AMERICAN RIVER COLLEGE

System Sizing 2

Lesson Plan

- NABCEP Practice Exam #2 Next week
- Cont. NABCEP Learning Objectives:

  PV System Sizing Principles

Calculating Module Efficiency

- Efficiency is around 14%. (How to check answer)
- Our modules are rated at 1000W/m2
- Formula: $\frac{\text{W / sq meters}}{\text{1000W/m2}} = \text{\% Eff.}$

Convert modules dimensions to meters

1 meter = 3.28084 ft

1 foot = 0.3048 m

1 meter = 39.37008 in

1 inch = 0.0254 m

Example Problem:

1 module is 3 ft x 5 ft = 15 sq. ft.

1 module is 0.9144 m x 1.524 m = 1.394 sq m

200 W / 1.394 sq m = 143.47 W per sq m

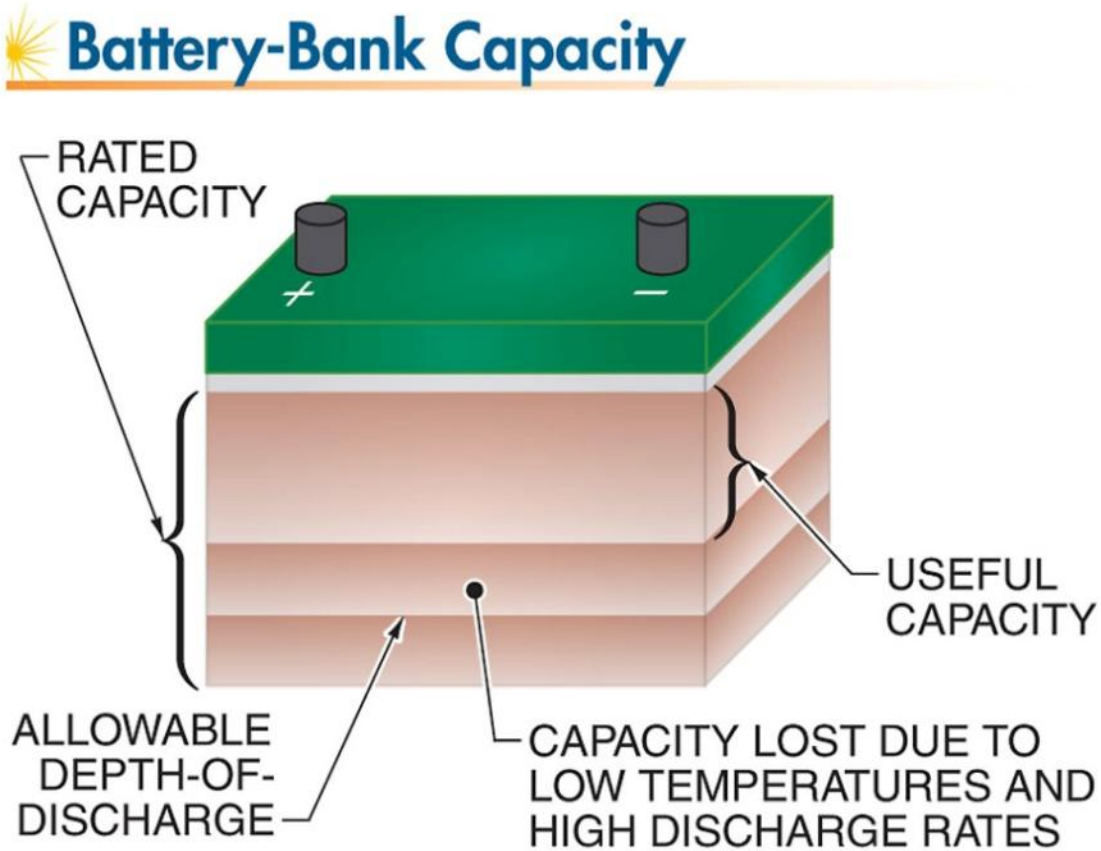
and then divide 143.47 w per m sq / 1000 w per m sq = 0.14347 or 14.347 % Efficient

- The battery-bank sizing worksheet uses information from the load analysis to determine the required size of the battery bank.

