4-H Gate City High School (GCHS) Energy Community Education and School Audit Project

Presented by
Aidan Freeman, Amira Farmer, Braylon Ford, Constance Woody, Nathaniel Gilliam

Advisers:
Mrs. Williams, Mrs. Rowlett, Mrs. Kasey

MEET OUR TEAM

AIDAN:
I played for Gate City's football team and was on the speech team.

I dream of being an electrician when I am older. This was a fantastic opportunity for experience.

AMIRA:
I am on the drama team, speech NSDA, and currently in other clubs.

I am involved in many school clubs and wanted to create something beneficial for our school.

CONSTANCE:
I am an honors student and a member of GCHS FCCLA as well as our school's ecology club.

My grandfather and great-grandfather were both coal miners, and teaching kids about coal and its attributes make me feel close to them.

BRAYLON:
I am a member of the GCHS Marching and Concert Band.

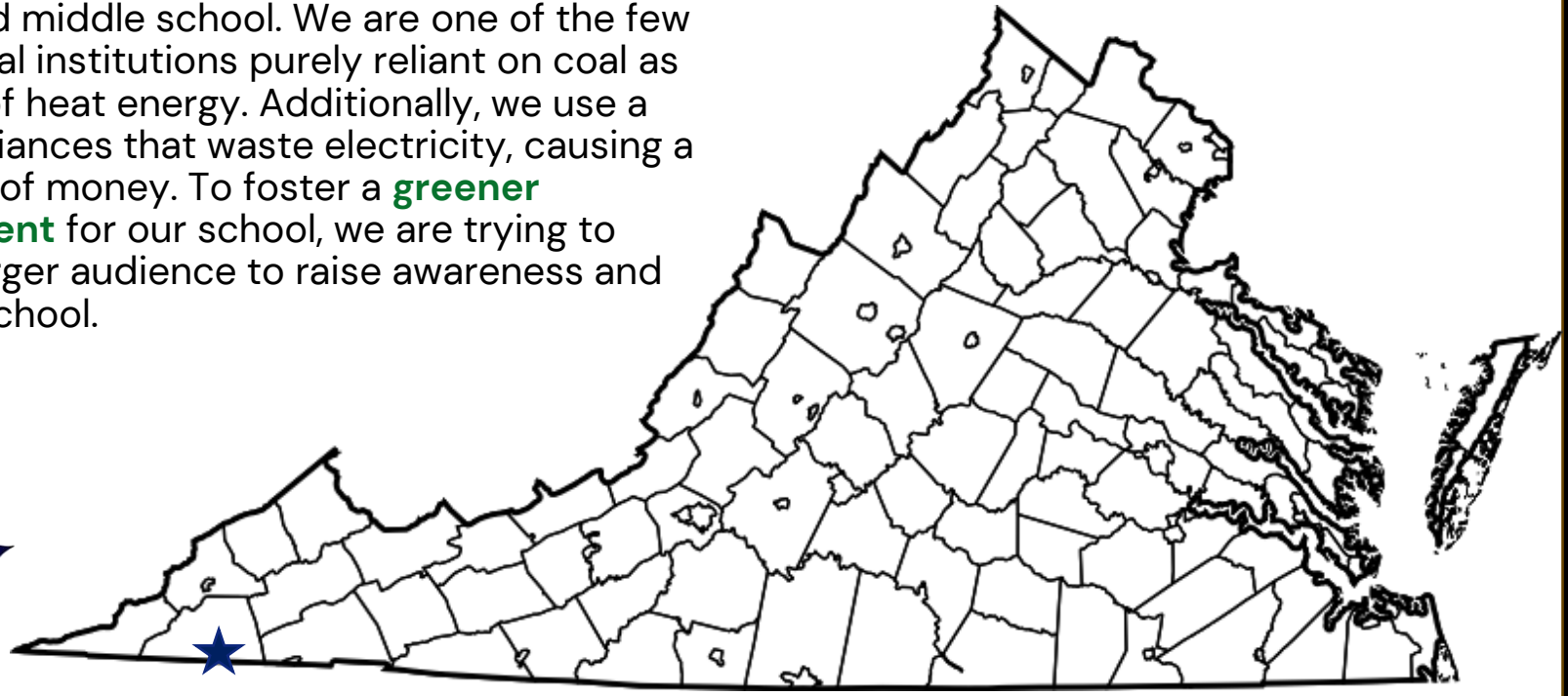
I always found energy interesting. I figured being a part of this project would make me discover more.

