Benha University

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Undergraduate Course

Solar Cells Fundamental

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Lecture (6)

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Summary

- Energy conversation
- PV anatomy
- PV characteristics
- PV wiring
- PV adv & Disadv
- PV Applications

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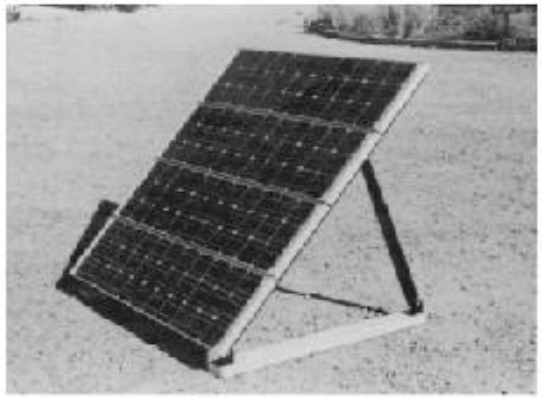
PV module mounting methods

- **Mounting methods:**
  - ground mount.
  - Track racks.
  - Side of pole.
  - Top of pole.



GROUND MOUNT

TRACK RACKS

SIDE OF POLE

TOP OF POLE

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Open circuit voltage and short circuit current

- The two most important parameter widely used for describing the cell electrical performance is the open circuit voltage (Voc), and the short circuit current (Isc).
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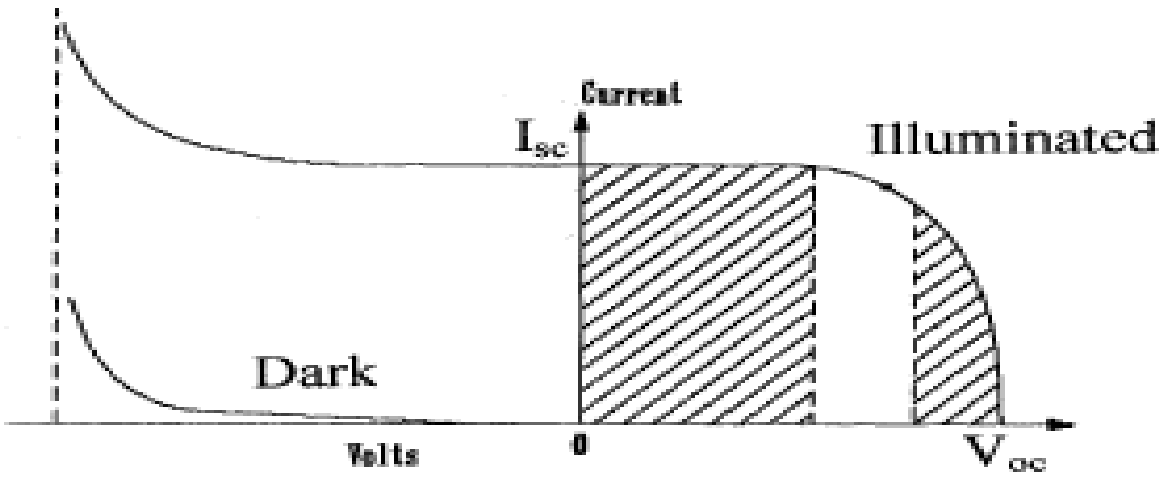

How to design PV system ?

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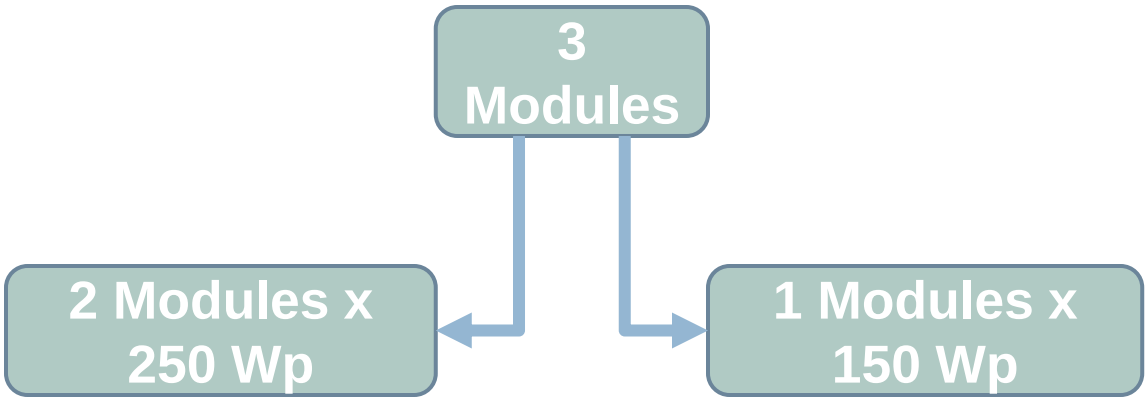
Example

