

Clean Cut Quarterly

NJARNG Sustainability Newsletter

In collaboration with Rowan University



June 2016 Volume 2 - Issue 2

NJARNG's 230 kW solar carport at Sea Girt generates over 260,000 kwh per year, which is the equivalent of reducing emissions from 38 cars! Learn more on pages 9-10.



In this issue...

It's a Great, Big, Beautiful, Solar-Powered Tomorrow at Disney World

You've seen ice cream bars and pretzels in the shape of Mickey Mouse, but what about a solar farm? Head over to [page 8](#) to see what strides Disney is making to become more sustainable through alternative energy practices

Interested in saving money in your home?

While looking to upgrade old home appliances, there are many opportunities for saving money. Choosing energy efficient appliances can save you money on your energy bills and can qualify you for rebates. Check out [page 5](#) for some available rebates.

Bees, Farming and Sustainability.

What do these three things have in common? How can planting a flower go a long way in helping with sustainability? Bees are a vital part of our society, but they are being endangered. Find out more on [page 14](#).

RU-NJARNG Audit Program Grad Takes Skills to the Navy

By: Samantha Valentine

The RU-NJARNG Energy Audit Center, created in 2012, has been providing Rowan University engineering students a unique opportunity to work with the New Jersey Army National Guard. Energy audits are used to identify energy conservation measures for facilities to reduce energy consumption. In order to comply with Federal legislation, 25% of NJARNG building area must be audited every year.

For the past 2 years, Sarah Schanck has been leading and managing multiple groups of students to conduct energy audits for the NJARNG, all while she has been working on her Master of Science in Engineering Degree and writing her thesis. Prior to her time as the graduate student associate on the NJARNG Energy Audit team, she was an undergraduate student energy auditor in the same program. Through the Energy Audit Center, Sarah has participated in 11 audits and has helped evaluate over 650,000 square feet of National Guard space. Now Sarah's taking what she learned with her as she begins her career in the engineering field. She's moving on from energy audits, but she gained valuable management and technical writing skills during her time with the NJARNG-RU Energy Audit program.

After speaking with her, it's easy to see how excited Sarah is to start working with the Navy. She'll be working as a Navy Civilian at The Navy Yard in Philadelphia doing Shock Test Certifications and Compliance Testing in the Ship System Hardening Branch of the Machinery Research, Logistics and Ship Integrity Department. Sarah's job will involve testing mission critical equipment to make sure that they can endure pressure waves

produced by explosions or military aircraft and assessing risk if equipment cannot. She'll be juggling multiple projects all at once, but managing student groups has helped prepare her for dealing with coinciding projects in different stages. Because of the opportunities she's had at Rowan through the NJARNG Energy Audit Center, she feels well prepared for her future career.



Best of luck, Sarah!

For a summary of last semester's audits, see page 4.

In the last issue of Clean Cut Quarterly, we ranked each facility by its percent reduction in energy use intensity, or **EUI**, from the first quarter of fiscal year 2015 to the first quarter of fiscal year 2016. In this issue, we have the first half of results (Quarters 1 and 2, encompassing the months of October through March) for each fiscal year. The NJARNG goal for annual energy reduction is 2.5%, and every facility is needed to help reach that goal. Look below to see where your facility stacks up and to see which facility is leading the way in percent reduction.

In the lead for biggest loser, and overtaking the Hammonton Armory is the...
CAPE MAY ARMORY!

Keep up the great work everyone! Check out the next issue to see results from Quarters 1, 2, and 3. Will your facility be the leading the way in energy reduction? Find out in September!

