Solar Bus Stop

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Abstract

Current bus stops do not have enough shelters, signage, lighting or information. Our solar powered bus stops can provide passengers with lighting and information while they wait, using energy from photovoltaic panels. Our goal is to not only provide convenience to all the passengers by setting up solar bus stop, but also produce clean energy for the environment.

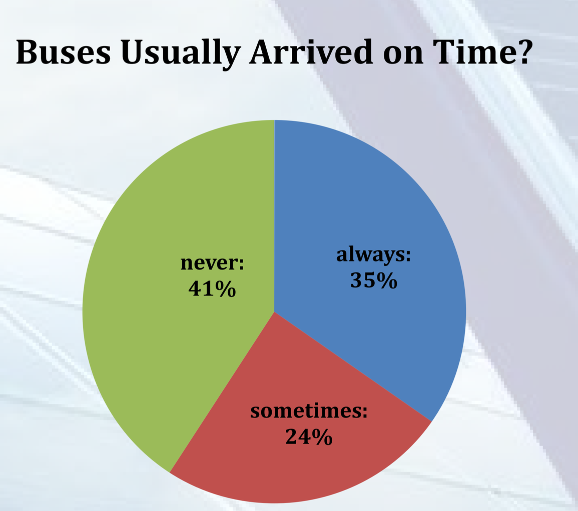
Background

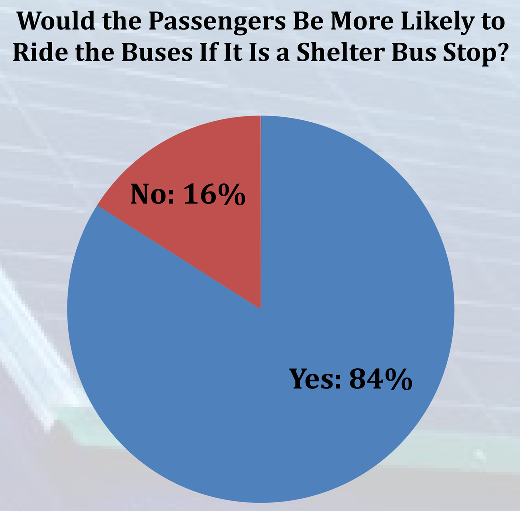
In fact, solar bus shelters connected to the grid have been used in Corona, California. (Solar Bus Shelters From GoGreenSolar 2011) However, this new product is not widely used. Our plan is to design a feasible solar bus stop to provide convenience for passengers by displaying bus schedule on a LED board and lighting at night. Solar panels make it possible to power the bus shelter, so we suggested placing them on the rooftops of the shelters—part of the solar energy could support the energy consumption of the bus stops and excess energy can be transferred back to the grid. Federal cash grant has 10% to 30% payment for renewable green projects depending on the project types, and 30% tax credit for solar projects. (Treasury.gov)

Project Goals

- To understand the existing technologies and make a workable plan to construct a smart solar bus stop.
- To evaluate the economic and future prospects for smart solar bus stop.
- To understand the feasibility of a smart solar bus stop.

Survey Analysis





Since our sample size is 50 passengers in Boston, MA, there may be a few flaws. However, from the first pie chart above, it clearly indicated that a display for real-time schedule is needed for passengers' convenience. In addition, a lit shelter bus stop will increase ridership according to the second pie chart.

Calculations

Cost of Each Item:

Equipment	Model	Cost per Item (USD)	Quantity
Shelter (5 – 8 grand) [1]	ALS510A0FR	6000	1
Computing Device [15]	Picotux Linux	90	1
LED Sign [8]	XR-2650x4 D	70	1
LED Light Tube [13]	T12 T8 LED Tube Light	70	4
Solar Panel [17]	AUO ACUnison PM240PA0	750	3
Power Inverter [18]	XOvision XO650	30	1
Battery [16]	SUN XTENDER PVX-690T	220	2
Maintenance Fee & Additional Cost	-	2000	-
Total Cost:		$ 11,160	

