Student Sustainability Committee Funding Application Step 2

General Information

Project Title:	Electric IT Cart and Solar Charging Stations
Total Amount Requested from SSC:	$55,081.12
Amount Requested as:	Grant
Topic Areas:	Energy and Transportation

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Electric IT Cart and Solar Charging Stations – SSC Proposal Step 2

Note: This document is a supplement to the official application for SSC's Step 2 proposal. The bulk of the document duplicates the information in the official application form, but presents it in a more readable format and includes a few illustrations. Several appendices provide additional information that has been gathered by the Linc (Learning in Community engineering class) students but was not considered directly in questions by the SSC.

Table of Contents

Project Background, Goals, and Desired Outcome

The overall goal of this project is to both fulfill the daily transportation needs of the FAA IT department and Allerton Park staff, and to promote sustainability on campus.

This project encompasses the design, construction, and testing of:

- a custom electric vehicle for the Fine and Applied Arts (FAA) Information Technology (IT) staff and their equipment
- solar panel charging station for FAA IT (capacity for two vehicles)
- solar panel charging station for Allerton Park Staff (capacity for six vehicles).

FAA is also in the process of procuring an additional electric vehicle for immediate use with its own funding. Allerton staff already have several electric vehicles.

Time line: After the design has fulfilled the needs and the functionality required of this specialty vehicle and two charging stations, parts will be ordered and fabrication, assembly, and testing will occur before delivery of the finished products in the Spring of 2013.

Preliminary IT Cart Project Design

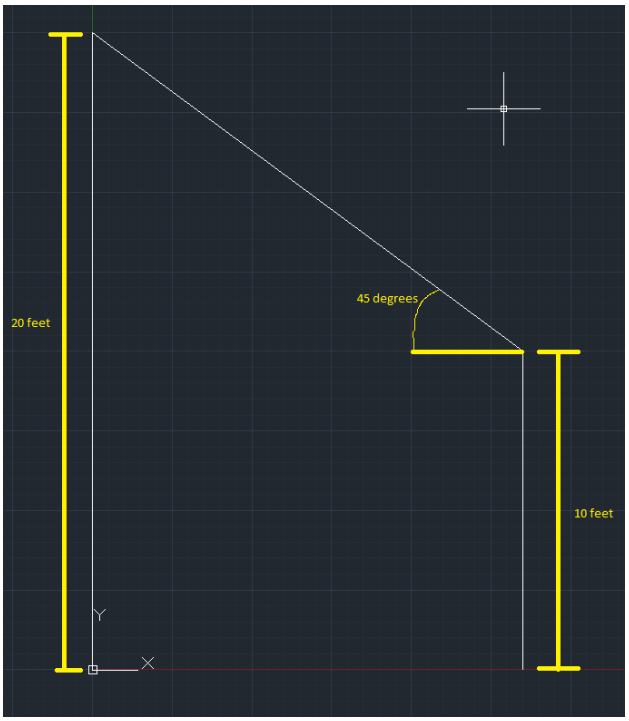
Currently, The FAA has employees driving their individual gas powered cars to all the buildings on campus. We would like to build a small, electric vehicle that will be able to transport the FAA employees around campus. This cart would be modeled after an electric golf cart but with an added bed for transporting computers from place to place. Our project will consist of 4 stages: design of cart, purchasing of the individual parts, construction of car, and testing of the vehicle.

FAA IT Initial Purchase Electric Vehicle:

An existing golf cart that inspires the custom design:

Preliminary Solar Project Design

The preliminary concept for the solar panel support structure uses Unistrut metal structures to hold up the panels. To link the panels together we will use 6 metal joints at each of the intersection points of the panels. To hold the whole structure up, and obtain a 45 degree angle, we will raise one end up 10ft and the other end up 20 ft. A side view is shown below. The final design will be simulated and analyzed by a team of graduate students to ensure that the frame is structurally sound and capable of resisting wind and snow loads.



A 3D conceptual view of the solar charging station is shown below:

FAA:

Allerton Park and Retreat Center:

How does this project promote sustainability?

