

Clean Cut Quarterly

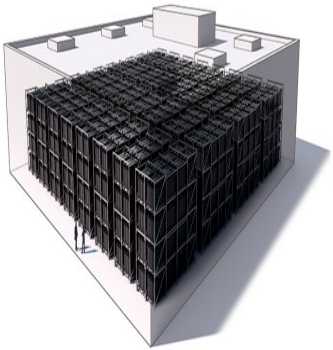
NJARNG Sustainability Newsletter

In collaboration with Rowan University

March 2016 Volume 2 - Issue 1

How Aquion Energy is Developing a New, Better, and Cleaner Type of Battery

By: Daniel Murray



Grid-scale energy operations involve batteries such as lead-acid and Lithium-Ion that are corrosive, flammable, and require thermal maintenance to prevent them from causing problems.

Check out **page 10** to see a new type of battery that is more efficient, safer to use, and can save money on power usage.

How the Best and Worst Energy Efficient Cars Stack Up Against Each Other

By: Jeff Dib

With the recent decrease in gas prices, some people may not be as interested about fuel efficiency and environmentally friendly vehicles as they were just a few years ago. But energy efficient vehicles, such as electric and hybrid cars, are key to our goal of reducing our carbon footprint.

Find out on **page 11-12** which cars are the most and least efficient of 2016!



Bizarre Sources of Energy!

By: Fred Bishop

Almost everyone knows that there is a limited supply of resources such as coal and oil that provide us with the energy we use every day to power things. The push for



alternative sources of energy has led to some great findings, such as solar, wind and water renewable sources of energy. Along with these, there are many more sources for alternative energy. Turn to **page 13** to take a look at some bizarre sources of energy that may become much bigger in the next couple of years.



What is the Clean Cut Campaign?

The Clean Cut Campaign was developed by the Department of Military and Veterans Affairs (DMAVA) Energy Team in collaboration with Rowan University. The goal of the program is to reduce the NJARNG's carbon footprint and impact on the environment by promoting energy and water conservation. Reducing energy and water use will ensure a greener workplace, a healthier environment, and promote a sustainable living culture throughout the state. The main drivers behind this effort are federal legislation, like the Energy Independence and Security Act of 2007 and Executive Order 13693, "*Planning for Federal Sustainability in the Next Decade.*"



NJARNG sees Clean Cut as a way to not only educate the army and state personnel about the various ways their daily decisions affect the environment, but as a way to embrace the competitive spirit that runs rampant through the National Guard and create a big change throughout the state of New Jersey.

Training for Veterans

Part of the Clean Cut Campaign is to promote the NJARNG effort to reduce energy and water consumption through education and awareness training. Raising awareness can help alter occupant behavior, which has been shown to be able to reduce energy consumption by as much as 10%. The first training session was done at Veterans Haven South in Ancora. The Energy Intern Program developed the training and presented it to the veterans.



The veterans at Vets Haven South can use what they've learned to help reduce utility costs at Vets Haven and in their future living space.

Pictured left: Sam Valentine (program manager) and 2 interns presenting training to veterans at Vets Haven South in Ancora under their new LED lights.

Energy Reduction Competition

Another aspect of the Clean Cut Campaign is the Energy Reduction Competition. This competition is a yearlong energy reduction program with the purpose of incentivizing participation in energy reduction initiatives. Ultimately, the goal is to encourage employee participation and to cut utility usage and costs.

In the last issue of Clean Cut Quarterly, we ranked each facility by its fiscal year 2015 energy use intensity, or **EUI**. In each issue, we will rank each facility's EUI compared to the same months from last year. In this issue, we have the First Quarter results (October, November, and December). The NJARNG goal for annual energy reduction is 2.5%, and every facility is needed to help reach (and hopefully exceed) that goal. Look below to see where your facility stacks up!

In the lead for the "biggest loser" title is the **Hammonton Armory**

Keep up the great work everyone! For tips on how to reduce your energy use and carbon footprint, please take a look at the Green Building Handbook:

www.nj.gov/military/installations/docs/CLEAN-CUT-Green-Management-Handbook.pdf

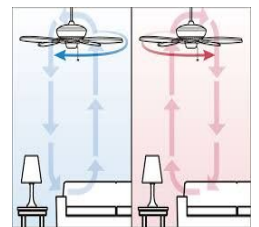
Rank	Facility Name	FY15Q1 EUI	FY16Q1 EUI	% Reduction
1	Hammonton Armory	32	4	88%
2	Cape May Armory	96	28	70%
3	Woodbury Armory	8	3	68%
4	Morristown Armory	26	10	60%
5	Toms River Armory	9	5	47%
6	Trenton AASF	28	16	43%
7	Lawrenceville DMAVA	28	18	37%
8	Tuckerton Armory	13	8	36%
9	West Orange Armory+CSMS B	25	17	33%
10	Lakehurst	21	15	27%
11	Lawrenceville Armory	11	8	27%
12	Fort Dix - T3BL	23	17	27%
13	Cherry Hill Armory	40	30	26%
14	Riverdale Armory	14	10	25%
15	Bordentown Armory	26	20	25%
16	Westfield Armory+OMS	22	17	23%
17	Freehold Armory	14	11	23%
18	Lawrenceville, USPF&O	17	14	21%
19	Somerset Armory	17	14	19%
20	Teaneck Armory	22	18	18%
21	Sea Girl Training Center	22	18	18%
22	Vineland Armory	37	31	17%
23	Woodbridge Armory	9	8	15%
24	Newark Armory	5	4	11%
25	Flemington Armory	3	2	10%
26	Dover Armory	10	9	7%
27	Atlantic City Armory	9	9	1%
28	Washington Armory	17	18	-3%
29	Mt. Holly Armory	17	20	-21%
30	Picatinny - FMS # 7	17	21	-25%
31	Hackettstown Armory	14	18	-28%
32	Jersey City Armory	17	27	-52%
33	Fort Dix - Headquarters	17	39	-124%
34	Woodstown Armory	1	35	-2981%

