Solar Salvation at WPI
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Goal
To examine the feasibility of photovoltaic systems on WPI campus

Abstract
Photovoltaic cells capture the sun’s energy and convert it into electricity. Many college campuses, such as Harvard University, Smith College, and the University of Vermont have already installed and implemented this energy saving technology. Based on these precedents, the Sun Riders studied the potential for photovoltaic cells at WPI. The group performed a cost analysis of environmentally friendly photovoltaic cells and calculated the payback period for installing a minimally complicated configuration of this technology on the rooftops of six buildings on the WPI campus. The costs savings would be $1,779,000 over the next 25 years with the initial cost factored in. Without any rebates, the payback period of this project is 19.5 years.

Methodology
1. Decide which buildings to put solar panels on
2. Decide which solar panel to use
3. Decide which inverter to use in order to convert direct current to usable alternating current
4. Determine the amount of sunlight Worcester experiences per unit area annually
5. Determine the efficiency of the proposed system
6. Determine the projected electrical production of the proposed system
7. Determine the annual savings based on the projected price of electricity
8. Determine the amount of time necessary for the system to pay for itself

Analysis
• Based on the satellite images from Bing Maps, we determined the available roof space on all buildings to be 8,890 square meters.
• Each solar panel as proposed would be tilted at an angle of 43 degrees above the horizontal. In order to prevent one panel from shading another, we determined that the amount of space needed for each panel would be 3.11 square meters.
• By dividing the total amount of space available by the space occupied by each panel, we found that we could use 2,888 panels. We knew the dimensions of each proposed panel, so we found that 4,087 square meters would be hit by sunlight.
• We found that the average daily insolation in Worcester, MA for a 43 degree surface is 5.299 kWh per square meter per day. Based on this number and our estimated system efficiency of 14.6%, we were able to find an estimated electrical production of our system. In 2009, the proposed system would produce 1,150,000 kWh. However, the panels are expected to degrade in production by 0.6% annually.
• The system would cost roughly $4,579,000. Rebates are not available for the proposed system, so the payback period for the system is roughly 19.5 years. This is a relatively long payback period, although 19.5 years is well within the solar panel warranty of 25 years. We realize that those paying for a project would rather experience short term profitability. Some other scenarios are briefly described in the conclusion section.

Conclusion
Solar energy is technologically well developed, and it has great potential to contribute to energy savings on our campus. It is clean, sufficient, and can be relatively economical depending on the manufacturing process used. There is much to explore before making a final decision about whether it is feasible for our campus.

Over the next twenty-five years, it is likely that there will be a vast amount of research and development done on solar technology to better improve its efficiency. If the efficiency of solar panels exhibited a strong increase in the coming years, then a project like this may sound more appealing to this campus in the not too distant future.

Rebates are the key to short-term profitability. However, these are only available to tax-paying institutions and PV projects under 500kW. We suggest that if WPI wanted to install photovoltaics, they should explore projects under 25 kW, where MTC rebates of $3.50 per Watt are available. The details of such a project can be explored further by other groups.

Resources

Acknowledgements

Sun Riders

Below is an image of our proposed solar panels, angled at 43 degrees above the roof surface. To account for solar shading, panels must be separated 1.07 meters apart.