There are many ways that the University could be more energy efficient. One of them is by replacing gasoline-powered vehicles used by different University organizations with electric alternatives. This would reduce carbon emissions and cut the cost of transportation by shifting dependence from gasoline to solar powered electricity. The University can be a leader by encouraging alternative energy, improving energy efficiency, and engaging students in supporting alternative sources of energy. This project is important and worthy of approval because it lowers our carbon footprint and helps the University reach its sustainability goals. These panels will be seen by many students on campus and they will be proud to go to a university that cares about sustainability. Ideally, the solar power charging stations will be available to anyone on campus wishing to recharge an electric vehicle. This will further encourage the use of electric vehicles on campus, with a hope to add several more "solar parking spots" across campus. Furthermore, some IT staff who feel compelled to use their personal vehicles for work purposes will be able to choose a more sustainable commuting mode.

Project Location

The cart itself will require a parking spot along with a parking permit to be provided by the university.

FAA: At the FAA, we will place the solar panels in a parking lot. in order to maximize visibility on campus (could be the same location as the cart or a different one). The exact location is to be determined and the project team will work closely with F&S to find a viable spot.

Parking spaces are typically 20' by 9', so our 4X4 array of panels (13.14' by 21.98') will take up approximately 1.5 parking spaces. These will be re-designed to occupy two parking spaces, to charge the two electric vehicles.

Allerton Park location: The ideal location for the solar array at Allerton is next to the electric vehicle (EV) garage which currently houses six EVs.

Allerton Park Solar Charging Station Location and Vehicle

Stakeholders

Many individuals and organizations are supportive of this project:

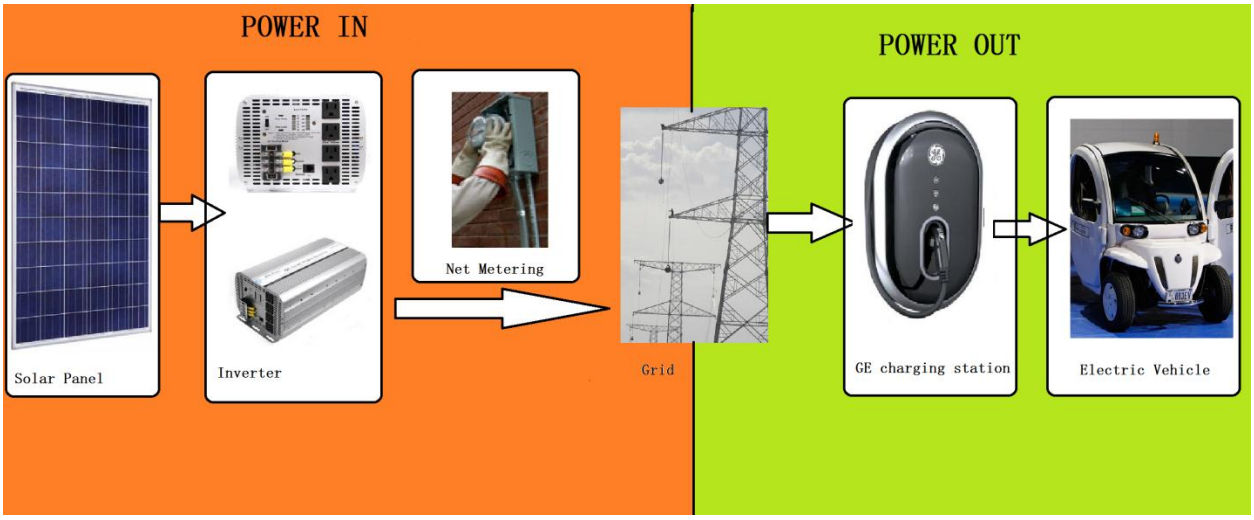
- The FAA Administration is very supportive of this project and they are funding the purchase of a second electric vehicle for the FAA (cost of approximately $15,000).
- Allerton Park is working on a plan to become carbon neutral and sought the help of the Linc class to help reduce power consumption.
- The Linc class will help with the construction of the vehicle and solar panels.
- The Linc students are working directly with the FAA IT Department and Allerton Park Staff to meet their needs for sustainable transportation.
- The students are also working with the Facilities and Services department to ensure that their vehicle will be street-legal and licensable, and to select an appropriate location for the charging station on campus.
- The Alternative Spring Break program plans to provide room and board for about 25 students to help with the construction of the Allerton solar charging station during spring 2013.
- Other departments, such as Intercollegiate Athletics department, have expressed interest in constructing similar facilities for their purposes in the future.

