Renewable Energy at NASA’s Johnson Space Center

Abstract

By Lindsay McDowall

This poster reviews various renewable energy initiatives of the NASA Johnson Space Center. It discusses a lessons learned report on renewable energy at the center over the past ten years, and how solar energy will impact space travel. It also analyzes the success and shortcomings of various solar systems onsite.
Renewable Energy at NASA’s Johnson Space Center
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Lessons Learned Report

Background

NASA’s Johnson Space Center has implemented a great number of renewable energy systems, making it necessary for renewable energy systems to continue to grow and thrive on this planet. These systems generate energy using renewable sources, water, wind, and sun, and we will not run out of Johnson Space Center to help pave the way by installing and studying renewable energy systems.

Objectives

The objective of this report will be to examine the completed renewable energy projects at NASA’s Johnson Space Center for a time span of ten years, beginning in 2003 and ending in early 2014. This report will analyze the success of each project based on actual vs. projected savings and actual vs. projected efficiency. Additionally, both positive and negative experiences are documented so that lessons may be learned from past experiences.

Renewable Energy in Green Buildings

Background

NASA is incorporating renewable energy wherever it can, including in buildings. According to the 2012 JSC Annual Sustainability Report, there are 321,660 square feet of green building space on JSC’s campus. The two projects described in this report are building 12 and building 20, both of which have renewable energy systems.

Objectives

The objectives of this project were to examine data from the renewable energy systems in two of the green buildings onsite at JSC. Building 12 has two solar inverters, located on the second floor, that collected the data from the solar photovoltaic arrays. Building 20 has a solar water heater system. By examining the data from the two buildings, it could be determined if the renewable energy systems are operating efficiently.

Results & Conclusions

In Building 12, the data from the solar photovoltaic arrays shows that the system is continuously collecting energy from the sun, as shown by the graph below. Building 12 has two solar inverters, located on the second floor, that collected the data from the solar photovoltaic arrays.

The data displayed here is the total energy produced by the system. These are cumulative amounts, so the last point on the graph shows all of the energy collected from the system since the start of its operation.

Total Energy Solar Inverter - Building 12 PV Arrays

In Building 20, data was examined from the solar water heater dating back many months and found that the pump for the solar water heater system was malfunctioning, as evidenced in the graph shown below.

The pump operates on a solar energy system, meaning that it collects energy throughout the day from the sun. Because of this, the system would stop operating shortly after the sun set because of a lack of sunlight. At that point, the graph should show a zero flow rate, but as exhibited in the graph below, this is not the case. It is clearly shown that the pump is continuously malfunctioning, even during the night. It was also observed that the majority of the time the pump did not turn on at all, despite good weather conditions. This led to the conclusion that the pump was malfunctioning, and needs to be examined and fixed.

Future

Applications of Solar in Space Travel

Studying sustainability and renewable energy systems on Earth has applications for sustainability in space and vice versa, not only for the International Space Station (ISS) but also for any long-term future missions. One of the most well known sustainable technologies with space applications is solar power using solar photovoltaic arrays made with silicon.

Evolution of Solar Power in Space

Past

Vanguard I, launched in 1958, was the first spacecraft that used solar panels. The arrays had a 14% terrestrial efficiency.

Present

The International Space Station is powered by over 60,000 silicon solar cells. These cells, at the time of their installation, had an average efficiency of 14.2%.

Future

Artists’ renditions of solar power on Mars (top left) and the Moon (top right) for future extended human missions. Currently, the highest efficiency achieved by a silicon solar cell is 42.3%.

References

www.nasa.gov
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