional monocrystalline solar panel. I found that OPVs are affordable, flexible, eco-friendly but currently less efficient than silicon based panels. However, they could make huge comebacks and bring game-changing results due to their ability to chemically bond. The efficiency of OPV can be increased by finding materials that work with anthocyanin to absorb more parts of the solar spectrum.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1238**

## How much voltage different fuels create

Hiroshi Valdez

Houston ISD /BCM Biotech Academy at Rusk - MS

Category

Energy and  
Transportation

I tested different fuels on a stirling engine (kind of like a generator) to see which one lasted the longest. I learned that oil burns the longest but not the best and that after shave is the weakest and one of the longest and that isopropyl (regular alcohol) burnt the best and the quickest. The reason on why this is important is because it can change generator fuels by making it instead of like using gasoline we can use a corn fuel since corn has a whole bunch of alcohol that can pretty much change fuels for the better of the world.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1239**

## Catching Air

Dax Stanforth

Clear Creek ISD /Seabrook Intermediate School

**Category**

**Energy and  
Transportation**

Innovative design to maximize the energy output in renewable energy capture is important. This project experimented with blade shapes to find out which is the most effective. The hypothesis was that when different blade shapes were tested, the egg-shaped blade would be the best because it was the most similar in shape to the blades used on the large wind turbines. Procedure: Five different blade shapes (rectangle, circle, half-moon, triangle, and egg) were tested to see which one would lift five different weights the fastest. A simple wind turbine was built and each blade was tested with a controlled wind source. Data Collected: The data collected was the time (in seconds) it took to lift each weight across ten trials for each blade shape. The mean for each blade shape and weight was calculated as well as the mean across all trials. The energy created/used to lift each weight was also calculated and the mean of those results was also determined. Conclusion: The results of the experiment were surprising as the egg shape, which is most like modern turbine, performed the worst. It would be interesting to see other shapes of blades tested against modern turbines in the real-world. Wind energy capture can still be maximized and the best way to do that is to continue to experiment with different designs to find the best way to do it.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1240

## Optimizing Solar Efficiency with Quantum Dot Nanoparticles

Daniela Chourio  
Conroe ISD /Knox Junior High

Category

Energy and  
Transportation

The solar cell's inefficiency is due to the margin of error within their recombination system. Recombination occurs when a free electron generated by light absorption encounters a "hole". In essence, they cancel each other out and release their energy as heat instead of contributing to the electrical current. Quantum dots are semiconducting particles that are thought to have the capability to make solar cells a lot more efficient because of their multiple exciton generation. Quantum dots can produce several electron-hole pairs (excitons) from a single absorbed photon, hence improving the conversion efficiency of solar energy. The hypothesis suggests that if quantum dots are applied to a solar cell then, there will be a significant increase in power because of the quantum dots' multiple exciton generation. This project seeks to test a prototype for a liquid-junction quantum dot solar cell. Project procedures outline the process for assembling, testing, and evaluating solar cells. After testing, data showed that the hypothesis was supported. The quantum dot solar cell averaged 0.69v a day within the 30-day testing period, while the commercial solar cell averaged 0.55v a day. The solar cell's efficiency showed an increase of about 25.14% percent increase when exposed to quantum dot nanoparticles. This information is useful for future applications because with further testing and scaling, quantum dot solar cells could play a significant role in increasing energy conversion rates while still contributing to a more sustainable future.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

1241

## Testing the feasibility of power generation through piezoelectric transducers

Mark Phillips

Clear Creek ISD /Westbrook Intermediate School

Category

Energy and  
Transportation

The energy generated from movement at higher speeds is greater than any other. This perfectly aligns with my hypothesis, and it is understandable, after all as shown in the equation  $F = M \times A$  the force which directly influences the output is affected by speed. Another interesting thing to note is that on a larger scale piezo roads generate 44000KWH per year comparing to the wind turbines which generate (per unit) 6000000KWH per year, to the 4000KWH from a 500W water turbine, and to the 600 KWH for 400W solar panel (!NOTE! this is per panel and the sunlight estimate for California.) as shown here, piezos are a good competitor for other forms of clean energy, but they aren't perfect and generate less energy than some forms of power. This doesn't mean they're inferior however, due to the fact that their cost is much lower than the one of the windmills and some solar panels (I understand that some cost more and some cost less)