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+Q2 EUI	FY16Q1+Q2 EUI	% Reduction
1	Cape May Armory	100.4	33.4	67
2	Cherry Hill Armory	23.1	11.8	49
3	Hammonton Armory	11.8	6.4	45
4	Atlantic City Armory	14.0	8.3	40
5	Westfield Armory + OMS	14.1	8.5	39
6	Washington Armory	41.3	26.7	35
7	Lawrenceville DMAVA	67.7	48.6	28
8	Morristown Armory	9.5	6.9	27
9	West Orange Armory + CSMS	11.4	8.5	25
10	Tuckerton Armory	3.1	2.3	25
11	Fort Dix - T3BL	21.4	16.8	22
12	Picatinny - FMS #7	7.3	5.7	21
13	Toms River Armory	7.1	5.8	17
14	Lakehurst CLTF	17.1	14.6	15
15	Riverdale Armory	9.2	7.9	14
16	Vineland Armory	24.6	21.6	12
17	Bordentown WTC	16.7	15.3	8
18	Lawrenceville, USPF&O	14.2	13.0	8
19	Freehold Armory	27.4	26.3	4
20	Woodbury Armory	5.6	5.4	4
21	Teaneck Armory	8.2	8.0	3
22	Trenton Mercer AASF	34.7	34.0	2
23	Flemington Armory	34.6	34.0	2
24	Woodbridge Armory	6.7	6.6	1
25	Sea Girt Training Center	21.3	21.1	1
26	Newark Armory	1.6	1.6	0
27	Hackettstown Armory	27.5	27.9	-2
28	Dover Armory	7.4	7.7	-5
29	Jersey City Armory	7.5	8.8	-17
30	Mt. Holly Armory	11.1	13.3	-19
31	Fort Dix - Headquarters	15.3	19.9	-31
32	Somerset Armory + DTMB	10.3	13.8	-34
33	Lawrenceville Armory	11.1	16.2	-46
34	Woodstown Armory	24.6	37.9	-54

Energy Audits

As part of federal energy requirements, NJARNG must conduct comprehensive energy and water audits on 25% of its facility space annually. This is accomplished through NJARNG's partnership with Rowan University. During the Spring '16 semester, Rowan engineering students audited 3 facilities: Atlantic City Armory, Cherry Hill Armory, and Woodbury Armory. Below is a summary of each audit.

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. It has an Energy Installation Status Report (ISR-Energy) rating of RED.

Recommendation	Installation Cost	Yearly Savings	Payback (Years)
Regulate Temperature Set Point	\$1,000.00	\$12,223.00	0.1
Occupancy Sensors	\$550.00	\$1,380.00	0.4
Replace Blood Pressure Monitor	\$50.00	\$75.00	0.7
Replace T8 Lights with LED Lights	\$3,770.00	\$340.00	11.1
Addition of Solar Panels	\$234,780.00	\$18,000.00	13

Cherry Hill Armory Audit

The Cherry Hill Armory is a 40,000 square-foot facility that has a large drill floor and consists primarily of office space and storage, and has an ISR-Energy rating of RED.

Recommendation	Installation Cost	Yearly Savings	Payback (Years)
Replace Broken Control Valve	\$1,875.00	\$15,734.00	0.1
Replace Broken Windows/Gaps	\$600.00	\$2,505.00	0.2
External Halogen Replacement	\$3,080.00	\$896.00	3.4
Install Occupancy Sensors	\$859.00	\$362.00	2.4
Drill Floor Halogens Replacement	\$2,156.00	\$1,077.00	2

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.

Recommendation	Installation Cost	Yearly Savings	Payback (Years)
Install Weather Stripping	\$600.00	\$4,866.00	0.1
Install Programmable Thermostat	\$325.00	\$8,689.00	0
Delamping	\$70.00	\$130.00	0.5
Install Occupancy Sensors	\$180.00	\$320.00	0.6
LED Light Replacement	\$5,945.00	\$665.00	8.9

Summer Energy Saving Tips

By: Fred Bishop

Summer is here, which means beaches, pools, and looking for ways to keep cool. It's important to try and stay cool and comfortable during the hot summer months, but running the AC all day wastes electricity. Instead, follow some of these tips to save money and feel comfortable this summer!

Thermostat Control

Make sure to keep appliances away from air-conditioning thermostats. Placing electrical devices that give off heat, such as lamps or TVs, near your thermostat can cause your air-conditioning to run longer than needed. The thermostat senses the heat from the appliance and believes the whole room is hotter than it actually is.



Fans and Windows

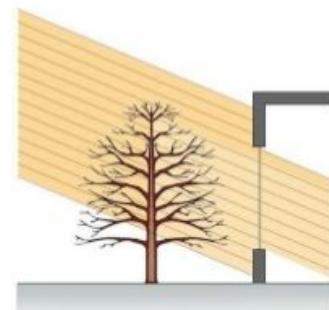
When the air conditioning is on, use a fan to help cool down too. You can raise your thermostat about 4 degrees without even noticing a difference, which can save almost 12% on your cooling bill. On days when there is a nice breeze and it's not too hot, open a window and turn off the air-conditioning! Just be sure to shut the windows when the air comes back on.



