Solar Grid for a Lunar Base

New Mexico Adventures in

Supercomputing Challenge

Final Report

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TEAM 053

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Summary

The purpose of this project is to create a program that can simulate a solar generator power grid on the moon. The program is written in C++ coding. C++ gives us the chance to type in a new variable for any additional wattage to add onto our grid. There were many factors that we needed to add onto our program, such as the moon's lack of atmosphere and radiation damage from solar flares. Our program is designed to calculate what would happen when these factors are applied to a normal solar-powered house.

Humans have been traveling in space for over fifty years, and it won't be long before mankind will want to establish bases on celestial bodies outside of Earth. Our goal is to create a program that could possibly help astronauts on the moon to construct a successful solar generator grid that could detect discrepancies in the grid.

Introduction

The Effectiveness of a Solar Generator Grid can be very helpful to astronauts because of the setup of the grid itself. The moon receives daylight for 28 days; this was important for us to know because we needed to plot where our solar panels would go. Our first suggestion was to place the panels on the axes so that when we install sensors the panels would always be facing onto the direction of the sun.

Significance of the moon

Recently we found out that the moon dose not stay still on its orbit; instead, the moon shifts its axis continuously over the 28-day period of rotation. We later discovered that one side of the moon's crests is heavier than the other side (which is why we always see only one side of the moon). Looking at this fact, we can say that if we establish the base on the side of the moon that receives the

most sunlight (i.e. the side we see from Earth), our solar panels will collect optimum solar energy.

Solar Generator

The type of solar generator that we programmed into our program was the same type of battery that the International Space Station is using currently today: a nickel-cadmium battery which could provide up to three kilowatts of electro power for the lunar base. Whenever the moon is covered in Earth's shadow, there is no way to collect electricity for the lunar base. So this is why it's important to lay out a grid that could calculate the amount of energy the generators can preserve energy when the shadow of the earth comes.

Energy Consumption

The energy consumption of our lunar base will consume a high amount of wattage. We coded our program to determine the amount of wattage our lunar base can consume in one day. And to our statistics we where quite intrigued with the results because the amount of wattage was higher than expectations.

Math Model

The process of powering the lunar base will begin when the solar panels convert the sunlight's photons into electricity, creating a direct current. Our solar cells will be multiple-junction research lab cells, giving the cells an efficiency of about 30%.

$$Po = A \times R \times E$$

Po = Power Output (Watts)

R = Solar Radiation (Watts/Square Meter)

A = Area of solar panels (Square Meter)

Our research tells us that we will get about 300 watts of power for every square meter of solar cell. The direct current will be stored in a battery, until we need it for the solar house. This is when we will use an AC/DC converter to change the current to alternating current, which we will use for our house. The house will require about 75,000 watts of current; though the number will change based on what equipment is on.

Conclusion

With more time we would attempt to create a code that is more accurate and more consistent of code. We did the best that we could to develop this program, though it was difficult it turned out to be really fun. As we worked on our project we learned many new types of formulas and different types of energy grids through our research. Even though we pointed out many possibilities of a solar grid system there could be more variables that we could be more accurate on.

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