Student Involvement

Approximately eight engineering students from computer, electrical and mechanical engineering fields this semester have been at work designing the electric cart and solar panel charging stations. Their two Project Managers are also students and are benefitting from leadership experience. Next semester, in the build stage, additional engineering students will obtain hands on experience building the electric car and campus solar charging station. Twenty-five students will be able to help with the construction of the Allerton charging station during spring break 2013. Additionally, FAA students will be able to help with the project aesthetics. Other students across campus will have the opportunity to see and interact with the electric vehicles and charging stations in their daily use and feel proud that their university is supporting sustainability.

Scope and Schedule

Here is an image describing exactly what we are going to do for our project:



Task	Timeframe (# of weeks to completion)	Estimated Completion Date
Design of vehicle and charging stations	10	11/30/2012
Order parts for cart and solar stations	1	12/13/2012
Construction of vehicle and FAA solar charging station	7	3/4/2013
Testing of vehicle, Construction of Allerton solar station	3	3/25/2013
Vehicle registration	2	4/8/2013
Final adjustments to vehicle and solar stations	2	4/22/2013
Completion of Vehicle and Solar Stations!	1	4/29/2013

Budget Estimate

Budgets for the three major components of the project are outlined below. The electric vehicle is the highest priority, with the Allerton Charging Station as the next highest priority, and the FAA Charging Station as the final priority if full funding is not available.

College of Fine and Applied Arts Custom Electric Vehicle			
Item	**Cost Per Item**	**Quantity**	**Total Request**
Base Vehicle (mechanical)	$14,000.00	1	$14,000.00
Motor Controller	$1,000.00	1	$1,000.00
Li-Ion Battery	$351.00	8	$2,808.00
DC Motor	$900.00	1	$900.00
Parts for Control System	$1,000.00	1	$1,000.00
Cabling	$800.00	1	$800.00
Custom printed Graphic Decal	$400.00	1	$400.00
Miscellaneous expenditure	$1,500.00	1	$1,500.00
Design margin (15%)	$3,361.00	1	$3,361.00
Total Anticipated Expenses			$25,769.00

College of Fine and Applied Arts Solar Charging Station						
Description	**Manufacturer**	**Part Number**	**Quantity**	**Unit Price**	**Total Price**	**Comments and Specs**
240 V Wall Charger	GE	EVWSWBC-CP01	2	$899.00	$1,798.00	GE WattStation Wall Mount One
Inverter	AIMS	pwrinv500024w	1	$469.00	$469.00	5000 W Rated Output Power 24V
Solar Panels	Solar World	SW 240 Poly	16	$277.45	$4,439.20	240 Watt Panels
Infrastructure for Panels	Unistrut		3	$400.00	$1,200.00	Panel Structure and Welding
Infrastructure for Panels	Unistrut		16	$5.00	$80.00	Corner Joints to hold panels together from bottom
25 Year Total Maintenance	N/A	N/A	1	$469.00	$469.00	Replacement of Inverter
Unexpected Expenses					$1,268.28	Adding a 15% design margin
Total Anticipated Expenses					**$9,723.48**	

Allerton Park and Retreat Center Solar Charging Station						
Description	**Manufacturer**	**Part Number**	**Quantity**	**Unit Price**	**Total Price**	**Comments and Specs**
Inverter	AIMS	pwrinv500024w	3	$469.00	$1,407.00	5000 W Rated Output Power 24V
Solar Panels	Solar World	SW 240 Poly	48	$277.45	$13,317.60	240 Watt Panels
Infrastructure for Panels	Unistrut		4	$400.00	$1,600.00	20 Foot Structure
Infrastructure for Panels	Unistrut		48	$5.00	$240.00	Corner Joints to hold panels together from bottom
25 Year Total Maintenance	N/A	N/A	1	$469.00	$469.00	Replacement of Inverter
Unexpected Expenses					$2,555.04	Adding a 15% design margin
Total Anticipated Expenses					**$19,588.64**	

Note: Please refer to Appendices B & C for design rationale.

Ongoing Funding and Maintenance

As with any automobile, maintenance will be required, yet very minimal for this vehicle. The main consideration is the replacement of batteries which is expected to occur roughly every 6 years. The FAA IT department will take full responsibility for the replacement. FAA and Allerton Park will be responsible for the maintenance and eventual replacement cost of the solar charging stations, respectively.