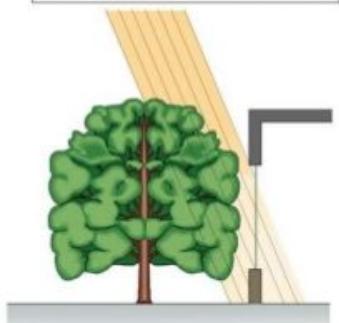
Landscaping

Not only does landscaping add aesthetics, but properly placed trees and bushes can be used to save money. A tree can provide shade for a part of the building that typically gets a lot of sun, which means the thermostat can be lowered.

SOLAR TRANSMISSION CAN BE AS HIGH AS 70% FOR A MATURE TREE IN THE WINTER



SOLAR TRANSMISSION CAN BE AS LOW AS 20% FOR A MATURE TREE IN THE SUMMER



BBQ

Cooking outside is a summer tradition. Along with eating great food, you are actually saving money! By cooking outdoors, you are not heating up the inside of the house. This means the air conditioning does not need to come on to cool the house.



Residential Rebates

By: Katie Hollywood

New Jersey's Clean Energy Program offers a variety of rebates for energy efficient equipment. Some are as simple as switching to LED lights or recycling an old refrigerator. Check out the Clean Energy Program at <http://www.njcleanenergy.com/residential/home/home> for more information. Applications for rebates can now be submitted online!

Central Air Conditioning	By replacing an air conditioner with a high efficiency central air conditioner or a ductless mini-split AC unit can save energy costs and qualify you for a \$300 or \$500 rebate by meeting certain efficiency levels.
Heating Pump	Rebates of \$300 or \$500, depending on energy and efficiency levels, are available for switching your heat pump to an air source heat pump, ductless heat pump, or non-electric high efficiency central heat.
Lighting	There are instant in-store discounts on selected ENERGY STAR LEDs.
Home Remodeling	ENERGY STAR offers 'whole house' solutions to reduce your energy costs and carbon footprint. Installing energy efficient upgrades can save you up to 30% on energy costs and qualify you for up to \$4,000 in financial incentives.
Washer and Dryer	Rebates of \$50 or \$75 are available for qualifying models of clothes washers. Rebates of \$100 or \$300 are available for qualifying models of clothes dryers.
Refrigerators	Recycling an old refrigerator can qualify you for a \$50 rebate. Rebates of \$50 or \$75 are offered for qualifying models of refrigerators.
Water Heaters	Rebates of \$500, \$900, \$1000, or \$1200, depending on efficiency level, are offered for upgrading your water heater to a gas water heater, heat pump water heater, or a solar water heater.
Heating Equipment	By switching your heating equipment to a gas furnace, gas boiler, oil furnace, or oil boiler, you can qualify for rebates of \$250, \$300, or \$500 for certain efficiency levels. Combination rebates of \$900 or \$1200 are available for upgrading your heating equipment and water heater.



