Martens Center/Human Kinetics Park Sustainable Development

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December 13, 2019

Milestone #3

ENVS 492- Sustainability Capstone Project Based Learning

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Executive Summary

What is your favorite place in your neighborhood? It might be a trail you like to walk on or a library you find peace in. Thanks to the Champaign Park District, north Champaign will have a space with greenery and recreational use for residents who are lacking it. As the Champaign Park District adds the Martens Center to Human Kinetics Park, residents can stay active, socialize, and participate in classes, workshops, and other activities. The neighborhoods that surround Human Kinetics Park are Shadow Wood, Bristol Place, and Garwood. They are underserved, lower socioeconomic communities and this project will provide a space dedicated to these families to promote community values. This space will not only be available for the 1,258 residents of the north Champaign neighborhoods, but it will stand for generations to come. The Martens Center will be equipped with both indoor and outdoor recreational spaces that includes two gymnasiums, an indoor playground, an education wing, a kitchen, and five multi-purpose rooms[1]. While this development will provide a great benefit to the community, the Champaign Park District will consider adding sustainable alternatives to the current design. The green initiatives are geothermal heating and cooling, solar energy, and alternative low-water plumbing. Geothermal heating and cooling provide and reduces heat from buildings which is a sustainable alternative to standard heating and air conditioning units as it saves money and energy for the Martens Center. Solar energy is a sustainable solution for the Martens Center because it is readily abundant, clean, and available. Lastly, low-water plumbing is an option in the restrooms of the Martens Center which will conserve water and save money on water usage. These solutions are fitting for the Martens Center because the facility will be open in the early morning for day care and it will close at the late hours of the night for after-school programs and to accommodate members who are ending their working day. The Martens Center will also be open for seven days a week and will serve over 1,000 patrons a day, so amenities will be expected to be running every day. This infrastructure will save the Champaign Park District money and will save energy and release less emissions compared to traditional units. The Martens Center paves the way for sustainable infrastructure and does not discriminate accessibility to multipurpose spaces that will be residents' favorite place to spend time in.

Image source: Champaign Park District

Introduction

In an underserved neighborhood on the north side of Champaign, Illinois, a 40,000 square foot park is being converted into a state-of-the-art sports and community center. This project is being directed by the Champaign Park District in collaboration with the Martens Center in the Human Kinetics Park. While the budget has its constraints, the Champaign Park District aims for the Martens Center to be a sustainable development that can be enjoyed by the public for recreational, educational, and work purposes. Ideally, the Champaign Park District would like to incorporate as many green initiatives as possible, such as alternative energy and stormwater management, while remaining within the constraints of the budget or potentially providing long-term cost savings. This report will inform the reader on who the Martens Center is directly serving by providing a demographics and existing conditions report on the Shadow Wood, Bristol Place, and Garwood communities, all of which are neighborhoods that surround Human Kinetics Park. Currently, the Martens Center is funded by a donation from Rainer and Julie Martens, founders of Human Kinetics Park in conjunction with the Champaign Park District.

Previously, the Champaign Park District has completed projects such as the Leonhard Recreation Center (LRC) in 2014, which features an indoor walking track, weight room, indoor playground, and a gymnasium for the community's sports and recreational needs. The LRC relies on a geothermal mechanical heating and cooling system that transfers heat by pumping water through underground pipes. The geothermal system at the Leonhard Recreation Center was partially funded by a grant from the Illinois Clean Energy Community Foundation and it can serve as a model for the Martens Center in regards to how much energy can be produced with geothermal energy. It is also a successful park project that can serve as an example to help estimate the number of individuals that will use the Martens Center. While the LRC is located in Centennial park and the Martens Center is located in the Bristol Place and Shadow Wood communities, the LRC can serve as a base estimate for number of families who frequent a public park throughout the year. These estimates will be conducted in conjunction with studies from the Champaign Park District.

The use of low-temperature geothermal heat sources is an efficient method to heat or cool a building while promising a comfortable temperature. Geothermal heating and cooling rely on the ground as a source or sink for heat and reduces the need for fossil fuel-based heating. Solar energy is a well-known form of renewable energy that can take advantage of unused space, such as the community center's rooftop, and sunlight to produce carbon-free electricity for the building. Low-flow faucets, dual-flush toilets, and no-water urinals are examples of potential water-saving features. These features could save the Champaign Park District on operating costs and reduce excessive energy and water usage. Further details on these sustainable alternatives will be provided in their respective subsections. Along with this, a copy of our research timeline and scheduled meetings with members of the Champaign Park District over a three-month timeframe can be found in this report. Further analysis on how much geothermal and solar energy will be needed to power the building and how many people will use the Martens Center needs to be researched, however. We hope that these sustainable, cost-effective infrastructure suggestions will prove useful to the Martens Center and assist in bringing the residents of Champaign together in one welcoming space.

