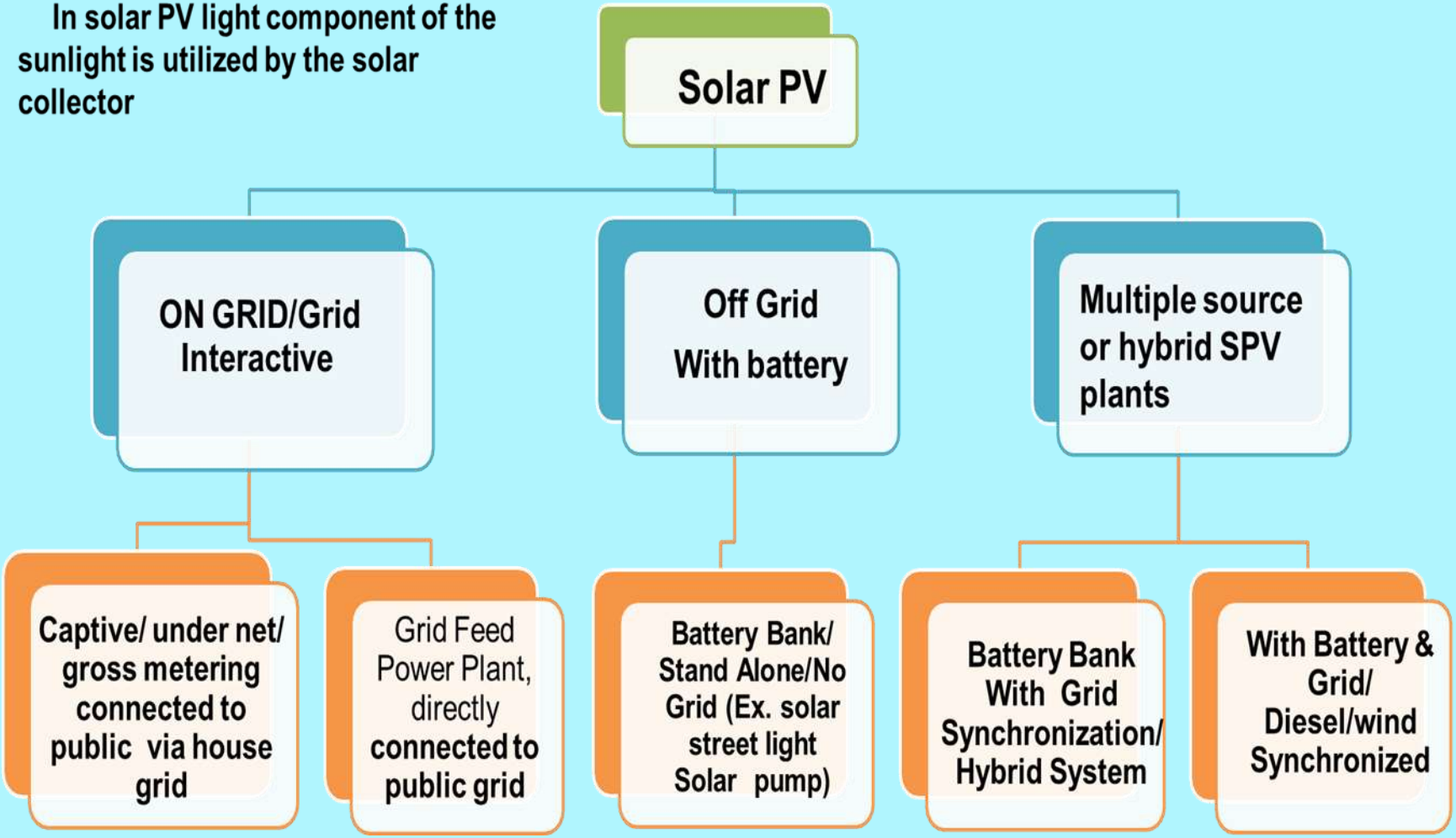
Unit 2:- Solar Energy

Lecture 3

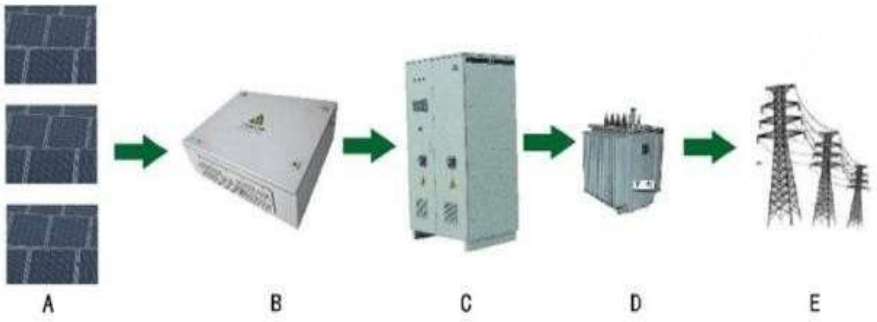
- Solar power utilization
- Different solar systems
- Floating SPV Plant
- Roof Top SPV Plants
- Roof Integrated Plants
- BIPV Plant and Terrace Garden PV
- RTSPV Features and Share
- 1st Generation SPV Plant
- 2nd Generation SPV Plant
- 3rd Generation SPV Plant
- Solar PV cell Classification

