**Cost/Benefit Analysis of Installing Solar Panels in Albany, NY**

**Introduction**

Over the last few decades the efficiency of solar panel systems available for residential use has steadily been increasing, with the costs associated with these systems trending inversely and decreasing significantly over the years. When solar panels were first introduced as an alternative power source to residential customers, prices were prohibitive and the early adopters were often those worried more about the invironmental aspect rather than the bottom line. As technology has improved and manufacturing has scaled up, the math has started to shift towards solar power being not only the 'green' option, but a profitable one. There are a multitude of Federal and State financial incentives for transitioning to solar power (<https://www.dsireusa.org/>); the costs associated with both instalaltion and upkeep have dropped significantly; many states have passed net metering laws (<https://www.seia.org/initiatives/net-metering>) which allow customers with solar power to essentially "sell back" any power they generate in excess of what they use - a huge boon since solar panels cannot generate power at night and "saving up" excess power with batteries can be extremely costly.

There are, however, limitations and considerations that need to be taken into account in order to evaluate the financial viability of transitioning one's home to solar power. One of these is the amount of sunlight one's roof is exposed to throughout the year - the National Solar Radation Database (NSRDB) has been tracking the Global Horizontal Irradiance (GHI) data for the United States for over 25 years (<https://nsrdb.nrel.gov/>). It provides information based on coordinate data for the amount of sunlight an area was exposed to on any day of a given year (hourly data is available). The azimuth of the roof the panels are installed on then influences how much of the sunlight the home is exposed to gets converted by the panels. Another factor is the length of time before the house is sold, since the major costs associated with solar panels are paid up-front. This aspect is counter-balanced by the value added to a home by the presence of solar panels (Soak up the sun Article). The area of one's roof obviously limits the size of the sytem a house can handle. Finally the power consumption habits of the household and local electricity costs impact the demands on the system and baseline cost-profile. All of these factors must be accounted for in a decision to switch to solar panel.

**Problem Formulation**

The costs associated with solar power have dropped dramatically over the years, and the benefit to the environment is both as real as it ever was and more important than ever. This project will look at homes in Albany, NY and create a calculator that will account for the factors discussed above in order to provide a consumer with a detailed prediction on how installing a solar panel system would impact them financially. Ideally it will ask for an address and use a google API to determine the roof surface area as well as azimuth.

**Objectives**

This project will provide an interactive calculator of the long term financial outlook of installing a solar panel on a home in Albany, NY. In order to perform this calculation, the calculator will:

* Run multiple simulations based on data from the NSRDB to estimate likely sunlight exposure over the next several years.
* In order to determine the output of the solar panel array, the surface area of the roof (and ostensibly solar panel array) and azimuth will ideally be gathered via a Google Maps API; failing that they will be entered as an input by the user.
* Different efficiencies present in the market will be simulated and presented in the output (<https://news.energysage.com/what-are-the-most-efficient-solar-panels-on-the-market/#:~:text=Most%20solar%20panels%20are%20between,are%20not%20above%2020%25%20efficiency.>)
* Energy consumption will be estimated based on household size (<https://www.sciencedirect.com/science/article/pii/S2352484716300932>) and (<https://compareelectricity.com/energy-usage/NY/Albany/12244>)

**Paper Summaries**

**Methodology**

**Evaluation**