The solutions for this structure are to equip it with geothermal heating and cooling, solar panels, and efficient water usage. The proposed geothermal heating and cooling is an appropriate solution to avoid excessive costs on air conditioning and heating in the interior of the building as well as use less energy to

create a comfortable temperature in the building. Solar energy is a viable option for the Martens Center because it is readily available and releases no harmful emissions. It will need to be installed on the roof of the Martens Center which can be collaborated with what the staff of the Champaign Park District has planned for the design of the building. Lastly, improving the water facilities in the restrooms of the Martens Center has been chosen to be implemented because it is estimated that 1,000 patrons will be using the Martens Center daily. This amount of people will be using the restroom facilities and saving water while people use the facilities is detrimental as this amount of people will go to the restroom once or multiple times while in the Martens Center.

The Champaign Park District has decided not to add an indoor swimming pool and aquatics center, so propositions for saving water with the swimming pool have ended. However, the three proposed sustainable initiatives will not only bring benefits from the environment, but also for the Champaign Park District. The main benefit that the Champaign Park District will face from the proposed sustainable infrastructure is that they will not have to pay as much money on their energy bill monthly. These options are also important not only for the Champaign Park District financially, but also for the members of the community because they will have access to a recreation center that is walking distance and the space will be available for generations to come with long-lasting and energy-saving infrastructure.

Objectives

What We are Doing:

Our project will contribute to producing a venue for residents of north Champaign to meet, play, and learn, while the building itself is designed with green initiatives and self-sufficiently produces its own energy. As there are multiple options in regards to improving the environmentally-friendliness of the center, our group will focus on the benefits and drawbacks of the following subprojects in order to create a narrow and well-defined scope:

1. Installing geothermal heating and cooling throughout the building
2. Investing in solar-powered energy by placing solar panels on the exterior of the Martens Center
3. Enforcing/installing environmentally-friendly mechanisms in the bathroom facilities (e.g. dual flush toilets, no paper towels, etc.)

Motivation/Benefits:

There are several motivations for this project, ranging from social to environmental to economical. With the installment of solar panels, the park will produce its own electricity to power street lamps, the community center, and electric vehicles. The leftover energy can be sold to third parties, and the funds could be used for future community events, like block parties, or public work projects. A geothermal heat pump system can be installed to decrease the costs of heating and cooling, reducing the part of the budget/grant allocated to the building's operation and maintenance. Both solar energy and geothermal energy are considered renewable sources of energy too. The bathroom facilities are expected to be used frequently by the public and are prime targets for money-saving appliances. While these projects require an initial investment, the long-term savings would be worth the expenditure. The public will benefit from a fully functional facility that is also environmentally conscious. Solar panels, geothermal heating and cooling, and water efficient appliances will be able to power the Martens Center for years to come so that

not only will the currents residents of Bristol Place, Shadow Wood, and Garwood will be able to use the space, but generations to come can enjoy it as well.

Expected Deliverables:

This project with the Martens Center will create a community space where the neighboring individuals can enjoy recreational time with each other, their families, and nature. The expected deliverables from this project include researching the surrounding neighborhoods and feasible renewable energy sources for the building. These deliverables are vital to ensuring the aforementioned social, environmental, and economic benefits are met. Through the research conducted on renewable energy and appliances, we can determine how cost effective it is for the Martens Center and the community as a whole. By studying the surrounding neighborhoods, we will learn and teach the public who the Martens Center is serving. Considering the timeframe of the project, it is assumed these smaller tasks are more achievable than other larger tasks, but nonetheless significant in the long-term building of the park.

Methodology

Throughout our meetings with our project sponsor and during our collaborative work with our group, we have determined the scope of our project to be main tasks that we focus on to ensure the feasibility of the Martens Center. We used our scope to help us outline and plan for the tasks that we studied and we analyzed how different topics and research can aid the Champaign Park District in their implementation of the Martens Center.

Task 1: Determined our timeline, budget, current conditions of the park, goals of the sponsor

Before we decided on the recommendations for the Champaign Park District, we determined what our project sponsor would like to see and what is possible given the budget and features already implemented.

1.1 Initial meeting with Project Sponsor, Allison Williams

Our project sponsor, Allison Williams, is a planning coordinator for the Champaign Park District. She is working on the construction of the Martens Center and has experience with other projects involving the Champaign Park District, such as the Leonhard Center.

1.1.1 Set Regular meetings – every other Friday

1.1.2 Asked about current conditions of the park and specified goals of the project through an email chain

1.2 Determined project timeline for our group and scheduled it into the overall project timeline

As a group, we created a schedule that told us how far along we should be in our research.

Task 2: Researched green infrastructure

The Champaign Park District has plans to use green infrastructure, such as solar panels, geothermal heating and cooling, and energy saving appliances. Our research explains how the Martens Center will benefit from these additions.

2.1 Green appliances

Green appliances will be installed in every room of the Martens Center; whether it be to help save water usage or energy from light fixtures, green appliances will help alleviate excess natural resource consumption.

2.1.1 Grey toilets – use of non-potable water to flush toilets

2.1.2 Energy Star appliances - potential dual-flush systems

2.1.3 Energy efficient lighting fixtures

2.2 Energy Efficiency

The two energy efficiency fixtures that the Champaign Park District plan for are solar panels and geothermal heating and cooling. We will conduct a cost analysis on how much money it will cost the Park District to install these features and how much the Park District will potentially save from these features. We will also look at how much energy the Park District will save by using solar panels and geothermal heating and cooling.