- **Design PV system for Residential Load (Home)**

1. **Solar PV system sizing**

Appliances	Working Hours (Hrs/day)	No.	Power (W)	Total Wattage (W)	WH/day
Lamps	5	10	20	200	1000
T.V	5	1	150	150	750
Receiver	5	1	50	50	250
Fans	5	3	60	180	900
Refrigerator	12	1	75	75	900
Total				**655**	**3800**

- Total appliance use = 3800 Wh/day.
- Total Wp of PV panel capacity needed = (Total Wh/panel generation factor).
- panel generation factor for Egypt = 6 Hours in Summer and Winter.
- Total Wp of PV panel capacity needed = (3800/6) = 633.33 Watt.
- Select Wp of PV panel capacity = (12 V) 250 Wp & 150 Wp.
- Number of PV panels needed = 2 x 250 Wp & 1 x 150 Wp



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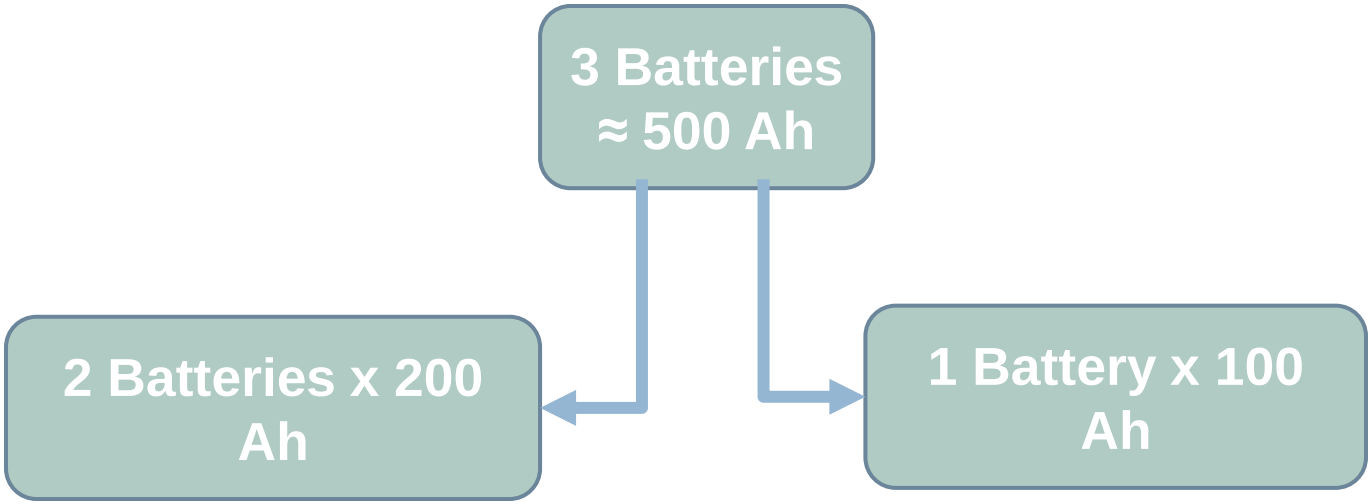
2. **Battery Sizing**

- Total appliances use = 3800 Wh/day
- Nominal battery voltage = 12 V

$$\text{Battery Capacity (Ah)} = \frac{\text{Total Watt-hours per day used by appliances x Days of autonomy}}{(0.85 \text{ x DOD x nominal battery voltage})}$$

$$\text{Battery capacity (Ah)} = \frac{3800 \text{ x } 1}{(0.85 \text{ x } 0.8 \text{ x } 12)}$$