Grid-connected photovoltaic power systems

In solar PV light component of the sunlight is utilized by the solar collector

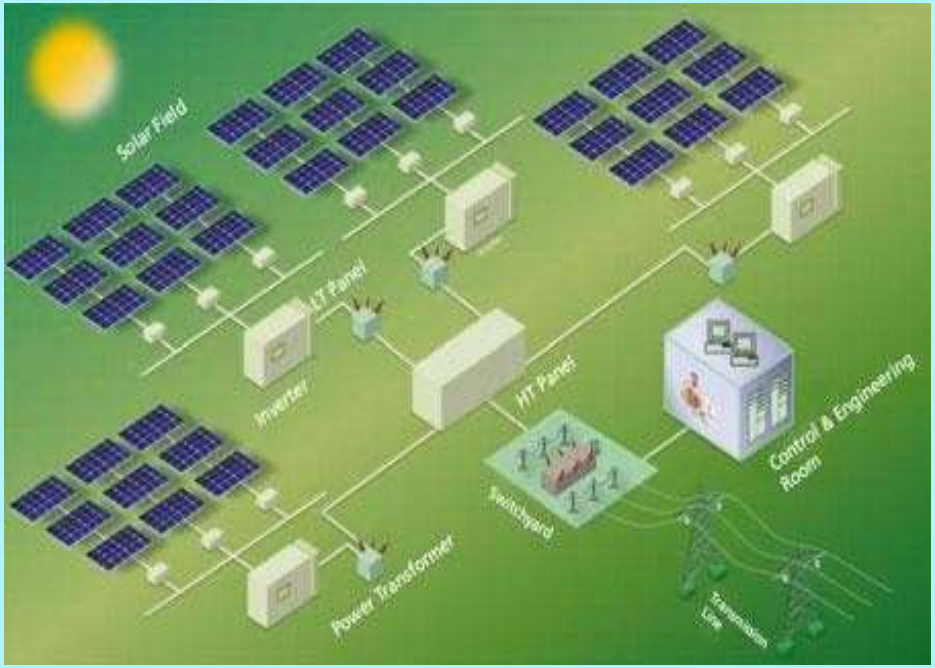


Grid-connected photovoltaic power systems



PV Power Generation System Constitute

Serial Number	Name
A	Photovoltaic Array
B	DK-PV serial PV Lightning Protection Combiner Box
C	Grid Connected PV Combiner Box
D	Step up Transformer
E	Public Grid



Grid-connected photovoltaic power systems are energized by photovoltaic solar panels, which are connected directly to the utility grid.

Solar Power Utilization

12MWp Solar Plant at Cochin International Airport[720P].MP4

Floating SPV Plant

- First Implemented in Japan,
- Effective use of the available space & no buying or leasing the land,
- Non-metallic, non toxic and high-density polyethylene material
- Resistant to both corrosion and the sun's ultraviolet rays
- Ensures zero loss in power output due to shadow cover,
- Naturally cooled by the constant winds and the evaporation of water
- Strong enough to withstand storms and even typhoons,
- Cleaning frequency is less and there are no trees for leaves to fall

