



SMALL ISLAND RESILIENCY STUDY: Energy Matters at the Local Level

Deep Creek, Eleuthera, The Bahamas



Introduction

Throughout the semester, the Energy Research Team has been working at The Deep Creek Middle School (DCMS) in partnership with the Grade 8 students, retrofitting sustainable technologies to the school. This is the first research group to work with DCMS. The team conducted an entire campus energy audit, created a unique Green Checklist and successfully installed a 3.6 kilowatt (kW) solar array to one of the buildings. The intention of the project is to spread the message on how cost effective and simple the solar transformation can be, along with helping DCMS maintain their sustainability. There are inherent challenges to living in Small Island Developing States (SIDS), one of the largest challenges being fossil based energy dependence, which is what this project focused on. The Bahamas has the 5th highest utility rate in the world and it is imperative that changes are made to shift the energy sector towards renewable resources (CIA World FactBook).



3.6 kW solar PV array installed on DCMS.



Energy Research Team with solar modules before installation on roof.

Energy in the Bahamas

The Bahamas is near totally reliant on imported foreign diesel (Bahamas National Energy Policy). Diesel is refined from crude oil, which is a naturally occurring mineral oil that can be refined into various fuels and other petroleum-based products. During distillation, the dark, thick crude oil is turned into the much lighter diesel fuel. Diesel is non-renewable and a pollutant. Every time this resource is used, it depletes oil reserves and extracting, refining, and transporting diesel releases harmful greenhouse gasses into the atmosphere. Greenhouse gasses, such as carbon dioxide and methane, absorb radiation, thereby warming the Earth. Importing diesel makes the Bahamas vulnerable environmentally and economically. Being unable to produce their own energy makes the island nation reliant on other countries; this leaves them susceptible to global crisis and price increases. Moreover, it is extremely costly for SIDS to import diesel; in fact, petroleum imports for Caribbean islands are often 200% - 300% above world market price (Weisser, A Role for Renewable Energy Technologies?). Complete reliance on diesel is unsustainable and continuing to use this resource slows the country's progress towards a renewable energy economy. In order to combat this issue, the Energy Research Team explored the use of solar photovoltaic (PV) panels, a renewable energy technology. This technology was explored because the Bahamas has a high solar energy potential; there are numerous hours of sunlight a day, and 320 days of sun a year.



Classrooms 2 and 3 with solar panels installed on the roof.

Deep Creek Middle School

Sharing similar missions and a focus on alternative education, The Deep Creek Middle School is one of The Island School's sister organizations. The Energy Research Team chose to work with DCMS to help advance their campus and maintain their prestigious Eco-School Green Flag status. With the intimidating reputation of the world sustainability in mind, we have implemented the concept of retrofitting. Retrofitting involves installing sustainable systems into an already existing building. The Energy Research Team installed a solar air conditioning system including twelve solar panels to the middle school. The Energy Research Team is hoping to create a more cost-efficient system for the school and reduce their reliance on the grid. Once the air conditioning units were installed, there was only positive feedback to be heard from the students and staff. There are noticeable differences in the student's behavior during the school day, more curious, and dedicated to further their schooling experience.

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Energy Investigation

The Energy Research Team began the improvement of DCMS's sustainability by getting a better picture of their energy usage before and after the air conditioning was installed (AC). First, the team analyzed historical energy bills from 2016. From analyzing this, it was concluded that each month, Room 1, 2 and 3 used approximately 350 kWh, 50 kWh and 125 kWh respectively, as can be seen on **Graph 1**. The team then started collaborating with the DCMS Grade 8 students to collect data for after the AC was installed. This allowed the students to get directly involved with the project and get a first hand look at the energy they're consuming as a school. The students collected data from their school's energy meter every day, which allowed the team to have a daily record of energy usage. After analyzing this data, it was concluded that after the AC was installed there was a drastic increase in energy usage, Room 1, 2 and 3 usage to approximately 40kWh, 25 kWh and 23 kWh respectively, as can be seen on **Graph 2**. **Graph 1** shows the historical electrical bills compared to a bill post AC. This increase in energy usage was expected, due to the high energy demand of the air condition systems. However, the solar panel array that the team installed is designed specifically to offset this usage.