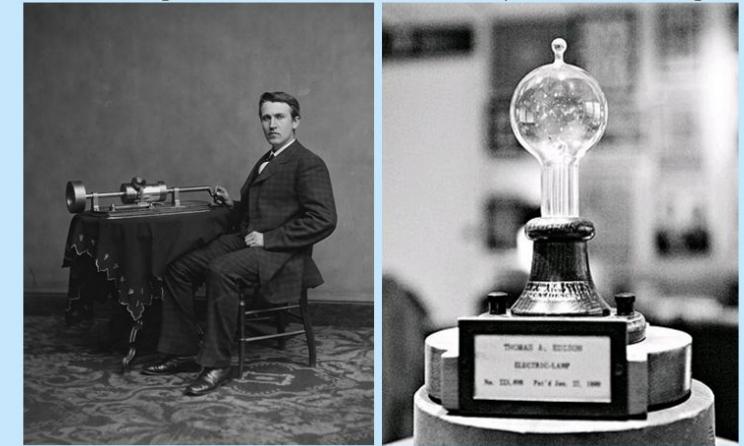
Vets Haven South LED Retrofit



By: Samantha Valentine

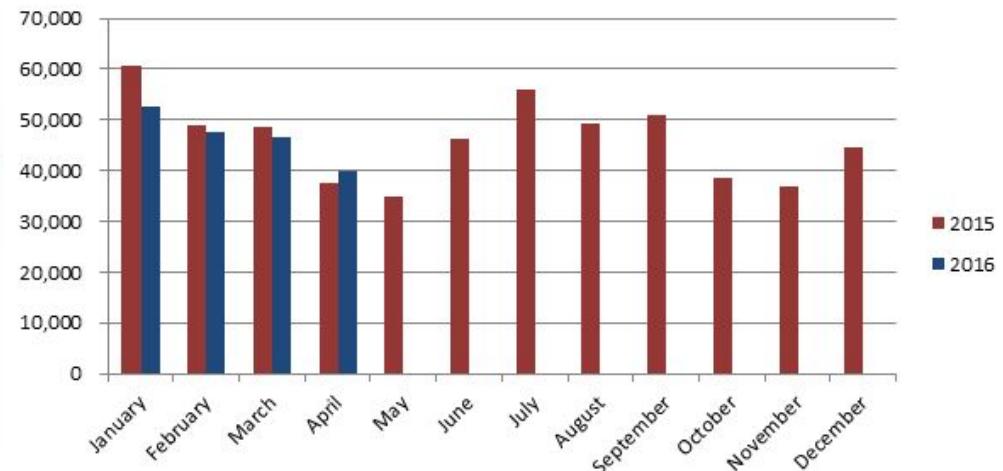
A primary aspect of the NJARNG Clean Cut Campaign is energy reduction. About 20% of energy use in the commercial sector is from lighting. Light Emitting Diodes, more commonly known as LEDs, are becoming a more popular choice due to their low demand for energy and their long life. They are more expensive up front, but over their lifetime they will end up costing less money than incandescent or CFL bulbs.

Thomas Alva Edison invented the phonograph in 1877 and the incandescent light bulb in 1879. It's 2016, so why are we still using one?



For Veterans Haven South in Ancora, NJ, a high upfront cost to replace light bulbs was not an option. Fortunately, the NJ Clean Energy Program has created a way to make a lighting retrofit possible in an easy and affordable way. This program, called Direct Install, is a turnkey solution that makes it easy and affordable to upgrade lighting, HVAC equipment and other operational equipment with high energy efficiency alternatives by paying for up to 70% of retrofit costs. Under the Direct Install program, the lighting at Vet's Haven South was upgraded in December 2015. Over 650 LED lights were installed throughout the building and parking lot. The total project cost of \$95,783 was offset by an incentive of \$67,048 (70%) paid by the program. The remaining cost is being paid over a 24 month period through the electricity savings on the utility bills. The implemented measures are expected to save \$21,800 annually in electricity costs, which is a 16 month payback. Since the retrofit, Vets Haven has saved over \$4000 in electricity costs.

Vets Haven South Electricity Usage (kWh)



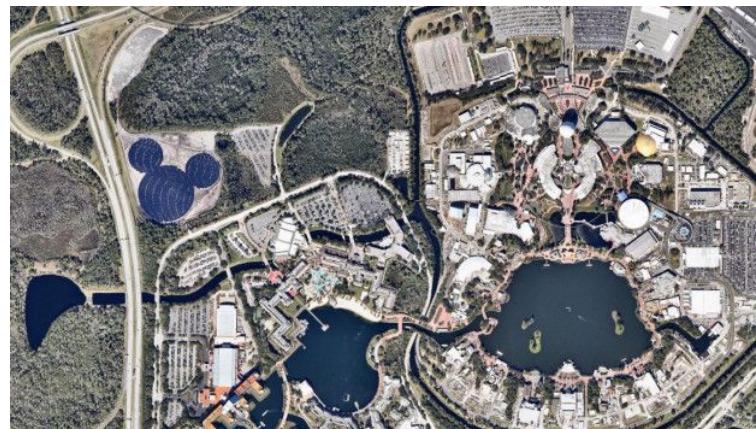
A New Hidden Mickey with a Not-so Hidden Energy Purpose

By: Jeff Dib

Alternative energy is reshaping the world we live in and can be seen everywhere we go. From solar panels on our houses and sports stadiums to wind farms, many efforts are being made to make our lives “greener”. These strides to conserve energy have been in motion for many years, and as of April 2016, Disney World has stepped its effort up in a Mickey Mouse-themed way.