** As one of the few facilities that still use fuel oil for heating, the Woodstown Armory's large EUI increase is somewhat misleading as it had fuel oil delivered during the FY16 Q1. As more of the year is included in the analysis, this value will be dispersed.

10 Spring Energy Saving Tips

By: Fred Bishop

1.) Service Air Conditioner	Make sure you replace and clean your air filters in order to save up to 15% in energy consumption. Also check the air conditioner's evaporator coil to make sure it's operating at optimal levels.
2.) Open Windows	Opening windows will allow you to cool your house without turning on the air conditioning. This is perfect to do in the Spring as the temperatures aren't too cold or too hot.
3.) Use Ceiling Fans	By turning on ceiling fans throughout the house, you can raise your thermostat by four degrees. This will help lower electric bills without becoming completely uncomfortable.
4.) Cook Outside / BBQs	Warm, Spring days are perfect for outdoor cooking and BBQs. Not only does this mean great, tasty food, but also it keeps the heat out of the house, which means no need to have the air conditioner on.
5.) Window Treatments	Installing window treatments, such as blinds, shades or other types of films can reduce the amount of heat that comes in through the windows. This can reduce energy costs and add style to your house!
6.) Air Leaks	Go around your house to make sure there is no air leaks. If there are, you can use a low-cost caulk to seal them up, which will keep warm air out.
7.) Bring in Sunlight	A beautiful spring day means plenty of sunlight! Instead of using artificial lighting, you can use the sun to light up your house.
8.) Set the Thermostat	Programming your thermostat when you're not home to a higher temperature can save about 10% on energy costs.
9.) Seal Ducts	Almost 30% of electricity costs are accounted for through the loss of air through air ducts. Making sure you seal and insulate these ducts will reduce the amount of air loss.
10.) Bathroom Fans	Bathroom fans are meant to suck out heat and humidity and therefore can be used to improve the comfort of your house without wasting too much electricity.



MEET THE STUDENTS

Energy Audit Overview

An **Energy Audit** is an inspection, survey, and analysis of energy use in a building. Energy audits can identify strategies to make a facility more efficient, healthy, and comfortable. As part of the Clean Cut Campaign, Rowan University established the "NJARNG-RU Energy Audit Center" with the purpose of providing resources and training to students so that they can conduct energy audits at NJARNG facilities. This program funds a graduate student who oversees and trains undergraduate students each semester and leads them during the audit. In addition, four professors oversee the program and ensure that NJARNG is receiving high quality data and results from the audits. Each year, 25% of NJARNG facilities must be audited.



