

# 2018-2019: An Energy Efficient Future

**By: River Valley High School Science Matters Club**

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We started our year with lofty goals but first wanted to explore ideas for projects. We visited Blue Rock Station, with Jay and Annie Warmke, learning about renewable energy, proper use of our resources and repurposing used bottles, boxes and other items. This gave us a start on a fantastic year of revisiting past projects, improving on them, and starting new ones.

Our overarching goal is to incorporate repurposing as a mode of saving energy, preparing us for an energy efficient future.



# Blue Rock Station



## Project Goals:

We visited the Blue Rock Station to learn about zero waste, and renewable energy, and to get ideas for our project.

## Activities to reach goal:

We took a field trip to the Blue Rock Station, and took a tour lead by Jay and Annie Warmke.

## Energy Content of Project and Resources:

We gained potential ideas for future energy projects, such as a covered walkway between our middle and high school.

## Student Leadership:

We had a group of four students, Sophia Thacker, Carla Diamond, Abby Bennett, and Caroline Lee, who took this extended trip.

## Evaluation:

The trip to the Blue Rock Station was a valuable experience for our project. We gained many ideas for our project and learned new ways to be environmentally friendly using energy, repurposing, and zero waste techniques.

## Project Goals:

We wanted to further our knowledge about recycling, energy efficiency, and repurposing items to better complete our own greenhouse prototype.

## Activities to Reach the Goal:

Some students from our group made a trip to Blue Rock Station to observe their recycled greenhouse and how they enforce their, for the most part, zero waste policy.

## Student Leadership:

Four of our students (Sophia Thacker, Caroline Lee, Abby Bennett, and Carla Diamond) made this trip in the fall of this school year.

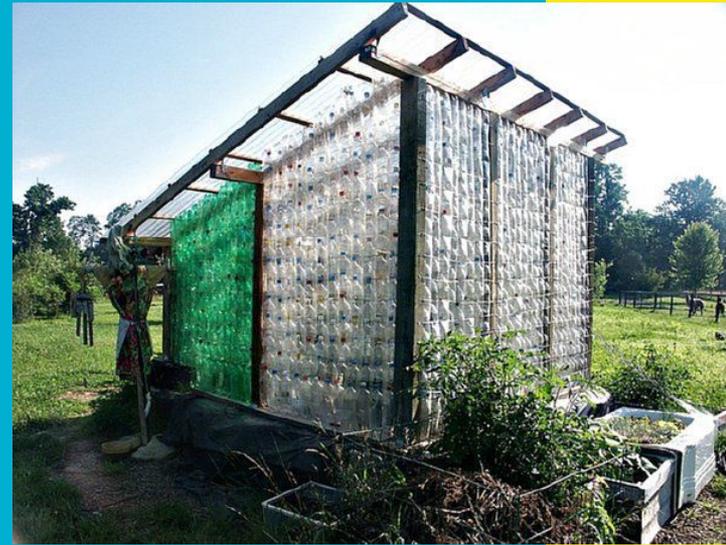
## Evaluation

As a result, we were able to come up with the basis of our design for our prototype greenhouse, as well as an idea for a full size one in the future. We used their two-liter bottle design and reinvented. We tweaked it with smaller bottles to make our prototype.

The top image is the actual greenhouse at Blue Rock Station.

The design we like the most is next.

We realize the last design is much more practical and feasible to construct.



## **Goal:**

Create a greenhouse prototype out of completely reused materials including water bottles, laminator paper, and string with the hope of building a full size one in the future.

## **Activities to Reach the Goal:**

We gathered bottles from home, as well as from other students in the school. We then spent many meetings assembling a small prototype to run tests on.

## **Energy Content of Project:**

Greenhouses are energy efficient by using and insulating renewable solar energy to feed the plants we put in them. They are a great alternative to using artificial lighting indoors. Our greenhouse specifically is even more energy efficient, as it is made out of completely recycled materials .

## **Student Leadership:**

All of the members of our group have contributed to the building of this prototype. The students of River Valley have also helped by throwing their bottles away in specific bins.

## **Community Education and Involvement:**

We presented this prototype to our school board, discussing the specifics of building a full size one outside. Our prototype does not look exactly like what a full size one would, however it can be used to show the base design for the bottles.