2.2.1 Geothermal heating and cooling

2.2.2 Solar panels

Task 3: Community Engagement

The Martens Center is located in a north Champaign neighborhood. We will study the demographics of the area and the activity that we will predict will occur when the Martens Center is built.

3.1 Researched existing reports

The City of Champaign and the Champaign Park District have resources on their

websites regarding information about the residents. Studying this information will help us and

the Champaign Park District see who they are serving with the construction of the Martens

Center.

3.1.1 Demographics of the surrounding neighborhoods

3.1.2 Economic development

3.1.3 Tax incentives available in enterprise zones

3.1.4 Regulations, requirements, and permitted uses of the zoned district

3.1.5 Champaign's Environmental Sustainability Plan

3.1.6 Study similar recreation centers that use renewable energy

Task 4: Prepared Our Presentation and Project Proposal

This is our final step in our project where we show our project sponsor, the Champaign Park District, our colleagues of ENVS 492, and our instructors our interesting findings and research in our project. This step includes presenting and submitting our reports and PowerPoints in a timely manner.

5.1 Finalized Project Proposal

We revised our Milestone 1 and Milestone 2 and pulled out information that we have found or created from past assignments in ENVS 492.

5.1.1 Determined final deliverables

5.1.2 Created a final draft of our proposal to the Champaign Park District

5.1.3 Submitted a proposal to the Champaign Park District

5.2 Final Presentation

This step includes creating a visual for our colleagues and instructors to view. We submitted our Milestone 3 and PowerPoint for our poster session.

5.2.1 Created a PowerPoint presentation

5.2.2 Presented our project proposal to the class

5.2.3 Presented our project proposal to Champaign Park District

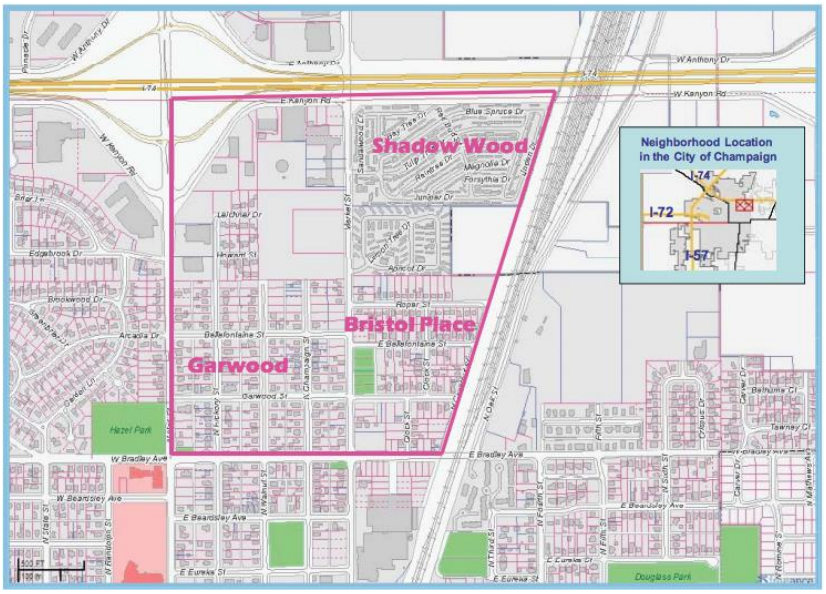
As we have been working through our tasks during our scheduled meeting time, dedicate group work time in class, and had bi-weekly meetings with our project sponsor, we have strengthened our scopes on different entities that must be considered when building the Martens Center. We have outlined our tasks in a schedule with tentative dates that we followed in addition to finalizing our PowerPoint presentation for the ENVS 492 poster session and our Milestone 3 to be graded.

Results and Discussion

Neighborhood Analysis

The land uses of the Bristol Park, Shadow Wood, and Garwood neighborhoods are residential, commercial, and industrial with no designated recreational or green space. The existing infrastructure in the area does have Bristol Park apart of Bristol Place and there are multiple public transit options with the Champaign-Urbana Mass Transit District. The other existing infrastructure near the neighborhoods, like schools and the Champaign Public Library, require pedestrians to cross busy arterial streets like Market Street and Bradley Avenue. There is a high rate of traffic-related incidents on these streets due to the lack of pedestrian-friendly infrastructure.

Map of the Shadow Wood, Garwood, and Bristol Place Communities



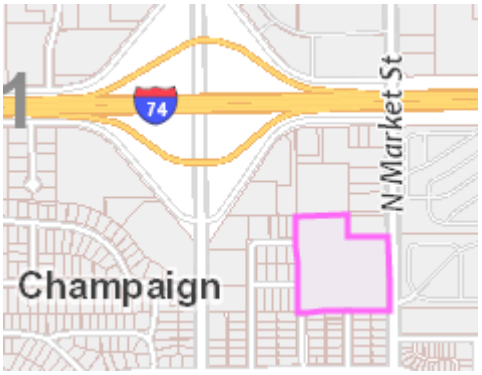
Source: Bristol Park Neighborhood Plan by the City of Champaign

The demographics of Garwood and Bristol Place are predominantly African-American while the Shadow Wood mobile home community is mainly Latino. The population of Bristol Place is 232 residents, Garwood has 413 residents, and Shadow Wood has 613 residents. So, it is expected for 1,258 patrons to use the Martens Center during the time that it is open, from 6 AM to 10 PM. The green initiatives that will be proposed throughout this report will directly benefit the Champaign Park District and the Martens Center's 1,258 patrons. With efficient amenities such as solar energy, geothermal heating and cooling, and water-saving features in the restroom, the community will not need to pay as much money on their water and energy bills and the 1,258 will be able to access the Martens Center at a low cost.