Solar as a Solution

Solar Photovoltaic panels (PV) are a way to convert solar radiation into usable DC electricity. Solar radiation is radiant energy emitted by the sun. Photons are tiny packets of energy that travel millions of miles to earth and eventually collide with our solar PV modules. When they strike the PV cells their energy excites the electrons, creating usable DC electricity. The Energy Research Team is applying these concepts at DCMS by installing a 3.6 kilowatt solar PV array. Once the panels were installed on the roof, they were connected to the AC units. While the AC units were already the highest efficiency available they still tripled DCMS's energy usage. The main goals of our project were to make DCMS more energy efficient by offsetting the grid usage and to also, demonstrate living sustainability can easily become common.



DCMS Grade 8 students learning how to take meter readings.



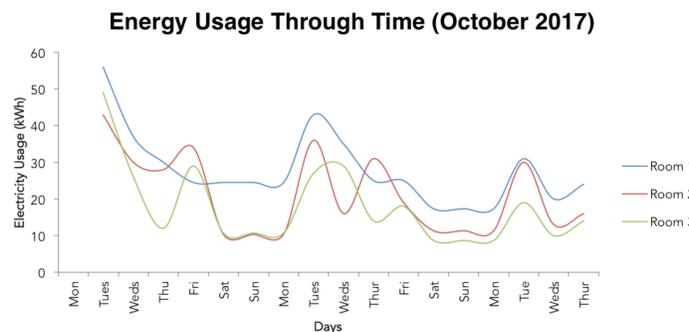
Energy research team giving solar lesson to the Grade 8 students.

Conclusion:

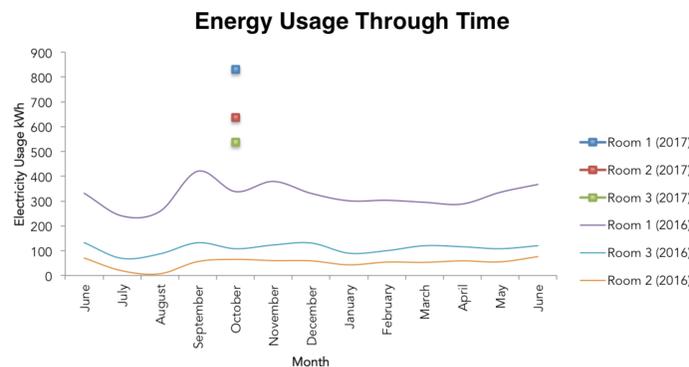
The Bahamas is too reliant on diesel. Small Island Developing States still exclude alternative forms of energy. The goal is to set out to demonstrate that these alternatives are not out of reach for SIDS. To recap what the Energy Research Team did at the Deep Creek Middle School is they performed an energy audit to educate students and staff the reality of real time energy use in their classrooms. Then a baseline checklist was created for which the school and other buildings can measure energy conservation and sustainability. Lastly they installed air conditioning paired with a 3 kW solar array to cool the classrooms and do so without burning fossil fuels. Renewable energy is a symbol of sustainability, one of the three defining pillars of The Island School. Using what students have learned about sustainability we want to capitalize on the semester's work, to catalyze the community and the country. Many small changes lead to one massive change. If all SIDS can see that solar is viable option to diesel, if even on a small-scale, this message can be spread wide. The community is proud that both The Island School and DCMS have taken steps towards a more sustainable future, and in doing so, demonstrating to the students and community members there is another way forward by thinking globally and acting locally.



Aerial view of the Deep Creek Middle School.



Graph 1: Energy usage in all three classrooms throughout time during October 2017 post air conditioning installation shown in days.



Graph 2: Comparison of energy usage before and after air conditioning installation shown in months.

Works Cited

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Green checklist

The green checklist is a working document that is used to evaluate how sustainable a specific property is. This green checklist is able to establish a baseline that shows the current sustainability status of a building and the potential it has to increase its sustainability. The checklist measures education, water conservation, waste management, energy, and infrastructure. The checklist was applied to both The Island School and The Deep Creek Middle School, who received a 75% and 35% respectively; showing that there is room for improvement at both schools. For The Island School, this improvement could look like improving their renewable energy technologies (RETS) and waste management. As for DCMS, they could improve in water conservation, waste management and energy usage.

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Energy research team at Deep Creek Middle School.