UHD Solar Park Canopy Proposal

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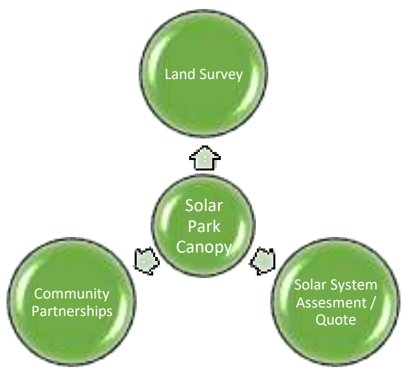
Contents

Introduction

Energy consumption and fossil fuel dependency are one of the many issues our planet and its inhabitants face. If we were to accurately calculate the total annual energy footprint of one person, we need to factor virtually all of mankind's activities. From the production and purchase of clothing to the heating and cooling of every building a person steps into. The average person will end up consuming twenty-million watt-hours of energy throughout a given year. This translates to 6.5 metric tons of carbon dioxide emissions (EPA 2018).

It is unrealistic to expect or force a change in human behavior whether it be our energy consumption or dependency on fossil fuels. Especially in a city like Houston, Texas, which shares a hot-humid tropical environment inside a highly dense urbanized populous that is heavily reliant on air-conditioning and personal transportation. However, we can consider integrating renewable energy practices like solar park canopies into the existing infrastructure on top of parking lots. A localized, sustainable solution that will not disrupt but enhance human behavior by acting as a covered parking lot to protect our cars from weathering while generating power for our ac units.

Implementation Steps



Land Survey

- A land survey allows us with the means to determine the size of our solar park canopy. It will give an idea of what engineering requirements we need along with any building or energy-related permits. A solar system installer will request this information prior to an assessment or quote. The information we will need to collect listed below.
    - Lot Size and Dimensions
    - Number of Parking Spaces
    - Engineering Requirements
    - Structural Design and Dimensions (CAD File)
    - Building and Energy Permits

Solar System Assessment and Quote

- One of the first questions a Solar System installer will ask for is the size of the solar system. They will follow up by asking for property dimensions and CAD files from a structural design engineer. Without an engineer or an assessment, we will not know our energy and financial savings. We will not have a clear-cut budget for the UHD board of regents and financial committee to consider and review our proposal.

Community Relationships

- Due to project costs, we might consider filing for government grants that pertain to green energy initiatives.
- Banking institutions are also known to be involved and typically own the green assets (solar panels) through a lease/loan agreement.
- An agreement made by an energy company like CenterPoint or Reliant will need to be made that will administer the transfer of energy into the city grid.

Potential Challenges

Initial Investment

The technology is proven but, the overall scope of the project would classify those that incorporate solar park canopies as early adopters. We believe the biggest challenge is the total upfront costs to develop and integrate a solar park canopy to an existing parking lot. Specifically, the costs associated with the set up of a solar system that will justify the initial investment. We will see mass adoption if the total project costs are lowered to provide a return of investment within eighteen to twenty-four months.

Time-Intensive

The most taxing challenge is the engineering requirements and relationships between the government and utility companies. For instance, The Department of Veteran Affairs has invested nearly five-hundred million dollars into solar-related projects (Gabel 2011). The solar system at Houston's VA Medical Center has been presumably built and awaiting Center Point approval for three-years (VA 2018). Other challenges might include land surveys and communication between contractors.

Research-Intensive

One of the more research-intensive challenges is to discover how much power we can save. This information can only be determined by knowing specific information about an institution's utility bill from energy consumption to a building's Leadership in Energy and Environmental Design (LEED) rating. We generalized these numbers in our proposal due to the intricates of this project. For instance, it is noted that the Diablo Valley College's solar park canopy can power two-hundred people per year whereas a typical solar system can power roughly 0.4 people per year (Switch Project 2017). The results vary on a case-by-case basis.

Sustainable Analysis

System	50kw	75kw	100kw	250kw	500kw	1,000kw
Solar World Installer Price	$75,900	$111,870	$147,840	$369,600	$694,400	$1,332,800
Property Size SQFT	3,342	5,013	6,684	16,710	33,420	66,840
Carbon Emissions Metric Tons	0.037	0.0555	0.074	0.185	0.37	0.74
Human Impact Est. Homes	10.5	15.8	21	52.6	105.3	211

The header row in the table above is sorted by the smallest to largest kW size of a solar system. The first and second row displays the estimated costs and property size. The potential carbon emission savings are seen in row three and are measured based on the system size. We measured the human impact by stating the average US home needs 4,750 watts of power on a daily basis. We divide one-thousand by the average electricity consumption then times this number by the chosen kilowatt system. A 100-kilowatt system is estimated to power roughly 21 homes.

Average Cost	Number of Panels	Power Generated	Savings	ROI	Suited to
$150,000	381-410	430-480 units per day	$30,000 - $40,000 Annually	3 – 5 Years	High energy usage, receive annual bills around $47,000

The table above depicts the economic forecast for a one-hundred-kilowatt system (Infinite Energy 2018). However, the average cost excludes the development of the parking structure. Angel Diaz, General Engineer at the Michael E. DeBakey Veteran Affairs Medical Center, states that the installment of a solar array on an existing carport structure will lead to a negative rate of return. He states this is one of the reasons most private entities do not choose this type of installation (Diaz 2018).

Our findings suggest that the structural design of the parking cover should incorporate the solar panel dimensions for optimal performance. The solar array must point true south where the line of sight between the panels and Sun is not obstructed by buildings. Prior to making the leap to a PV Carport Solar System, we also suggest conducting further research on Solar Thermal Systems as it might be more expensive yet most efficient in comparison to Mono-Crystalline, Poly-Crystalline, and Thin-Film panels (Gabel 2011).

Proposal Overview

We believe UHD's best localized, sustainable solution is the implementation of a solar park canopy. Parking Lot A receives optimal sunlight hours and is frequently utilized by faculty and staff. A small investment in UHD's greater mission of becoming the most sustainable urban university in America.

Parking Lot	System kW	Solar World Installer US Dollars	Structural Size SQFT	Lot Size *SQFT*	Carbon Emissions Metric Tons	Human Impact Homes
A	100	$147,840	6,684	71,806	0.074	21

The proposed one-hundred-kilowatt system holds enough power to provide electricity for twenty-one homes and eliminate one-hundred sixty-seven pounds of carbon emissions with a price tag between one-hundred to two-hundred thousand dollars. UHD will receive a return on their investment within five years and will be built on top of seven-thousand square feet of underutilize space and attain a minimum annual savings of thirty-thousand dollars through the energy produced.

Conclusion

It is unrealistic to expect a change in human behavior. However, we as a UHD family can change through the modernization of carport solar. Our one small step to fossil fuel independence can encourage the adoption of Electric Vehicles (EV) at our institution. To entice and make the ownership of an EV a practical daily urban driven car through the attachment of plug-in adapters from our solar carports. A way for us to retrieve the electricity we use for our air cooling and heating units. The path paved by UHD to a sustainable future.

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