

Feasibility Question:

Can the printer be powered using just a battery and solar panels for a period long enough to perform a non-trivial amount of work?

To determine how long the printer system can run, we must calculate the peak load, or the power the printer system uses, and determine how much power the battery and solar panels can provide.

If the printer runs on 12V and is rated for 300W then it is assumed that there is a need for $300\text{W}/12\text{V} = 25\text{A}$ of constant current draw. This is the average current draw of the system and it will be the value used to calculate the time the system can run.

If the system needs 25A at 12V continuously then that is what the combined battery and solar panels need to provide. If the system works as intended, the solar panels would provide some of the necessary power. If the solar panels are rated for 100W then they will provide a portion of the power the system needs.

To determine the power the solar panels provide, calculations show that $100\text{W}/12\text{V} = 8.33\text{ A}$ which when subtracted from the 25A needed for the system to run leaves the battery providing the last $25 - 8.33 = 16.66\text{A}$. The actual power provided by the solar panels in will be less than the value they are rated for due to system losses. In addition, the power rating is based on standard testing conditions which are almost never the same as operating conditions, so, the estimation of the power provided by the panels must use the correction factor provided on the solar panel data sheet.

A battery will be rated for a specific Amp-Hour capacity and this means that the battery can provide the rated amp-hour value of current at the rated voltage for 1 hour before running out of power. If a battery is rated for 100 Amp-Hours then it could provide 100 A for 1 hour, or instead it could provide 25 A for 4 hours instead.

The power that the battery needs to provide in this case is 16.66A. So if there is a need to run the system for 6 hours, with the assumed solar panel's 100W being provided, the battery must be rated for at least $16.66\text{ A} * 6\text{ Hrs} = \sim 100\text{ Amp-Hours}$. A battery of this spec is something that can be purchased.