A 15-year agreement between Disney and utility Duke Energy has allowed Duke Energy to build a solar farm on the 22-acre plot of land just outside of Epcot and Disney's Yacht and Beach Resort. Duke Energy can operate the land during its lease and supplies solar power to Walt Disney World.

The solar farm comprises of 48,000 photovoltaic panels, equivalent to the size of 1000 residential solar arrangements, and can produce a peak output of 5 megawatts, which is enough energy to power 820 homes. When running at that optimal production, this solar farm can create 1,200 kilowatts of continuous power, which equals close to 10.5 million kilowatt-hours per year. This amount of power would save them at least \$500,000 per year, using the cheapest rate of 4 cents per kilowatt-hour.

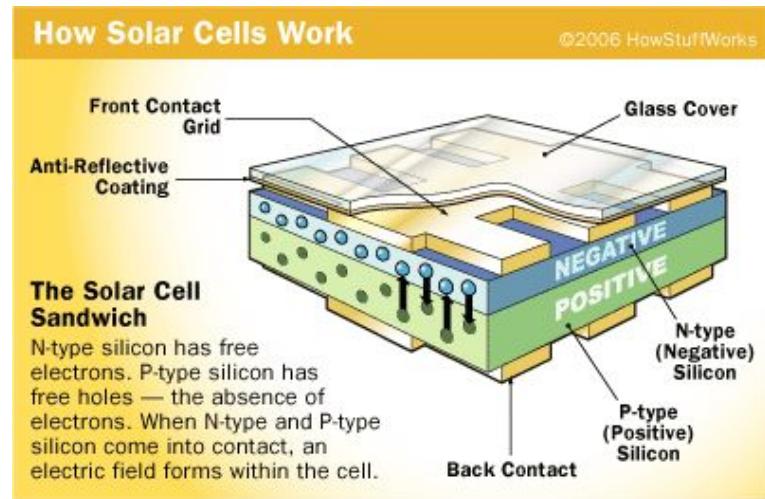
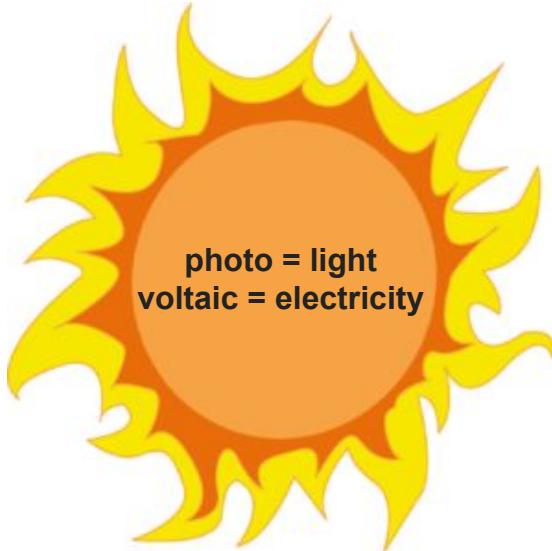


This project is part of Duke Energy's plan to increase Florida's solar capacity up to 500MW by 2024. It's also part of Disney's program to reduce its net emissions by 50%, compared to its emissions in 2012, by 2020. This has not been Disney's only effort toward renewable energy projects, as they have cut their emissions in half by converting their bus fleet to R50 fuel, which is a cleaner diesel fuel made from vegetable oil. Although it has taken Disney a while to build a large solar facility, Epcot has had solar panels on the roof of its Universe of Energy since October 1982.

Solar Panels: How do they work?

