SIP: Progress Report 2
Solar Project for Pine Ridge Reservation, SD, USA

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1 Revised Control Diagram

In response to prior feedback, a more comprehensive flowchart diagram illustrating the behaviour of the control system is presented in Figure 1

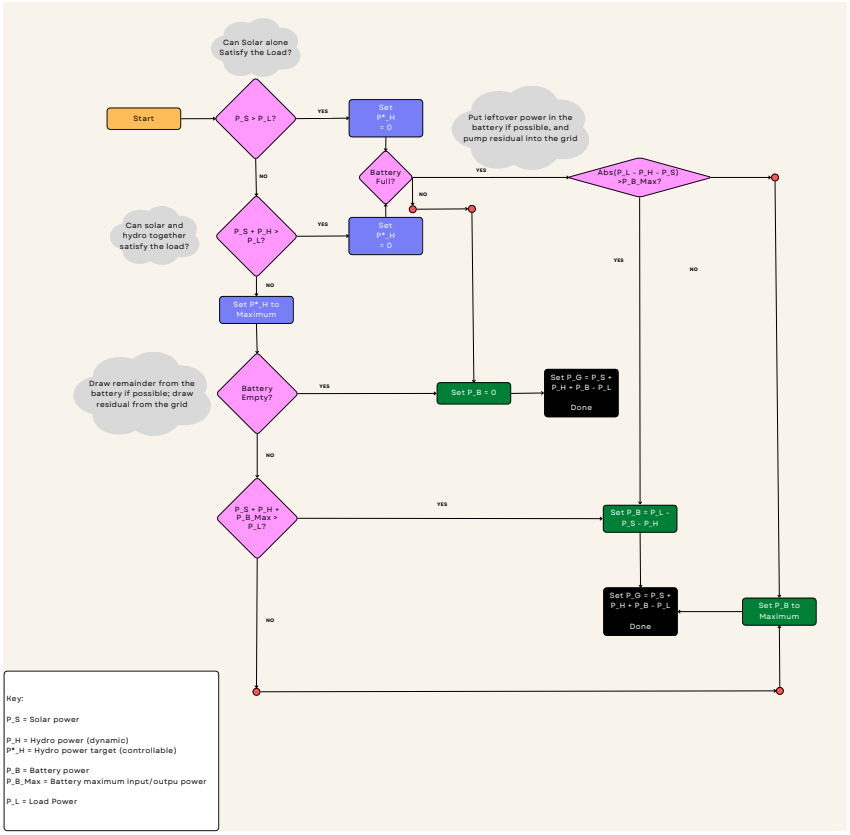

Figure 1: Caption

2 Revised System Sizing

In response to prior feedback, the system components were resized to afford weeklong autonomy from the grid (i.e., the system should be able to operate for a week with approximately no power going in or out of the grid, except perhaps to mitigate the malaffects of momentary spikes in supply or demand). The same components are used everywhere; the new sizes are as follows

1. Solar: 921.86 kWp

2. Hydro: 387.2 kW

3. Battery: 1032.5 kWh (usable energy, given that operation is limited between 30% - 80% of overall charge)

3 System Behaviour in Representative Scenario

In order to demonstrate the functionality of the combined control and power simulations, a plot of all relevant variables is created for a sample week. Note also that, in response to previous feedback, the load curve has been made substantially more erratic, representing the stochasticity of demand for the region. Note also that the battery state of charge is with reference to the usable energy - for the purposes of this simulation, it is not permitted to exceed the 30% - 80% cycle limits chosen to lengthen the battery's lifetime (i.e. SoC of 1.0 (0.0) corresponds to the battery being at 80% (30%) overall charge.

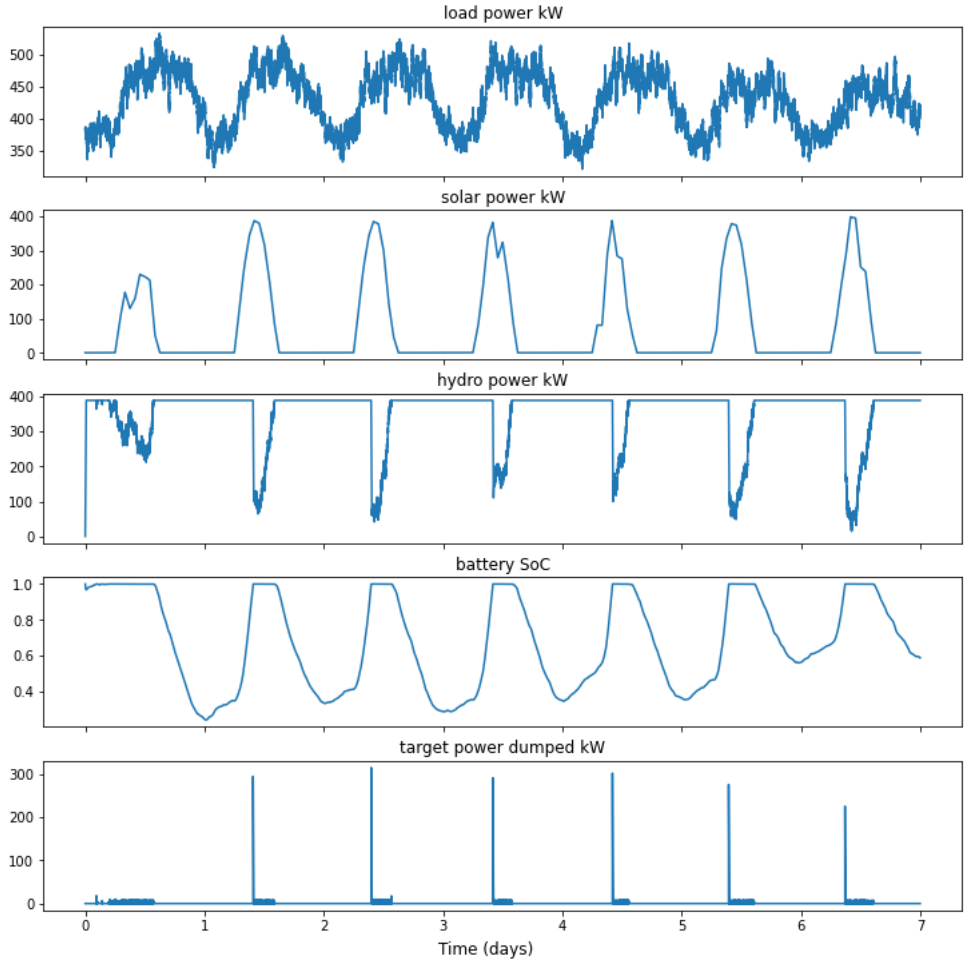

Figure 2: A plot of all relevant system variables over the course of a week. Units in title.

It is noteworthy that there are several cases where a large amount of power must be dumped to the grid for a very short time - this is due to the fact that, in moments of excess production, hydro-power does not begin to scale down as the battery nears its maximum; a slightly more intelligent control system would ramp down hydro-power as the battery approaches its maximum (or the battery might be allowed to slightly exceed its charge limitations for these few seconds). For the present this is not implemented, as this result was observed so recently - we hope to implement this in the final simulations.