Connection to Campus Sustainability Goals

This cart will both reduce the campus' net energy usage while additionally promoting clean renewable energy on campus. This vehicle will use only sustainable resources (electric solar energy) while consequently not relying on fossil fuels. The charging station at Allerton Park is part of their effort to become carbon neutral. The visible nature of these projects will be an example to the campus community of how to meet a practical need in a sustainable manner and will inspire other campus units to follow suit.

Greenhouse Gas Impact

This project will not have a negative greenhouse gas impact due to the use of renewable solar energy to charge the vehicle. We cannot however account for the emissions used in manufacturing the parts needed. The solar panels (both stations combined) should produce enough energy to reduce campus carbon emissions by 44.9 metric tons per year.

Publicity

The design of the vehicle allows for ample space for FAA graphic design students to contribute graphics promoting sustainability. Due to the usage of the vehicle, it will be highly mobile around campus and thus this sustainable electric vehicle will be widely promoted. FAA administration also plans to use the vehicle and charging station for their own marketing and promotional purposes (student recruiting and alumni events) to show the college's commitment to sustainability. FAA and Allerton Park will post an informational sign about the charging station and Allerton will use it in other publicity about their plan for carbon neutrality. The FAA IT department also plans to have a blog about the carts and charging stations and may track energy savings for educational purposes.

Outreach Goals

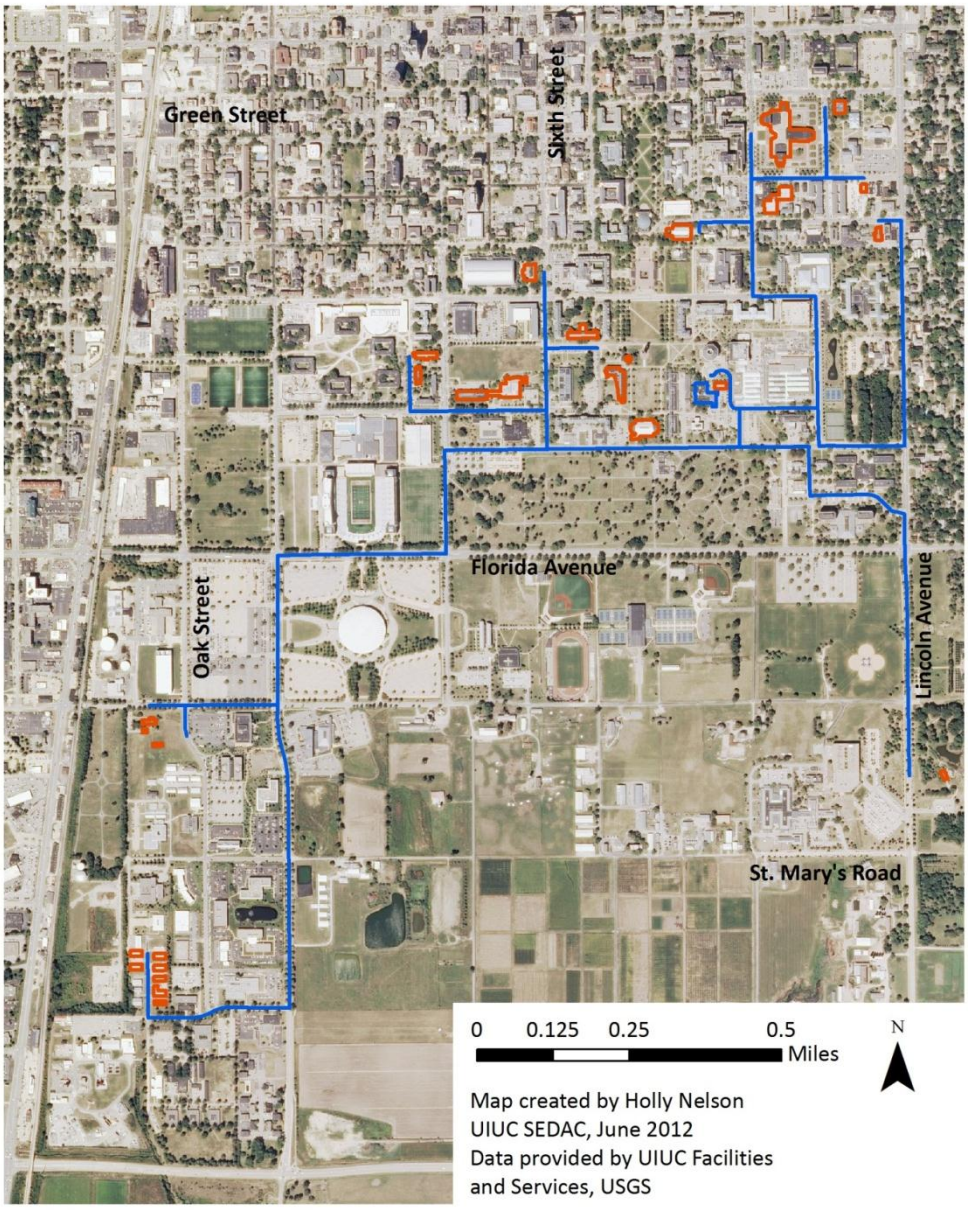
We have two main outreach goals. The first of which is to improve the perception of electric vehicles. Although this will be difficult to measure, the usage of the vehicle will clearly demonstrate the practicality of current electric vehicle technology. Our second goal is to influence other departments to move towards more sustainable methods of both transportation and general department activities. One way to measure the outreach of this project is if other departments decide to purchase or build their own electric vehicles and charging stations.

