

Homework 2 Solar Power Africa
Due Monday September 4, 2023

- 1) Make a table with items, cost, and power requirement as well as a plot of the expected power consumption over a 24-hour period for a clinic in rural Ethiopia. The clinic will need a vaccine refrigerator, a fan, 10 LED lights, a laptop computer, a laser printer, a cell phone charging system, a radio, and a kettle to boil water. All of this equipment will need to be purchased. The cost in Ethiopia is twice the price on the European market for technical items like computers. Your table should list the items, give operation power, W, number, average hours of use per day, average Watt-hours per day, cost for the item purchased new in Ethiopia. Compare the Average Wh/day with what you can garner from your usage plot (the plot should result in a lower Wh/day that is a more reasonable value). You are only interested in the peak power usage for instance, if you won't use the kettle and computer at the same time their power consumption shouldn't be directly added.
- 2) From the internet find the peak sun hours per day in Harar Ethiopia (Dire Dawa or Djibouti could substitute) It should be about 12. Assume a system efficiency of 60%. Calculate the rated peak power of the solar panel array that you need based on the Wh/day from part 1 and these numbers.
- 3) Using the specification from part 2, search on the internet for PV modules with the necessary peak power and find their price. Find a price for deep cycle 12V batteries rated at about 175 Ah each. Calculate the number of batteries required to power the clinic for two days from your estimates of total power requirement. Price a charge controller and inverter for this system. Give a total price for the system in the US and multiply by two to estimate the price in Ethiopia.
- 4) Comment on how you would go about implementing this electrification of a clinic on the ground in Ethiopia if you had a two-week trip in December to accomplish this project. What kind of local contacts do you need. Would it make sense to hire a contractor?