Battery-Bank Sizing

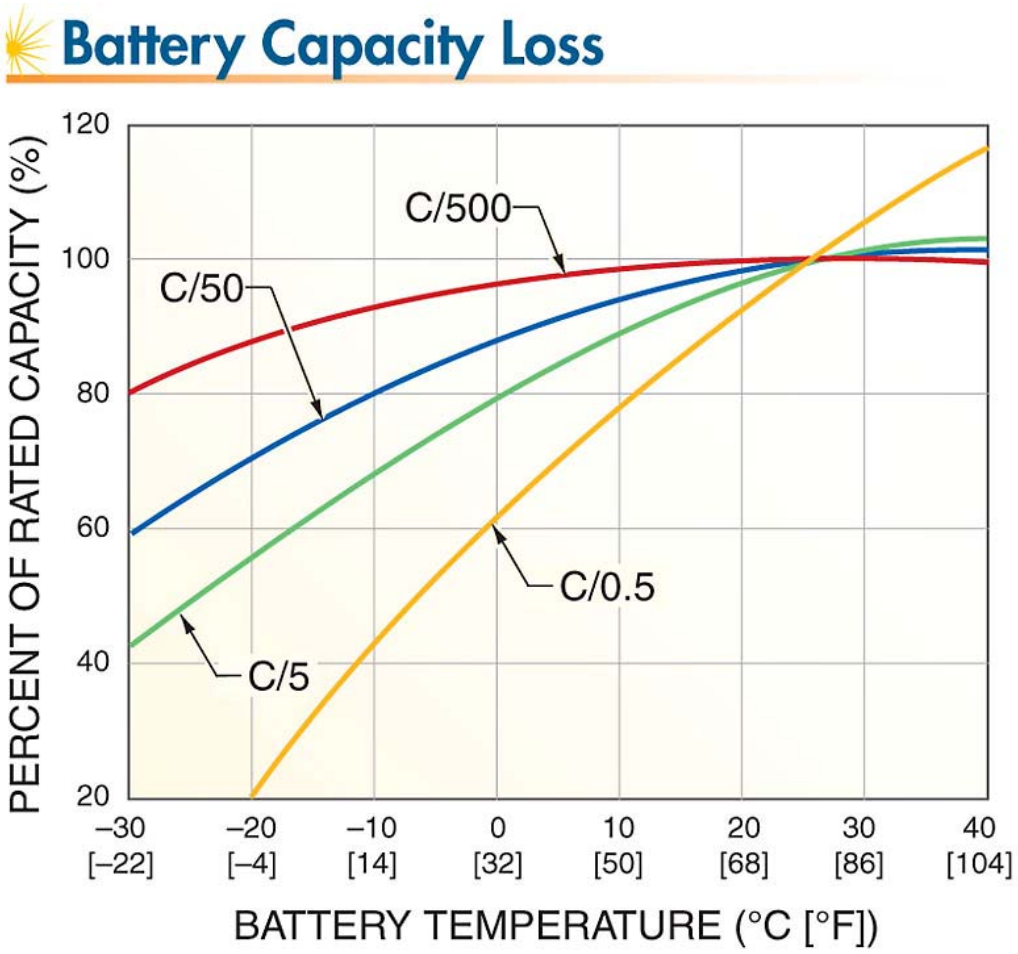
BATTERY-BANK SIZING

Average Daily DC Energy Consumption for Critical Design Month		Wh/day
DC System Voltage		VDC
Autonomy		days
Required Battery-Bank Output		A-h
Allowable Depth-of-Discharge		
Weighted Operating Time		hrs
Discharge Rate		hrs
Minimum Expected Operating Temperature		°C
Temperature/Discharge Rate Derating Factor		
Battery-Bank Rated Capacity		A-h
Selected Battery Nominal Voltage		VDC
Selected Battery Rated Capacity		A-h
Number of Batteries in Series		
Number of Battery Strings in Parallel		
Total Number of Batteries		
Actual Battery-Bank Rated Capacity		A-h
Load Fraction		
Average Daily Depth-of-Discharge		