Roof Top SPV Plant

Roof Integrated SPV

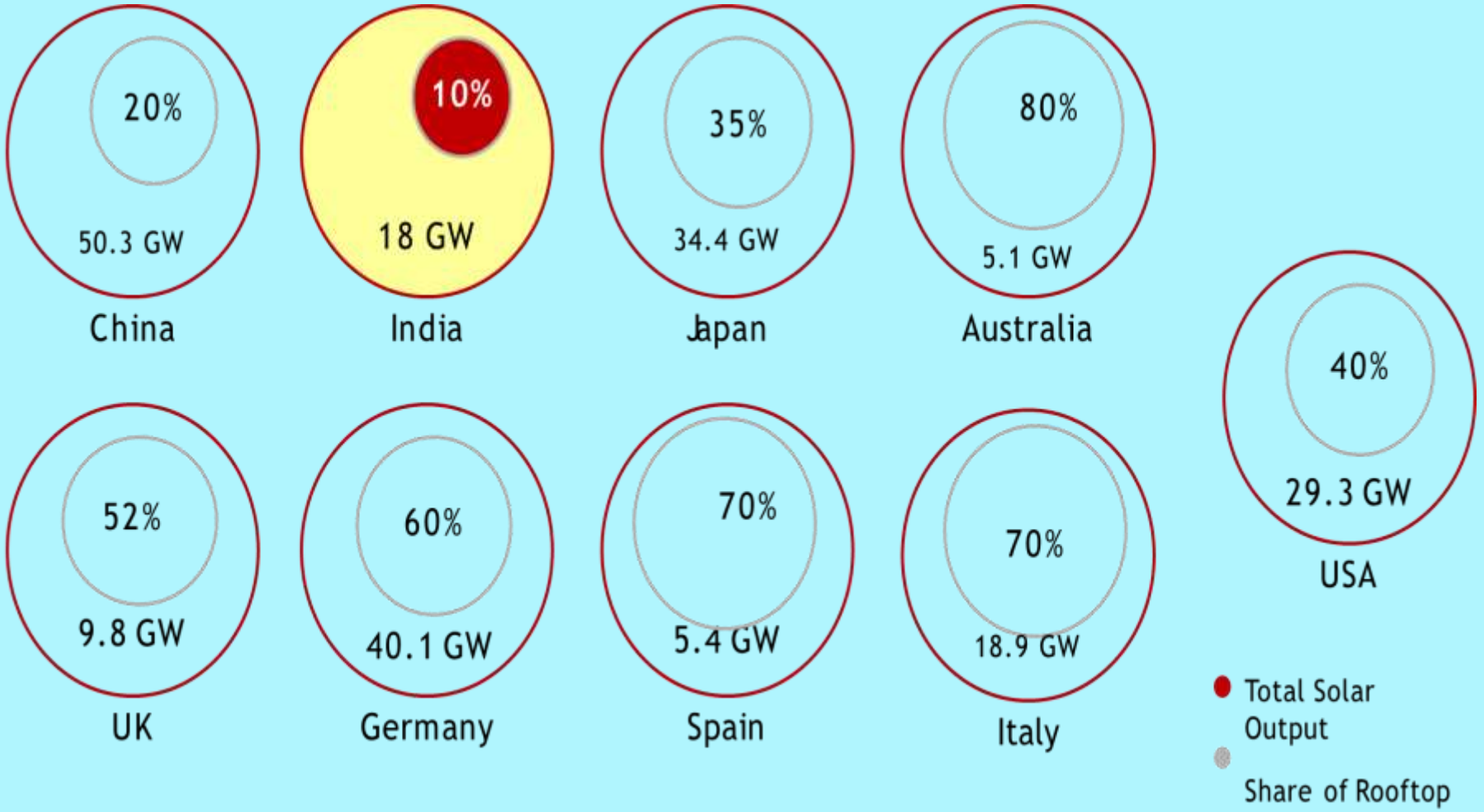
BIPV (Building Integrated)