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1242**

## **Wind Energy: A Sustainable Solution**

Dhyani Shah  
Sarah Bui  
Alief ISD

**Category**

**Energy and  
Transportation**

We conducted this experiment in order to learn about aerodynamics and the scientific process by which wind turbines have developed throughout history. This is a valuable topic due to the current need for renewable and safe energy sources that can help avoid the massive influx of waste accumulated within our planet. Our hypothesis is, "If we test different blade shapes on our wind turbine model, then the Modern Blades will produce the most volts per minute." To test this, we created five different wind turbine models used over the course of decades and tested their small-scale developments of volts per minute. Using a fan and voltmeter, we discovered that wind turbines with longer, more narrow, and slightly curved blades had accumulated the highest amount of volts per minute. Examples of such blades are the "Modern" Rotor Blades, and Bilaou's Venimotor, which prove to be similar in structure and redirected airflow most effectively when referenced to a given time period. This new information assists us with being able to effectively reference the progression of a variety of blades compared to current, more coherent designs. Therefore, we can use this knowledge to understand the improvements of wind turbines across the centuries and apply these features to enhance wind turbine efficiency.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no





# Abstract: Science and Engineering Fair of Houston

**1243**

## **Vegetable Power!**

Santiago Campos

Houston ISD /BCM Biotech Academy at Rusk - MS

**Category**

**Energy and  
Transportation**

My project will give scientists the information of what type of vegetable produces the most amount of electricity. Since vegetables are already useful for their health benefits. I thought for my hypothesis, that the lime will produce the most amount of electricity because of the electrolytes and the I thought that the potato will produce the least amount of electricity because of there electrolyte deficiency. I used 3 Potatoes 3 Cucumbers,3 Limes, Multi meter ,Copper bolt , Zinc induced nails. My results showed that my hypothesis was correct as the lime produced the most amount of electricity. Meaning that the lime is the best vegetable battery source.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**1244**

## **The Best Blade**

Jack Kemper

Conroe ISD /McCullough Junior High

**Category**

**Energy and  
Transportation**

The purpose of this science fair project is to discover the best blade shape for a wind turbine. The hypothesis is, if the shape of the blade has more curve, then the rate it spins will increase. First, I built a wind tunnel out of a cardboard box, wrapping paper tubes, and a fan. Then, I designed three sets of wind turbine blade designs using Toybox CAD software and 3D printed them. Then, I built a stand made of wood and LEGOs to hold the blades. After that, I put reflective tape on one blade of each set of three. I inserted the 3D printed blade design into the stand. I turned on the fan at medium speed. Then, I pointed the tachometer at the reflective tape on the spinning blades. The tachometer measures in Revolutions Per Minute (RPM). I recorded my data on a table and made graphs with that data. My purpose of this project was to figure out which blade shape design was the most efficient. The second blade design proved to have the greatest RPM, which means it was the most efficient.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**3207**

## **Assessing the Capabilities of Energy Generation Through Serpentinization**

Neev Pratap

Saketh Tammisetti

Fort Bend ISD /Elkins High School

**Category**

**Energy and  
Transportation**

Hydrogen is considered to be the future of energy; however, electrolysis, the current leader in sustainable hydrogen production, requires a high activation energy and hence its efficiency is quite low. Serpentinization refers to the hydration and metamorphosis of olivine, the most abundant mineral in the Earth's mantle, to produce serpentine, a silicate, and most importantly, hydrogen. This investigation seeks to determine the plausibility of serpentinization as a sustainable energy source. We've identified the conditions of this reaction to be a temperature of 250 degrees Celsius and a pressure of 160 Mpa, and accordingly designed a fluidized bed reactor to facilitate this reaction. Using supercritical water as our fluid, and with a few assumptions, we found the ideal dimensions and properties for our reactor. With this info along with material selection, we were able to determine the wall thickness required to achieve a safety factor greater than 1 at 1.776 meters and achieved an efficiency of 267.2%. With this in mind, we modeled and simulated a prototype reaction vessel on Autodesk Fusion 360 capable of withstanding the design conditions with minimal permanent deformation.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**3208**