ATLANTIC CITY

India Woodruff

Electrical/Computer Engineering, Junior

Brandon Nelan

Mechanical Engineering, Junior

Craig Szot

Civil Engineering, Senior

CHERRY HILL

Logan Greer

Mechanical Engineering, Junior

Joe Mandara

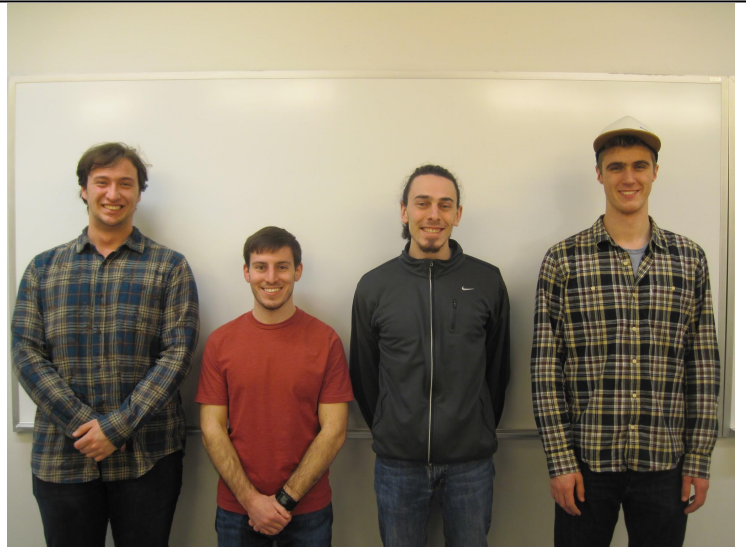
Mechanical Engineering, Junior

Aaron Sorin

Mechanical Engineering, Junior

Andrew Reilly

Mechanical Engineering, Junior



WOODBURY

Steve Michetti

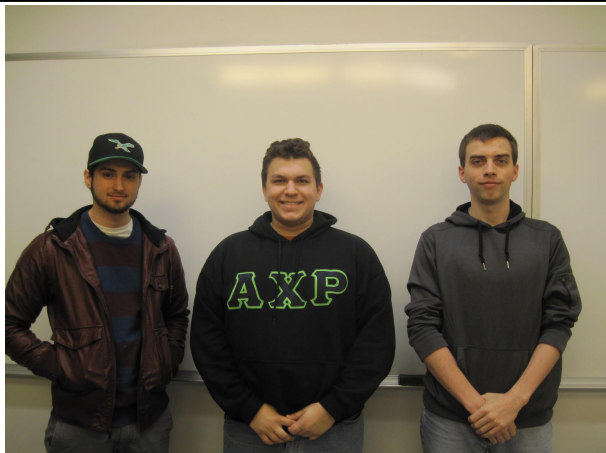
Mechanical Engineering, Junior

Adam Ciesielski

Electrical/Computer Engineering, Junior

Patrick Quirk

Electrical/Computer Engineering, Senior





Energy Audits

Atlantic City Armory Audit

The Atlantic City Armory is a 52,500 square foot facility made up of mostly office space and a large indoor track. The Atlantic City Armory was previously audited by Rowan University in December 2012. The building's overall ISR rating is RED. Some of the recommendations to improve the efficiency of the building include:

- Remove unused refrigerators or use timing activated refrigerators
- Replace remaining exterior lights with LED fixtures
- Remove Blood Pressure Monitor or keep unplugged when not in use
- Install occupancy sensors in hallways

Cherry Hill Armory Audit

A team of engineering students from Rowan University conducted an energy audit of the Cherry Hill National Guard Armory located at 2001 Park Boulevard. The 40,000 square-foot facility has a large drill floor and consists primarily of office space and storage. An Installation Status Report energy analysis rated the building in the "Red" category. This indicates that the building is in need of renovations to improve its sustainability and energy efficiency. Some recommendations to improve the building's efficiency include:

- Repair heating control valve between boiler and classroom
- Repair broken windows on the drill floor
- Install Smart Meters to better regulate electricity, natural gas, and water usage
- Install occupancy sensors
- Replace lights with LED bulbs

Woodbury Armory Audit

The Woodbury Armory is a two story multi function building with approximately 69,000 square feet of floor space. The second floor is mostly general purpose for events however the first floor is mostly offices for operations and occupied throughout the week. Rowan University is conducting its second energy audit at this location, the previous being in 2012. The audit will be compared to the previous audit from 4 years ago in terms of energy savings and improvements to the facility since then. Some of the recommendations the team will be looking at to improve the efficiency of the building includes:

- Installing Rooftop Photovoltaic Panels
- Installing Room Occupancy Sensors
- Reduction of Fluorescent Tubes in Fixtures
- Managing Open Windows
- Managing Missing Ceiling Tiles
- Installing Digital Thermostats
- Minimizing personal heater use

Installation Operations Go Virtual

The NJARNG is undertaking a new challenge: to create virtual building models of NJARNG facilities. These virtual representations, or Building Information Models (BIM), will help improve collaboration, asset management, and decision making within the Construction Facilities Maintenance Office (CFMO). Making these improvements can reduce construction costs and time, as well as annual operation and maintenance costs.



Above: Rowan students brave the rainy weather to set up weather stations at the Woodstown Armory.

A pilot study is currently being conducted on the Woodstown Armory by Rowan University in order to optimize the necessary workflows and show the usefulness of BIM to the National Guard. The study will include an in-depth energy analysis, updated floor plans, and a breakdown of space allocation. A microclimate study is also being conducted in conjunction with the BIM study in order to capture how surrounding conditions affect energy use inside the building.

On February 23, the Rowan Energy Intern Program conducted its first reality capture trip. For energy modeling, it is especially important to capture existing conditions of the building. The reality capture is being done with Faro Focus 3D laser scanners

Left: Faro Focus 3D X330 set up at the Lakehurst CLTF.