NATHANIEL:
I played for Gate City's football team, now going to play for the University of Pikeville.

My papaw and his father were coal miners, and this team helps me understand what they did better.

INTRODUCTION

Our team advocates for responsible energy usage, environmental sustainability, and electrical literacy. **Gate City**, a rural community, serves around 600 students across our high school and middle school. We are one of the few educational institutions purely reliant on coal as a source of heat energy. Additionally, we use a lot of appliances that waste electricity, causing a great loss of money. To foster a **greener environment** for our school, we are trying to reach a larger audience to raise awareness and help our school.



Community Collaboration

We collaborated with many community partners to mark our **first year** of having an official youth energy team.

List of Community Partners:

- Shoemaker Elementary School
- Scott County Gifted and Talented Program
- 4-H (main sponsor)
- Robert Sallee, Scott County Public Schools Maintenance Supervisor/Supervisor of Building Service
- Clinch River Appalachian Electrical Power Generation Plant

Within our portfolio, we recorded progress on our **three goals** for the 2025/26 academic year:

1. Increase knowledge of energy for team members
2. Conduct an energy audit
3. Educate youth in community on energy

4-H GROWS HERE

GOAL 1: **Increase knowledge for team members**

GCHS, founded in 1959, has used a coal boiler from the beginning; this is primarily because of the replacement cost associated with converting to clean energy. Team members visited our boiler room to learn how coal works to heat our school.

Our Boiler Room

GOAL 1 continued...

Clinch River AEP Generation Plant

Members of the energy team visited the Clinch River AEP Generation Plant. During our trip, we gained a basic understanding of thermal energy generation. Employees showed us how natural gas is used to generate power for electricity. These plants can power many communities; this is important given the increased demand for electrical generation as technology develops (e.g. Data centers). It was a crucial step in our journey because we discovered other types of energy firsthand and understand the complexity of generating power.

<u>Goal 2:</u> Conducting an energy audit in our school

For guidance on conducting an energy audit, we met with Robert Sallee, Scott County Maintenance Supervisor. He provided a comprehensive understanding of how our school uses energy. He explained how the ventilation turns on automatically based on a room's temperature.

We analyzed data in five rooms from information provided by Mr. Sallee; these five rooms were selected due to team members' experience in the room. Many members experienced fluctuations in temperature throughout class time within these rooms; this sparked our interest in learning more about the consistency or lack of consistency within temperature in the rooms.

The temperatures of each classroom we tested:

1.) Mrs. Raymond - Average Temperature of 59°F
2.) Mrs. Whisenhunt - Average Temperature of 70°F
3.) Mr. Cole - Average Temperature of 76°F
4.) Mrs. Gardener - Average Temperature of 74°F
5.) Mrs. Williams - Average Temperature of 73°F

Meeting with Robert Sallee discussing energy consumption of Scott County Public Schools

Goal 2 continued...

In addition to monitoring classroom temperature, we also measured energy usage of common classroom items: Air purifier, Smartboard, and Chromebook (when charging).

Air Purifiers = 122.2 v x 0.13 amp = 15.886 W

- 15.886 W x 12 hrs* [/1000 kWh] = 0.19 kWh
- 0.191 kWh x 10.6 ₵* = 0.202 ₵
- 0.202 ₵ x 365 days* = $73.73
- $73.73 x 44* = **$3,244.12** yearly

- **Smartboard =** 1228 v x 0.89 amps = 109.559 W
- 109.559 W x 7 hrs* [/1000 kWh] = 0.766 kWh
- 0.776 kWh x 10.6 ₵* = 0.8226 ₵
- 0.8226 ₵ x 365 days* = $295.65
- $295.65 x 44* = **$13,008.60** yearly

