Course: Sustainable Energy Technology -1
12150310

Title: PV Technology-PV system Components – L4

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Photovoltaics Systems components

3- Lithium Batteries:

Lithium –Ion

Lithium-ion is a low maintenance battery

There is no memory and no scheduled cycling is required to prolong the battery's life.

Low self-discharge

High energy density

Disadvantages:

It needs a protection circuit

More expensive

Subject to aging (Some capacity deterioration is noticeable after one year)

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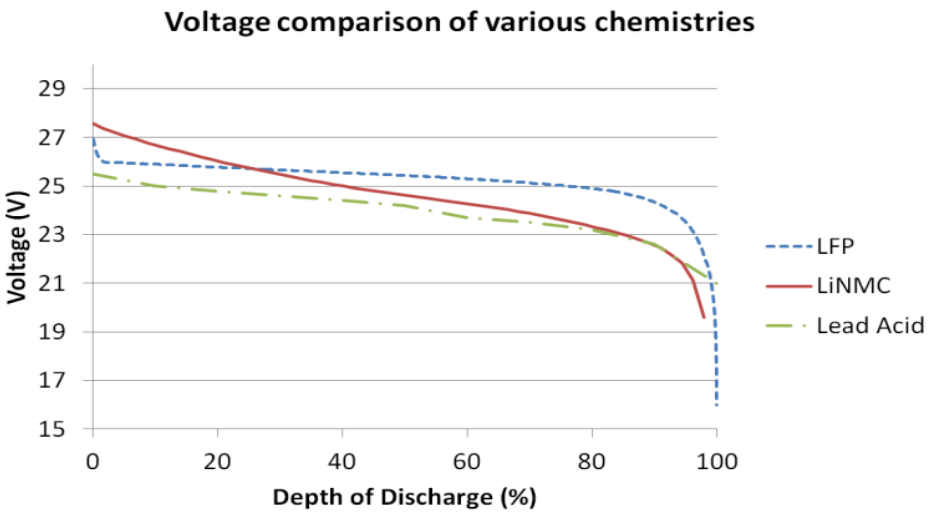
Battery Efficiency:

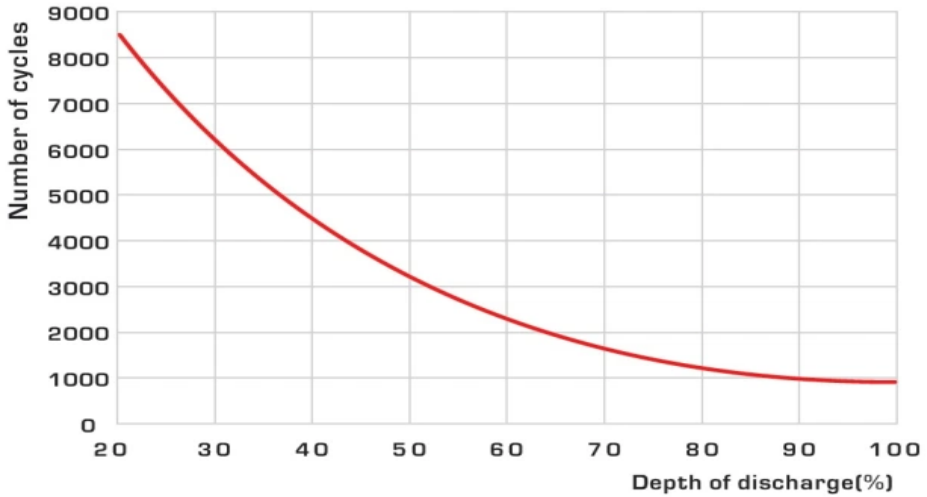
Battery efficiency (ηAh): is the ratio of the energy taken from the battery (number of Ah discharged), to the energy provided to the battery to be fully charged (Number of Ah required to fully charged it).

Battery efficiency ηWh

Depth of Discharge (DOD): is defined as the capacity that is **discharged** from a fully charged battery, divided by battery nominal capacity. **Depth of discharge** is normally expressed as a percentage. (Manufacturer specification)

State of Charge (SOC) = 100%- DOD





Typical cycle life versus DOD(20℃)

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Battery System Connection: (Series /Parallel)

This depends on: Total Ah capacity; DC bus voltage; The CAh of each battery; and the voltage of each battery.

CAh-total = CWh-total / DC bus voltage.