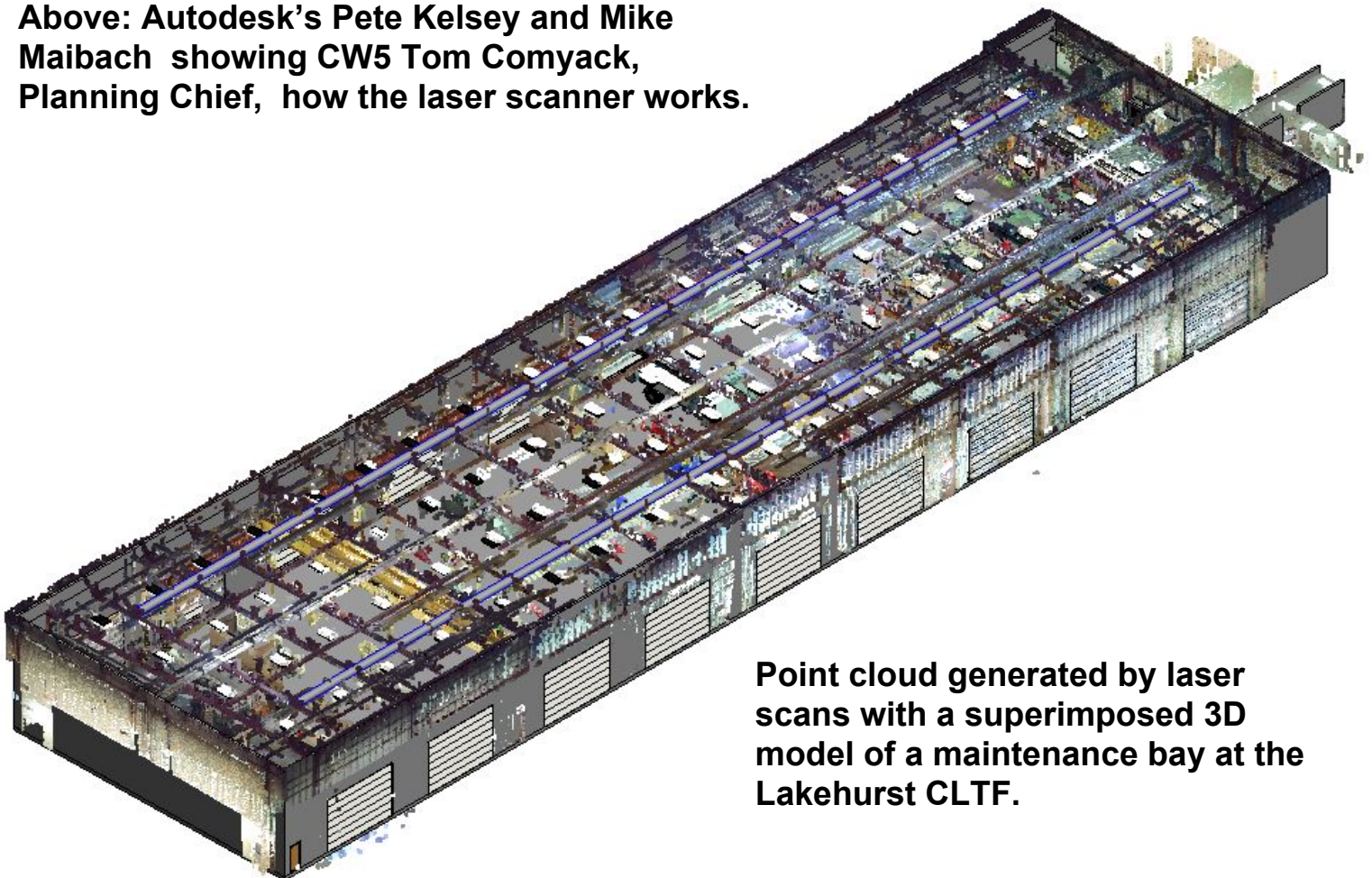




BIM is rapidly changing and modernizing the Architecture, Engineering and Construction industry, and making design and construction projects proceed much more efficiently. The National Guard has a unique opportunity to help drive change in the government sector by making an early switch to a BIM-driven organizational system. Rowan's BIM pilot study will be used to help promote BIM throughout the Guard and to help improve the Civil Engineering curriculum at Rowan.

For more information about the BIM project, contact Sam Valentine at valent80@rowan.edu

Above: Autodesk's Pete Kelsey and Mike Maibach showing CW5 Tom Comyack, Planning Chief, how the laser scanner works.



Point cloud generated by laser scans with a superimposed 3D model of a maintenance bay at the Lakehurst CLTF.

How Aquion Energy is Developing a New, Better, and Cleaner Type of Battery

By: Daniel Murray

Energy storage is a vital component for any major building's electronic systems. However, most common types of batteries in grid-scale operations, including lead-acid, sodium sulfur, and Li-Ion, can be toxic or flammable; causing long term harm towards the grid or for the people working on them.

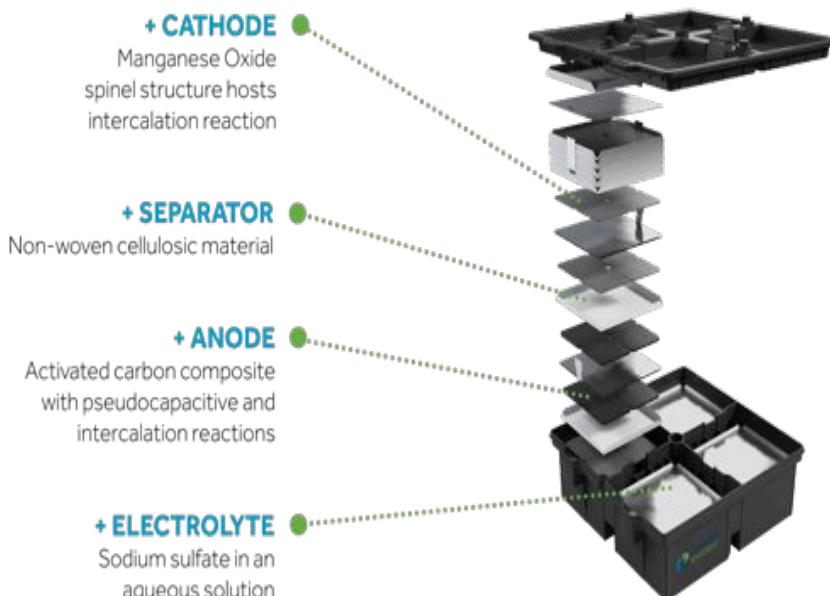
Since 2014, Aquion Energy has been producing safe and efficient batteries that save money, resources, and labor.



