Solar Sustainability:

Converting The University of Winnipeg Bike Lab to an Off Grid Power System

A report submitted in partial fulfilment of the requirements for ENV-4614 Campus Sustainability

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Table of Contents

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Introduction

The University of Winnipeg is a unique post secondary school located in the heart of Winnipeg, Manitoba. The University of Winnipeg is sustainably ahead of many other Canadian universities. For example, it was the first university in Canada to ban the sale of plastic bottles of water on campus. Another unique aspect to the university is that we are lucky enough to have a bike lab for the students to access. The bike lab has the tools to fix or build a bicycle, and helpful people who run it. Early in the school year there was news that a new building was going to be built where the bike lab was, so the lab was going to have to be moved. There was an idea of taking the bike lab off the power grid. Off grid means that the bike lab would not be relying on any power from the university but producing its own. The idea proposed is that the lab would be powered by photovoltaic solar cells.

Purpose and Objectives

The purpose of my project is to promote a healthy campus by incorporating a sustainable resource. The resource that highly interests me is the sun with the use of solar panels. I am preposing a project of bringing solar panels to the university. My report will be a feasibility and benefit analysis of solar panel

installation on The University of Winnipeg's campus. Although installing solar panels would be the end result I would hope for, that may not be realistic with the time of this course. The location for my solar study will be on the Bike Lab, as their main goal is to go off the grid. This project will also look into preliminary questions that will not be addressed in the feasibility study. I discussed with a local engineer consultant to learn about the costs the university wants to spend as well as the feasible side to the project. My project will also include some communicative and social learning opportunities for the Bike Lab's new location as well as its energy source.

Benefits and Downfalls

Installing an off grid system can result in many benefits. Economically, solar panels that are installed will eventually pay themselves off. This means that you will not have to monthly or annually be paying for energy or electricity because you're creating your own. This is called a payback period. With a simple equation you can derive your payback period. You take the total cost of the solar system, divided by the value of electricity generated, divided by the annual electricity used by the building or house, and then you have your payback period. It would be an easy way to discover the bike lab's payback period but, the lab is

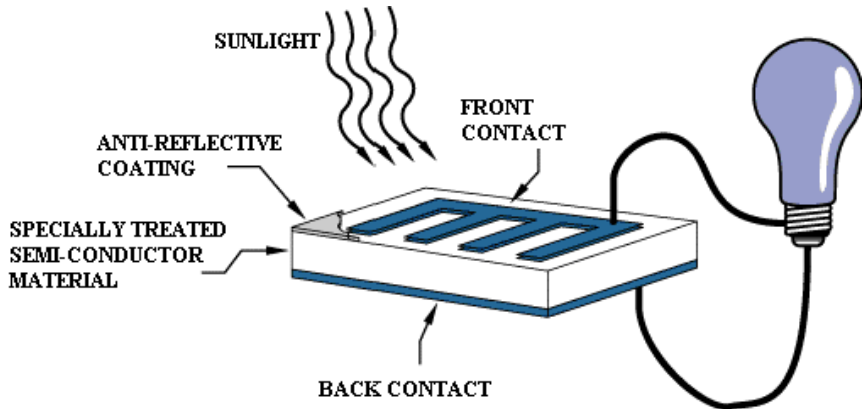
not metered, therefore we do knot know how much energy is being used per hour or annually.

Environmentally, the university will be reducing their carbon footprint and helping slow the rate of climate change because the electricity for the lab will not come from a dependance on fossil fuel. By creating your own energy you're helping the earth regain its original state. Although we will not be using fossil fuels for the consistent electricity of the bike lab, there are some downfalls of the production and batteries that hold the solar power. The production of the solar panels and the batteries are manufactured in non-sustainable ways, that do use fossil fuels. Therefore, installing solar panels is going to use the resource of the sun, but the manufacturing of the hardware is detrimental to the environment.

How it Works

Photovoltaic panels are one of the newer ways to harness sustainable energy sources. Photovoltaic panels or solar panels are large black surfaces that absorb and convert the sun’s rays into usable energy at an atomic level. When light hits the solar cells, the energy turns into an electrical current which we can then harness for power. For the bike lab, a maximum of 12 photovoltaic panels of 320 watts each can fit on the roof. This is a lot of power that is going to be generated but we can store the energy that is created when the bike lab is not in

use. We can do this with batteries that are going to be stored in the bike lab. When the lab is not using any power but creating electricity during the day it can be stored in the batteries to use later on as well as at night. This is helpful for our winter nights when the sun goes down early. Conveniently there are many different types of solar panels. There are panels that can work effectively in our harsh climates and can withstand our heavy snowfall. Panels can be pressure sensitive as well as adjust themselves so the snow can fall off of them and they can continue attracting the suns rays.