The Martens Center is located in a Tax Increment Financing (TIF) District of the Bristol Place Redevelopment Project. A TIF District is a tool that is given by the state to local governments to aid them in economic restoration. TIF Districts allows municipalities to invest money in developments and give incentives to businesses or other developers to build on the property and raise property values in that space. Because of this, the City of Champaign brought incentives to the Champaign Park District to develop the Human Kinetics Park in the Bristol Place TIF District.

TIF District Example in Champaign

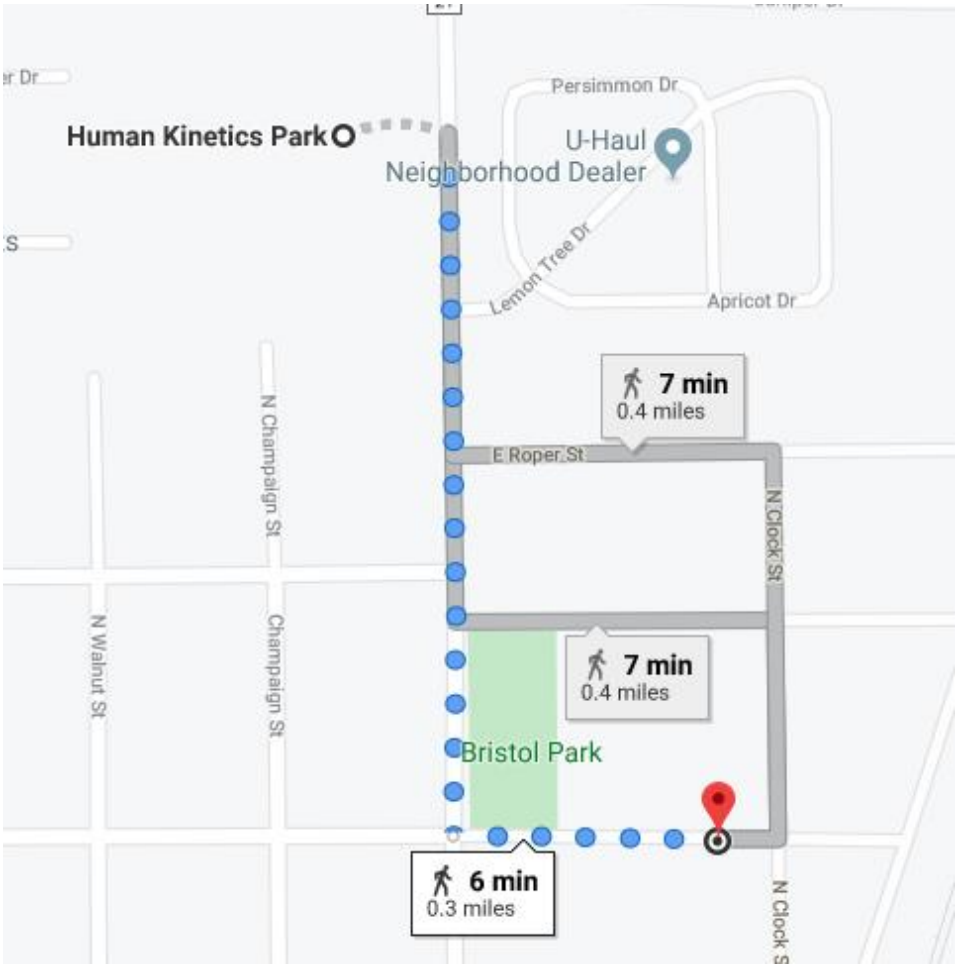
The red shaded area represents the TIF District and the pink box is Human Kinetics Park.



Source: Champaign County GIS Consortium[2]

The neighborhood where Human Kinetics Park is located has an annual income of $48,323 and has an average household size of 2.38 people. Based on the Housing and Transportation Index, 26% of that income is allocated towards housing costs and 22% of that income is spent on transportation. Nearly half of residents' income who live near Human Kinetics Park is spent on both housing and transportation costs. Less money can be spent on transportation by riding on the C-U Mass Transit District. This option is extremely affordable and the Martens Center can advertise this to their patrons. There are MTD bus stops on Neil Street and Market Street, but the Champaign Park District should encourage the stop to be right in front of the building instead of across the Martens Center Parking lot and on a busy road. This will not only alleviate the stress and enhance safety for bus riders waiting for the MTD, but also help physically or cognitively disabled individuals be prioritized while catching their ride. Additionally, riding public transit is an extremely sustainable choice for individuals. Driving in a single-occupancy vehicle equates to 1.2 carbon emissions per mile in a vehicle trip whereas riding in a transit bus emits 0.8 pounds of carbon.