## The Faraday Cycle Of Induction

Oscar Carrillo

Conroe ISD /ACES: Academy for Careers in Engineering and Scien

Category

Energy and  
Transportation

Abstract The purpose of my project is to explore the concept of Electromagnetic Induction as well as test the efficiency through 2 major experimentations. My methods of testing how low and high speeds of RPM affect energy output has led me into proving my hypothesis correct. This was accomplished by building a small platform out of wood and connecting two copper coils equally distant from each other. Once this was completed a motor and magnet attached together by an rc car tire was put in the middle of the two coils. To create a low and high RPM two pairs of double A batteries were used, one of the pairs were brand new resulting in Maximum speed of the motor, or a higher RPM, this was used for experimentation #1. The other pair were used, and at a low percentage resulting in a much lower RPM speed, this was used for experimentation # 2. During both experiments both the exact RPM speed, along with the electrical output in Milliampere (mA) were recorded. In addition to this I had observed that the Milliampere had small fluctuations during experimentation #1, and large fluctuations during experimentation #2. After this observation was made I ran an investigation to understand exactly why this occurred. I found that electromagnetic induction is non-conservative Consequently resulting in my data having such large fluctuations during high and low RPM. With this I had concluded that the changing magnetic field is what determines the efficiency, and what determines it being non-conservative.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**3209**

## **Testing Parts of a Thermoelectric Generation Device to Optimize Voltage and Current Output by using Temperature Gradients**

Benjamin Burket

Kaiden Patel

Conroe ISD /AST: Academy of Science and Technology

**Category**

**Energy and  
Transportation**

Increasing global reliance on fossil fuels and chemical batteries has severe environmental consequences, including contribution to climate change and air quality harm. This project focuses on thermoelectric generation (TEG) as a sustainable alternative energy source. TEG devices convert thermal energy into electrical energy using temperature gradients, offering a cost-effective and environmentally friendly solution that can be applied anywhere. This study aims to find the optimal properties of the components of a TEG system to maximize power output. Different heat sources, thermoelectric modules, and heat sinks were tested for efficiency relating to their heat generation, conversion, and dissipation properties. The results of the study showed that the hand-warmer was the optimal heat source due to consistent, long-lasting thermal output from the constant iron-oxidation reaction. The SP1848-27145 was the optimal module with its high Seebeck coefficient. The cooling-patch was the optimal heatsink, effectively maintaining the temperature gradient through its use of phase-change materials (PCMs). The results of this study indicates using continuous exothermic reactions, phase-change materials with optimized melting points, and thermoelectric modules with high seebeck coefficients will result in optimal power output from a TEG system. Future applications include further research into accessible and regenerative exothermic reactions and radiative heating that can be used in a small or large scale TEG system, as well as using PCMs for more heat dissipation applications. This study highlights the practicality of TEG systems as low-cost energy solutions for developing regions that have energy access issues, addressing global energy challenges while reducing environmental harm.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**3210**

## **LIFE SHIELD - A Novel System to Minimize Road & Workplace Accidents using a combination of Real Time Electromechanical & Software Systems, AI & Machine Learning**

Shivam Gupta

Friendwood ISD / Friendwood High School

Category

Energy and  
Transportation

Last year, my mother almost lost her life after getting hit by drunk & drowsy drivers which motivated me to do this project. Moreover, DMV & OSHA estimate that one person dies or sustains severe injuries every 39 minutes due to vehicle accidents or machine mishaps because of drowsiness, fatigue & intoxication. Broadly speaking, approximately 50% of accidents occurring every year are due to these three compromised statuses resulting in loss of thousands of lives and billions of dollars worldwide. LIFE SHIELD is a novel system offering modular, scalable & usable design with a potential to be integrated with new vehicles / machines built. The hardware system accomplishes two critical functionalities: detection of intoxication in real time and detection of drowsiness & fatigue using AI, computer vision / machine learning & IoT. The software system is a simulation that analyzes data feed of the driver's and/ or machine operator's behavior / expressions to detect & predict abnormal behaviors or postures using AI, machine learning through application of sophisticated CNN algorithm (Densenet121 model), & computer vision (OpenCV). In either hardware or software system, if the system detects compromising behavior, it will sound an alarm to alert the driver / operator. The system's front-end and back-end are meticulously designed using Anaconda (open-source artificial intelligence platform for Python) and Spyder (open-source cross-platform IDE) respectively. Results reveal a high level of precision & accuracy in intercepting & processing data and predicting results. I believe my system will significantly improve driver safety and minimize impairment-related accidents.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

