EE/CprE/SE 491 WEEKLY REPORT 8

4/2/23 - 4/9/23

Group Number: 16

Project title: Feasibility of Solar PV Energy for Puerto Rico

Client &/Advisor: Vikram Dalal

Team Members/Role: Adam Curtis, Hannah Nelson, Isaac Buettner, Larry Trinh, Manuel Perez-Colon

o **Weekly Summary**

We had a team meeting with Professor Dalal (which we had postponed 1 week) due to being busy. We have gotten to a good point with research and have a good idea of what we want to do going forward. We are trying to figure out which type of PV system works best for Puerto Rico: rooftop, community, or large-scale. We have eliminated large-scale due to a lack of space and resources, so we are currently looking deeper into community and rooftop PV.

o **Past Week's Accomplishments**

Hannah: Researched further about Casa Pueblo, which is the first community PV system in Puerto Rico. They had a lot of detailed, quantitative documentation about the reasoning for the design and data from Oak Ridge National Laboratory. They took surveys of local residents to see how often their power was out, how long, and how it made them feel. This was a good perspective to look at in terms of ideas for how we would "advertise" our design to residents.

Manuel: Researched the project centered on the Puerto Rico Convetion Center. They recently covered their open air parking lot with solar panels and also installed rooftop PVs. This totals to a 5MW PV system that generate around 8000 MWh a year. The cost for this system was approximately 20 million dollars. I still need to find the current maintenance cost for this system.

Adam: Looked into ways to calculate payback period on a rooftop/one home solar system. We will require multiple datapoints for each case we plan to analyze. Specifically, we will need to calculate:

- Cost of Solar Panels, Installation, connection to grid, and batteries.
- Subtract any tax incentives/rebates from initial cost. May not be relevant in PR unless the U.S. incentives also apply to PR.
- Determine current Pre-solar installation electricity cost per month
- Determine Annual savings due to avoided electrical costs via solar generation, add in any annual incentives that may also reduce cost
- Finally, divide Net cost of installation (total initial investment) by the money saved annually via incentives/avoided electrical bills and you have the number of years it takes for the investor to break even on their investment. Usually this is around 8 years, and solar systems can last 25-35 years, so every year the system is active after the payback period is pure profit for the investor.
- We could account for inflation as well
  https://www.energysage.com/solar/benefits-of-solar/solar-payback-period/

Larry: Last week, I did some research about microgrid costs. Basically, there are many different microgrid component costs such as conventional generation cost, renewable generation cost, energy storage cost, control cost, soft cost, additional infrastructure cost. For the community microgrid, conventional generation cost and energy storage cost are taking the largest portions which are 54% and 15%. Soft costs include engineering, construction, commissioning, and regulatory costs.Additional electric infrastructure costs include all the expenses on tangible assets, excluding generation equipment.
https://www.nrel.gov/docs/fy19osti/67821.pdf

Isaac: Began research on transmission and distribution (T&D) in Puerto Rico, including reviewing assessments, reports, and fiscal plans regarding T&D. There are a few separate factors that impact the reliability of these T&D systems, including aging, damage, and poor system maintenance all impacted quality of power delivered to customers. With all of these factors combined it creates another large problem where around 70% of power generation is in southern Puerto Rico, while 70% of the power demand is in northern Puerto Rico. There are 3 primary transmission loops in Puerto Rico, a western, central, and eastern loop, all of which stretch from the south to the north, all the way across the island. With minimal to no maintenance on these transmission lines, when hurricane Maria came through and knocked down these lines in 2017, teams had difficulties reaching sites for repairs because the lines which cut through the jungle had become overgrown from vegetation since no funds were put into maintenance after the lines were put in place.

Individual contributions

NAME	Individual Contributions *(Quick list of contributions. This should be short.)*	Hours this week	HOURS cumulative
Adam Curtis	Research	4	37
Hannah Nelson		4	37
Isaac Buettner	Research	3	34
Larry Trinh		4	34
Manuel Perez	Research, Finding contacts for projects	6	27

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

Hannah - I don't have a specific goal in mind yet, but we have our team meeting on Monday, where we will discuss what we want moving forward. Dalal had asked us to do an economic analysis, so I plan to find the investment needs/returns for a community solar farm.

Manuel - Waiting until the team meeting to understand what we need to focus on for the coming week. Sugeetsing we all work on something together to give Dalal a model for next week.

Adam - Work with the team to make an economic model of a community solar farm as well as a rooftop model. We will have to decide what size of system we want to analyze. Will discuss details in the meeting.

Larry - We will have a meeting on Monday to discuss our goals for next week. I plan to do some research about each cost component, and try to figure out how we can reduce the cost for each component in order to low the cost for a microgrid project.

Isaac - I want to get a bit more back on track for this upcoming week, I don't have too much in mind yet but would like to discuss this during our weekly meeting. I think it was good to start this look into the current state of T&D in Puerto Rico, but perhaps it should have been started at a different time.