

Renewable Energy for DRSS Through Solar Power-Generating Carports

Lucas Ferrari, Mason Osten, Maddie Smith

The Dayton Regional STEM School

Created for review by the DRSS Administration

April 8, 2021

Table of Contents

Executive Summary.....	3
Introduction	4
Problem Statement.....	5
Goals and Objectives	7
Goals	7
Objectives.....	7
Methods.....	8
Evaluation.....	9
Budgeting.....	10
Future Funding.....	11
Alternative Solutions.....	12
Alternative 1	12
Alternative 2	12
Alternative 3	13
Conclusion.....	14
Appendix	15
Meeting +Minutes	15
Memo.....	17

Executive Summary

We are a group of 11th graders at the Dayton Regional STEM School who are passionate about renewable energy in our school. We are presenting a proposal for our school to transition to renewable solar power energy as its main source of energy. We plan to place solar panels on carports in the school's parking lot, so that the solar panels will receive the maximum amount of sunlight without the potential for damaging the school building's roof. We have contacted solar panel contractors to get quotes on car port designs and have planned out possible design options. Our future plans ensure that we are protecting the building while also improving it. The possible financial cost of the solar panels can be found in our budget section, and our total cost ranges between \$400,000-\$700,000 (depending on contractors, materials, warranties, and installation fees). Our proposal identifies alternatives to our solar panel car port plan which include solar panels placed on the North Field, solar panels placed on the roof, and wind energy. Ultimately our plan is the best for the school because it allows us to transition to clean energy, return money back to the school in a timely manner, protects fragile areas of the building, and transitions our school to sustainable energy while keeping it pleasing to the eye.

Introduction

Our names are Maddie Smith, Mason Osten, and Lucas Ferrari, and we are juniors at the Dayton Regional STEM School. As a part of our Technical Reading and Writing class, we are proposing a plan to achieve 100% renewable energy for the school. Since 6th grade, we have been learning about sustainability, and have been familiarizing ourselves with the school's culture through the Zero Waste Initiative.

We propose the installation of solar power carports covering parts of the school's parking lot. Through our proposal, the school's energy will be provided from a renewable power source (the sun). The school will secure an additional income source, which would help fund other projects. The school will receive a federal tax credit for the installation, and the school's students will gain a new educational opportunity to learn about renewable energy. Visitors, staff, and student drivers will have their cars protected from rain, snow, and overheating, and the school will look and feel more like a STEM school to the general public.

Problem Statement

Transitioning our school's power into solar power energy is a great opportunity for our school. Converting to solar power energy will allow our school to have more chances to teach children, save money, and help the environment. Using solar panels as our main source of energy will allow students interested in natural electricity and career fields related to solar power energy to have a chance to understand how it works in an up-close environment. "Sun Power Source," written by Barry Tonkin, states that it is important for students to understand how solar power energy and clean energy works, so that in the future we can make educated decisions about how we can preserve our planet.

Switching to solar panels as our school's energy source will also give us the opportunity to grow our zero-waste program here at STEM. Using a clean energy source will help students and parents realize how serious our school is about saving the environment and the commitment we have to zero-waste. A teacher at The STEM school stated that switching to solar panels would speak very highly of our school. Not many schools or companies have made the transition to solar energy and that it would show other people how serious our school is about saving the environment.

Converting to solar power energy has many benefits to our school itself. Nowadays, solar panels are an investment. Eventually, the solar panels will pay for themselves and in return make money. Also, with rising electricity bills solar power energy is a great way to save money and switch to a cleaner system. A teacher at the Dayton Regional STEM School stated this when asked if it was a good time for our school to transition to renewable energy, "Anytime is a good time and the sooner you do it the better. The sooner you do it the better it is for the environment." Solar panels efficiency has increased a lot over the past few years and with technology always evolving changing to solar power now is a safe option.

Going through with this proposal would benefit every aspect of our school. A clean energy source would make use of our space and provide kids with an immense amount of knowledge for the future. Not only would the system end up paying for itself in time, but it will also bring in money for our school. Our proposal includes the next steps to meet with solar panel contractors for the final plans and a range of prices. With everything changing, now is the best time to switch to solar panels because the real world starts with renewable energy.

Goals and Objectives

Goals

Our school will have a series of solar panel carports installed in the school's parking lot. The school's electricity, weather permitting, will be 100% green and clean, and the school will gain another source of income. In addition, DRSS will show on the outside of the building what we practice on the inside – Zero Waste and sustainability.

Objectives

- Solar panels are completely and correctly installed by an independent contractor
- Power management system is completely and correctly installed
- Weather permitting, the school will draw 100% of its electricity from the solar panels, with no power from the power grid. If a large draw in power occurs, the school may need to use some grid power to supplement its own production.
- On sunny days, the school will sell 5%-10% of the power it produces back to the power grid, simultaneously paying off the loan on the panels themselves and providing additional income for the school.