Efficiently Store Energy

Aqueous Hybrid Ion (AHI) batteries are great for storing energy generated by solar or wind power. This reduces the dependency of using energy from the power grid, lowering electricity costs. AHI batteries additionally enable a consumer to:

- Consume solar and wind energy produced, on-demand, when it is needed
- Control utility energy costs that rise based on time of day or demand charges
- Reduce or eliminate dependency on the grid
- Have backup power during grid outages



How it Works

The battery uses a combination of a saltwater electrolyte, manganese oxide cathode, carbon composite anode, and synthetic cotton separator. Non-corrosive reactions occur at the anode and cathode of the battery to prevent deterioration of the materials.

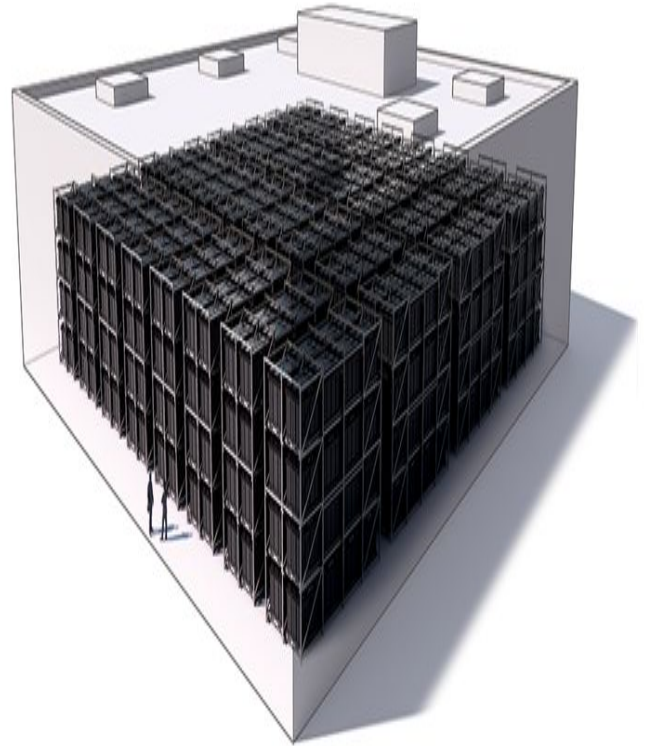
The batteries are proven to be flameproof and non-corrosive, meaning that they will not be harmful and won't require thermal maintenance.

Bulk-Energy Storage

Grid-scale applications, such as those used at armories for the National Guard, can use the bulk-energy storage to efficiently store and deliver power. These pallet-like stacks are scalable for a wide range of interior configurations, optimizing space for any kind of room design.

Some key features that the bulk-energy storage offers are:

- Very high cycle life
- Extremely abuse tolerant
- Low acquisition costs (\$/kWh)
- No regular maintenance
- No thermal management
- No corrosive acids or noxious fumes
- No active management required



Energy Management

AHI batteries are designed for energy management applications including:

- Demand response
- Peak shaving
- Power quality
- Self-consumption

Save Money

Electricity usage fluctuates throughout the day in what is known as “peak hours”. Peak hours are when a large amount of energy is being used by a local grid; usually during work hours when buildings and facilities have to be running.



Energy used during peak hours is more expensive, and also more harmful for the environment as the grid has to put out more energy to any application using it.









AHI batteries can store energy from the grid during off-peak hours and then use it during the day, saving money on energy demand charges. Additionally, because of their long life cycle and non-corrosive or flammable chemistry, AHI batteries can be used for years without replacements or maintenance.

How the Best & Worst Energy Efficient Vehicles Stack Up Against Each Other

By Jeff Dib

Check out the next two pages to see which car is the best and worst energy efficient in its class. For more information, and to see where your car stacks up, visit: <https://www.fueleconomy.gov/feg/best-worst.shtml>

Class	The Best	The Worst
Two-Seaters	smart fortwo electric drive Convertible 	 Lamborghini Aventador Roadster
	Combined MPGe: 107 Power Use: 32 kWh/100 miles Total Range: 68 miles	Combined MPG: 12 Consumption: 8.3 gal/100 miles CO₂ Emissions: 727 grams/mile
	Annual Fuel Cost: \$600 Cost to Drive 25 miles: \$1.02	Annual Fuel Cost: \$2,750 Cost to Drive 25 miles: \$4.60
Mini compacts	Fiat 500e 	 Aston Martin DB9
	Combined MPGe: 112 Power Use: 30 kWh/100 miles Total Range: 84 miles	Combined MPG: 15 Consumption: 6.7 gal/100 miles CO₂ Emissions: 587 grams/mile
	Annual Fuel Cost: \$600 Cost to Drive 25 miles: \$0.97	Annual Fuel Cost: \$2,200 Cost to Drive 25 miles: \$3.68
Sub compacts	BMW i3 BEV 	 Bentley Continental Convertible
	Combined MPGe: 124 Power Use: 27 kWh/100 miles Total Range: 81 miles	Combined MPG: 15 Consumption: 6.7 gal/100 miles CO₂ Emissions: 604 grams/mile
	Annual Fuel Cost: \$550 Cost to Drive 25 miles: \$0.88	Annual Fuel Cost: \$2,200 Cost to Drive 25 miles: \$3.68