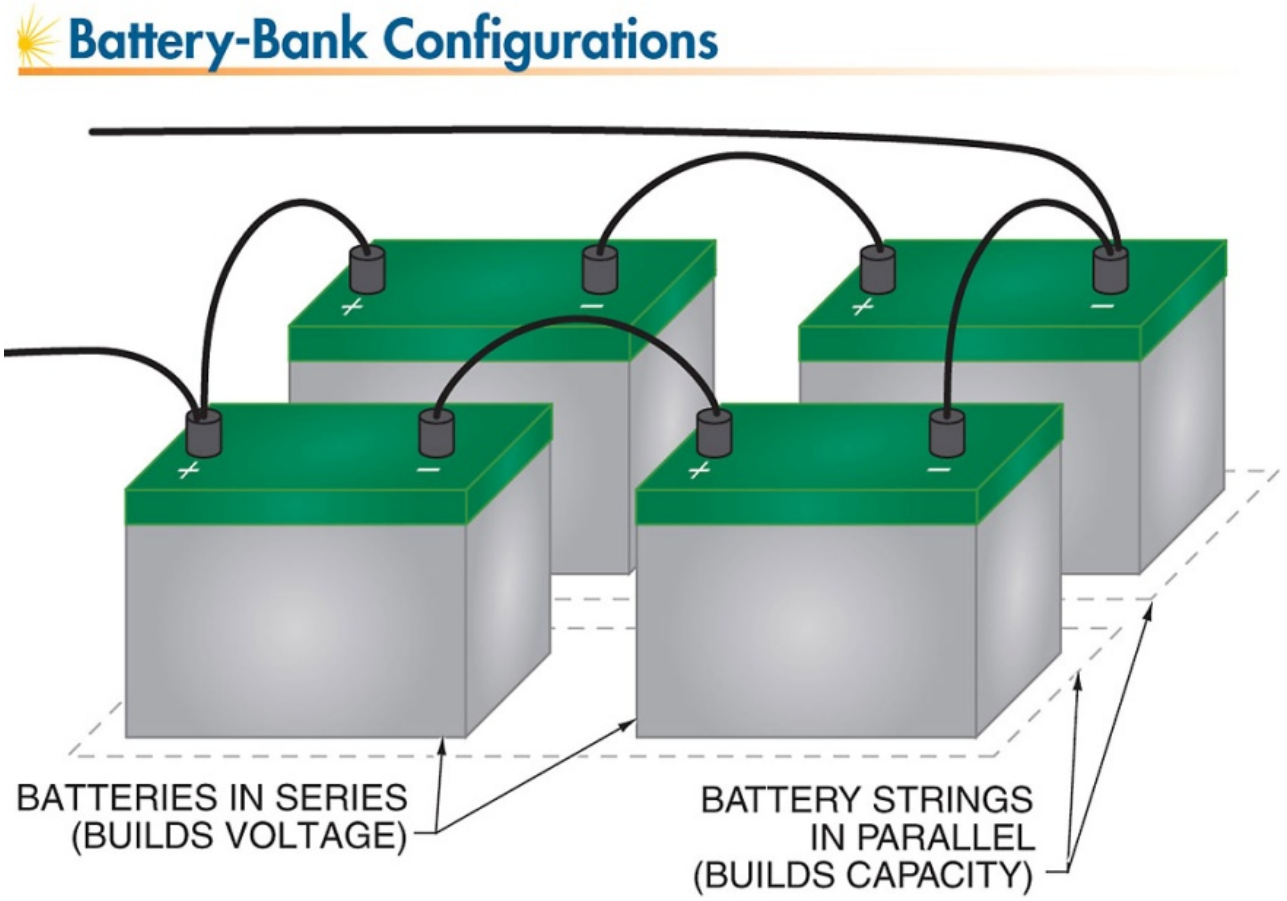


- Due to the allowable depth-of-discharge, low temperatures, and high discharge rates, the amount of useful output in a battery bank is less than the rated capacity.

- The amount of useful output from a battery bank depends partly on the operating temperature and discharge rate. These factors may have different effects for different batteries.



- Batteries are configured in series and parallel to match the battery-bank rated capacity needed to produce the required output.



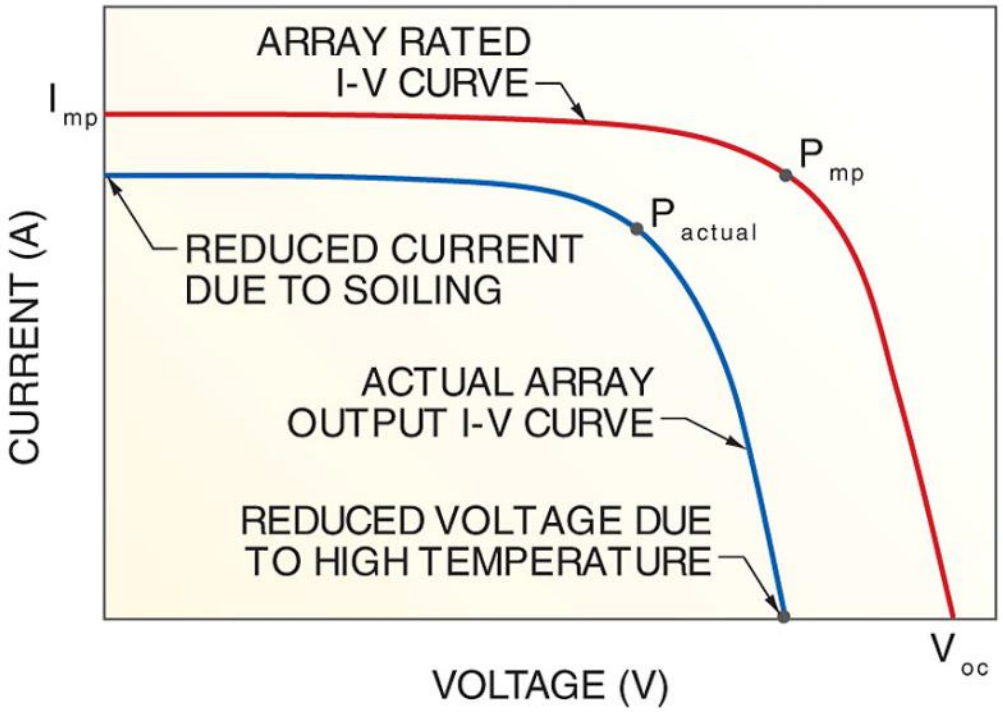
- The array sizing worksheet uses insolation data and load requirements to size the array.