Methods

The steps that we will be taking to finish our solar panel proposal will begin with these steps:

1. Asking people how our proposal could be implemented.
 - Where can a solar power system go? Why would it be a good reason to switch to solar power now? How can we implement solar power in our school?
2. Obtain proposal-critical information.
 - How much energy (in kWh) do we use on a daily, monthly, and yearly basis? How much money will the solar panels cost to provide energy to our school? How many years until the solar panels pay off their cost?
3. Call potential contractors and ask them for an estimate.
 - We will call solar panel companies and ask them for an estimate cost of solar power. We will next try to get a quote from them.
4. Determine feasibility of solar panels on the roof.
 - Potential alternatives include the North Field and solar carports.
5. Find a way to potentially fund our project.
 - This can be through grants, company donations, etc.
6. Finish our proposal.

Post-completion steps would include:

1. Get the proposal approved by the school's administration.
2. Secure funding towards obtaining the solar carports for our school.
3. Secure a contractor and schedule them a time to install the solar carports (most likely during the summer when school is not in session).
4. Successfully begin generating power for the school from the carports.

Evaluation

The project will be considered a success when the following requirements are met:

- The school's main parking lot area is covered with correctly installed solar carports.
- On a sunny day, the carports will provide 100% of the school's power.
- On very sunny days, the carports will begin producing excess solar power, resulting in a net monetary gain for the school evident in its power meter bill.
- The carports will be properly maintained every year, and will last 30 or more years before needing to be replaced.

Budgeting

As of current planning, the estimated cost of our proposal is \$500,000-\$800,000 for the solar carports, maintenance, and installation. After the next steps of the proposal are completed and the contractor submits their proposal for review, the price will be finalized. The price range includes the solar carports, maintenance, and installation. As the solar panels continue being used, they are being maintained. Solar panel cleanings should occur at least once a year to maintain solar panel efficiency. The average price of a solar panel cleaning can differ depending on the kW size of the system and number of panels. The cost of a cleaning can be anywhere from \$150-\$1,000.

Category	Estimated Cost	Justification
Solar Panel Carport System	\$450,000- \$750,000	To provide the maximum amount of energy efficiency, we will need a 500-kW solar carport system. This system will allow for our school to obtain all of our power from renewable energy. Solar carports are the safest and most design-friendly way to implement a solar power system at our school. They will also keep parked cars cool in the summer, and dry when it rains.
Installation	\$5, 000- \$40,000	We need installation fees to make sure that the solar carports are put in properly. This cost varies on the system you put in and the contractor that is being used. The average cost is \$12,000 for installation.

Maintenance	\$150-\$1, 000 (yearly)	To ensure that we are using the maximum efficiency of the solar panels, cleanings must occur once a year. The prices will vary depending on the solar panel system and the number of panels. Cleaning the solar panels is the best way to ensure long-term efficacy.
-------------	--------------------------------	--

Future Funding

Our project has a wide, potentially expensive price range, so outside funding is necessary. There are many grants dedicated to providing financial to help make schools energy efficient. One such grant is The Lawrence Foundation Grant. This grant is a grant given out every two years to a location that is benefits its local community. The grant is for one year, but it can be renewed yearly. The foundation is a private family foundation. There is another program funded by Ohio Department of Development that allows for schools to receive a grant of \$200,000 for installing solar panels. Another option is to find a way of receiving donations from the contractor themselves (or another unrelated energy company) to cover these costs, in exchange for a dedication to the company in some way. This could be similar to Vectren helping to fund the school's expansion and the company getting an area of the school named after it. With these future funding options and more, we can potentially reduce the price of the solar panel project to make it more economically feasible for the school's budget.

Alternative Solutions

It would be in the Dayton Regional STEM School's best interests to reconsider the way it powers itself. Our group proposes the installation of solar carports in the school's parking lot. These carports will provide shade for parked cars, while providing renewable energy to the school. We propose hiring a local contractor to install these carports and the associated equipment.

Alternative 1

Solar Panels on the North Field

One alternative to installing roof panels is covering in whole or in part the field in-between the school building and the Goodwill Outlet to the north. The reason why this alternative is less desirable is the utility of the North Field. It is also used for Fitness classes, for recess, for science experiments, and for potential future development (outdoor eating area, etc.). Covering this space with solar panels will make the North Field unusable for the students, while still costing a comparable amount compared to our group's carport solution.