By: Samantha Valentine

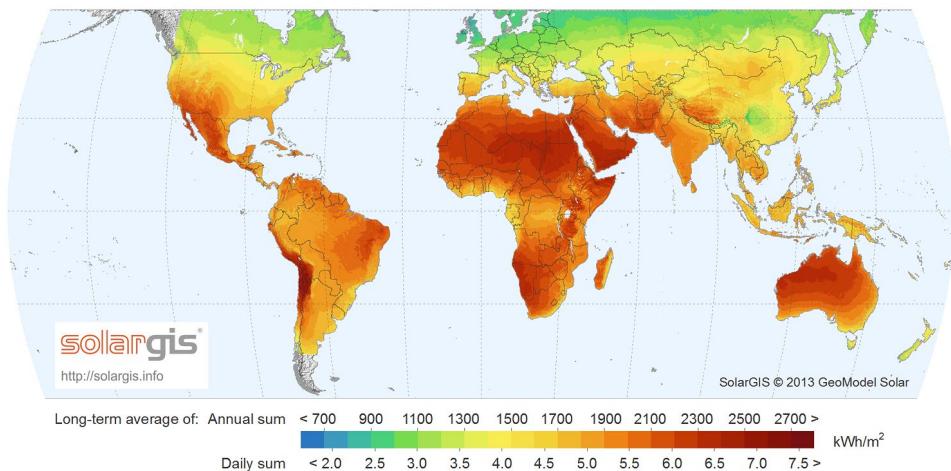
A **solar panel** works by allowing particles of light (the photons) to collide with atoms and break electrons free. This generates a flow of electricity. Solar panels actually comprise many, smaller units called photovoltaic cells, or PV cells.



On its own, a solar PV cell won't produce much power. That's why you see solar cell sold in bigger sheets called solar panels, or modules. These modules can be tied together to make Solar PV Arrays. You can find arrays in different places: on the ground, on a roof, or over a parking lot.

Depending on where you are in the world, you can get varying amounts of power from the sun, called solar irradiance. There are several other things that affect solar panel performance, including temperature, shading and type of solar panel system.

It is important to consider all factors when deciding to purchase solar panels. If you are interested in seeing if solar panels would be a good fit for your home, you can start by using the [PVWatts Calculator](#) developed by the National Renewable Energy Laboratory (NREL). The calculator will estimate performance of a potential PV array and provide an estimate of cost and savings.



To learn more about solar electricity and other types of energy, go to: [science.howstuffworks.com/environmental/energy](#) and [solar4living.com](#)

NJARNG's Solar Portfolio Continues to Grow

By: Samantha Valentine

As per the requirements of Executive Order 13693, *“Planning for Federal Sustainability in the Next Decade”*, the NJARNG has set its sight on achieving 25% of electric power produced by on-site renewable energy by 2025. The NJARNG Solar Portfolio already includes 2.45 MW of solar photovoltaics, which has offset 20% of electric demand. The NJARNG is on its way to meeting the federal requirements ahead of schedule!

Not only does producing clean energy help the environment, it helps the NJARNG save money. The current solar arrays come with an annual cost avoidance of \$400,000. Saving on utility bills means that money can be spent on other energy saving initiatives, like installing high efficiency LED lighting, which saves even more money for the NJARNG.

The newest solar array can be found at the Sea Girt Training Center. This 611 kW carport array adds to the 230 kW carport array on the other side of the SGTC campus to offset 40% of the electricity used at the installation.

Five solar arrays are in design for construction. In addition, a 6-year solar plan for future arrays is in development by NJARNG Energy Manager Chris Moore.



If this plan is implemented, total electric generation for solar PV will increase to **6.06MW**. Energy savings will increase to **7.9MWh** annually. That's 58% of the current electric use! Energy cost avoidance will increase to **\$1 million** annually.

New Jersey Celebrates Earth Day

By: Katie Hollywood



Rowan dean delivers TED talk

Ken Lacovara, paleontologist and founding dean of Rowan's School of Earth and Environment, became Rowan's first faculty member to deliver a TED talk. His message was delivered at the annual TED Conference in Vancouver and encouraged listeners to dig deeper into their knowledge and understanding of the Earth's past and future.