Class	The Best	The Worst
Compacts	Volkswagen e-Golf 	 Rolls-Royce Phantom Coupe
	Combined MPGe: 116 Power Use: 29 kWh/100 miles Total Range: 83 miles	Combined MPG: 14 Consumption: 7.1 gal/100 miles CO₂ Emissions: 638 grams/mile
	Annual Fuel Cost: \$550 Cost to Drive 25 miles: \$0.95	Annual Fuel Cost: \$2,350 Cost to Drive 25 miles: \$3.95
Midsize	Nissan Leaf 	 Ferrari FF
	Combined MPGe: 114 Power Use: 32 kWh/100 miles Total Range: 68 miles	Combined MPG: 13 Consumption: 7.7 gal/100 miles CO₂ Emissions: 697 grams/mile
	Annual Fuel Cost: \$600 Cost to Drive 25 miles: \$0.96	Annual Fuel Cost: \$2,550 Cost to Drive 25 miles: \$4.25
Large	Tesla Model S AWD-70D 	 Rolls-Royce Phantom EWB
	Combined MPGe: 101 Power Use: 33 kWh/100 miles Total Range: 240 miles	Combined MPG: 14 Consumption: 7.1 gal/100 miles CO₂ Emissions: 637 grams/mile
	Annual Fuel Cost: \$650 Cost to Drive 25 miles: \$1.07	Annual Fuel Cost: \$2,350 Cost to Drive 25 miles: \$3.95
Station Wagons	Kia Soul Electric 	 Mercedes-Benz AMG E63 S 4matic
	Combined MPGe: 105 Power Use: 32 kWh/100 miles Total Range: 93 miles	Combined MPG: 18 Consumption: 5.6 gal/100 miles CO₂ Emissions: 498 grams/mile
	Annual Fuel Cost: \$600 Cost to Drive 25 miles: \$1.04	Annual Fuel Cost: \$1,850 Cost to Drive 25 miles: \$3.07

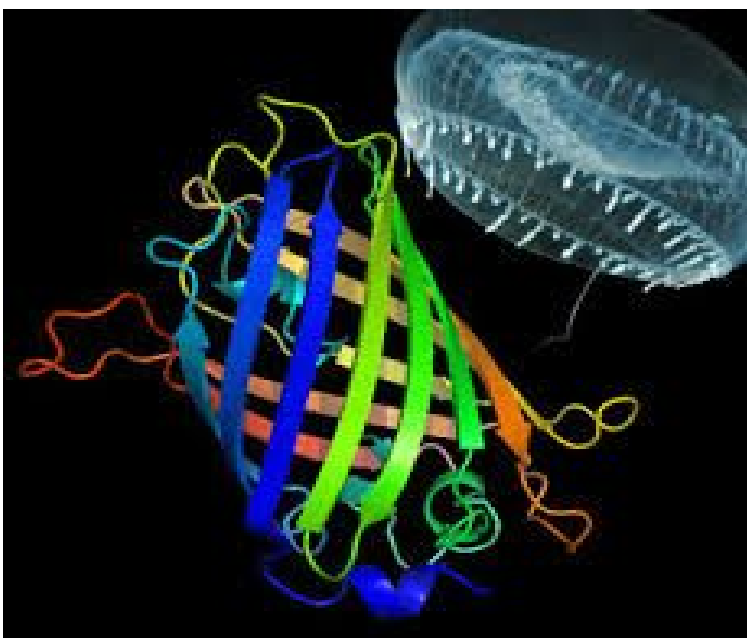
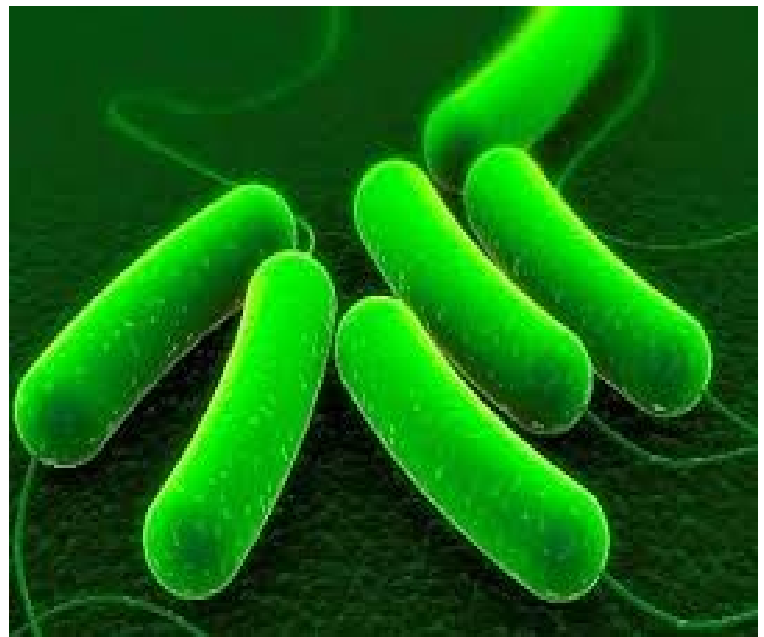
Bizarre Sources for Alternative Energy

By: Fred Bishop

As many people know, there is a huge need to find alternative sources of energy. Some of the most common are solar, wind and water. However, there are other, more bizarre, sources that can be used. These can range from things as small as bacteria, all the way to things as large as exploding lakes!