Alternative 2

Solar Panels on the Roof

The installation of solar panels to the school's roof was the first option our group analyzed. Ultimately, it was the least viable solar option. In its previous life, the school building was a Value City Furniture Store, and as a result, the building's roof was not designed to support large structures. In addition, the roof is aging, making solar panels even more unlikely. The only way to resolve this issue is for

our proposal to include a reconstruction and renovation of the roof entirely, followed by the mounting of solar panels. This would cost the school way

Alternative 3

Wind Power

Another alternative is to abandon solar power entirely and turn to a different type of renewable energy: wind power. A wind turbine takes up much less surface area on the school property, so the roof's structure wouldn't be an issue, and the North Field wouldn't need to be covered. However, the largest problem for wind power is the cost. A 15kWH wind turbine system would cost over \$100,000 in up-front costs, not to mention maintenance costs. Also, the school building is an area that doesn't receive as consistently high wind speeds as opposed to surrounding areas. Sticking with solar panels is better and easier for the school building.

Conclusion

Our proposal, if approved, would guarantee clean, renewable energy for the Dayton Regional STEM School for the next several decades. Solar panels are the best option for our school, and they will provide benefits in all aspects of school life. We can do our part to slow the climate change crisis, while helping the school earn more money for its other goals. We can do this together. Implement our proposal, and you help the Dayton Regional STEM School live up to its goal of fostering interest in science, technology, engineering, and mathematics.

Appendix

Meeting +Minutes

Team meeting: Lucas, Mason, Maddie, with Dr. Fisher

Main Ideas:

- Implementing a zero-waste energy system.
 - (Dr. Fisher liked the idea of Implementing a zero-waste energy system with solar panels.
- Providing another source of income for the school through energy buy-backs.
 - (Dr. Fisher liked the idea of this, but didn't seem to understand it much, Lucas was trying to explain it better.)
- Helping DRSS look more like a STEM School. Being powered by solar panels proves our focus on science, technology, and engineering.
 - (Dr. Fisher said that it brings a more interesting way for kids to learn about solar panels and look at a more technology side of things. They are always looking at ways to do this.)

Questions:

- How much power does the school use? The cost of solar panels is calculated by the kilowatt-hour.
 - (Dr. Fisher stated that she would have to look more into this, probably go around and ask a few people.)
- What does the school's budget have available for solar panels? There is an up-front cost of installation, and monthly installments paying back the solar panels.

- (Dr. Fisher told us to look around for prices of solar panels and what the cost would be for our school.)
- Where can the solar panels go? Our team's proposal considered the school roof as the solar panels' location.
 - (Dr. Fisher told us that they would not go on the roof because of issues, but there would be potential places to put them otherwise. Behind the school would be one recommendation.)
- For the next 25-30 years, how can we maintain the solar panels? What systems can we set up to ensure the solar panels are taken care of? Sustainability and Engineering classes could implement this maintenance into their curriculum.
 - (We didn't go over this question since we did only have 10 minutes. Further asked questions will be answered.)
- Has a renewable energy system ever been considered before for our school?
 - (Dr. Fisher stated that there was development before this with solar panels, but the proposal didn't succeed because of flaws in it.)
- Is now a good time to start looking at different ways to make our school more green?
 - (Didn't get much on this question, but from her responses on the other question I am inferring that this is a good time to add things to our school since the construction in Phase is finally done.)
- How will our school's energy usage go up, down, or stay the same over the next few years?
 - (Dr. Fisher stated that the energy will stay the same due to our school's construction being completed. The part that uses the most energy would be the GRILL.)
- Do you think that solar panels would be a good addition to our school?
 - (Similar to what we are looking for, but Dr. Fisher stated that it would be good for our STEM School to have solar panels, with the rising of

technology we can get students to learn about hands on activities with the technology powering the school.)

Personal Thoughts:

- Is there anything else we should know about solar panels at STEM?
 - (Dr. Fisher told us that there has been recent production on this idea but hasn't been a main priority. She told us that there were some problems, so they decided to put it in behind for now.)
- Are there any concerns or suggestions relating to our proposal?
 - (Dr. Fisher stated that since there has been a plan in the past, that we might be able to use those and she suggested that we might have a good chance of where we are headed.)

Memo

To: Lucas, Maddie, Mrs. McDaniel, Ms. Mack

Date: 3/18/2021

From: Team Member Mason

Subject: Solar Panels for our STEM School

As you all know, we are trying to get solar panels into our school. We have gotten some information on the proposal, but we need to learn more about how we can get them.

Overall, the meeting was a success. Some of our questions were answered. We learned that we cannot have the solar panels on the roof because the roof is not stable, and the solar panels would fall through. We learned that the school has planned to put solar panels in the past, but they ended up getting rid of the plan because cost and disorganization. We learned that the amount of energy is not going up due to the school finally being done with construction.

We are going to email a local contractor, Mr. Bottelier, and Mr. Lail on how we can incorporate solar panels into our school, the power we are using, and if there have been things done in the past with renewable energy. We are going to ask people if solar panels will be a good addition to our school. [What do we need to do next.]

Since the meeting we are reconsidering where to put solar panels around our school. Some ideas consist of putting them along the side of the building, out in the field, or on carports in the school's parking lot.