Appendix A: Partner Profile and Issues Analysis

The College of Fine and Applied Arts (FAA) and the Allerton Park and Retreat Center are interested in constructing a solar charging station capable of charging golf cart sized electric vehicles.

The FAA requires a solar charging station sized for two electric vehicles, while the Allerton Park and Retreat Center will need a solar charging station sized for six electric golf carts. Each electric vehicle will need a range of approximately 30 miles per charge (see map below for FAA routes to campus buildings). The electricity used by the eight total electric golf carts will come from two arrays of solar panels, which will result in almost zero marginal energy cost after installation. The solar charging stations will be designed to generate slightly more energy from the sun over a course of a year than is consumed by the electric vehicles. This results in a slight net positive transfer of sunlight generated power back to the electricity grid. In addition to lowering the cost of electricity, the solar panels address a commonly held misunderstanding that charging an electric car simply pushes carbon emissions to the power plant [7].

Figure 1: IT Routes to Fine and Applied Arts Buildings



Appendix B: Design Rationale for IT Cart

Body Design:

The basic chassis of the vehicle will be designed from a golf cart chassis with a modified structure to haul a load of up to 600 lbs. The vehicle will seat two people, and due to this design, the cab will be able to accommodate a small bed for loading and unloading equipment. This cab will also be modified to fit an enclosure for all weather situations. The tires will be changed from the standard street tire to possibly an off-road type design in order to handle driving not only the pathways, but also snow and other conditions which make travel difficult. Removable doors will be provided for protection during changing weather.

Power System:

The car will be powered by 8x 6V Trojan Battery T105. This is a relatively strong battery capable of supplying 225 Amps per hour. This is more than sufficient to traverse approximately 20-25 miles on a single charge. The battery itself will have a 3-5 year lifespan, which at the cost of $152 per battery, makes this a very economically sensible option. The battery will power a 48 V, 2.5 Horse power Shunt Wound DC electric motor. Shunt Wound motors are excellent for precise speed control. It is classified as a constant speed motor because the motor is designed in such a way that torque does not decrease as much as typical motors when the speed increases. Only after going 2.5 times the regulated speed will the motor's torque delivered actually decrease dramatically. This makes for a very reliable motor that will be easy to control. While speed control will not be a large issue, for added safety, we will also implement a kill switch into the power system to immediately cut off the power in case of an emergency.

Control System:

The control system for the electric vehicle will almost be entirely created from scratch. A very basic initial plan for the control system is to use an Atmel AVR microcontroller board which will have the ability to read input values for any sensors or input from various user settings. Additionally the output from the microcontroller allows us to use the same microcontroller to control the power system. Many current vehicles use separate systems for each of these elements. Not only do separate systems over complicate a reasonably basic control structure, but by having the entire vehicle controlled by one central node, we will be able to easily incorporate many innovative technologies. Some of these may include automatic headlights, backup sensors and automatic shutdowns.