Walk from Bristol Place to Human Kinetics Park



Source: Google Maps

Design elements that the Martens Center can implement are wide public space with multiple access points throughout the park, lighting, and wayfinding. Wide spaces will be recommended to the Champaign Park District and this feature will emphasize on the human scale and encourage individuals not to drive, but rather walk or cycle to the Martens Center. The Champaign Park District can influence and advertise to the patrons of the Martens Center that the MTD is available with various bus stops throughout the Urbana-Champaign community. Champaign does have minimum parking requirements in Downtown and Campustown and this can continue in the north Champaign neighborhood. Encouraging individuals to walk, bike, or take public transit to the Martens Center will reduce carbon emissions daily and will promote a healthier lifestyle, which is exactly what the Martens Center intends as its mission is to improve public health in the neighborhood. The Champaign Park District can also partner with Walk and Bike to School, an organization that promotes to young children to working adults that they should bike or walk one day a year. This annual event aims to bring communities together through the outdoor activity while staying active before and after work or school. The Martens Center will host head start and after school programs in the morning and in the evenings for students which is an excellent option for children to make friends and memories in their neighborhood as well as keeping them engaged in creative hobbies or sports. During these programs, moderators of the Martens Center would have the opportunity to introduce Walk

and Bike to School day and motivate the young people to stay moving and exercising throughout the day. Street lighting is an excellent option to make people feel safe being at the Martens Center after dusk. The street lighting throughout the space can be powered with the solar panels on the structure. Lastly, wayfinding throughout Bristol Place, Shadow Wood, Garwood, and the Martens Center will help people know where the Martens Center is.

Geothermal Heating and Cooling

Geothermal heat pumps take advantage of low temperature thermal sources in the earth to provide heat for or remove heat from buildings. The advantage lies in the fact that the temperature in the grounds stays fairly constant throughout the year, even as air temperature swings drastically (Figure 1). In the winter, the ground is at a higher temperature than the surrounding air and heat can be transferred from the ground to warm the building. In the summer, the ground is cooler than the air and the process is reversed, heat is transferred from the building to the ground.

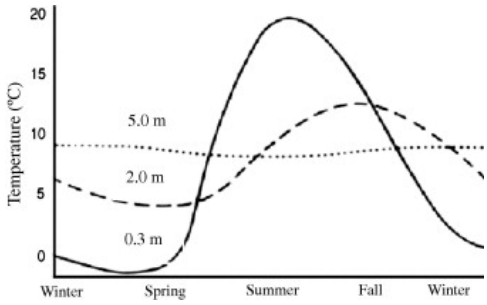


Figure 1: Ground Temperature as a function of depth from Self et al.[4]

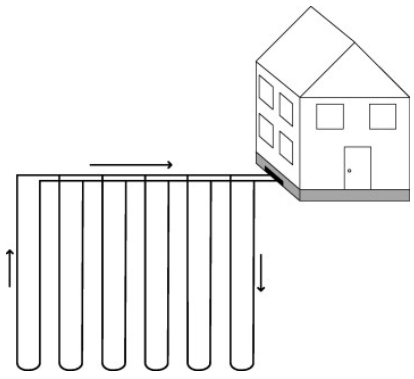


Figure 2: Vertical Closed Loop Geothermal Heat Pump[4]

The efficiencies of heat pumps are measured as a coefficient of performance (COP), a ratio of the amount of heat transferred and the amount of input energy required. The COP for a geothermal system is around 3-5, whereas the typical COP for high efficiency natural gas furnaces are around 0.88-0.97.[4] Using this as a proxy for cost, it is clear that adding a geothermal heating system will reduce operating costs. We can look to the Chicago Center for Green Technology and the Leonhard Recreation Center as examples of these savings. A full life cycle analysis that was done on the developments made to the Chicago Center for

Green Technologies found that about 27 terajoules of energy was saved as a result of the geothermal and photovoltaic systems implemented.[5] They do not clearly state, however, the exact contributions between these two systems. According to the Illinois Clean Energy Grant Proposal for the Leonhard Center, the geothermal system will save 920 BTUs per year with an estimated cost savings of $16,000.[6] The Marten's Center geothermal system will likely have similar cost savings as the Leonhard Center as both facilities are about 40,000 square feet and two stories. The proposed operating hours of the Marten's Center is also very similar to the current operating hours of the Leonhard Center. This comparison gives a good estimation of the potential energy and cost savings of the Marten's Center, but it may have been useful if the actual data of the savings that was seen in the Leonhard Center were available. Tracking these numbers for both centers may be of interest to the Champaign Park District if geothermal systems are to be implemented in any future buildings.