3211

## EchoPhase: Renewable Sound Energy Harvesting Through Electroacoustic Transducers For Sustainable and Resilient Energy Solutions from Noise Pollution

Victoria Velasquez Anderson

Conroe ISD /AST: Academy of Science and Technology

Category

Energy and  
Transportation

With the growth of renewable energy, there is a decrease in fossil fuel demand, but it is projected that millions will lack access to electricity by 2030. Unlike other energy forms, prevalent noise pollution lacks mainstream commercial use due to low efficiency. Through electroacoustic transducers, this engineering project aimed to increase voltage output and reduce dimensions from previous designs utilizing magnetic induction actuated by vibrating diaphragms and measuring efficiency from decibel changes. Several reiterations tested diaphragm materials between Kapton, PVDF, and Mylar, in addition to the effects of conical shape and spring usage on the diaphragm based on voltage and decibel-dependent changes. Furthermore, an Ultra Low Boost Converter increased output voltage, improved efficiency, and allowed for analysis using multimeter measurements. A conical diaphragm was the best performing, with the highest voltage (2.3 mV) and current (3.5 mA). ANOVA tests showed no significance between materials and spring dynamics, demonstrating an overall voltage increase from previous designs. Regression models predicted needed decibels for a desired voltage output from four diaphragm shapes. The successful design had an efficiency of 11%, a voltage increase of 300%, and a decrease in volume of 94%. In real-world applications, EchoPhase implementation in areas with high noise pollution through projection can be used to harvest noise pollution and provide a renewable electricity source by charging small batteries. To further the scope of its impact, sound pressure level variations and material resonance can be improved to increase current output.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no





# Abstract: Science and Engineering Fair of Houston

**3212**

## **Power the Future with Longer-Lasting Solar Panels**

Trevor Plaster

Diego Canela

Conroe ISD /ASHP: Academy for Science and Health Prof

**Category**

**Energy and  
Transportation**

This study dives into the impact of water-based cleaning on solar panels to make them more efficient. Over time, dust, dirt, and debris accumulate on the surface of photovoltaic (PV) panels, reducing their ability to capture sunlight and decreasing overall performance. Our research aims to clean these solar panels so users can continue to accumulate power effectively. Our results indicate that this water cleaning system will increase energy output up to 20% over an immediate period under intense dirt and debris environments. This 20% could drastically increase if used over a long period of time, making this statistic undermining just how important this machine is to solar power users. This study also examines optimal water usage to maximize performance gains. In regions with high dust accumulation, regular water-based cleaning could substantially increase long-term power generation. These findings suggest that water-based cleaning is an effective way for improving solar panel efficiency, potentially leading to better overall system performance and reduced operational costs.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no