Array Sizing

ARRAY SIZING

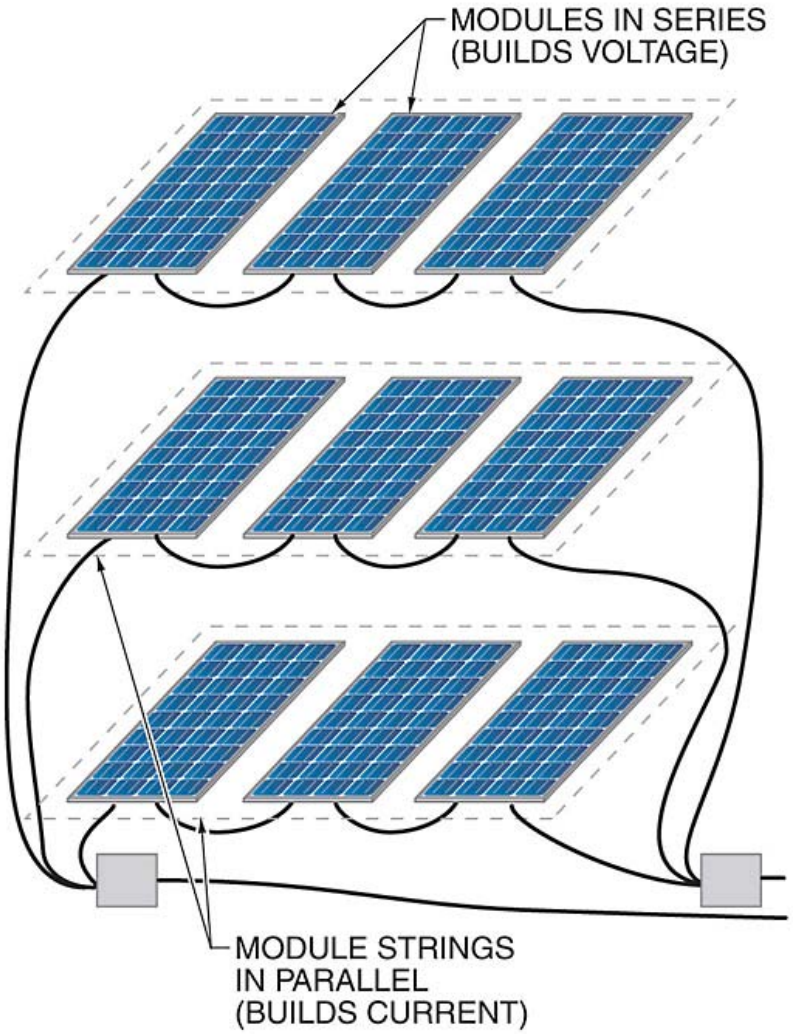
Average Daily DC Energy Consumption for Critical Design Month		Wh/day
DC System Voltage		VDC
Critical Design Month Insolation		PSH/day
Battery Charging Efficiency		
Required Array Maximum Power Current		A
Soiling Factor		
Rated Array Maximum Power Current		A
Temperature Coefficient for Voltage		/°C
Maximum Expected Module Temperature		°C
Rating Reference Temperature		°C
Rated Array Maximum Power Voltage		VDC
Module Rated Maximum Power Current		A
Module Rated Maximum Power Voltage		VDC
Module Rated Maximum Power		W
Number of Modules in Series		
Number of Module Strings in Parallel		
Total Number of Modules		
Actual Array Rated Capacity		W

Array Output Loss



- Actual array output is often less than rated output due to soiling and high temperatures.

Array Configurations



- Modules are configured in series and parallel to match the array rated capacity needed to produce the required output.