Power Budget Calculations

The power budget is an analysis of how much power a data collection site requires. The analysis is required to determine how long a data recorder or a remote telemetry unit (RTU) will operate from a battery of a given capacity (amp-hours) without recharging and what size solar panel (or charging source) should be used to sustain the battery.

A power budget is determined by calculating how much time a data recorder or RTU spends in each of its operating modes and then summing the power used in each mode. For example:

Task	Current	Percent Time	Average Current
Collecting Data	40 mA	5 sec/900 sec = 0.55% (5 seconds every 15 minutes)	0.2 mA
Quiescent	10 mA	100%	10 mA
Transmitting	3000 mA	45 sec/14400 sec = 0.31% (45 sec every 4 hrs)	9 mA
		Total Average Current	**19.2 mA**
		Total Average Power(I*V)	**230 mW (19.2 mA*12 V)**

It is best to use actual measurements, for each mode, when establishing a power budget. Hint, once values of average power consumption have been collected save them for reference use when trouble shooting a system.

Time Between Battery Charging

Having calculated average power consumption, it is possible to calculate the maximum time between battery charging and the required solar panel size. The theoretical time between battery charging is equal to the battery's capacity divided by the average current draw. Using the data from the above example and a 7 Amp-hour, 12 V battery gives:

(7 Amp-hour)*(1000 mA/Amp)/(19.2 mA) = 364 hours (~15 days)

In practice, a lead-acid battery cannot be repeatedly 100% discharged. Therefore, it is necessary to de-rate the battery by some amount, generally 25%. In this example, 25% of 364 hours is 91 hours or a practical time between recharge of

364 - 91 = 273 hrs or ~11 days.

Solar Panel Size

In general the size of a solar panel required to support a known power load should be 10 times the average power requirement. In the above example the average power draw is 230 mW. For this power load a minimum size panel would be 2300 mW or 2.3 Watts. A standard 5-Watt panel will be more than adequate for this system.