# Abstract: Science and Engineering Fair of Houston

**3213**

## **Optimization of Solar Cells through Simulation of a Quantum Dot Buffer Layer**

Rishan Hemrajani  
Suchay Kommisetty  
Jay Sahni  
Jordan - HS

**Category**

**Energy and  
Transportation**

The total solar radiation from the Sun possesses enough energy to fully power the world's energy grid many times over. However, humanity has already hit the near maximum theoretical efficiency of major types of solar cells, unable to harness the full power of the Sun. One minimally-researched solution has massive potential to overcome these challenges: Quantum Dot Solar Cells (QDSC). Their nanoparticle nature and multiple exciton generation allows their properties, including their bandgap, to be tuned by altering their size, allowing us to bypass the theoretical efficiency of traditional solar cells. Yet, research is principally centered around lead sulfide (PbS) and cadmium telluride (CdTe), which are cytotoxic, environmentally hazardous, and scarce, making them unsuitable for large-scale adoption. Therefore, in this study, alternative materials are being explored as the base of quantum dots. The Solar Cell Capacitance Simulator (SCAPS-1D) is utilized to simulate quantum dot-based solar cells and test them among multiple performance metrics including power conversion efficiency (PCE), open-circuit voltage ( $V_{oc}$ ), and short-circuit current (ISC). Moreover, a standard perovskite solar cell structure is tested with different quantum dot parameters including nanocrystal size and defect density. This study identifies multiple materials with the potential to replace PbS and CdTe. They possess similar solar energy conversion efficiency without the environmental and health hazards of toxic heavy metals. These findings provide direction for future research and a foundation for developing more sustainable, efficient solar technologies

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

3214

## The Effect of a Changing Magnetic Field on a Microbial Fuel Cell (MFC)

Eyad Kassem

Conroe ISD /AST: Academy of Science and Technology

Category

Energy and  
Transportation

The purpose of this project was to demonstrate if magnetic induction would positively affect the output of a microbial fuel cell (MFC). A two chamber MFC was created with an agar salt bridge and graphite electrodes. The anaerobic chamber was filled with mud, and the aerobic chamber was filled with water. For the trials which involved magnetic induction, a motor with magnets attached was rotated next to the side opposite from the anode to observe the effect of the induction on the bacteria themselves. This process was repeated three times with the motor and once without as a control within the span of two days. Light was minimized in the area the experiment took place and temperature was stable. The control group's value at 360 minutes was approximately 94% higher than the experimental trial with the most output at 360 minutes, which was trial one at 165 millivolts. In addition, the application of three T tests between each experimental trial and the control showed a significant difference between the data. Further inquiry into how different velocities of magnetic flux induct electrons within microbes, and how the cell membrane could affect predefined principals within Fleming's left hand rule would assist in the development of a possible treatment of diseases related to electron transport such as Parkinson's through the use of magnetic induction to assist with electron transport. This knowledge could also be applied to weaken certain cells through the use of nanobots fixed with rotating magnets at precise velocity and intensity.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

human participants

potentially hazardous biological agents

vertebrate animals

microorganisms

rDNA

tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

yes

no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

yes

no

4. This project is a continuation of previous research.

yes

no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

yes

no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

yes

no



# Abstract: Science and Engineering Fair of Houston

3215

## Novice Application of Sand Batteries for Efficient Thermal Management in Medical Ceramic Oxygen Generators in Remote Areas

Daniel Vassiliev

Clear Creek ISD /Clear Lake High School

Category

Energy and  
Transportation

The Medical Ceramic Oxygen Generator (M-COG) uses ceramic ion transport membranes heated to 600°C to produce medical-grade oxygen, making it ideal for remote areas without access to compressed oxygen tanks. This project explores thermal management to minimize overnight heat loss and optimize M-COG oxygen production during solar eclipse. It hypothesizes that a sand battery, with its high thermal capacity, will retain heat more effectively than other systems, thereby improving oxygen production. The setup simulated the M-COG stack with cement-bound firebricks, high-temperature graded wires, and embedded thermocouples. Four thermal systems were tested alone and combined: no insulation, ceramic fiber insulation, a 65W battery, and a sand battery. Temperature changes over 12 hours, linked to oxygen output, were recorded. The results showed that the sand battery kept temperatures up to 40% higher, boosting oxygen output by 3,570 liters daily when combined with a 65W battery and insulation, enabling the treatment of three additional patients. Its low cost and ability to absorb and release heat gradually make it a viable option for off-grid applications. The data was validated using a stored energy budget model, estimating that a 273 kg sand battery is needed for a functional M-COG. Despite limitations, including ambient temperature fluctuations, heating constraints to 600°C, and challenges replicating real M-COG conditions, the findings highlight the sand battery's potential. Future research should focus on testing a sand battery with a fully operational M-COG, using realistic dimensions and materials to validate these findings, and exploring its application for Mars missions with Martian regolith.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**3216**

