Solar Energy: Is It Worth It?

New Mexico
Supercomputing Challenge Final Report

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Executive Summary

With depleting supplies of fossil fuels, countries have sought to find alternatives to provide electrical power to homes and businesses.[1] Solar energy has been identified as more environmentally friendly than fossil fuel energy and is a renewable source of power. However, concerns have been raised about the high cost of installing the panels and wires needed to use solar power. [2] The purpose of this project was to determine if the benefits of utilizing solar energy outweigh the high implementation cost. To solve, or help solve, this problem, I researched how much power common household appliances use by using a watt meter. In addition, I researched the cost per kilowatt hour for power provided through traditional power companies and through hybrid power sources to power the same household appliances.[3] Python was used to develop a computerized model of my variables and to compare the different sources of power. I concluded that hybrid sources of power provided the most feasible alternative to traditional sources of power but only in some areas of the country.

Solar Energy: Is it worth it?

Introduction

Concerns regarding the long-term availability of fossil fuels and the impact of their use on the environment have led to research into alternative sources of power.[4] Solar, wind and water have all been identified as alternatives to use of fossil fuels to provide electrical power for our homes and businesses.[5] However, the high cost of implementing use of alternative energy sources has been described as a barrier to their use.[6,7] Consequently, the question is whether solar power is worth the high cost of implementation. The purpose of my project was to create a computerized model to see if using solar energy is feasible. My findings may influence the use of alternative sources of power.

Description

To make an accurate/semi-accurate model, I created a model of a typical home containing common household appliances (i.e. a stove, lights, washer/dryer). My model home was based on a home with common appliances, 5 rooms, and around seventeen light bulbs and the average power consumption of a home this size. I researched online sources to identify the cost per kilowatt hour of traditional power and the implementation costs for solar and wind power. This information was used to identify the point where the implementation costs of hybrid power have been recovered and the hybrid power began paying for itself. Graphs were created on the side of the model to show the differing cost between traditional electrical power and hybrid electrical power (solar and wind) for the house day/night over time measured in years. My model showed that for a "typical" house hybrid power might be a reasonable alternative to traditional power sources.

Results

My model showed that the cost of implementing solar power can be recovered over time. However, I learned that having a house that only runs on solar power is impractical due to limitations on the amount of power that can be stored, lack of sun at night, and lack of sun during bad weather. While having solar power is eco-friendlier and is a good alternative to fossil fuels, it is very hard to provide a consistent source of power to completely run a house. I also learned that after paying off the cost for the implementation you can get paid for the unused power your system creates, depending on which power company you use to get your power converted or

your solar system installed. This helps recover the implementation costs faster, but does not address the reliability concerns mentioned above.

Conclusion

After analyzing my results, I have reached the conclusion that the benefits of utilizing solar power are dependent on the circumstances. Power usage during the daytime versus at night and the region of the country affect the benefit provided by solar power. Someone who lives in an area where there are not many sunny days or whose power use occurs during night-time hours would find that hybrid power is a more expensive option than traditional power sources. As a result, the most significant achievements of my project were learning how to code with Python in a couple of months and creating a working computer model designed in Python.

Recommendations

While use of solar power provides a clean energy source, the feasibility of using it without a back-up source is questionable. It also takes several years to recover the implementation costs. More research should be completed using a model that compares combinations of hybrid energy sources like wind and solar. Due to time constraints and the complexity of the coding, it was not feasible to create a model that would make those comparisons for this project.

Acknowledgments

I would like to acknowledge my father for helping me learn Python and my mother for keeping me on task and on time with my project.

End Notes

[1]Azimoh, L., Wallin, F., Klintenberg, P., Karlsson, B. (2014) An assessment of unforeseen losses resulting from inappropriate use of solar home systems in South Africa. *Applied Energy*, 136: 336-346 http://dx.doi.org/10.1016/j.apenergy.2014.09.044.

[2]Rhodes, J. "When Will Rooftop Solar Be Cheaper Than the Grid?," *US News and World Report*, March 31, 2016. https://www.usnews.com/news/articles/2016-03-31/when-will-rooftop-solar-be-cheaper-than-the-grid.

[3]PNM. *PNM Customer Solar Energy Program*, https://www.pnm.com/solar.

[4]Rhodes, "When Will Rooftop Solar Be Cheaper Than the Grid?"

[5]US Department of Energy. *Energy Sources*, https://www.energy.gov/science-innovation/energy-sources.

[6]Rhodes, "When Will Rooftop Solar Be Cheaper Than the Grid?"

[7]Timilsina, G., Kurdgelashvili, L. & Narbel, P. (2012, January). Solar energy: Markets, economics and policies. *Renewable and Sustainable Energy Review*, 16(1): 449-465.

References

Azimoh, L., Wallin, F., Klintenberg, P., Karlsson, B. (2014). An assessment of unforeseen losses resulting from inappropriate use of solar home systems in South Africa. *Applied Energy*, 136: 336-346 http://dx.doi.org/10.1016/j.apenergy.2014.09.044

PNM. *PNM Customer Solar Energy Program*, https://www.pnm.com/solar.

Rhodes, J. "When Will Rooftop Solar Be Cheaper Than the Grid?," *US News and World Report*, March 31, 2016. https://www.usnews.com/news/articles/2016-03-31/when-will-rooftop-solar-be-cheaper-than-the-grid.

Timilsina, G., Kurdgelashvili, L. & Narbel, P. (2012, January). Solar energy: Markets, economics and policies. *Renewable and Sustainable Energy Review*, 16(1): 449-465.

US Department of Energy. *Energy Sources*, https://www.energy.gov/science-innovation/energy-sources.