This diagram shows how one photovoltaic cell works. Solar cells are made of semiconductor materials, such as silicon. In solar cells, a thin semiconductor wafer is designed to form an electric field, positive on one side and negative on the other. When light energy hits the solar cell, electrons come loose from the

atoms in the semiconductor material.The electrical conductors that are attached to the cell have positive and negative sides. This forms an electrical circuit, the electrons are captured in the form of an electric current that can then be stored in batteries. This is how one cell works. Solar panels are made up of many cells put together forming sheets of surfaces.

The University of Winnipeg's bike lab is not metered therefore we cannot effectively say how much energy from the grid it is using and how much would thus be saved by installation of the solar panels. A group of engineers from the University of Winnipeg and Physical Plant decided that the 12 panels at 320 watts each would cover the estimated amount of energy the bike lab would need. In someways this can be a lot of energy when the bike lab is not operational on cold winter days, because it will be producing copious amounts of energy when not in use. Therefore, where is all the power that is being created going, if the

batteries that are storing energy are full? Evidently this power is going to be wasted, because there will be no more room to store it. There has been a question of whether or not the energy from the bike lab can be rerouted back into the grid to help power the university. This is a rather good idea but not feasible because of cost. This is not in the plan that the University of Winnipeg has for the future of the bike lab.

The university would like to look at installing solar panels on some of the main buildings in the future to create their own energy other than rerouting energy from the bike lab. Some buildings that have enough load bearing weight have been looked at, to see if there is enough room for solar panels. Eventually the University of Winnipeg would like to add solar panels to the main buildings to help take care of the electricity costs and increase sustainability. As of right now this is not feasible because of the many other projects currently going on in the university, as well as cost, but hopefully in the near future it will be.

Similar Projects

Currently few similar projects are being done in a University environment. Thompson Rivers University in British Columbia is currently working on a project to place small glass solar panels on their front walkway. They will be salt and slip resistant as well as have enough load bearing weight for vehicles to drive on.

They will generate around 10,000 kWh a year that will be directly fed into the grid without the use of batteries. The solar walkway will be powering the University's Arts and Education Building.

The main reason that solar power has yet to take flight in Canada for institutions is the cost. Solar power is a very expensive way to create energy and the demand is not yet there.

A different approach that has yet to make way to Canada, is a project north of Amsterdam. There is a bike path that generates power through photovoltaic panels. Within the first six moths of being open, the 70 meter long strip generated more than 3,000 kWh of electricity, enough to power a small home for a year. This was a surprise as it surpassed their estimate of what they thought it would create. I think this would be useful in Manitoba, especially downtown because of the many people that commute by bicycle.

Results

The University of Winnipeg has an amazing group of engineers that make it possible for this to work. They know the right way to go through with the projects we have at the university. The reason this works is because of their efforts to better the sustainability at the University of Winnipeg. Projects like this can be expensive, but the university has a fund for sustainability projects. The

university's budget for this specific project is $35,000. This is around the price the university has to spend but there is no detailed coat analysis yet.

The University of Winnipeg wants to create an environment that shows initiative to help climate change and to lead in sustainability. The University of Winnipeg has 10 Sustainability goals and adding the use of solar panels would be aiding towards one of them. The first sustainability goal is to: Reduce total GHG emissions. Photovoltaic panels can help this goal because of its lack of need for natural gas. They are dependant by not needing any source of energy to run.

The University of Winnipeg Bike Lab has been moved to its new location. This was one of the results that I was hoping to see be achieved. Now with its new location that will give it more sun, the solar panels are able to be installed. With the new building, Leatherdale Hall, going up, the panels won't be going up right away. It is predicted that it will be a couple of months specifically around July 2016 before they are purchased and installed, but with the bike lab already moved it is on it's way to becoming off grid. The University of Winnipeg is working with a business called Solar Solutions that designs, manufactures, distributes, and installs photovoltaic panels. An advantage of working with this company is that it provides comprehensive solar technology services and thus there is no need for the university to retain multiple companies. Results that I

was hoping for would be for the photovoltaic panels to be installed, but the term is not long enough to see those kind of results happen. Although we are pleased to see the bike lab move to its new location.

Methods

Methods used for this project were staying in touch with the engineers that help make projects like these possible. Staying on top of what is happening with planning as well as doing research of my own. During this endeavour I had many different sources that I could rely on, Kyle Macdonald, was the engineer that I was in contact with. He answered many of my questions and was able to help my understanding of many different aspects of this project. Alana O'Malley and Alex

Wieb attended our classes to give positive feedback and constructive criticism. All of there efforts were very helpful and useful, thank you to all who helped with this project. My main acknowledgement of course is to Alan for creating a fun, challenging new course and guiding us towards the finish line, as well as my classmates that had many helpful ideas and suggestions, thank you.

Next Steps

Next for the bike lab would be a detailed cost analysis, that would be feasible for the university. Then carrying on with Solar Solutions to create the perfect design for the roof of the bike lab and finally installing the solar panels. These are very strategic next moves for the University of Winnipeg, as it can be a costly project. The University is leading in sustainability and adding solar panels will make it even more recognizable. In the farther future, adding solar panels to the main university buildings may be a feasible next step.

