Powering Maui with PV Solar

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GBS 180 - Ecosystem Management

Introduction

Maui, full of beaches, blue skies, palm trees and most importantly, sun. All this sun on Maui and all these advancements in solar panel technology combined with rising energy costs lead to one conclusion: Use more solar power! We live in a time where we are running out of non-renewable energy sources and on an island where its sunny 90% of the time let’s take advantage of that and use what we get.

Problem Statement

How can we use the sun to power Maui? Is it possible? What about the right? How much space would it actually take? Do we have enough room for this on our small island? These are the questions that need to be answered to take advantage of our paradise environment.

Methods

First the data. Maui Electric Company’s website says the combined total power the power plant produces is about 300 megawatts. According to solar panel manufacturer Tera Solar they offer panels that can produce 335W and are about 123W better in size about 16% efficient. Soler and CEA-Leti, France, together with the Fraunhofer Institute for Solar Energy Systems ISE, Germany have made a solar cell that is 16% efficient, which can make 10.8W per square centimeter. That’s 12.7W per square inch theoretically. The “Tesla Powerwall” can store 3.3kWh or 7kWh and are about 7 ft^3. It would take about 90909 of them to store 300 megawatts of power. They would take up the space equivalent to about half the size of an average Wal-Mart. Using ArcMap I found a couple different suitable location options for both the solar panel farm and the battery farm to store it all. I analyzed the data using Geoprocessing tools such as clip and intersect to find what places have the best solar insulation to provide the most sunlight to the panels.

Results & Discussion

I am going to need to find an area with approximately 460 acres to fit just the panels alone. Realistically for everything to fit with space around each panel and all connections and buildings I will look for a place with close to 630 acres. And if I can’t I will show alternative methods and a theoretical location using possible future technology numbers. My results maybe require more space than I can realistically find available. This was a little surprising I did not think it would take this much space. The technology is still new and we have not fully advanced it enough yet. But there are plenty of possible possibilities with much more efficient solar cells that will take up a lot less space.

In conclusion I think powering the island right now with our current solar technology is unrealistic but it is possible. Other methods such as solar roads and the possibility of future solar technology that will be much more efficient and take up less than half the space will change things in the future. With these new upcoming advancements in solar technology we could find a good solution to power our island using just the sun.

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I am going to need to find an area with approximately 460 acres to fit just the panels alone. Realistically for everything to fit with space around each panel and all connections and buildings I will look for a place with close to 630 acres. And if I can’t I will show alternative methods and a theoretical location using possible future technology numbers. My results maybe require more space than I can realistically find available. This was a little surprising I did not think it would take this much space. The technology is still new and we have not fully advanced it enough yet. But there are plenty of possible possibilities with much more efficient solar cells that will take up a lot less space.

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References

• Lane. n.d. 8 December 2015 <https://en.wikipedia.org/wiki/Lane>
• Powering Maui with PV Solar Farm. 2015. 10 December 2015 <http://www.solarroadways.com/>
• Solar Roads. n.d. 4 December 2015 <https://www.gisworld.com/4th-december-2015-

Solar Insolation Levels

Properties = 400 Acres and > 450C/sq.cm/Day

Land Owner-Labeled

Figure 1: Solar Insolation is a measurement of how much sun the area gets per day. The darker the red the more sun the area gets per day thus the more power a panel can generate in a day.

Figure 2: All properties greater than 400 acres in the 450 to 550 c/sq.cm/Day range. These would be the best places to place the amount of solar panels needed to make 300MW watts.

Figure 3: All properties greater than 400 acres in the 300 to 450 c/sq.cm/Day range. These would be the best places to place the amount of solar panels needed to make 300MW watts.

Figure 4 – The Tesla Powerwall in the 400-550 c/sq.cm/Day range. The widths of vehicle lanes typically vary from 9 to 13 feet. Assuming 12 feet per lane approximate used area was 32120 square feet as shown in the table above. This is way more area than the pink squares in Figure 3 showing the solar panel area with the prototype technology. This could also cut ourour area needed with currently available panels to approximately 140 acres of land. If we include all Highways, Fences and Green lines we could use the ready road for panels. Also another time to compare the size of the island to the approximate size of a NAPW Solar Farm.