For more information, visit:

<http://today.rowan.edu/home/news/2016/04/21/magic-geological-record-rowan-deans-ted-talk-focuses-on-earths-past-and-future>

NJ Tree Foundation, "Trees for Trails"

The NJ Tree Foundation promoted the planting program in Camden designed to improve air quality, manage stormwater, and provide shade as an Earth Day Celebration. Volunteers joined NJ Tree Foundation for the "Trees for Trails" project in Camden. This community tree planting event brought more beautiful trees to the regional Circuit Trail network. Volunteers dug holes, planted trees, and laid mulch.

For more information, visit:

<http://njtreefoundation.org/2014/11/trees-for-trails-foresting-the-circuit-in-camden/>



Cheesquake State Park Hike

An Earth Day Program and Arbor Day hike was held by the Cheesquake State Park Nature Center. During this event, volunteers met at the park's Nature Center to plant trees and take a hike while cleaning up the trails.

For more information, visit:

<http://www.gmnews.com/2016/04/19/earth-day-fest-hike-scheduled-park/>

Rowan Celebrates Arbor Day

By: Morgan Doherty



Above: Landscape architect Vincent Nichnadowicz instruction interns Matthew Bettin, Morgan Doherty, and Nick Murphy (left to right) on how to properly plant a tree.

Below: Trees laid out for planting



red cedar, and smooth sumac) were planted by the EMB and interns on Arbor Day this year.

By completing this project “in house”, the EMB was able to save a considerable amount of money. In addition, the project was a great opportunity for interns to learn how to properly plant trees, get their hands dirty, and help restore a disturbed area. Everyone worked as a team to plant, water, and mulch each tree, as well as replace an old silt fence, which provides sediment control and protects the newly planted trees from erosion and rainwater runoff. The growth of these trees will be observed and it is predicted they will flourish in the years to come. Overall it was great day for all involved.

On April 29, 2016, the New Jersey Army National Guard Environmental Management Bureau (NJARNG-EMB), along with students from the associated environmental internship program (through Rowan University), celebrated Arbor Day 2016 with a restoration project.

A few years ago, the National Guard Armory in Pitman, New Jersey, became subject to remedial activities due to contaminants found in the groundwater. During this remediation, a small portion of the forested wetland buffer area was excavated in an attempt to find the cause and resolve the contamination issue. Wetlands are critical part of the environment; they provide habitat for plants and animals, assist in flood control, and improve water quality. As such, there was a stipulation in the remediation permit to treat the contamination: habitat appropriate flora species must be replanted in order to restore the affected area to its original state.



Above: Chuck Appleby (NJARNG-EMB Chief) and Morgan Doherty (Rowan University intern) hard at work planting and watering trees.

Below: The finished product.



Rowan's Solar Hot Water Study

By: Katie Hollywood

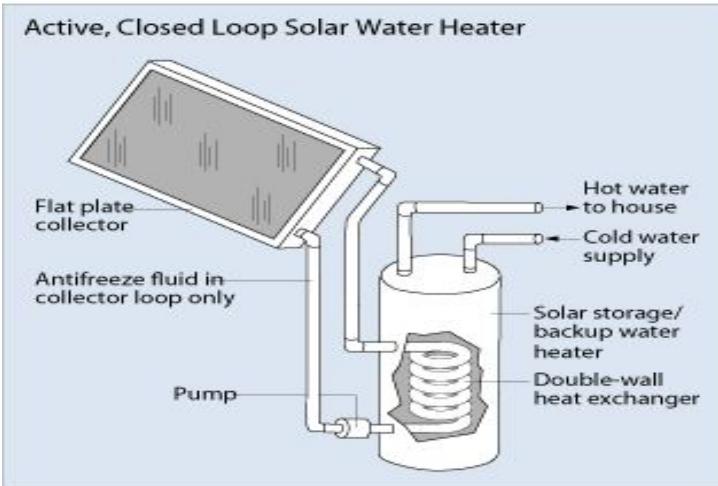
The New Jersey Army National Guard is looking to reduce the usage of electricity and natural gas used to heat water at the NJARNG Sea Girt training facility.

Purpose

Installing a solar thermal system will reduce their hot water costs, reduce their carbon footprint, and meet sustainability goals. By 2025, 25% of NJARNG's total energy consumption must result from a renewable resource as mandated by EO 13693, the NJARNG goals and requirements of the *Clean Cut Campaign*.

What is solar thermal?