The annual cost savings may be enough to convince some of the benefit of geothermal heating and cooling, but does this system actually reduce carbon emissions and significantly reduce the impact on human and environmental health? We can gain a general understanding by looking at a life cycle analysis done by researchers in Poland.[7] They compared the impacts of three different systems, an electric heat pump, an absorption heat pump, and a natural gas fired boiler. Both of the heat pumps used a geothermal heat source. They found that the use of a geothermal heat source significantly reduced environmental impact, however the electric heat pump drastically increases the impact on human health. This is because the electricity generation in Poland comes primarily from coal (53.5%) and lignite or brown coal (32.1%), both of which release harmful carcinogens into the air. In Illinois, 50% of electricity generated comes from nuclear power, 28% from coal, 17% from natural gas, and 5% from renewable sources.[8] The human health impacts in Illinois from an electric heat pump would be less than that in Poland since significantly less coal is used, but a more thorough analysis can be done on this.

Solar Energy

Sunlight is one of the most abundant renewable energy sources available on the planet. It is readily available and clean, as it produces no carbon or greenhouse gas emissions. Advanced technology has made it possible for some domestic, commercial, and industrial installments of solar panels to even make a profit. The different options for harnessing sunlight will now be discussed before proposing an optimal combination at the end.

There are three main methods of harnessing solar energy: photovoltaics, solar heating and cooling, and concentrating solar power. Solar heating requires a large use of water compared to the other two methods, which is not sustainable nor cheap. Concentrating solar power involves the installation and use of mirrors, which is not feasible for the construction and limitations of the Human Kinetics Park.[8] On the other hand, due to advanced technology, photovoltaics is the most widely-known and commonly installed of these options. Because of these reasons, photovoltaics will be used to harness solar energy.

There are also three primary methods for how photovoltaics can be incorporated into infrastructure: rooftop, façade, and glazing. Of these three, rooftop was selected as the most realistic choice. Considering that the Champaign Park District wants to optimize the 40,000 square feet space allotted for the Martens Center for the multipurpose rooms and other athletic facilities, it was deemed inefficient to use part of the lot to build an array of photovoltaics. At this point in time, the Champaign Park District had also already been working closely with contractors and settled on their building materials. Façade and glazing both require replacing some of these predetermined materials, such as the glass windows, with photovoltaics. The wisest suggestion would be to make use of already existing space, hence the rooftop method.[8]

Now that roofing photovoltaics has been selected as the optimal method of harnessing solar energy, the best location for installation must be selected. The blueprints for the design of the community center can be seen in the image below. One can see that part of the roof is pointed in a triangular fashion, or pitched, while the rest of it is flat. Because of these unique shapes, grounded solar panels are recommended for the flat parts, while solar shingles are recommended for the pitched parts, both of which are outlined in red in the picture below. This is suggested in order to maximize the amount of sunlight the respective roof parts are exposed to, as the highlighted parts are facing the south cardinal direction and there are limited obstacles/other parts of the roof that can potentially overshadow them. Going along with this, a metal roof is recommended for the solar shingles, and an EPDM membrane is recommended for the grounded solar panels. According to HomeAdvisor, a metal roof is one of the cheapest options in terms of building materials. As the solar shingles will be covering a majority, if not all, of the area, it is only logical to cover the roof with a material whose only function is to serve as a base layer that prevents the actual roof itself and the solar panels from touching one another. EPDM is one of the most commercially used material for flat roofs. Not only is its cost favorable, but they are known to be compatible with solar arrays and waterproof features due to their hydrophobic properties. It is important for water to be able to slide off the flat roofs instead of pooling and collecting, potentially damaging the photovoltaics. A cost comparison will be conducted for these two potential roofing combinations based off current price markets for the materials.[9,10]