Chromebook (when charging) = 120.1 v x 0.67 amp = 80.47 W

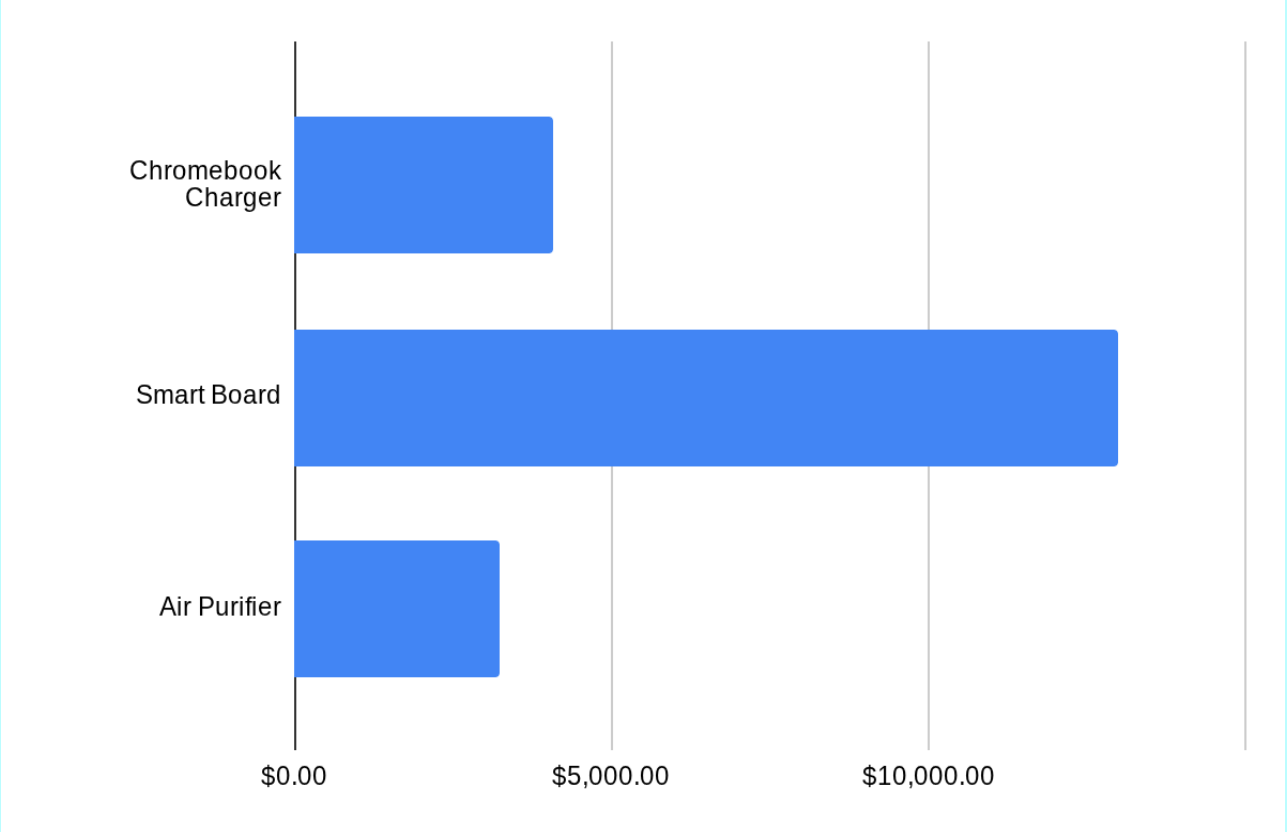
- 80.47 W x 3 hrs* [/1000 kWh] = 0.24 kWh
- 0.24 kWh x 10.6 ₵* = 0.255 ₵
- 0.255 ₵ x 365 days* = $93.075
- $ 93.075 x 44* = **$4,095.30** yearly

**average time used in school day* **# of rooms in school* ** electrical rate* **annual consumption*

AUDIT data

- *Air Purifier*- **$3,244.12** annually
- *Smart Board*- **$13,008.60** annually
- *Chromebook Charger*- **$4,095.30** annually

Based on our data, we can conclude the Smart Boards in our school use the most energy. If we cut the usage to four hours instead of 7, we would save **$7,436** yearly.



DATA ANALYLIS

GCHS - 2025	School
Meter Number	587974302
Account Number	020-636-388-0-9
Date	**Cost**
1/14/25-2/11/25	3,019.17
KWH	
2/12/25-3/12/25	3,034.42
KWH	
3/13/25-4/10/25	3,747.04
KWH	
4/11/25-5/12/25	3,678.35
KWH	
5/13/25-6/11/25	3,248.24
KWH	
6/12/25-7/11/25	4,146.01
KWH	
7/12/25-8/11/25	4,592.57
KWH	
8/12/25-9/10/25	4,623.03
KWH	
9/11/25-10/9/25	4,113.90
KWH	
10/10/25-11/7/25	2,877.35
KWH	
11/8/25-12/8/25	2,586.44
KWH	
12/9/25-1/7/26	2,701.60
KWH	
TOTAL	42,368.12