Terrace Garden SPV

Roof Top SPV Plant

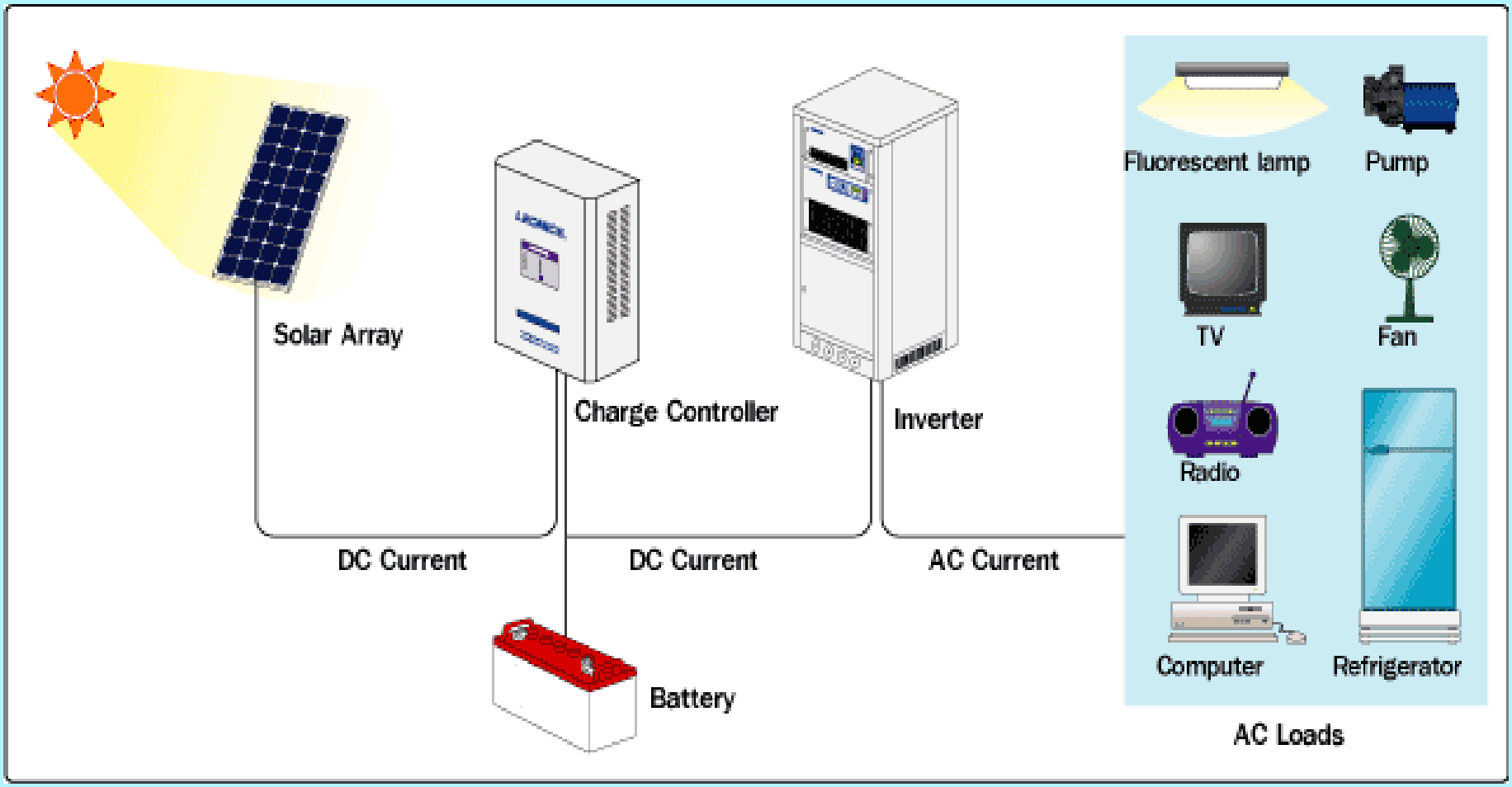
Solar Deployment areas/ benefits	Land Requirement	T&D losses	Investments	Optimal utilization of infrastructure
Large ground mounted solar projects	Need dedicated land for 25 years	High losses similar to conventional power projects (15-30%)	Need large investments	Need new transmission lines & enhanced grid capacity
Large solar rooftop projects (industrial/ commercial/ institutional)	Un-utilized roofs can be put to use	Minimal losses due to consumption at generation point	Medium investments Can be mobilized from small to medium investors	Infrastructure expansion needs can be minimized
Small rooftops projects (residential)			Small investments Can be mobilized from retail investors	

