Solar Panel Integration

Grassfield High School - Mr. Thomas Spencer

Renewable energy can increase the energy efficiency of any building. With this knowledge, our group searched for a way to provide clean energy for our school, benefitting itself and the environment. Our group decided that installing solar panels on the roof would help us accomplish this goal by providing us a way to produce solar energy.

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Project Goals

- Ultimately, our goal is to improve the energy efficiency of our community through the implementation of solar panels throughout the roof of our school
- However, we must first “repair” the structural integrity of our roof, as there is a significant amount of puncture and erosion
- The utilization of solar energy will negate our school’s energy inefficiency and sustain additional power

GRASSFIELD HIGH SCHOOL ELECTRICITY USAGE AND COST HISTORY

Read Date	Bill Days	Total kWh	2018:
12/7/2018	32	281,400	
11/5/2018	31	309,000	
10/5/2018	29	369,000	
9/6/2018	30	343,800	
8/7/2018	29	256,200	Total kWh:
7/9/2018	32	292,800	3,694,800
6/7/2018	30	371,400	
5/8/2018	29	280,800	
4/9/2018	32	264,000	Total Expense:
3/8/2018	29	277,200	$443,768
2/7/2018	30	297,000	
1/8/2018	31	352,200	

Read Date	Bill Days	Total kWh	2017:
12/8/2017	32	301,200	
11/6/2017	31	337,200	
10/6/2017	29	351,000	
9/7/2017	31	354,000	
8/7/2017	31	300,600	Total kWh:
7/7/2017	29	323,400	3,739,800
6/8/2017	30	363,600	
5/9/2017	32	345,000	
4/7/2017	29	334,200	Totatl Expense:
3/9/2017	29	339,000	$418,917
2/8/2017	30	390,600	

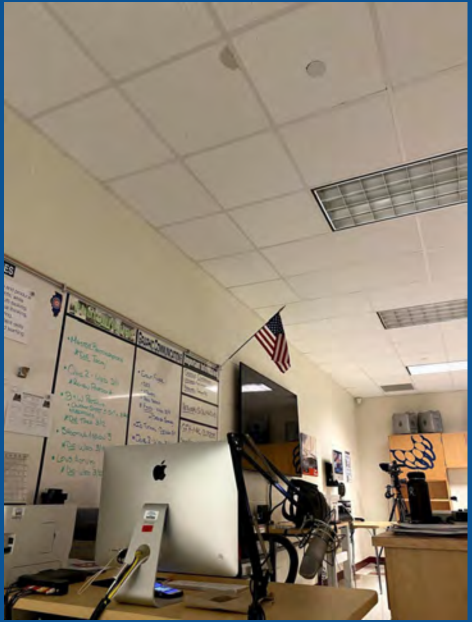
Read Date	Bill Days	Total kWh	2019:
12/6/2019	32	285,600	
11/4/2019	31	304,800	
10/4/2019	28	347,400	
9/6/2019	30	309,000	
8/7/2019	29	266,400	Total kWh:
7/9/2019	32	280,800	3,556,800
6/7/2019	30	373,200	
5/8/2019	30	297,600	
4/8/2019	31	271,200	Total Expense:
3/8/2019	29	263,400	$632,756
2/7/2019	30	311,400	
1/8/2019	32	246,000	

Stage 1: Roof Repair

Our team decided to go around our high school and pinpoint all of the roof damage on the ceilings. We took photos of those damages as well.