## **This is our prototype:**



## **This is our intended design for the future:**

### **Evaluation Method:**

The greenhouse warms the air inside more than the air outside. The greenhouse model is stable And feasible to make. The greenhouse is transparent enough to allow plants to grow. We presented it to the school board for approval.



<https://wonderfuldiy.com/wonderful-diy-plastic-bottles-green-house/>

# Working on our greenhouse prototype

In the picture below, we are drilling holes in the prototype so we can eventually secure them together.



Above, bottles were sorted, washed and trimmed. We experimented with them to pick the ones best suited for the project.



In the top picture, we are stringing bottles together to make the sides of the prototype greenhouse.



In the second picture, we recycled old laminator paper, but it was opaque. We heated it with a heat gun to make it transparent. Then we used it to wrap our greenhouse prototype to make it airtight.



## Goal:

Measure the effectiveness of the greenhouse prototype.

## Activities to Reach the Goal:

We put our greenhouse outside with temperature sensors inside and outside. After an hour in the sun, we brought the equipment inside and analyzed the data.

## Energy Content of Project:

The data shows the inside temperature was at least 1 degree C higher than the outside temperature. This indicates the greenhouse is working by maintaining a higher temperature than outside.

## Student Leadership:

All of the members of our group have contributed to the building of this prototype. Several members were responsible for collecting and analyzing the data.



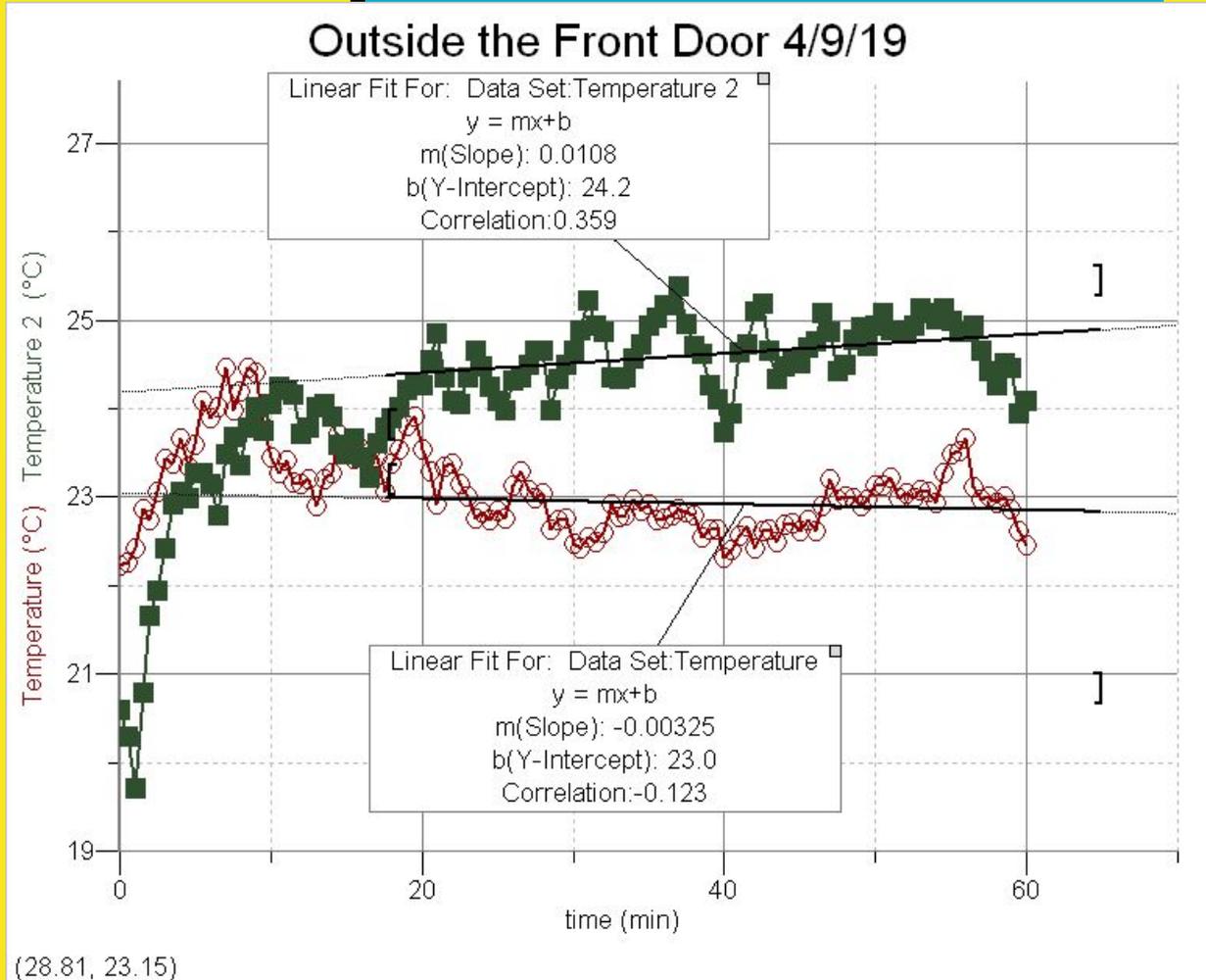
## Evaluation Method (see next slide):