Solar thermal is the use of technology to collect and store thermal energy from the sun. Thermal energy is collected and transferred to a fluid, typically water, through a flat plate collector. It's then transferred to a box to be heated. The flat plate collector transports the hot water to a storage tank, where the water can be used for domestic hot water or space heating applications.



Pictured above: FDT 40 flow meter chosen for the solar hot water study

Current work

So far, Rowan's solar hot water clinic team has done the following: researched the variations and benefits of solar thermal, determined an appropriate flow meter to measure hot water usage at the facility, specified the buildings that are appropriate for a solar thermal system, and performed sample calculations.

Future work

Future clinic teams will install the flow meter at Sea Girt, collect water usage data over a designated time period, calculate hot water usage, determine the cost and savings of a solar thermal system, determine if solar thermal is economically feasible, and if it is, design a solar thermal system.

The Buzz on Sustainability

By: Fred Bishop

Bees are a vital part of our natural ecosystems. They are responsible for the pollination of 71% of crops that provide 90% of the food worldwide. To put this into perspective, that means bees are responsible for one out of every three bites of food that you take. Unfortunately there has been a large decline in bee populations in Europe, America, and Asia. In 2012 37 million bees died in one month at a Canadian beekeeping operation. This decline is jeopardizing biodiversity and global food production.

Why are bees dying?

The short answer is no one is exactly sure. However, many believe it is due to the use of neonicotinoids, a type of pesticide that is widely used. A study found that bee hives that were treated with the pesticide never increased their population after the winter months. Instead, these bee hives continually declined in population. The bees from the pesticide-treated hives abandoned their hives and found other hives that had not be treated.



What can you do?

The obvious thing to do is to reduce the amount of pesticides, especially while plants are in bloom and bees are out. Also planting helps give bees more to pollinate, so anything from a window box to a whole garden can help. Buying local fruits, vegetables and honey also help support local beekeepers in your area. Finally, you can donate to the Pollinator Partnership. They are devoted to protecting all pollinators, not only bees.

Rowan GIS Interns Visit PEC, AR

By: Jill McKeown & Josh Schmid

During April, co-interns Josh Schmid and Jill McKeown were given the opportunity to attend the Construction & Facilities Management Office (CMFO) Programming Guidance conference at Camp Robinson, AR. As college students (and civilians) it was a unique opportunity for us to share our personal experience as interns in the NJARNG GIS Program that supports the mission of the National Guard.

Lasting for a week, there were several GIS classes offered that focused specifically on those issues involving the National Guard's core applications of GIS technology: facility management and resourcing. Instructors discussed challenges in the collection of spatial data and orthoimagery with the intention of using collective experience to derive cost-effective solutions. Leaders in the field of planning explained various methods of determining site development suitability, while technical specialists provided demonstrations of their newly published geoprocessing tools.



There was also a user presentation series designated to showcase the project methodologies and accomplishments of more experienced employees. Another particularly worthwhile learning experience was the Spatial Data Standards for Facilities Infrastructure & Environment (SDSFIE) Workshop. With a new version of SDSFIE now available, the workshop offered one-on-one support for our the transition to the new database format, which eliminates unnecessary attributes and offers simpler naming conventions. We have been working on several of these projects with DMAVA including the SDSFIE migration and Real Property Development Plans, so we were able to contribute our experiences and take away valuable lessons on what's ahead for our projects.

Though our time at PEC was strictly scheduled, we still managed to enjoy some down-time. We hosted a "GIS social" to bring the state GIS managers together and network. Following a long day of seminars, we managed to pack a room with state GIS staff from all over the country—including Alaska and Hawaii. The strong turnout allowed us to flex our networking muscles and led to job leads and thoughtful insight from experienced GIS'ers.

Overall, our trip to Camp Robinson afforded us realistic perspectives of employment in the field of facilities management and planning which we otherwise could not take from a traditional university classroom. Every teacher supplied a wealth of technical knowledge on each subject but the best parts of the classes were the shared input and experiences of all the fellow attendees.

Meet The Interns!



Katie Hollywood

Civil Engineering, Junior

“Hi! My name is Katie Hollywood and I enjoy hiking and spending time with my dogs in my free time. I like to travel to new places and hope to go back to the Grand Canyon again.”



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.”

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