Image Source: Champaign Parks District

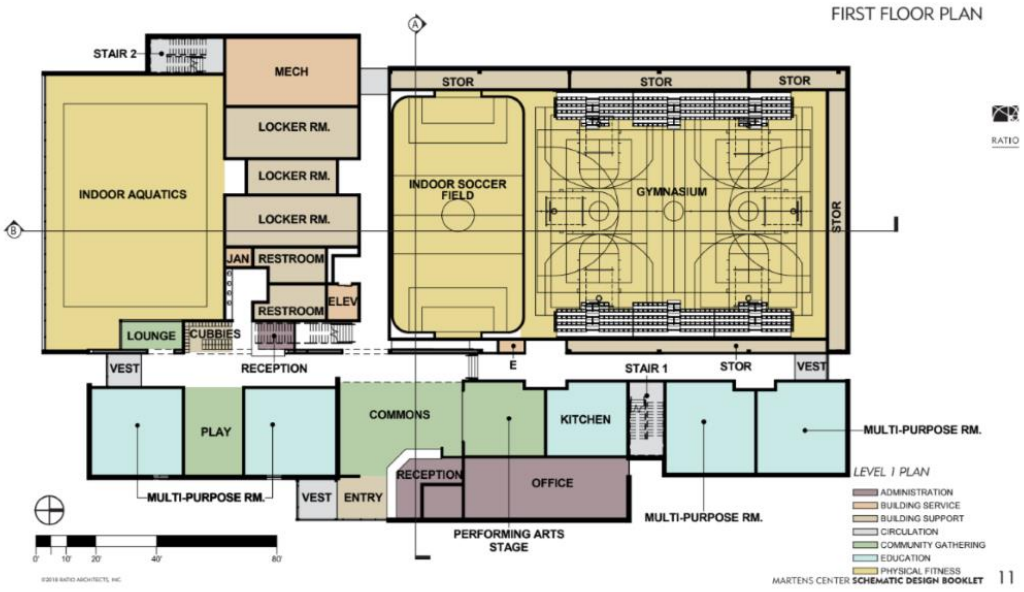


Image Source: Champaign Parks District

Image Source: Champaign Parks District

Using the scaled diagrams, the length of the flat roof was estimated to be about 105 feet long, while the length of the pitched roof was found to be about 162 feet long. The shared width was measured to be about 93 feet wide. The height of the pitched roof was about 18 feet tall. Taking into account the low angle of the roof, the area of the pitched roof comes to about 30,691 square feet. For the flat roof, its dimensions create an area of 9,765 square feet. According to FIXR, one of the widely-known home remodeling and solar panel installation industries, considering that solar shingles cost about $21-25 per square foot, the installation of solar shingles on the pitched roof would total about $244,125.[9] Using an average 6 kW $18,000 solar panel as the basis of comparison, installing a solar array on the flat roof would total around $220,975.[10]

A summary of the aforementioned information can be found summarized in the following table below. It should be noted that these are rough estimates provided off the most recent set of blueprints that were provided to the group and from information from local solar panel installation websites.

Flat Rooftop	Grounded Solar Panels	EPDM Membrane	~9,765 sq feet	~$18,000 per 6kW solar panel system per 2,500 sq feet [9]	~$220,975
Pitched Rooftop	Solar Shingles	Metal Roof	~30,691 sq feet	~$21-25 per sq foot of shingles [10]	~$244,125

Water Usage

In a facility that provides several different amenities to the community such as the Marten's Center there is a lot of room to improve water efficiency, which then leads to financial savings. The biggest area of focus for this topic was on the bathrooms in the facility, specifically water use. Waterless urinals provide an economic benefit due to decreased water usage and less maintenance costs. These urinals, unlike your traditional flush model, have no moving parts and do not need to be connected to a main water line, only a line to the sewage. The gel/oil used to trap the odor and push the liquid into the sewer will need to be changed after roughly 1,500 flushes, but that is the only piece that needs maintenance on the entire system. Along with toilets, dual-flush models provide two options for how much water to use in that flush, either 0.8 gallons/flush or 1.6 gallons/flush. Since we all look for things to pass the time while we are on the toilet, it would be ideal for Marten's Center staff to include a poster or message board touching on the sustainable fixtures being used in that bathroom on the stall door and throughout the facility itself. By showing off these sustainable fixtures on posters we can make the public more aware of these simple and cheap alternatives that they can go and install in their own bathrooms too. Lastly, while there are only a couple showers in the plans, installation of ultra-low flow showerheads saves half a gallon per minute of run time based off the current EPA standards. And even better numbers with the ultra-low flow faucets which save 1.2 gallons per minute based off the same standards. Below is a table with data based off a 20,000 ft^2 prototype building, and although the Marten's Center is designed to be 40,000 ft^2 the difference in square footage should not affect the data very much. These are all easy sustainable installations, since construction has not even started yet, that can start saving money and our planet.

Source: The Home Depot

Source: FaucetsComplete

	Incremental First Cost Per Unit	Incremental First Cost Per 1000 ft²*	Annual Cost Savings Per 1000 ft²*	Simple Payback (yr)
Ultra-low-flow showerhead	$4.99 per showerhead	$0.50	$0.33	1.5
Ultra-low-flow faucet aerators	$5.87 per faucet	$2.35	$8.14	0.3
Dual-flush toilets	$50.00 per toilet	$10.00	$3.58	2.8
No-water urinals	-$282 per urinal	-$42.30	$4.53	Immediate

* Costs were converted to a dollar value per 1000 ft² of gross building floor space to compare types of features. Cost values were rounded to three significant digits, although the convention of showing two numbers to the right of the decimal place (for cents) was maintained. Simple payback periods are shown in tenths of a year.

Source: Energy.gov

Conclusions

We believe that adding the following measures of: (a) geothermal heat pumps to help with heating and cooling of the building, (b) rooftop solar panels to provide renewable electricity, (c) environmentally-friendly bathroom fixtures that will reduce water use, or some combination of the aforementioned, into the design of the Martens Center will reduce operating costs and increase the sustainability of the building. The combined residents of the Shadow Wood, Garwood, and Bristol Place neighborhoods are expected to use the facility, and the addition of the Martens Center will add a parcel of green recreational space in an area that is lacking it. Geothermal heating and cooling, solar energy, and water efficient appliances in the restrooms are viable options for the Champaign Park District to consider, as construction has not yet begun on the site and there is still time for the blueprints to change. However, it ultimately comes down to funding/donations and the TIF district that the Human Kinetics Park lies on. The Martens

family donated $4,000,000 for the development, and while a geothermal heating and cooling unit, solar panels, and water efficient appliances would come at a large initial investment, they would also incur great long-term savings. It should be noted that operational costs were not considered in the phases of development from the Champaign Park District. If a geothermal unit and solar panels are not feasible, then our group strongly recommends the minimum of the installation of water efficient infrastructure, due to its quicker payback period and lower initial investment costs. Despite how the Champaign Park District chooses to proceed from here in regards to our recommendation, our group hopes the people of the Shadow Wood, Bristol Place, and the Garwood neighborhoods benefit from this new park and recreational space close to home.