Bacteria:

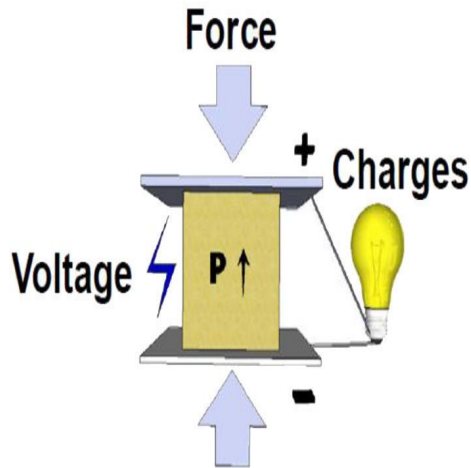
Bacteria can be found all over the Earth and have survived billions of years. One of the survival strategies bacteria, specifically E. Coli, have is its ability to store fatty acids when there is a limited food supply. These fatty acids are needed to make biodiesel fuel. Scientists are trying to figure out how to genetically modify E. Coli to overproduce these fatty acids. This means that the same bacteria that can make you sick, may one day provide fuel to transportation.



Jellyfish:

Certain jellyfish possess a green fluorescent protein (GFP) which makes them glow. When this protein is put onto aluminum electrodes and exposed to UV light, it releases electrons that produce electricity. These can then make biological fuel cells, which produce electricity without an external light source. These fuel cells than can power small medical devices used inside the body.

Vibrations and Body Heat:



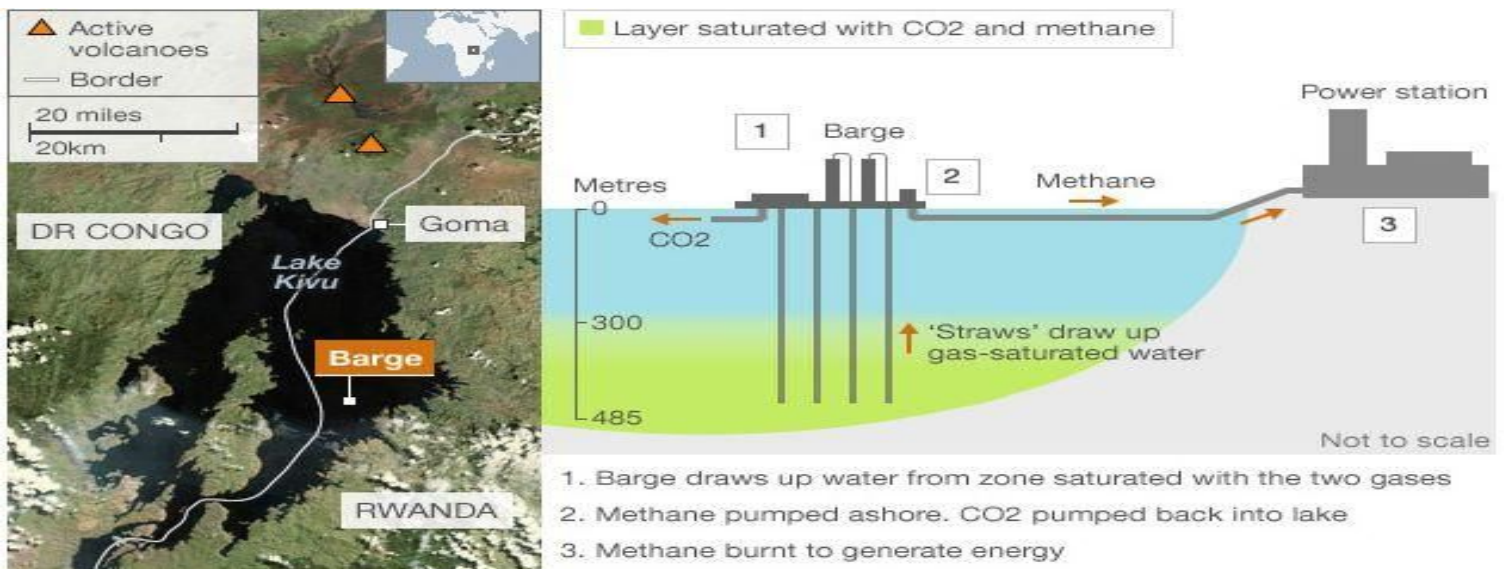
Piezoelectric materials can produce an electric charge when put under stress. This means that electricity to power lights can be generated from people walking or dancing, as one night-club does.

This technology is also being looked at by the U.S. Army. They figure they can put this material in boots to power and charge their portable devices. Body heat can also be used and transferred from places that have large crowds. London announced a plan to take body heat from subway tunnels and use it in other places.

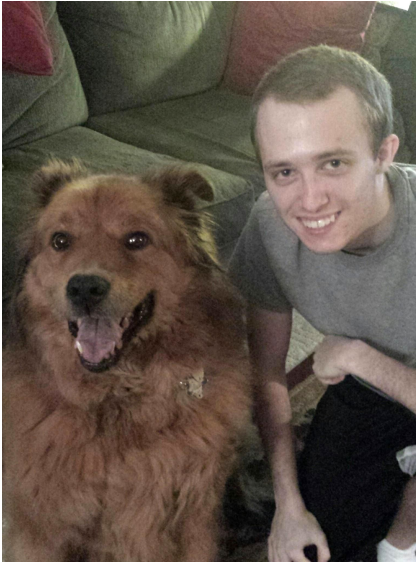


Exploding Lakes:

Although there are only three known “exploding lakes” in the world, they can be used to produce a lot of electricity. The lakes contain large amounts of methane and carbon dioxide trapped in the water. If all these gases were to be released at once, then it would cause a huge explosion of carbon dioxide, killing thousands of people and animals in the surrounding area. Instead, a power plant can be put onto these lakes that would consume these gases. Lake Kivu, in Rwanda already has a power plant that powers three large generators, producing 3.6 megawatts of electricity.