Roof Top SPV Plant Share Global



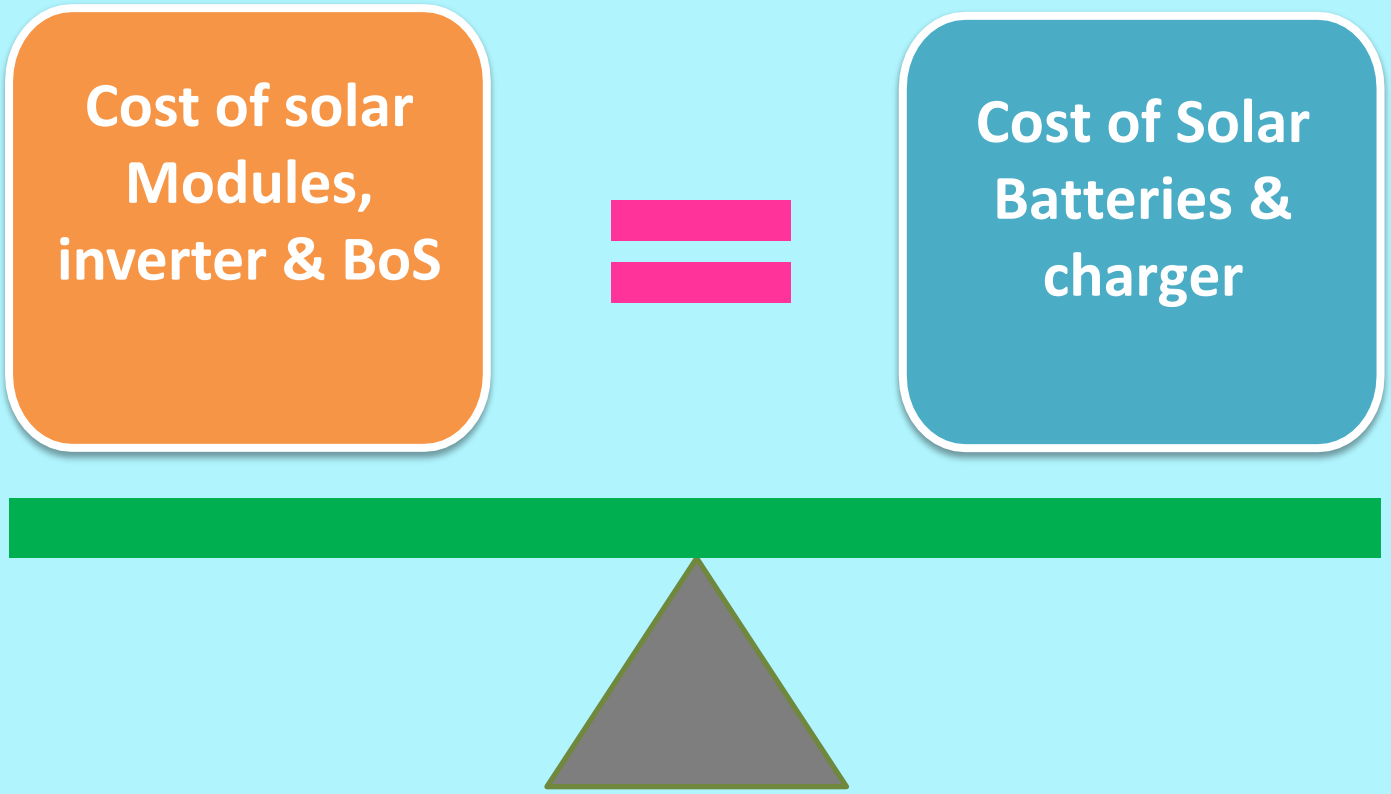
1st Generation Solar PV Plant

With Battery Bank/ Stand Alone/No Grid



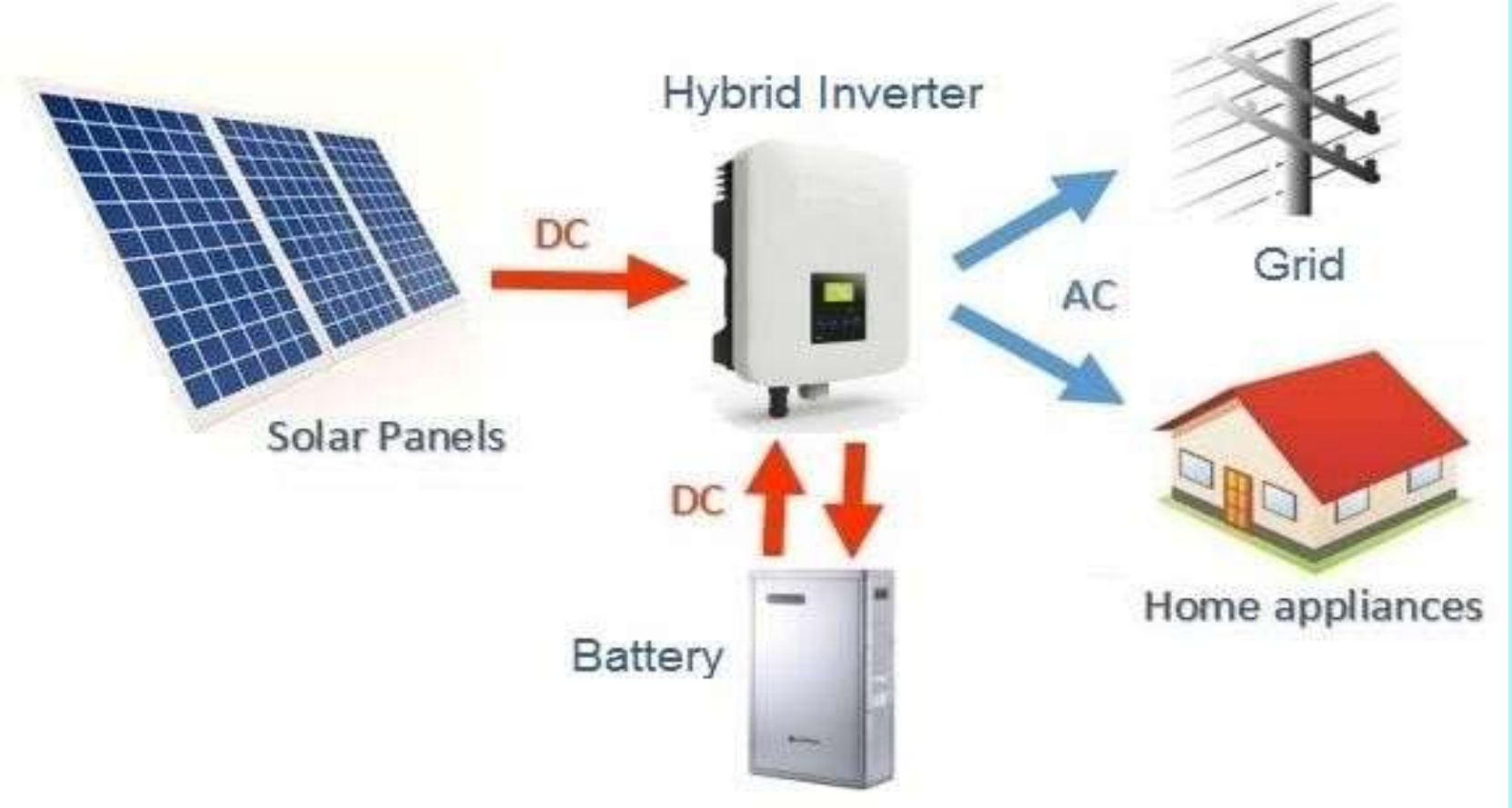
1st Generation Solar PV Plant

