

To: Dr. Trevas

From: Daniel McConnell

Date: October 29, 2019

Re: Self Learning

Introduction

The Solar District Cup capstone for fall 2019 and spring 2020 was one of the 35 qualifying teams to enter into the second phase of the competition, adding battery storage. To compete with the other teams, the NAU capstone team will need to research implementing battery storage, and decide how to use if any. One of the resources that is recommended by the competition holders is the National Renewable Energy Laboratory's open source tool REopt Lite [1]. This tool is used to evaluate the optimal amount of battery storage that could be used for a project. The team will complete trainings in this software in order to use it for making the system design proposed more efficient and effective. Learning this tool will develop the concept evaluation aspect of design for the team members. This memo explains the trainings that were completed and a PDF showing the results of using the software for the projects current design.

1. Initial Video Trainings

The first trainings completed for this tool were videos posted by NREL. There are a total of 6 videos summing to a total of about 22 minutes. These videos show the user how to use the software, what the inputs are and how to run a simulation [2]. The first video is just a summary of the inputs. The second video explains what the load profile input is. The third gives a tutorial on how to make an advanced utility rate as an input instead of the standards provided. The fourth video explains the resilience inputs. The fifth the financial inputs and lastly, the sixth video explains what the resilience outputs are. After completing these videos the teams was able to simulate some designs in Reopt lite but there was confusion on how to interpret the outputs and how to tweak designs to optimize the battery storage, so another video with examples of designs was watched in order to get a better understanding of the tool.

2. Advanced Video Training

The advanced training video was about 65 minutes and it explained the newest features of REopt lite and in-depth examples using real data to show what should be considered when designing a solar+storage design [2]. After watching this video, the team was confident that an accurate model could be simulated for the current design but ran into some issues while inputting data. The team then referred to the user manual of the REopt lite tool [4].

3. Using REopt Lite

Utilizing the user manual, the team created both a financial and resilient simulation using the current design. Shown in figures 1 and 2 are the summaries of both the financial and resilient designs respectively.

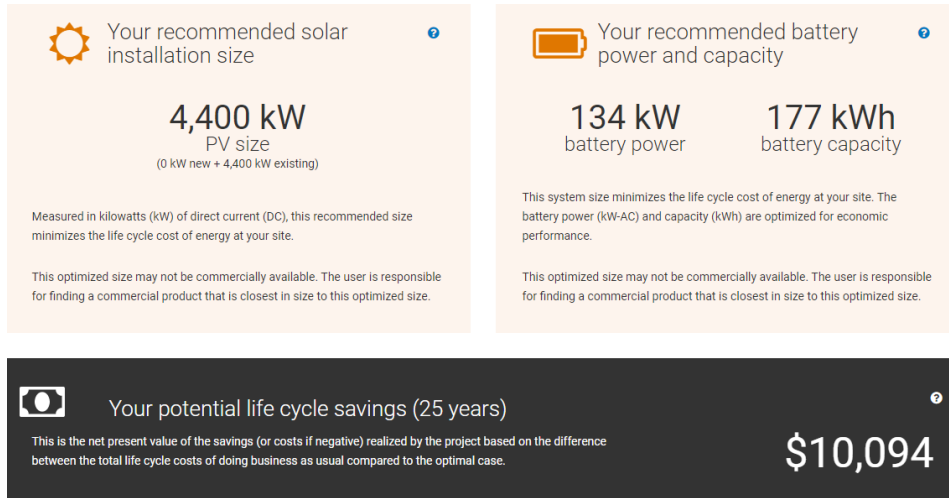


Figure 1. REopt Lite Financial Simulation using Current Design [1]

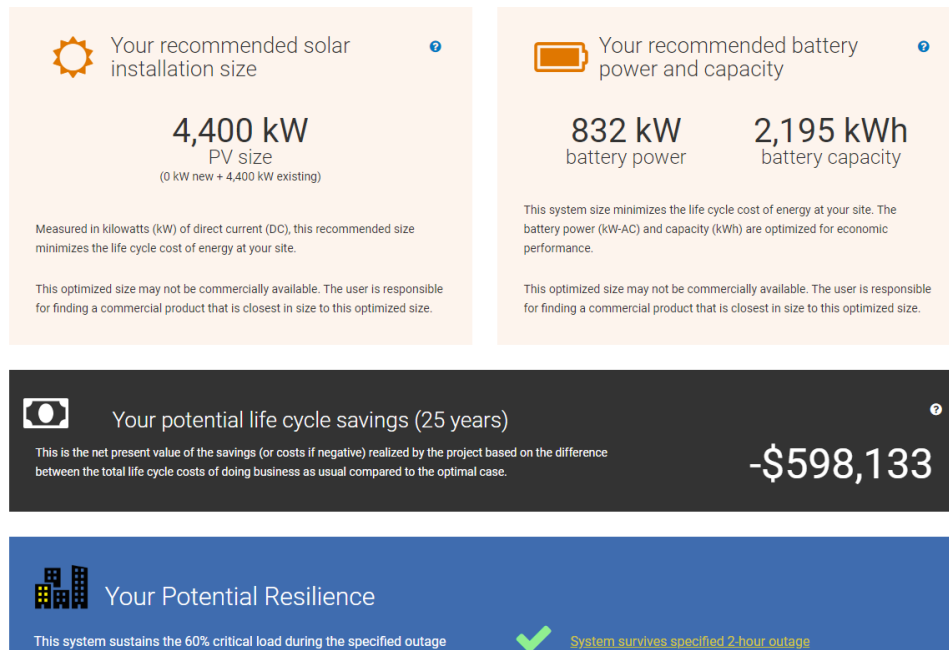


Figure 2. REopt Lite Resilience Simulation using Current Design

These figures show that implementing a battery with 134 kW power and 177 kWh capacity would increase the saving of the project by 1 about \$10,000 but to survive a 2 hour outage the design would need a battery with a power of 832 kW and a capacity of 2,195 kWh and would cost the university around \$600,000. The team will continue to optimize the design to possibly increase the amount of battery storage while decreasing the cost.

Conclusions

After learning how to use REopt Lite the team found that REopt lite will be a helpful tool to get rough estimates of how much battery storage would be efficient. This will help the NAU capstone team be competitive because REopt lite simulations are very fast so making many simulations, changing small details will be easy. The team will use REopt lite and possibly make two PPA's to show the possibility of a money saving design and also a design that will be robust, providing power incase of any grid outages.

References

- [1] National Renewable Energy Laboratories, "REopt: Renewable Energy Integration & Optimization," National Renewable Energy Laboratories, [Online]. Available: <https://reopt.nrel.gov/tool/results/7f38449a-d524-4ee5-aecc-a7e3e424faa3>. [Accessed 24 1 2020].
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- [3] Clean Energy Group / Clean Energy States Alliance, "Simplifying Resilient Power Design with REopt Lite: NREL's Solar+Storage Tool (7.25.2018)," YouTube, 16 January 2019. [Online]. Available: https://www.youtube.com/watch?v=m-9ULBe_3ZA&t=12s. [Accessed 24 January 2020].
- [4] National Renewable Energy Laboratories, "REopt Lite User Guides," [Online]. Available: <https://reopt.nrel.gov/user-guides.html>. [Accessed 24 January 2020].