Miscellaneous:

We plan on collaborating with fine and applied arts students as per the design/ general aesthetics of the vehicle. We are additionally planning on having advanced features such as back up warnings, automatic headlights and convenient features to enable IT supply.

Performance:

- Performance Seating Capacity: 2 Person
- Weight Without Batteries: 820 lbs.
- Curb Weight: 1310 lbs.
- Bed Load Capacity: 550 lbs.

- Vehicle Load Capacity: 1000 lbs.
- Outside Clearance Circle: 22.0 ft.
- Intersecting Aisle Clearance N/A br.>Ground Speed (level ground): 16 mph ± 0.5 mph
- Towing Capacity: 600 lbs. max load
- Power Source: 48 Volts DC
- Horsepower (kW): 2.5 hp. (1.9 kW) at 2700 rpm
- Electric System: 48 Volt
- Key or Pedal Start Pedal Start

Appendix C: A Rationale for Solar Panels

Should we only use solar panels, or should we use some other form of renewable energy?
Solar is the best option because it is very space efficient, and allowed to go on rooftops and anywhere we decide fit. For the amount of power we plan to generate, solar panels will be the least expensive option. Even a small wind turbine will cost over ten thousand dollars.

Should we integrate our solar panels to the grid?
We have determined that grid integration is the best option. If we did not integrate the solar panels to the grid, then we would have to have some sort of energy storage. Among the energy storage options, batteries would be the most logical. The reason we have chosen grid integration is because batteries are costly and they need to be kept at a certain temperature range to be effective. Using grid integration will allow us to have net metering, which can have a significant project payback. Because we are using grid integration, we need to purchase an inverter to convert DC to the 120V AC grid.

Should we invest in suntracker technology?
We have determined that we will not use suntracker technology. We will place the panels at the optimal 45 degree angle to the horizontal and facing south. Suntracking technology will use power and cost extra money, and thus is not be the most economical option.

What type of solar panels?
We have decided to use Solar World solar panels. These are 240W panels. The reason we chose Solar World panels is because the cost per kilowatt, ($277.45/$240W)*(1000W/1kW) = $1156.04/kw, is the lowest cost we could find. More information and specification can be found at [5].

How does net metering work?
Net metering allows Ameren's electric customers who generate some or all of their own energy to offset energy provided by Ameren. If you install a solar energy system you will first use the power your system generates. If more energy is needed, the meter pulls it from the Ameren grid. If you generate more solar energy than you need at the time, the energy goes to the Ameren grid for others to use and will be deducted from your bill.

We will connect our solar panel station to a big building that consumes a great amount of energy every month, so the energy that is generated will never go above the building's power consumption. Since we will not be overall energy producers, we will not need to sell any of the energy we generate back to the grid. According to the 16-107.5 section of the Illinois Compiled Statutes , after we have our solar panel station it will be rated as not competitive because we are not overall producers.

How are we going to charge the vehicles?

We have been looking for the best EV charging station, after some comparisons we decided not to use the *Schneider Electric EVlink Full 30A* for being too big while giving the same power (7.2 kW.) We were looking at the *Siemens Versicharge 30A Black Bottom* because it was $30.00 less than the *GE WattStation Wall Mount one*, but it would take at least two months to have it delivered. So we finally decided to get the *GE WattStation Wall Mount one*.

All of these charging stations are "level 2 stations" which means that they work with 240V. We decided to use these ones because the time to charge decreases drastically, versus using a wall outlet (approximately 6 times faster). The GE station will use 30A which will give us 7.2 kW at 240V since Power=Voltage *Current. Depending on the capacity of the battery in the vehicle, and the state of charge or the (Remaining Capacity / Expected Capacity), this charger will be able to charge batteries in one to two hours.

The GE WattStation is the smallest one we found (only 24 x 16 x 6 in). This can be used both indoors and outdoors, which gives us more flexibility. Finally the GE charging station is the only "intelligent one" in terms that ensures zero consumption when the unit is not in use.

We have decided to buy from Amazon because it is the cheapest place to buy it. They will cost $899.00 including shipping, and it should arrive 2-3 weeks after we purchase it.

What will the charging time be for the vehicles?