Issue of cost



BOS: Balance of Solar System components

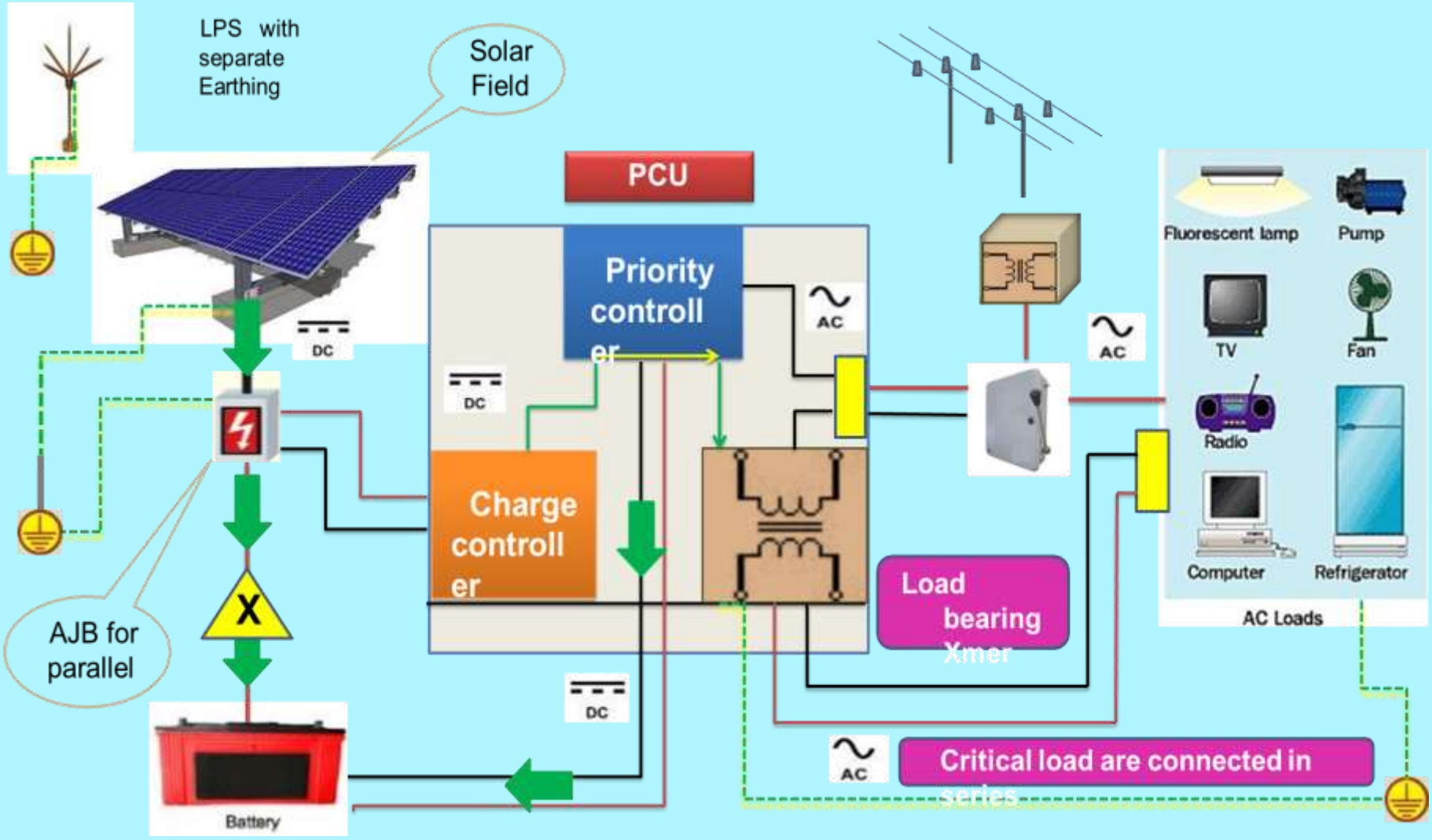
2nd Generation Solar PV Plant



Smaller size of the batteries used to reduce the cost of the plants

Wind & Solar Hybrid Plant