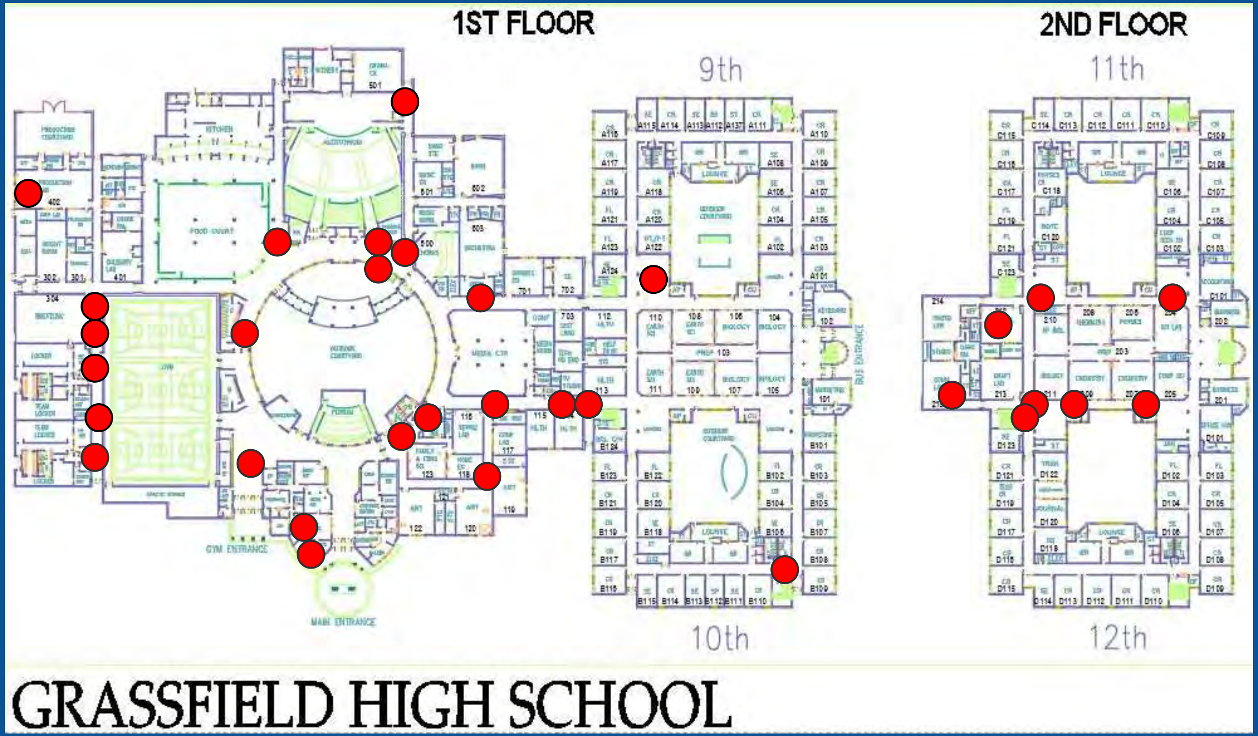
Roof Leaks

Roof Leak Effects



Damaged Ceiling Tile Locations

- Room 212
- Room 215
- Room 402
- Black Box Theater
- Outside of 213 & 212
- Main Circle

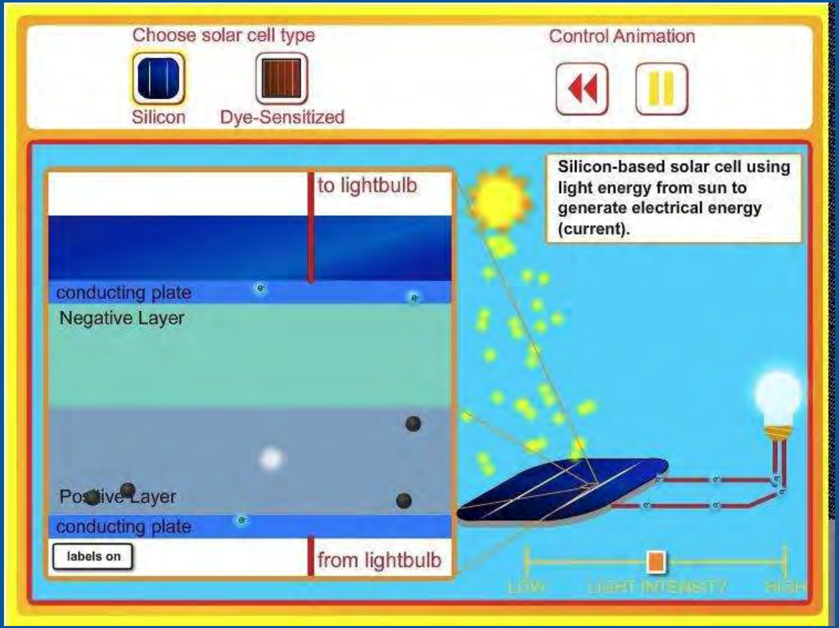


Stage 2: Solar Integration

In order to install solar panels, our team would first have to do the following:

- Learn about solar energy
- Understand how panels work
- Brainstorm how it would affect our school
- Find out how we could be provided with panels
- Ensure that the roof can withstand the added weight

How Does Solar Work?



- Photovoltaic Cells cover the entire panel
- Sunlight is converted directly into electricity as it hits the cells
- Sunlight is composed of photons, particles of solar energy
- After enough energy is absorbed, electrons are dislodged
- Electrons create voltage potential that connects to circuit

PROS

- Renewable energy
- Save money
- Reduced carbon footprint
- Low Maintenance

- Hefty equipment
- Costly
- Weather dependent
- Takes up a lot of space

CONS

Community Interactions

Once we finalized the idea and what we are going to do for our project we put together a meeting with engineers from Virginia Natural Gas and some representatives from the Chesapeake School Plants to promote our project and to be able to get feedback on how to reach our goal.

Community Interactions

We decided that our next step was to see where the solar panels would come from and how they would be installed. This is when we were introduced to Suntribe Solar, a solar panel company in our area. We found out that with a Power Purchase Agreement (PPA), we would be able to have solar panels installed without any cost to the school. We then took it a step further by asking Suntribe Solar to conduct a cost benefit analysis for our school if we had solar panels.

Cost Benefit Analysis and Helioscope: provided by Sun Tribe Solar

Monthly Production

Annual Production

	Description	Output	% Delta
Irradiance (kWh/m^2)	Annual Global Horizontal Irradiance	1,569.3	
	POA Irradiance	1,686.9	7.5%
	Shaded Irradiance	1,659.8	-1.6%
	Irradiance after Reflection	1,607.9	-3.1%
	Irradiance after Soiling	1,591.8	-1.0%
	Total Collector Irradiance	**1,591.9**	**0.0%**
Energy (kWh)	Nameplate	2,947,791.8	
	Output at Irradiance Levels	2,927,215.1	-0.7%
	Output at Cell Temperature Derate	2,819,878.8	-3.7%
	Output After Mismatch	2,815,904.6	-0.1%
	Optimizer Output	2,776,425.3	-1.4%
	Optimal DC Output	2,768,142.8	-0.3%
	Constrained DC Output	2,719,294.1	-1.8%
	Inverter Output	2,664,100.0	-2.0%
	Energy to Grid	**2,637,460.0**	**-1.0%**

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