Meet The Interns!



Daniel Murray

Civil Engineering, Junior

“Hello! My name is Dan and I enjoy gaming on my computer and playing with my dog. This past summer I took a cruise to Spain, Italy, and France.”

Fred Bishop

Chemical Engineering, Junior

“Hi! My name is Fred and I like to swim, row and workout in my free time. It has always been my dream to travel to all 50 states in the U.S. I also like trying new foods from around the globe.”



Jeff Dib

Civil Engineering, Junior

“Hey! My name is Jeff and I enjoy playing sports with my friends and when I’m not playing, I’m watching my favorite teams, the Yankees, Knicks, and NYCFC. I also enjoy going on vacation to Disney World and on Disney Cruises with my family.”



Bird Study Takes Interns to New Heights

By: Hannah Jacobson, Department of Geography & Environment, Rowan University

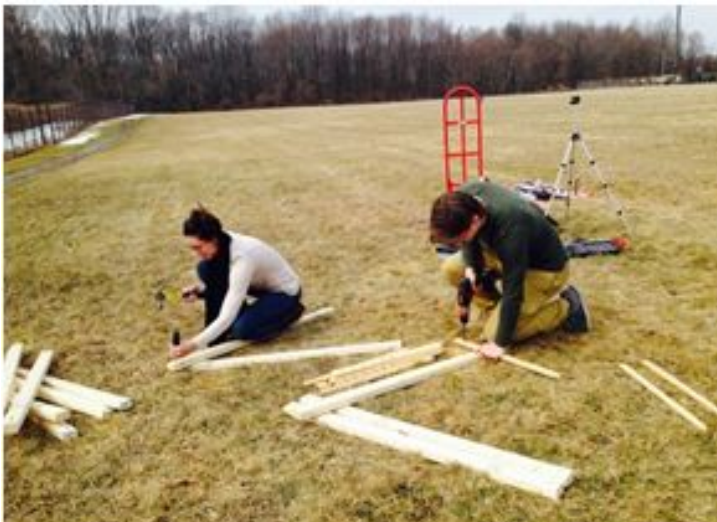
Over the recent fall and winter months Rowan's Geography and Environment Department continue to team up with the New Jersey Army National Guard's Environmental Bureau through an internship program. During these months the intern team and program manager have conducted some data collection in the field with EMB Environmental Specialist, but have focused on analyzing data collected over the summer months.

Pictured right: Interns Matthew Bettin, Caitlin Montgomery, Morgan Doherty (from left) performing a soil analysis.



The major task at hand is analyzing data for the rare species planning level survey which the Guard is required to update every five years. Bioacoustic recorders were set up throughout the summer at 11 NJARNG facilities to capture both ultrasonic bat frequencies and rare bird calls. Now the intern team, program manager, and Environmental Specialist Bill McBride are working to analyze those recordings using frequency recognition software. The software will help identify any rare bird calls picked up by the recorders and auto-identify bat calls.

This project is especially beneficial for the intern team as they are going to be able to see the entire rare species planning level survey through to completion, from initial planning from data collection to final data analysis to assisting with the final report. Other recent responsibilities include collecting data on monitoring wells located on NJARNG facilities, forming a database containing all monitoring well information, and updating spill plans for the Guard. They have been completing these tasks with the assistance of environmental specialists at the environmental bureau, Anjelica Sinigaglio and William McBride.



Pictured above: Interns Morgan Doherty and Matthew Bettin constructing structures to host bioacoustic recorders.

The interns are looking forward to another field work season with new additions to their team. During the summer they will continue to maintain a Natural Resource Management Plan at the National Guard Training Center in Sea Girt, NJ, collect data from remaining sites for the rare species planning level survey, and much more. It will be a busy and productive field work season with new boots on the ground.

For more information contact Hannah Jacobson (program manager) at jacobsonh@rowan.edu

NJARNG Energy Team

Want to know more?

❖ Contact the Energy Team!



Christopher Moore

Chris received his Bachelor's Degree in Civil Engineering from Rowan University and his Master's Degree in Sustainable Design from the Boston Architectural College. He has over 5 years of energy management and sustainability consulting experience with non-profit, private, and government organizations. Chris enjoys biking, drawing, and gardening.

Samantha Valentine

Sam received her Bachelor's Degree ('12) and Master's Degree ('14) in Civil Engineering from Rowan University. Her academic interests include sustainable design, low impact development, and climate science. Sam enjoys cooking, boating, and adventuring in the great outdoors.



For more information, please contact:

Christopher Moore

DMAVA Energy Manager

Please contact Chris if you would like to learn more about the *Clean Cut Campaign* at:

christopher.moore@dmava.nj.gov

Samantha Valentine

NJARNG Energy Intern Manager

If you would like to learn more about how Rowan University is helping NJARNG's sustainability efforts or to make suggestions for future issues of *Clean Cut Quarterly*, please contact Sam at:

valent80@rowan.edu