Worksheet 1 Solutions: The history & benefits of PV

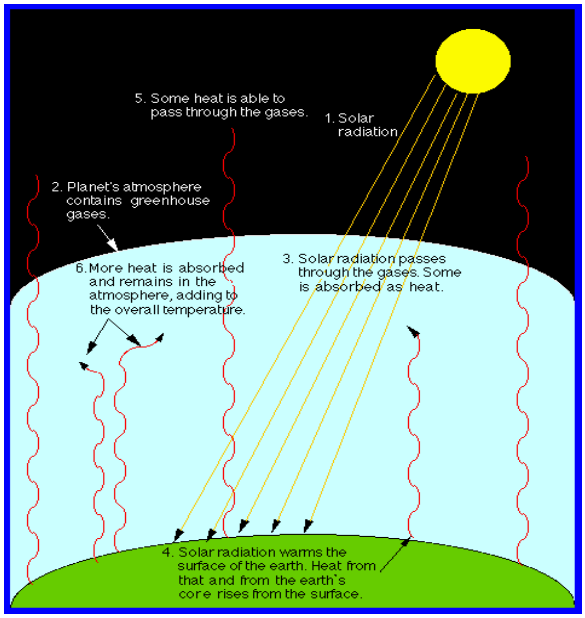
1.
1839 - Alexandre Edmond Becquerel discovered the photovoltaic effect
1870's - Willoughby Smith and William Adams illuminated a junction of selenium and platinum to demonstrate the photovoltaic effect in the first solar cell
1918 - Jan Czochralski discovered a method of single crystal silicon production. This made possible the first single crystal silicon cell production
1964 - Sharp Corporation developed the first commercially viable silicon solar cells

2. Space – to power satellites used for communication, television and GPS etc. This was the first application for solar power due to the remoteness of space and the need to power satellites. The large budgets of space programs gave the photovoltaics a real kick start
Cathodic protection of pipelines and bridges to prevent corrosion – The DC provided by PV can be used directly to counteract the natural corrosive electrochemical currents between ions in soil and water & the metal pipes/structures. The acids and ions in water and soil are an electrolyte in transferring electrons to the metal equipment. The metal is then an anode and gets corroded. By providing an opposite current with PV, the metal becomes the cathode, and is not degraded by incoming electrons.
Buoys and marine navigational equipment – There are high costs of regularly replacing batteries on offshore buoys and such devices. PV however, can greatly extend the lifetime of such battery systems by powering rechargeable batteries. Further, PV is very much suited to increasing the lifetime of such storage systems because the loads on these navigational aids are very small (a few lights etc.).
Remote area radio telephony – A transmitter and aerial are required to access the nearest repeater station. These require a small amount of power which can be easily provided by PV. It is very difficult to get grid-power to some remote locations.

Also see the solar water pumping sample engineering report provided with this module package.

3. Lighting at night allows 2 main development benefits:
- Children can study at night, allowing them to advance their career opportunities
- Adults can work at night and produce more items to sell and earn income from

4. GHGs increase the absorption of infrared, and due to the increase in GHGs production, the amount of infra red absorbed will also increase. This causes the earth temperature to increase. The use of photovoltaic for energy supply means that there will be less fossil fuel combusted to provide that energy, and less carbon dioxide (greenhouse gas) emitted. This means that the absorption of infrared to the earth's surface will be less severe, and it help to prevent the rapid effect of global warming.



5.

Gases	Sources
Carbondioxide (CO2)	Combustion of fuel, deforestation
Methane (CH4)	Anaerobic decomposition of bacteria
Ozone (O3)	The release of hydrocarbon in industry and car causes ozone in troposphere to decompose and cause pollution
Nitrous oxide (NOx)	High temperature environment in car, lightning
Sulfur dioxide (SO2)	Smelting of ores

6. **Increase in energy supply security** : PV provides a means of maintaining local electricity supplies without having to import fuels

- **Reduced transmission and distribution loss:** The use of photovoltaic make it possible for on site and local generation of electricity – no transmission loss.
- **Rural Independence :** Local rather than grid/utility dependence in rural areas
- **Sustainable job creation:** High technology industry, which can create new jobs in manufacturing, distribution, installation and maintenance. Also, dispersed application means that employment is created in regional areas, as well as in industrial centers.
- **Grid Voltage Support**: Dispersed photovoltaic power systems feeding into electricity grids provide more reliable electricity supplies during power outages caused by summer peaks or emergency situations.

7. In rural health clinics:

- Vaccine refrigeration to keep vaccines from spoiling
- Lighting for service area of clinics, to prevent unlit night births etc.
- Water pumping to provide fresh water to the clinic for sanitation
- Purification of pumped water