## **Exploring Passiflora edulis Derived Oil as a Biodiesel Feedstock**

Aimee Wang

Conroe ISD /AST: Academy of Science and Technology

**Category**

**Energy and  
Transportation**

This project explores *P. edulis* seed oil as a biodiesel feedstock. The study aimed to determine if this oil could be used for biodiesel synthesis and how its properties compared to standard diesel. Biodiesel, an eco-friendly alternative to fossil fuels, is synthesized through transesterification using alcohols and catalysts. Passion fruit seeds, often a byproduct in the fruit industry, contain 14.9%-30.1% oil, with ideal characteristics for biodiesel production, including high lipid content, a mix of saturated and unsaturated fats, and low free fatty acid levels. The oil was heated to 60Å°C and combined with a sodium hydroxide-methanol solution to catalyze the reaction. The mixture was processed, purified with deionized water, and analyzed over three trials. Tests included viscosity, total acid and base numbers, sulfur content, sodium content, water content, pour point, infrared spectroscopy, and copper corrosion. Results showed that while some properties, like density, sulfur content, and water content, aligned with diesel standards, others, such as viscosity, total acid number, and sodium content, differed significantly. The biodiesel's higher viscosity suggests potential combustion issues, and its total acid number indicates incomplete removal of acetic acid. Despite these challenges, biodiesel derived from *P. edulis* seed oil shows promise as a renewable energy source, using agricultural byproducts to reduce waste and lower greenhouse gas emissions. While further optimization is needed, this study highlights the potential of biodiesel in creating sustainable energy solutions.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

3217

## Machine Learning Enhanced Traffic Management System Integrating Real Time Environmental Data

Ethan McGowan

Felix Everhard

Conroe ISD /AST: Academy of Science and Technology

Category

Energy and  
Transportation

The purpose of this science fair project was to reduce the amount of emissions released from gas vehicles by optimizing stoplights. Due to the millions and millions of people driving everyday, emissions released at a stop light have become a giant contributing factor to global warming. This science fair project used real time environmental data inside of a simulation that tracks the emissions and the amount of cars stopped at a stoplight. Changing the amount of traffic that the stoplight was experiencing was important too, creating 'rush hour traffic' and 'normal traffic'. This was done to vary our results and show more of a difference depending on traffic amount. Each car contributes carbon emissions, and depending if the car is waiting or moving it will release a different amount of emissions. If the car is idle, it will produce less emissions than while it's moving. The first step to optimization was to use random values for the stoplight times to test which would be the most efficient and release the least amount of emissions. Then, a Machine Learning model was implemented to further reduce carbon emissions released at the stoplight. At the end of the project, the normal traffic amount of emissions released was reduced by 46.2% and rush hour traffic amount of emissions released was reduced by 41.5%. Overall, this experiment had a significant impact on global warming and the overall environment.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

**3218**

## **Magnetic Energy**

Azriel Vanegas

Abraham Zuniga

SST - Champions College Prep - HS

**Category**

**Energy and  
Transportation**

The purpose of this research and the experiment is to prove that Magnetic Energy is more useful than general energy so we can build our future with this type of energy. We ask the question of what is the general concept of magnetic energy, then we formed a hypothesis of the possibilities with this energy and what we can do, after our research I built the mini generator with the help of my dad, while my partner got some materials, and its homemade so its easy to do. After that, we ran some test and got the maximum of 1.5 volts, but what's important is the load or the shell of the whole thing, its what defines the generator's energy and that is by the coil designs and they were also a variable on the making of it. We can apply this to different fields in engineering, but overall of this is that this is the future's renewable resources ever used to power the entire globe while keeping us within nature's balance.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no



# Abstract: Science and Engineering Fair of Houston

3219

## DynaCap: A Dynamic Wheel Cover System for Improving the Range and Performance of while Reducing CO2 Emissions from Automobiles