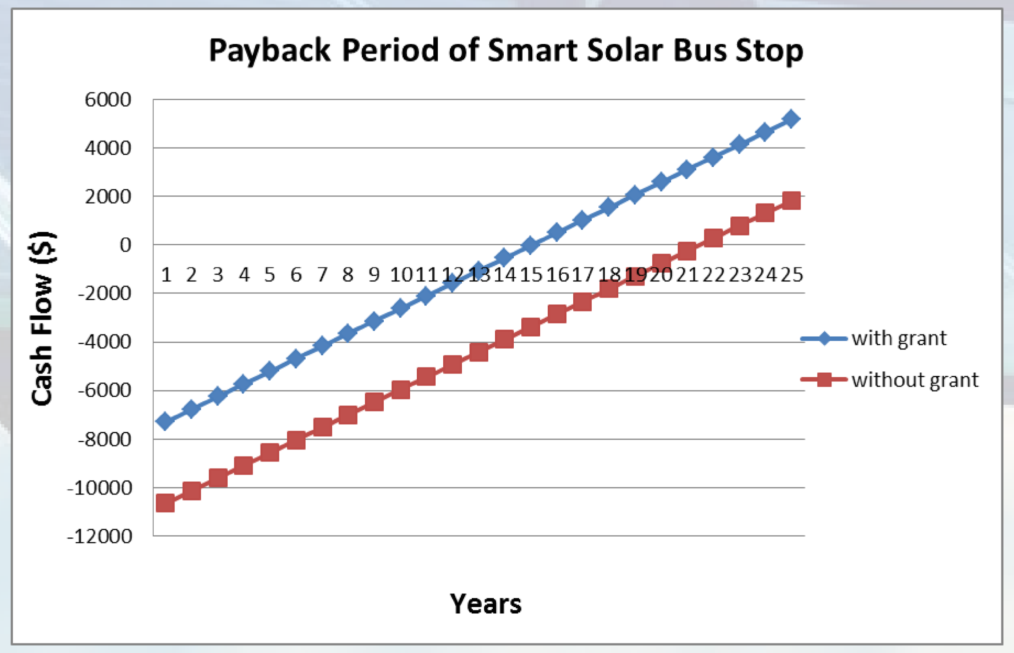
Energy Consumption of Each Item:

Equipment	Energy Cost (Kw)	Quantity	Running Time (H)
Computing Device	0. 000825	1	24
LED Sign	0.112	1	6
LED Light Tube	0.017	4	12 (Night time)
Total Cost:		1.5078 (kWh) per day	

Power Generation of Solar Panels:

Equipment	Model	Quantity	Generation (kW)	Running Time (H)
Solar Panel	AUO ACUnison PM240PA0, 240 Watt	3	0.24	10 (Daytime)
Total Generation:		7.2 (kWh)		

7.2kWh - 1.5078kWh = 5.6922 kWh sent back to grid per day,
365 days * 5.6922 kWh/day = 2,077.653 kWh sent back to grid yearly.
The public transportation get pay back $250 for every megawatt hour, that equals to $0.25 per kilowatt hour, including solar energy credits.
2077.653(kWh) * $0.25(per kWh) ≈ $519.41
11,160/519.41 = 21.4 ≈ 21 years
This project will earn the construction money back no more than 21 years since it will raise the ridership. Assume the federal cash grant provides 30% of the total cost of the bus stop, the total cost of a bus stop with grants will be $11,160*(1-30%)=$7,812. The project will earn the construction money back no more than 15 years with grants. The following graph compares the payback periods between project with grants and without grants.



Interview Analysis

Mr. O'Neil, head of the WRTA, told us that they are already implementing some of our ideas; they use GPS to track their busses, as well as data such as where passengers are getting on and off the bus. However, he was unsure of putting technology in the shelters for fear of vandalism.

Smart Solar Bus Stop Structure

- Shelter with solar panels on the roof
- A LED display for real-time schedule and other information
- Lighting system
- Excess energy is sent back to the grid

http://www.inhabitat.com/wp-content/uploads/bottlebusstop-ed01.jpg

Conclusions

- The smart solar bus stop will make profit after 21 years without grants and make profit after 15 years with grants. Since the smart solar bus stop will increase ridership, the public transportation authority will make more profit, and they can spend the profit expanding this project or another project.
- Smart solar bus stops are feasible with the following advantages:
    - No utility expenses
    - Energy Saving
    - Increase ridership

Acknowledgments

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