The greenhouse does warm the air inside more than the air outside. The greenhouse model was stable, although it did need to be placed in a protected area. The prototype will fall apart when exposed to gusty winds. This means the full scale model must be constructed to withstand gusts. The greenhouse is transparent. Further study is needed to determine which wavelengths are transmitted and which are absorbed by the construction material. The prototype is NOT large enough to house large plants.

## Results:

The inside temperature ranged from 24 to 25.4 degrees Celsius (See the green dots on the graph from 20-60 min.).

Simultaneously, the outside temperature ranged from 22.3 to 23.8 degrees Celcius. (See the red dots on the graph from 20-60 min.)



## Project Goals:

Our goal was to increase our understanding of science and energy efficiency and better ourselves at explaining the basics of energy to younger students.

## Activities to Reach the Goals:

We went to the AEP summit where they taught us more about what we were looking for. We then taught at 2 fairs where we explained what we learned.

## Energy Content of Project and Resources:

In this summit we talked about different types of energy and in the fair we taught others about them.

## Student Leadership:

Here you can see the members of our club taking the lead on their projects and teaching the kids about the specific type that they learned about.

## Community Education and Involvement:

The community in this case is the Columbus students that came in and learned what we had to teach.

## Evaluation Methods:

We met our goal of learning more about energy and teaching others about it. This is evident because the kids were able to answer questions at the end of our teaching.



## Goal:

Repurpose excess waste produced in our school district by students and teachers to be used in projects related to our greenhouse prototype previously mentioned.

## Activities to reach goal:

We gathered paper milk cartons to be used as biodegradable flower “pots”. They can be put under the greenhouse to hold the plants, or they can be planted straight into the ground. We also gathered the bottles used as the base of our greenhouse prototype.

## Energy Content of Project/Resource

By repurposing milk cartons and water bottles, we are saving the energy that it takes to recycle them. Repurposing is the more energy efficient option.

## Student Leadership:

To prepare the milk cartons, members of our group worked on cutting off the tabs on the top. We also had to cut down the bottles to make them fit into each other on the prototype.

## Community Education and Involvement

We plan on selling flowers in milk cartons to the staff and parents to promote the use of energy efficient and eco friendly methods of gardening.



## **Goal:**

To work toward zero paper waste in our school community

## **Actions to reach the goals:**

We encourage the use of existing recycling bins in classrooms to collect scrap paper created through classroom worksheets and activities.

## **Energy Content of Project/Resources:**

By recycling and reusing materials, we are conserving the energy it would take to make a new product.

## **Student Leadership:**

To achieve this specific goal, we will need the effort from all the students in our district to recycle their paper waste and completely eliminate throwing it into trash cans.

## **Community Education and Involvement**

Our recycling company, Rumpke, along with our custodial staff are developing an action plan for implementing a paper recycling plan on campus.



## **Evaluation Method:**

We were successful in continuing our recycling program, in that every classroom participates in the recycling bin. Several classes are involved in collecting paper recycling on a weekly basis. We are closer toward our zero paper waste goal, but we need more data to better evaluate our progress.

## **Project Goals:**

Something that we wanted to improve on in our school community is reducing the amount of water bottles that our students and staff use by funding a water refill station.

## **Activities to Reach the Goal:**

The first action that we took was to track the amount of plastic water bottles used in the building. This encouraged students to create a legacy project by selling reusable water bottles. They found, on average, we are recycling 4-60 gallon trash bags full of water bottles per week.

