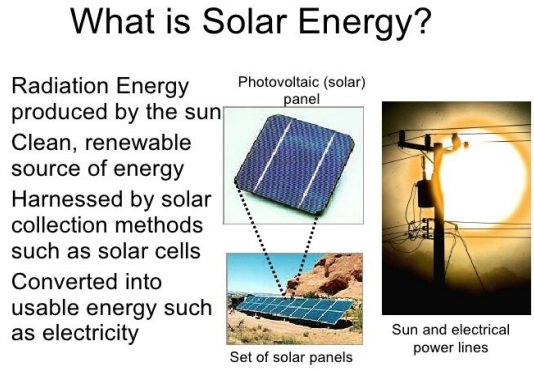
What is Solar Energy?

1. Solar Energy is a Renewable Source:

The sun is one of the principal sources of renewable energy. Solar energy is basically the direct conversion of sun's energy into electrical power with the use of solar panels and collectors. Solar energy is heavily reliant on power known as nuclear fusion that is generated from the sun's core. The energy obtained from the sun is gathered and the conversion into electricity can be done in diverse ways such as the use of solar collectors to heat water and the use of solar attic fans to cool the attic for domestic purposes. There are also complex technologies that can be employed to carry out the conversion such as photovoltaic cells, reflectors and boilers. However, our modern day society cannot be solely powered with the use of solar energy as it is entirely dependent on the sun.



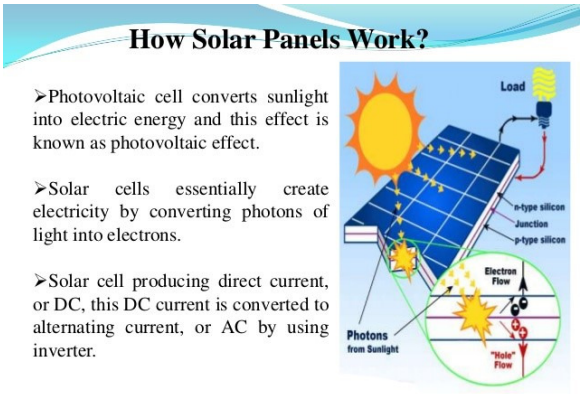
Apart from the sun energy, there are other alternative and renewable sources of energy such as wind power, hydroelectric energy, biomass, geothermal power, and hydrogen and fuel cells. The wind power can be utilized for purposes of pumping water or creating electricity. However, it is important to note that it requires far-reaching areal exposure to generate noteworthy energy amounts. The sun is an important element in the generation of wind power as the atmospheric movement is highly driven by temperature variations at the surface of the earth when lit by sun rays.

Hydroelectric energy utilizes the gravitational potential of elevated water that has been lifted with the aid of sunlight from the oceans and other water bodies. Biomass is the energy that is obtained from plants. Geothermal power is the energy that is generated from the initial earth accretion. It is augmented by the use of heat that is available from a number of radioactive decays present in the earth.

As a renewable source of energy, solar energy can be used either through the utilization of photovoltaics or solar thermal systems. It is renewable meaning that one needs not purchase the solar energy before using it. It is just available in natural form for use by each and every person who is willing. In the production of electricity, solar energy does not cause any form of pollution. It reduces the cost of electricity as one does not have to pay utility fees for electricity if they have their own solar panels. Its maintenance level is equally quite low and no obstructions are caused while using solar panels. In addition, the value of any residential building increases when installed with a solar panel.

2. Conversion of Sunlight into Electrical Power:

The energy obtained from the sun can be converted into electricity and this is termed photovoltaic (PV). The photovoltaic cells generate direct-current electricity that is passed through a power inverter and ultimately converted into alternating-current electricity. This form of electrical power can be used in both residential and commercial buildings as it is more or less similar to the one generated by utility power companies. There are grid-connected and stand-alone systems that are used in the generation of electricity from sun energy. The systems that are connected to the grid are mainly utilized in commercial infrastructures. Systems that are off-grid are used for purposes of feeding electricity directly to facilities in order to be utilized immediately, or into a battery system so as to be used in the future.



3. Why Solar Energy?

- It's Free: Sun light contains many energies within such as heat, light etc. Solar power is generated by solar PV panels using light energy of Sun.
- Solar Energy is the most readily available source of Energy In northwest corner of the Arabian Gulf, like Kuwait Sunlight is available at least 4383 hours, which averages to 12 hours of sunlight and daylight per day. This is divided into an average of 3347 hours (76%) of sunlight per year, or 9 hours of sunlight per day. The remaining 1036 hours (24%) is daylight per year, or 3 hours of daylight per day which is likely present with cloud, shade, haze, or low sun intensity. Moreover solar PV panels are capable to generate at least 20% energy in dim sunlight like cloudy and rainy days.
- Sun also the most important & largest of Non-Conventional Resources of Energy Conventionally not much attention was paid to utilize sun energy as fossil fuel availability was more at cheaper price. With time we have understood that the fossil fuel reserve is limited and it is creating damage to environment at every stage. Also solar energy is the most reliable energy source.
- Highly Efficient System On good solar Intensity day 4-7 kWh per m2 power is produced per day.
- Long term Power Production. Solar power plants has no moving parts or combustion process. The structure is robust, lasts long. Solar power is long term Energy revenue Generator.
- Eco friendly Power No Green House Gas Emissions. Other power production technics doesn't even come closer to solar power production process when it comes environment protection.