Concluding Comments

Thank you to Alan for putting this class on and spending time creating it. Over the span of the course I have learned a lot of new and useful information about solar panels and The University of Winnipeg. I can’t wait to see the results

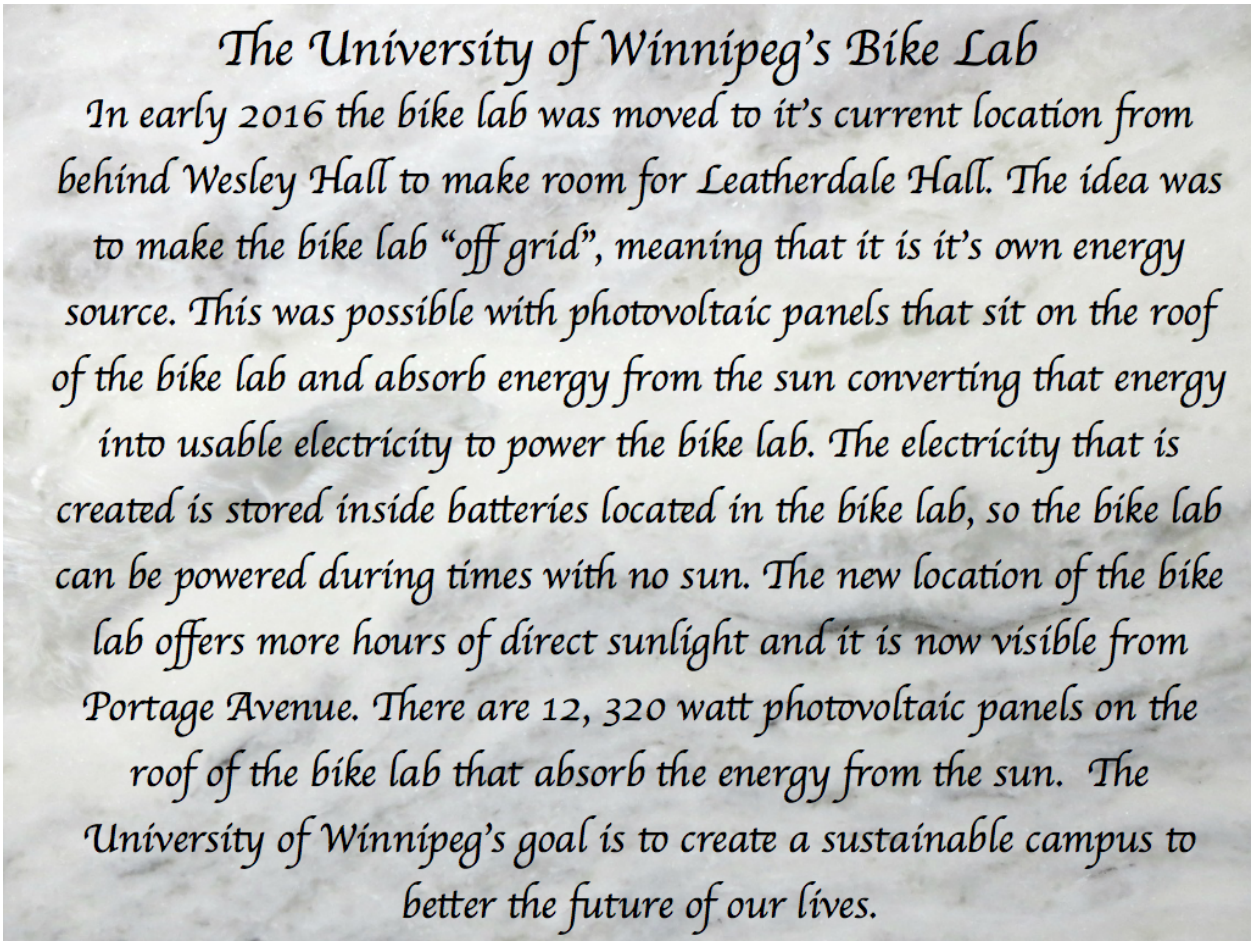
of the bike lab going off grid. The University is becoming more sustainable every year and I am fortunate to research a small part of it. Thank you again to everyone that has helped with the process of all the Sustainable Campus Living students.

Interpretive Signage

The University of Winnipeg is very interested in community learning and creating an educational aspect with many of their projects. In the University of Winnipeg Community Learning Policy, their purpose states, “To provide an institutional framework for the management and support of community learning activities, with a view to increase access to and participation in post-secondary education for those who are traditionally underrepresented in the University population, with a focus on Indigenous people and new Canadians.”

For the bike lab I wanted to created a sign that can go up in front of it to explain the panels and why the university chose to do this project. It is important to include a community learning aspect so not only anyone interested in this project but people walking by can learn about it. The sign will be posted on the bike lab so people walking by can spot it and read about the bike lab photovoltaic project. I have come up with an idea of what this sign can look like, and say. This

ties into the community learning policy by letting any person passing by to learn what the University of Winnipeg has accomplished.



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