## **Energy Content of Project and Resources:**

This greatly decreased the use of water bottles which helped save a lot of energy, and the water refilling station would be more efficient for students.

## **Student leadership:**

The environmental science class, which included some Science Matters members, took the lead on this project. They sold the water bottles, got the word out about them, and were determined to fund the refilling station.

## **Evaluation:**

Overall the students were very successful in profiting the water filling station and funded over  $\frac{3}{4}$  of it.



## Project goals:

We want to encourage staff to further their energy conservation by building upon the information we covered in last year's activities and energy audits.

## Activities to Reach Goal:

We organized a contest to see which of the staff members continued their energy efficient actions this school year.

## Energy Content of Project and Resources:

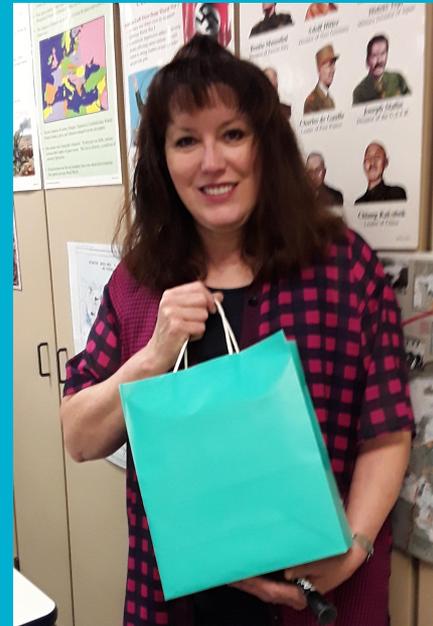
As motivation, we gave out a box of LED bulbs and gift cards. We randomly selected two names as winners. The bulbs helped us save energy by reducing released heat by 90%. The teachers helped reduce energy by unplugging, reducing usage, and turning off unused equipment at night. The prizes help the winners save energy at home too!

## Student Leadership:

This event is fully lead by the students in our Science Matters club.

## Evaluation Method:

This action effectively helped reduce the amount of energy used in each classroom. We had 16 responses showing how each teacher is saving more energy than they had the year before.



## **Project Goals:**

To develop a way to power our cameras at our recycling bins with solar electricity in order to deter illegal dumping.

## **Activities to Reach the Goal:**

We consulted a student who had constructed a solar array last year. He stated it's possible to acquire the correct voltage, using a circuit of solar panels, but not the needed amperage. We consulted a representative from the recycling center, scheduling a meeting at which we will construct a better circuit.

## **Energy Content of Project and Resources:**

We are wiring together several solar panels to create an array to power two security cameras. This requires no nonrenewable energy source. It can also run continuously, eliminating the need for batteries.

## **Student leadership:**

Several members worked on wiring the solar panels together and working with our consultant.

## **Evaluation:**

This project is not complete. It will be successful when the solar panels are wired correctly and installed with the cameras at our recycling station.

## **Project Goals:**

To inform our local school board and gain construction approval for a full scale greenhouse.

## **Activities to Reach the Goal:**

We will present our project to the school board, answering several questions.

## **Energy Content of Project and Resources:**

We will use a computer and projector. The presentation uses some electricity. There is no other energy content related to the presentation, but building the actual greenhouse will require construction materials, construction equipment and lots of recycled bottles!

## **Student leadership:**

Several members worked on the presentation preparation, sharing the presentation duties.

## **Evaluation:**

This school board meeting has been postponed to April 18th, after the due date for this presentation! ( It was originally scheduled for April 11th) The goal will be successful upon the completion of the presentation. Another indicator of success will be the board's permission to continue with research and development of a full scale greenhouse, to be constructed on school grounds.



# In The Future...

1. We will continue to recycle the water bottles and paper products, as well as gather concrete data, to assess our progress toward zero wastes, schoolwide. We will do this by emphasizing reduction of recycling material volume and encouraging the use of reusable water bottles.
2. We will continue to encourage conservation of electricity by “unplugging” more consistently.
3. We will install a water bottle filling station at our school, monitoring its effect on recycling bottles.
4. We will continue our full scale greenhouse project.
5. We will build more solar/mechanical recharging stations, for phones possibly.



This is what we want to build next year!