4. Why Solar Roof Top Systems?

Rooftop Solar systems can be installed on the roofs of residential, industrial and commercial complexes, housing societies, educational institutes, community centers, government organizations, private institutions etc. The solar panels can also be installed on ground, terraces and on parking sheds too. No additional FSI is utilized.

Due to solar PV panels array on roof, roof remains cooler and in turn the temperature of the floor below gets reduced by a degree Celsius, thereby reducing the load on the air conditioning equipment and saving electricity.

Further, if solar PV panels are installed on raised fabrication structure (super structure), a spare hall is created on the roof without consuming any FSI.

In many cases the super structure of solar plant, helps resolving water proofing issues too.

The solar power plants are designed depending on annual power consumption of the client; keeping in mind seasonal & weather changes and also the available sunny days. The plant is designed such that the utility bills can be reduced to almost zero (except demand charges and D zone electricity usage in case of TOD: Time of Day meter.)

The payback period for Solar Power Plant is typically 3 to 7 years. (Depending upon utility charges)

The solar Power Generation is Government approved, in fact, more encouraged. The solar power approvals are given by (Ministry of Electricity & Water, Govt. of Kuwait).

So in briefly we can say…..

- Solar panel structure on roof reduces the temperature of the rooms below
- Roof top solar resolves water proofing issues
- No Battery Maintenance
- Five Years Warranty for Grid Inverter & 25 Years for Solar PV modules**
- It can be installed quickly.
- It has almost zero noise.
- It requires very little maintenance.
- It's efficient. The electricity it produces is used where it's needed: on-site or by the grid; meeting an immediate electricity need.
- No need for costly transmission infrastructure.
- Photovoltaic technology is field proven for more than 20 years in performance and availability.
- Solar irradiation is highly predictable in Kuwait.

Creates a relatively easy way to enter the renewable energy market for a unique power-generating opportunity for a long period of time.

5. Solar Power Generation plants:

There two main types of Solar Rooftop systems: On-Grid Solar power system and Off-Grid Solar power system:

On-Grid solar power solutions:

In On-Grid Power Generation, Solar Photo Voltaic (SPV) panel produces DC power, this DC power is converted to AC power in Inverter and is fed to consumer load. When the production / Generation is more than need, excess power is fed to grid through net meter.

Similarly, when demand is more than generation power is taken from grid through net meter. This way net meter keeps record of power fed to grid as well as power consumed from grid.

The solar power plants are designed keeping in mind these seasonal & weather changes also the annual power consumption of the client. Available sunny day's data is used to design the plant such that the utility bills can be reduced to almost zero.

On-Grid power generation is always preferred as it gives good returns on investment.

Kuwait recommends on-grid solar power solution to almost every application. Residential consumer, society common utility consumption, industrial used, hospitals, schools and education institutions, finance institutions, etc.

Off-Grid Power Solutions:

In Off-Grid solar power system Solar Photo Voltaic panel converts received sun light into DC voltage. That DC power is regulated and batteries are charged. Inverters are fed with these battery DC power. Inverters convert DC into AC. AC output of inverter serves as power source to the load. While no sun-hours or no utility / electricity hours of the day the stored power in battery is used as power source

Komax recommends off-grid power solution for users those who do not have easy access to grid electricity e.g. farm houses, resorts etc.

Off-grid solar power systems offer complete autonomy and independence from the national grid and power companies, meaning they never have an electricity bill. Some hybrid off grid system uses utility (grid), solar and even wind mill with batteries.

Main constraint in the off-grid solar power plant is that it requires large no. of batteries if load and backup time goes up.

6. Comparison between On-Grid vs Off-Grid Solar:

On-Grid Solar:

Definition: On-Grid Systems are solar pv systems that only generate power when the utility power grid is available. They must connect to the grid to function. They can send excess power generated back to the grid when you are overproducing so you credit it for later use.

Benefits: These are simplest systems and the most cost effective to install. These systems will pay for themselves by offsetting utility bills in 3-8 yrs.

Downside: These do not provide power during a grid outage.

Off-Grid/Hybrid Solar:

Definition: These systems allow you to store your solar power in batteries for use when the power grid goes down or if you are not on the grid. Hybrid systems provide power to offset the grid power whenever the sun is shining and will even send excess power to the grid for credit for later use.

Benefits: Provides power for your critical loads when the power grid is down.

Downside: Cannot be expected to provide power for all your loads since the cost and volume of batteries would be prohibitive. Off-Grid systems require a lot more specialized equipment to function that is more costly and more complex to install. Specifically they require a central/string inverter, a charge controller as well as a batteries.

Sizing the solar array and the batteries required is complex. Detailed analysis of your requirements will be needed to provide for your minimal critical needs. You'll also need to rewire you main electrical panel to isolate the "critical loads" so that only they are provided power in an outage. This means that your well pump, refrigerator and a few lights are provided power while your air conditioners and TV and other non-essential loads are not.

This is definitely more complex to install as well. There are dangerous components, mostly dealing with high amp batteries so caution needs to be exercised. Also, batteries are expensive, require ongoing maintenance and periodic replacement.

Given the additional specialized equipment required and the fact that it requires come complex installation, expect a off-grid system to cost four (4) times as much to install per watt and to require ongoing maintenance outlays.