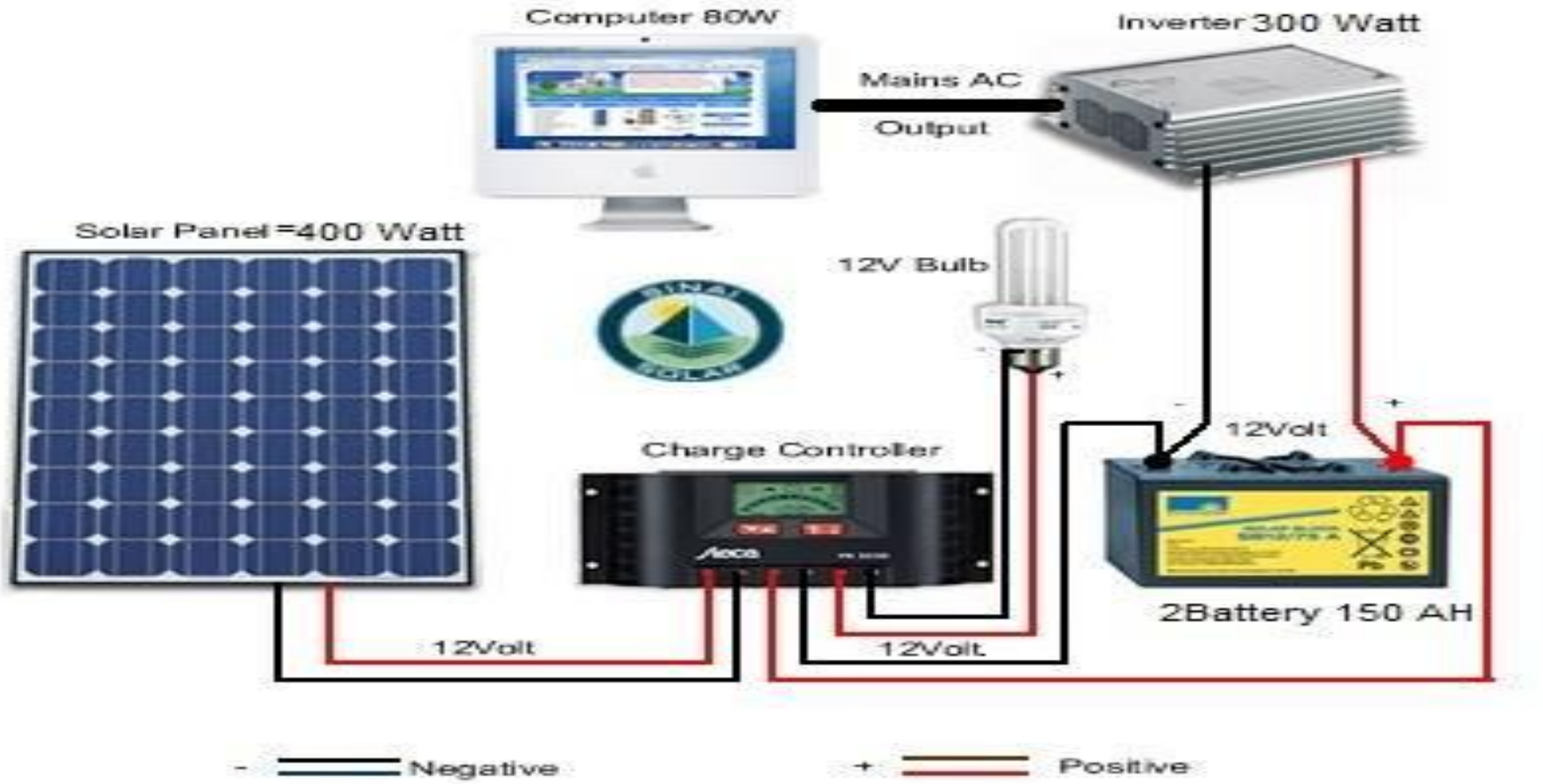
- Where; **DoD** is the Depth of Discharge which is inversely proportional to life time of battery.
- Total Ampere-hours required 465.68 Ah



3. **Inverter sizing**

- Total Watt of all appliances = 655 W.
- For safety, the inverter should be considered 20-30% bigger size.
- Inverter Size = 655 x 1.2 = 786 W.
- The inverter size should be about 800 W or greater

Connection



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