Acknowledgements

We would like to thank Professor Lance Schideman and Vincenzo Spagnola for their aid and feedback in our research, presentations, and reports. We would also like to thank Allison Williams, our project sponsor from the Champaign Park District. Allison was willing to meet with our group bi-weekly to discuss the progress of our research project and answer any supplemental questions we had. Additionally, we would like to acknowledge the help of Joe DeLuce, the Champaign Park District Executive Director. Joe took time out of our day to answer specific questions regarding the amenities about the Martens Center and its potential to install renewable energy. We would like to thank additional sustainability experts Jennifer Marten and Joy Scrogum from the University of Illinois for their support. Lastly, we would like to acknowledge Cynthia Hoyle, Javier Garcia, and Egemen Okte for their assistance and for providing a higher level of knowledge for our research. Without their help, we would not have been able to complete our research, reports, and presentations to its fullest potential.

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Group Reflections

Carol Lin: I loved learning about the different ongoing projects that are occurring throughout campus and in the Urbana-Champaign neighborhood. If it weren't for this class, I may not have discovered them otherwise. Sustainability is present and important in all majors and fields, and the numerous projects my fellow classmates worked on served as a great reminder of that. For example, the Marten's Center project that my group and I worked on felt similar to urban planning and architecture, but projects like CCFPD Emissions involved a great deal of computer science and coding. Nonetheless, it was a great way to step slightly outside my comfort zone and have a real-world impact. I enjoyed working on the Marten's Center project and can't wait to hopefully come back to campus in a few years and see how the project has further progressed. Sometimes the project required expertise beyond my limits, and I'm grateful to Professor Schideman and Vince for providing that. But I think this only exemplifies how in the real world, collaboration is key to any project. Everyone brings different knowledge and experience to the table, and we all had to come together to meet our group objectives.

Kush Patel: One of the main aspects of this class that I enjoyed was learning about project management and organization. I haven't really learned how to work in a group on a project in any of my other classes, even in the ones that have group projects. Learning about how to define a scope, organizational breakdown structures, and work breakdown structures was interesting and changed the way I approach big projects. These skills will be extremely beneficial for me for future projects in classes and post-graduation. In my chemical engineering classes, my projects have been mostly theoretical designs of some chemical process or plant. Working on the Marten's Center project was considerably more enjoyable since the project had very clear real-world implications.

Samantha Lenoch: I have found that listening to multiple project sponsors about new development in Urbana-Champaign was in itself interesting to me. As an Urban Planning student at UIUC, most of my work, if not all, focuses on the Champaign-Urbana community and I enjoyed listening to different city employees discuss their plans to better their communities. Some of the developments, such as the recycling program and Brown Woods solar farm, pertained to my previous and current Urban Planning classes, so it was useful to take what I have learned in ENVS 492 into my Urban Planning classes. As for my research in the Martens Center, I have found that the structure and help from Lance and Vince helped my group and me to give our project a timeline as we progressed. Meeting with our project sponsor bi-weekly and working in class gave us a chance to strengthen our project and further our research. I can see how the three neighborhoods surrounding Human Kinetics Park are underserved as I have rarely heard about them, besides Bristol Place because it is so new. The Martens Center does remind me of the Champaign Public Library, which I believe is a fairly new development. The Champaign Public Library is a space that is available in a neighborhood that seemed to have lacked a free library, whereas Urbana has a beautiful library that residents frequently visit. The Champaign Public Library is a space that I visit often because it is unique to the community and it has events that bring community members together, such as study sessions or Toast Masters. I believe the Martens Center will have a similar effect on the community and with club meetings and recreational space that everyone can enjoy. I hope the Champaign Park District takes our recommendations and I am excited to see the future of the Martens Center.

Cody Kolbus: Coming into this class I did not know what to expect besides that it was going to be project-based, but after learning about all the projects involving sustainability in the nearby communities and actually getting to work hands-on with one has taught me more than I would have thought at the beginning of the year. The skills I leaned throughout this semester regarding team work and research has prepared me for projects I could expect to see in my career which is a great background to have before even graduating college. Along with team work comes decisions and making compromises, throughout the semester we had to make a couple compromises regarding what sort of alternatives we were going to recommend to the Champaign Park District and how to lay those ideas out clearly and professionally. Along with professionalism, being the main contact for our group with our project sponsor I was able to work on digital communication skills with emails and setting up meetings in a professional manner which can really carry over to any career. I would not call this a mistake, but I wish we could have had more evidence backing solar energy for the Marten's Center like we had for geothermal but the largest challenge regarding that is since the facility was not operating already we had no idea what their actual energy usage will look like. Overall I am very happy with the course and the skills I learned because this class offers a different group project setting than your typical project you'll come across in college.