2nd Generation Solar Plant



3rd Generation Grid Connected Solar Plant

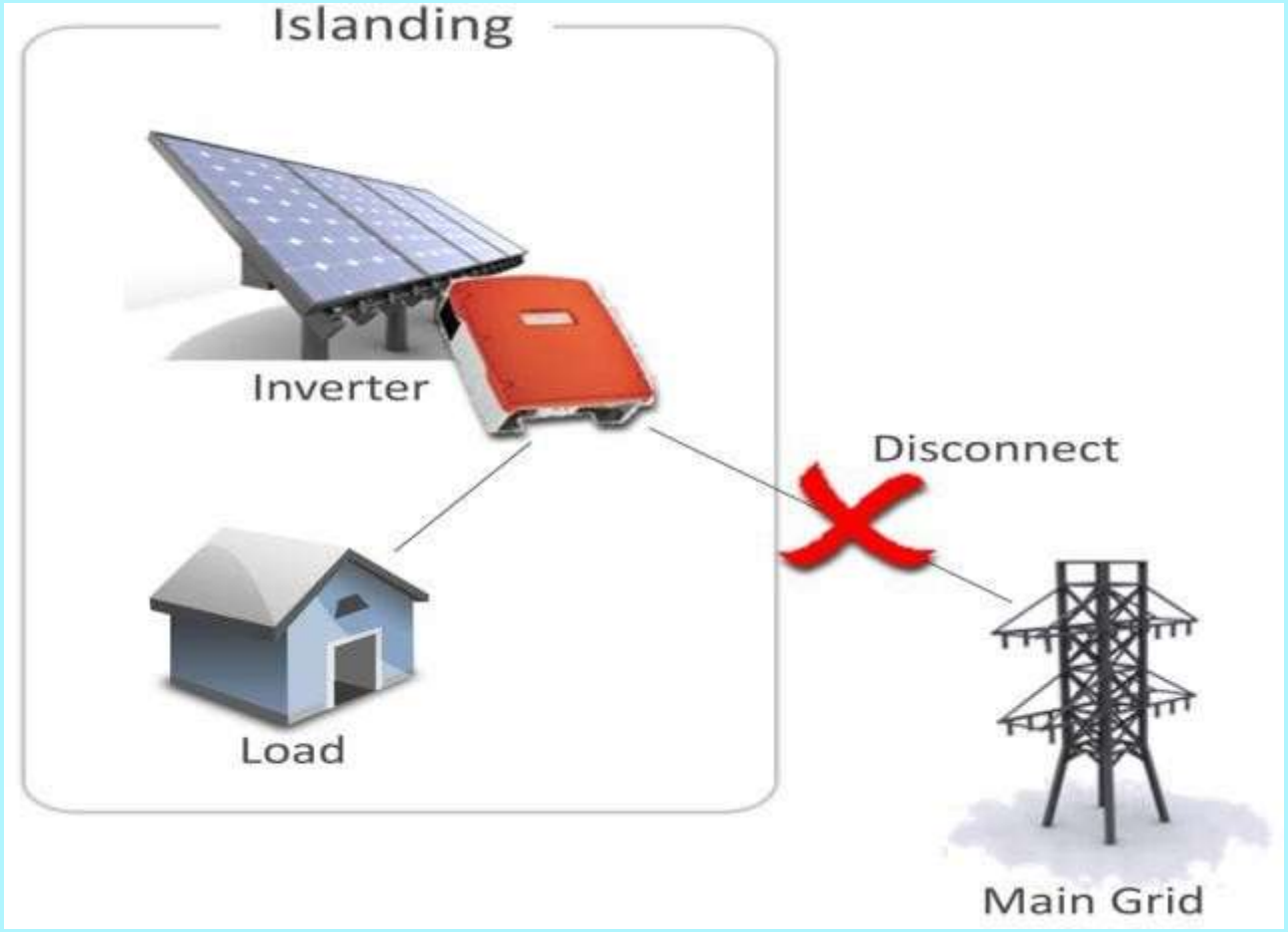
1. Solar Panels
2. Solar inverter
3. Solar meter
4. Connected Load
5. Net meter
6. Grid Synchronization