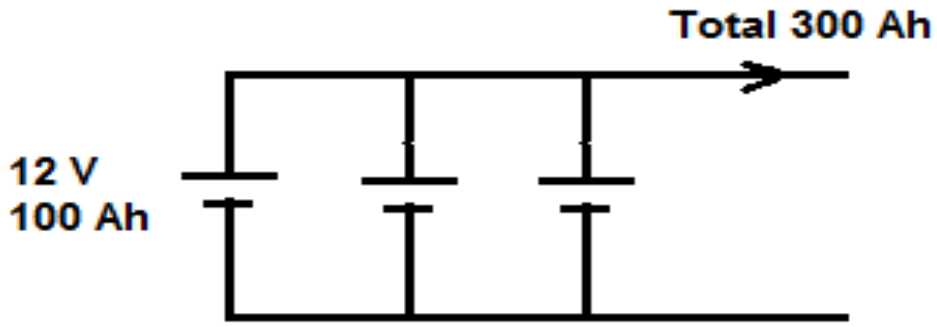
- Number of series batteries in each string = DC bus voltage / voltage of each battery
- Number of parallel strings = CAh-total / CAh-each battery.

Example1: A total storage of 3600 Wh is required by a battery system where the DC bus voltage is 12 V. Build the battery system that uses 12 V battery with 100 Ah each.

Number of series batteries in each string = DC bus voltage / voltage of each battery = 12/12 = 1

CAh-total = CWh-total / DC bus voltage = 3600 / 12 = 300 Ah.

Number of parallel strings = CAh-total / CAh-each battery = 300 / 100 = 3 Strings



Photovoltaics Systems components

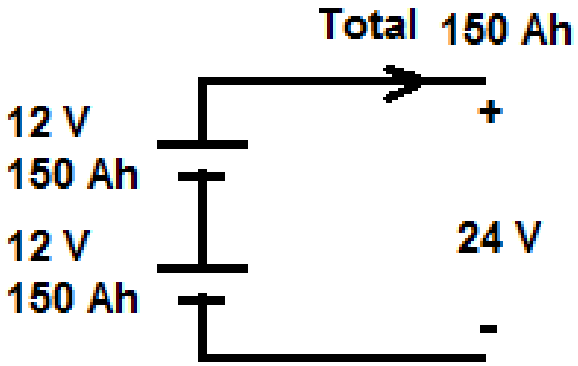
Battery System Connection: (Series /Parallel)

Example 2: A total storage of 3600 Wh is required by a battery system where the DC bus voltage is 24 V. Build the battery system that uses 12 V battery with 150 Ah each.

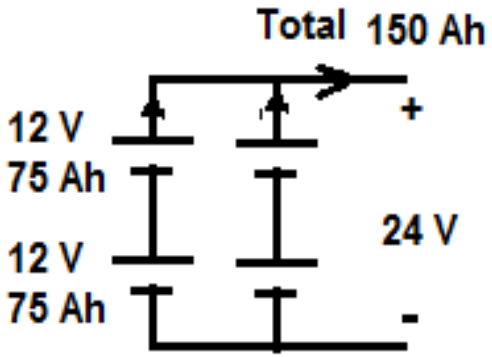
Number of series batteries in each string = DC bus voltage / voltage of each battery = 24/12 = 2

CAh-total = CWh-total / DC bus voltage = 3600 / 24 = 150 Ah.

Number of parallel strings = CAh-total / CAh-each battery = 150 / 150 = 1 Strings



Example 3: The same as example 2 but using batteries 12 V and 75 Ah each.



Photovoltaics Systems components

Battery System Connection: (Series /Parallel)

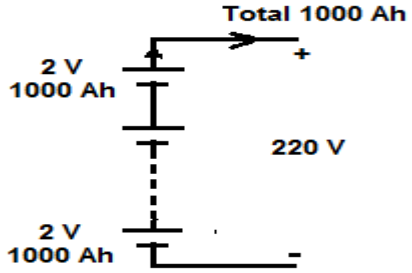
Example 4: A total storage of 230 kWh is required by a battery system where the DC bus voltage is 220 V. Build the battery system that uses 2 V battery with 1000 Ah each.

Number of series batteries in each string = C bus voltage / voltage of each battery= 220/2 = 110

CAh-total = CWh-total / DC bus voltage = 230000 / 220 = 1045 Ah.

Number of parallel strings = CAh-total / CAh-each battery = 1045 / 1000 = 1.045 Strings

Usually in these cases, we take the bigger integer value, but in our case as the value 1.045 is very near to 1, we take the value 1, so the number of strings is 1



Example 5: as example 4 but using batteries with 2 V and 350 Ah each.

In this case, we need 3 strings in parallel.