With our setup, we have determined that charging one golf cart sized vehicle from 0% capacity to 100% capacity will take approximately 1.055 Hours. Since the fully discharged batteries of one golf cart sized electric vehicle are going to sum up to 7.6kwh, this means that it will take (7.6kWh / 7.2 kw) = 1.055 Hours to charge the batteries from 0% capacity to 100% capacity.

How many peak sun hours per day are we going to have?

We used [6] to calculate the number of sun hours per day. We had to make an assumption that we are at the same latitude as Indianapolis. With this assumption and the USA Solar Store guidelines, we determined that Champaign receives an average of 4.2 sun hours per day.

How many solar panels do we need?

The designs for the charging stations for College of Fine and Applied Arts, and the Allerton Park and Retreat Center will be similar because they have very similar needs . Our research showed that a golf cart sized electric vehicle will have a 7.6 kWh battery pack. Therefore, for two electric vehicles of golf cart size, the combined battery capacity will be 7.6*2=15.2kWh, and for six electric golf carts, this goes up to 7.6*6=45.6 kWh. If we assume that all cars will drain the battery completely each day, then we will need solar panels that will generate 15.2kWh/day and 45.6kWh/day on average, in order to have a net zero grid usage for the electric vehicles.

A single panel would produce 1.008kWh per panel per day. This was calculated by multiplying the panel output (240W) by the peak sun hours per day (4.2) = 1.008kWh/day. Then we took our target of 15.2kWh and 45.6kWh and divided by 1.008kwh. This turns out to be 15.08 panels and 45.238. As engineers we like to round up because you cannot have a fractional solar panel, therefore we will use arrays of 16 panels and 48 panels. Our 16 panels will give us (16*1.008kWh/day) = 16.128kWh/day, and our 48 panels will give us (48*1.008kWh/day) = 48.384kWh/day.

What type of inverter are we going to use?

There are lots of inverters on the market that you can choose from. For the FAA and Allerton Park and Retreat Center, we chose the *AIMS 24 Volt Power Inverter (model #: pwrinv500024w).* We chose this inverter because our solar panels will produce 16.128kWh/day. We have 4.2 sun hours per day, and the rated output of our inverter is 5000W. Now if we multiply (4.2*5000) = 21kWh/day, which is more than we will normally need, so in case there is a hot day we will be under our ratings. For Allerton, we will purchase another two inverters to compensate for the required rated output. Another advantage is the small size for the output; dimensions are 17.5"X 8"X 6". A second great advantage is that this inverter has a 34 to 20 Volts input (we will be working with 30V) eliminating the need for a DC-DC converter. Without an added DC-DC converter, we will have a higher efficiency. The inverter efficiency is between 90 and 95%. The price will be $469 in TheIverterStore.com and we will have it within 3 business days [9] [10].

How large is the physical size?

Each panel is 65.94" by 39.41". For the FAA, the total array of 16 panels (4x4) is 13.14' by 21.98'. For the Allerton park and Retreat Center, we will have an array of 48 panels (8*6) = 26.27' by 32.97'.

Appendix D: Project Scope, Deliverables and Broader Impact

We are going to design a solar charging station with grid integration. We will not utilize the suntracker technology to change the angle of the panels with respect to the sun.

The one-time cost for the FAA solar charging station is $9,723.48, however over the long term it will pay for itself. The estimated rated output for a single charging station is 16.128kWh/day, considering the electricity price for our state is around 12 cents/kWh, we must multiply all these together. For one year it is 16(kWh)*0.12(dollar/kwh)*365(day/year) = 700.8 dollar/year. Ideally it takes less than (9,723.48/700.8)=13.9 years to pay back the cost. After 13.9 years we could make about $700 dollar annually.

Practically our solar panels enjoy a 25 years linear performance guarantee (-0.7%) and extension of product warranty for 10 years. Our inverter can hold up to 90%-95% efficiency for 15-20 years. In a 25 year period the profit is approximately (assume 92% efficiency for inverters)

$$\sum_{i=1}^{25} 700.8 \times 92\% \times 99.3\%^{i} = 14730.56$$

Since our inverter has an average lifetime of about 15-20 years, we assume one replacement of the inverter in a 25 year period, of $469.00. The lifetime of the GE WattStation is 25 years, so we will be ok for the 25 year span we are considering.