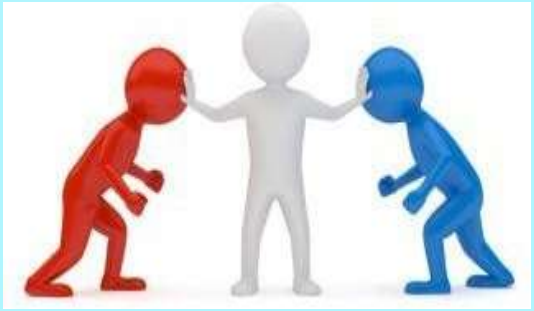
V, f, Phase sequence & wave form

Completely battery less system

to minimize the cost of RTSPV & to connect in load sharing mode

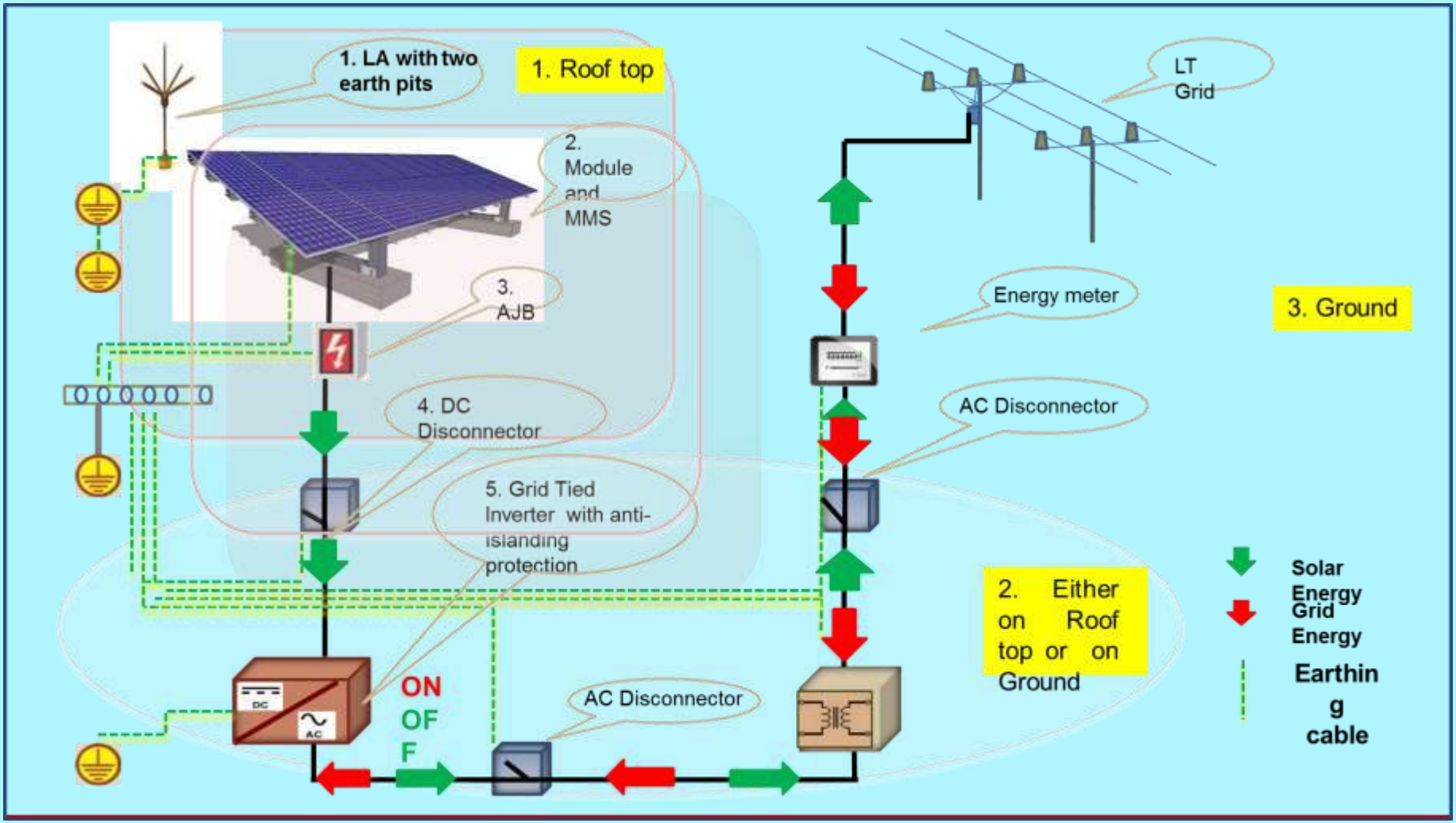
Grid Connected Solar Plant Working





No grid power No AC electricity from inverter

Grid Connected Solar Plant Working



Grid Connected Solar Plant Working

- On-grid plants needs **reference voltage (AC power)** from Grid
- It gets **synchronized with the grid usually in 1 min** with the grid
- Afterwards start converting DC power coming from SPV in to AC
- The **AC voltage** generated by the **solar inverter is slightly higher then Grid voltage** Due to this solar power will get the first priority for connected loads
- On-grid plant is **connected in parallel** hence it is a **load independent system**
- On-grid plant act as a **load sharing device in the electric circuit**
- **It has inbuilt Anti islanding feature, which provide immediate (0.2 seconds) isolation** from the grid and **complete isolation in 2 seconds** when there is loss of reference from the grid

Solar PV cell Classification