Inu Baek

Conroe ISD /AST: Academy of Science and Technology

Category

Energy and  
Transportation

Climate change continues to worsen through greenhouse gasses as up to 40 billion tons of gasses will be in the atmosphere by the end of 2023. With a fourth of those emissions coming from gas-powered passenger vehicles specifically, a dynamic, accessible wheel cap system was developed in order to increase the vehicle's range and reduce its CO2 emissions. When the vehicle's brakes heat, the system autonomously opens based on temperature to allow for cooling. To demonstrate this system, a proof of concept model was developed using a custom CAD wheel cap moved by a contact free pushing mechanism created through repelling neodymium magnets. A thermistor and servo motor circuit was connected to a microcontroller and was programmed to rotate the servo motor once the thermistor reading exceeded an established threshold. The system's wheel enclosure was simulated on real wheels using tape and through a CFD software for its contribution to reducing the vehicle's fuel consumption. By averaging between the two tests, the wheel cap was able to provide a 13.13% decrease in fuel consumption, resulting in potentially saving 123.8 million metric tons of CO2 annually and 6.3 billion dollars in CO2 damages if nationally applied. The CFD also simulated wheel caps at an open state, determining maximum brake cooling time and additional drag added when braking, helping to reduce wear on the tires. Overall, the system was an accessible solution, maintaining vehicle functionality while reducing its carbon footprint.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no





# Abstract: Science and Engineering Fair of Houston

**3220**

## **Developing a Low-Cost, Quasi-Solid State Sodium Ion Supercapacitor With Novel Electrode Design for Enhanced Energy Storage and Delivery**

Siddharth Jain

Vuk Popovic

Conroe ISD /AST: Academy of Science and Technology

Category

Energy and  
Transportation

Due to increased demand for renewable energy and electric vehicles, the global battery market is set to grow from \$125 billion in 2024 to \$681 billion by 2034. Today, Lithium-ion batteries lead the way due to high energy density and lifespan. However, they face challenges such as flammability, power density, instability and dependence on scarce deposits of Lithium. Solid state electrolytes look to reduce issues that liquid ion batteries face but incur high production costs. As an intermediate, quasi-solid or gel-state electrolytes improve ionic conductivity and maintain stability. Supercapacitors are a diverse electrochemical storage system that leverage the power densities of capacitors while using energy density from electrochemical processes in batteries. This research seeks to develop a sodium-ion supercapacitor featuring a gel electrolyte. Sodium was used alongside a polymer matrix of polyvinyl alcohol and chitosan. NaI serves as the ion while MnO<sub>2</sub> and activated carbon were used as the cathode and anode respectively. To improve performance and prevent side reactions, naturally derived chitosan was utilized in the synthesis of the cell. With a 3x2 inch cell costing well under a dollar, the supercapacitor provided a maximum voltage of 1.6 V based on the electrochemical stability of the solvent and electrode materials. The supercapacitor provided energy density comparable to market supercapacitors with higher power densities than battery alternatives. While further development of the cell could decrease the minimal internal resistance and increase electrode efficiency, this synthesis provides a cost-effective solution to traditional Lithium-ion batteries.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no





# Abstract: Science and Engineering Fair of Houston

**3221**

## **Hydroquinone-Functionalized Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXene Electrodes for Enhanced Electrochemical Performance in Supercapacitors**

Shashank Lankireddy

Conroe ISD /AST: Academy of Science and Technology

Category

Energy and  
Transportation

The increasing demand for high performance energy storage devices had led to significant breakthroughs in supercapacitor development. In this research, a hydroquinone-functionalized Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXene was fabricated to enhance the energy storage capabilities of traditional supercapacitors by improving its redox activity and overall capacitance. The modified MXene showed a significant improvement in capacitance when compared to pure Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXene, with about a 25% increase based on Galvanostatic Charge Discharge measurements. The specific capacitance for the functionalized MXene was measured at 280.1 F/g compared to only 224.3 F/g for the unmodified MXene. Further electrochemical testing concluded that the functionalized MXene electrode had enhanced conductivity and stability as well as an excellent capacitance retention (~93%). This energy-dense MXene-hydroquinone supercapacitor holds great potential for applications in energy storage, renewable energy, and could help address issues related to the overconsumption of fossil fuels.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human participants       potentially hazardous biological agents  
 vertebrate animals       microorganisms       rDNA       tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only.

- yes       no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

- yes       no

4. This project is a continuation of previous research.

- yes       no

5. My display board includes non-published photographs/visual depictions of humans (other than myself):

- yes       no

6. I/We hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work.

- yes       no

