Energy Usage Analysis

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Introduction

(20 Marks)

- Origin
- Why is it important to me
- Show first 5 or 6 lines of data to help understanding

Questions / Hypothesis

- ?? Solar linked to sunshine/irradiance?
- ?? How well does solar generation cover house consumption? How much is the grid still used?
- ?? How much is house consumption impacted by absence?
- ?? What impact does temperature have? On house consumption? On solar generation?

Scope of The Data

This analysis looks at the generation and domestic use of solar engergy during September 2024 in the southern highlands of Scotland. The objectives of the analysis is to see how well solar generation covers the demands of a domestic residence at the tail end of the summmer and to see if additional solar generation and battery storage is needed.

The data comprises three main parts:

- Weather: Daily temperature and solar irradiance readings (see note below)
- Power Generation & Use: Daily solar energy generated and consumed
- House Occupation: A simple flag to indicate if the house is occupied or not

Weather

Weather data is sourced from a local weather station, see https://www.blscc.org/weather. Temperature is the mean daily temperature in °C and is derived from 6 readings taken at 4 hourly intervals during a 24 hour period. Solar irradiance is a measure of the solar energy experienced over a specified area, it is measure in W/m^2; typically this is used to actually caluclate the power generated from an array of solar panels, but here it is used here as a proxy for daily sunshine hours because this data was not available.

Power Generation & Use

Power data is downloaded from an iPhone App that controls the distribution of power to the domestic house being analysed, see Figure 1. This is a Tesla Powerwall and controller that takes electricity from: i) an array of 36 solar panels; ii) battery storage; iii) the national power grid and then intelligently routes this for: i) consumption by the house; ii) battery storage; iii) export to the nationla power grid. Electricty is measured here in kWh.

It should be noted that there are some lmitations in the data that could be obtained. Onlu solar generation and house consumption was used and energy flow to and from the battery was not readily available.

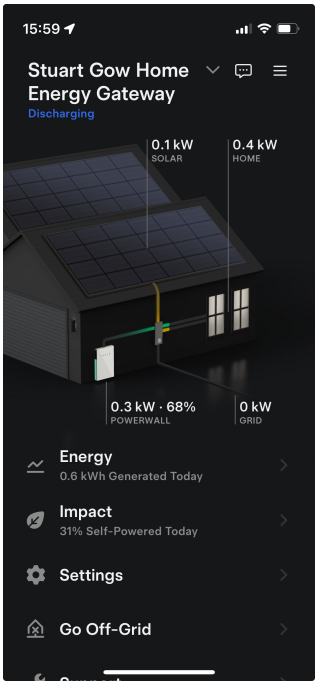

Figure 1: Tesla Powerwall App

Methods and Results

(40 marks)

Conclusions

(20 marks)

xxxxxxxx

Test citations (Crawley, 2014) and as Fraix-Burnet (2016)

References

?? Bother to quote a link to Wikipedia? See Wikipedia

Crawley, M.J. (2014) *Statistics: An introduction using R*. 2nd Edition. John Wiley & Sons.

Fraix-Burnet, D. (2016) 'Introduction to R', *Statistics for Astrophysics: Clustering and Classification*, Volume 77(2016), pp. 3–12. Available at: https://doi.org/10.1051/eas/1677002.