Appendix E: Analysis of Safety, Environmental, and Ethical Issues

IT Cart:

We will strive to build a cart according to the American Society of Mechanical Engineers (ASME) as well as the state of Illinois standards. According to Illinois law, "Golf carts, four-wheeled ATVs and similar

"non-highway vehicles" may operate only on streets with a posted speed limit of 35 mph or less". We have not found any legislation that would prohibit the use of the above prescribed vehicle in the Urbana-Champaign vicinity. Additionally, special registration is required for a custom vehicle in Illinois as described at http://www.dmv.org/il-illinois/custom-built-cars.php.

While we cannot attest to the safety of an un-built, untested vehicle, we will design the vehicle using the utmost safety precautions. An emergency stop button will be readily available for the driver in the case of a malfunction. Because we will be building the control system and power system, malfunctions are a very real possibility. However, the system will be designed that in the case of a failure ex: motor controller malfunction, the control system will be able to safely handle the situation. Additionally, we must make sure that our physical design does not obstruct driver vision in any way. Finally, we must be very careful that the IT cart holder on the back will always steadily hold the cart as to prevent pieces from falling.

Because the cart will be completely charged from the solar charger, the cart will result in an MPGe (miles per gallon equivalency) rating of infinity. At this stage in the design, we cannot accurately determine output efficiency. One of the major environmental concerns is the battery system. When the batteries must be replaced, the IT department must be aware of proper battery recycling procedures.

Charging Stations:

Each and every charging station we design will meet all of the necessary safety standards. When working on energized equipment, safety is always a number one priority. Measures such as Lockout Tagout will help ensure everyone is working in a safe environment. We must also be sure that the components we select are up to safety standards. Our GE WattStation meets all of the following standards compliances: SAE J1772; NEC 625; UL 2231, 2251, 2594; NEMA and NIST; CUL 2594 and 2231 [3]. Our inverter Complies with UL 458 Standard [1]. Our solar panels are UL 1703 IEC 61215 and IEC 61730 safety tested [5].

A large reason for the creation of these charging stations is not only to provide energy for vehicles, but instead to make a positive environmental impact in the Champaign-Urbana community. These charging stations will reduce our overall carbon footprint. Using the carbon footprint calculator, we have determined, that using the solar charging stations in conjunction with the eight electric golf carts, we will reduce our total carbon footprint by 44.90 metric tons of CO2 per year [8].

Creating this group of charging stations will be a win-win situation for the school and the students. Staff will gain access to an environmental-friendly mode of transportation while the students taking the Learning in Community course will have the most hands-on experience learning and building the transportation system. We will be making an impact on future generations, students will understand the need of cleaner transportation systems and this project can be something that we can all be proud of.

Appendix F: Information Sources

[1] Sunray 3000 Inverter Information

"Ramsond SunRay 3000." *Ebay*. N.p., n.d. Web. 26 Sept. 2012. <http://vi.raptor.ebaydesc.com/ws/eBayISAPI.dll?ViewItemDescV4&item=180974712208&t=0&tid=10&category=41980&seller=padovaimports&excSoj=1&rptdesc=1&excTrk=1#datasheet>.

[2] GE WattStation Wall Mount Information (Amazon)

"GE WattStation Wall Mount - Level 2 EV Charger - 7.2kW, 30A." *GE WattStation Wall Mount*. N.p., n.d.

Web. 26 Sept. 2012. <http://www.amazon.com/GE-WattStation-Wall-Mount-Charger/dp/B0069VTGPE/ref=cm_cr_pr_product_top>.

[3] GE WattStation Wall Mount Information (Home Depot)

"Shipping Methods." *Residential Electric Vehicle (EV) 40A Level 2 Watt Station with Plug-EVWSWBC-CP01 at The Home Depot*. N.p., n.d. Web. 26 Sept. 2012. <http://www.homedepot.com/h_d1/N-5yc1v/R-203001939/h_d2/ProductDisplay?catalogId=10053>.

[4] Level 2 Charging Station Information

"The Chevy Volt Review - Featured Article." *Chevrolet Volt Level 2 Charging Equipment 240v Installation, Costs, Rebates, and Incentives (updated)*. N.p., n.d. Web. 26 Sept. 2012. <http://www.mychevroletvolt.com/chevrolet-volt-level-2-charging-equipment-240v-installation-costs-rebates-and-incentives>.

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