GCHS- $42,368

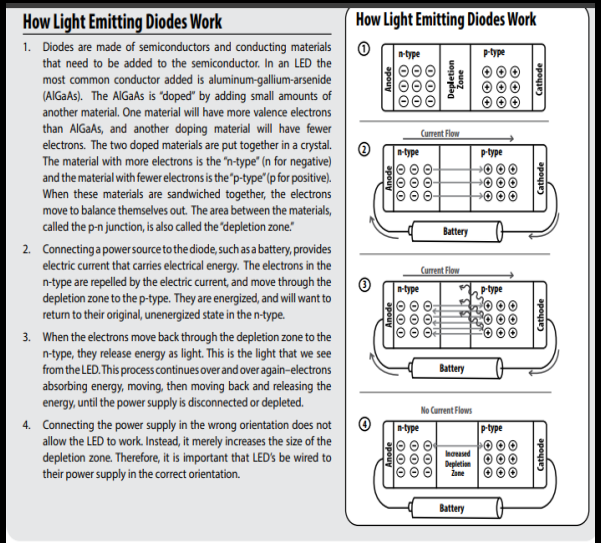
Mr. Sallee gave us the monthly information from the year prior on the school's energy use and the total cost to run the building. He also gave us information on other local schools' energy cost. We use ~$20,000 less than other schools, even though they have more updated equipment. However, through our audits, we learned we can use **even** less.

Goal 3: Share energy education with community

In this goal, we educated a younger audience on energy. We introduced them to electrical circuits by completing NEED Sidekick Circuits activity.

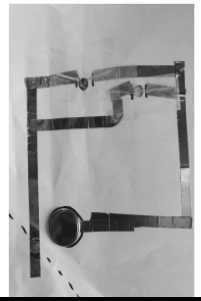
Within this activity, youth learned the difference between conductors, insulators, and open/closed circuits. Additionally, we briefly mention our audit and the importance of energy conservation.

We chose this project because it proves that even with few resources, we can educate on sustainable energy.



How Light Emitting Diodes Work

1. Diodes are made of semiconductors and conducting materials that need to be added to the semiconductor. In an LED the most common conductor added is aluminum-gallium-arsenide (AlGaAs). The AlGaAs is "doped" by adding small amounts of another material. One material will have more valence electrons than AlGaAs, and another doping material will have fewer electrons. The two doped materials are put together in a crystal. The material with more electrons is the "n-type" (n for negative) and the material with fewer electrons is the "p-type" (p for positive). When these materials are sandwiched together, the electrons move to balance themselves out. The area between the materials, called the p-n junction, is also called the "depletion zone."
2. Connecting a power source to the diode, such as a battery, provides electric current that carries electrical energy. The electrons in the n-type are repelled by the electric current, and move through the depletion zone to the p-type. They are energized, and will want to return to their original, unenergized state in the n-type.
3. When the electrons move back through the depletion zone to the n-type, they release energy as light. This is the light that we see from the LED. This process continues over and over again–electrons absorbing energy, moving, then moving back and releasing the energy, until the power supply is disconnected or depleted.
4. Connecting the power supply in the wrong orientation does not allow the LED to work. Instead, it merely increases the size of the depletion zone. Therefore, it is important that LED's be wired to their power supply in the correct orientation.



Numbers Served

Shoemaker Elementary: 14 Youth, 6th grade

Scott County Gifted and Talented Program "STEM DAY": 29 Youth, 3rd – 7th grade

Future Aspirations

Our primary goal is to expand our team for a larger impact. To achieve this, we are planning to engage more elementary schools to inspire youth to one day join the energy team, take part in school board meetings to share our findings from our audit, and develop fundraising for the future teams. We stay committed to raising awareness about energy sustainability.

EVALUATION

This project has enhanced our understanding of energy usage and changed our perspective on the world around us. It has deepened our appreciation for our school and community. Through our shared passion for energy, we desire to create a sustainable future by bringing awareness to energy consumption. Together, we are committed to creating a brighter, more responsible world for generations to come. That starts with our small energy team in our small town.

Resources

1.) “The NEED Project.” *Need.org*, 2018, www.need.org/.

2.) “Clinch River Plant.” *Aep.com*, 2015, www.aep.com/environment/ccr/clinchriver/

3.) “Energy Audits Calculations NaturalGasEfficiency.org.” *Naturalgasefficiency.org*, 2026, naturalgasefficiency.org/for-industrial-facilities/products/energy_audits-calculations/.

All Accessed 14 Apr. 2026.