UNLOCK THE POWER OF THE SUN

AND THE BEST WAY TO TAP INTO SOLAR

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Contents

Executive summary:

Energy is the derived power from the utilization of physical, chemical resources that provide the strength and vitality required for sustained activity, be it man or machine. This implies that energy is the prime mover of the world.

Energy production is the freest market in the economy.

The recent propensity of the world towards the production of energy through solar can be easily understood if one looks a little closely. The traditional method of production of electricity (the most widely used form of energy) is not very clean. Carbon emission, coal sludge, nuclear waste etc. are very serious pollutant that affect the environment in a very adverse manner.

Most of these energy sources are limited in supplies, depleting resources of fossil fuel gives rise to new kind of problem: dependency on a select-few country that are rich with these natural resources. Current geopolitical environment suggest that energy crises will continue to increase in the near future. Prices of oil, natural gas, coal etc. have already skyrocketed and demand for ecologically friendly and economically viable alternatives has increased.

Above all energy sources today solar energy shows the most potential. Solar is unbeatable in terms of availability and abundance.

Now, there are solutions innovative enough to help you take care of energy requirement through solar. Grid-tied solar photo voltaic system is unique way that can provide you/your firm with a readily available source of energy, efficient use of the sun & your roof area along with significant savings on your electricity bills.

One more thing, it adds to no extra burden on you or your staff.

Role of solar energy

To fully appreciate the power of solar energy, a good understanding of where the traditional energy comes from is required.

- **What is renewable energy?**
- **What do you mean by sustainable energy?**

Renewable form of energy constantly replenish itself with little unknown no human intervention.

Supply for water, solar, wind and such sources will never end no matter how much you use. However, to make sure the resources last, focus is required, recycling, restoration and renewable & alternative energy sources. Such a holistic approach is the core concept of sustainability. Sustainable resources are not only renewable they also have the ability to conserve the eco system.

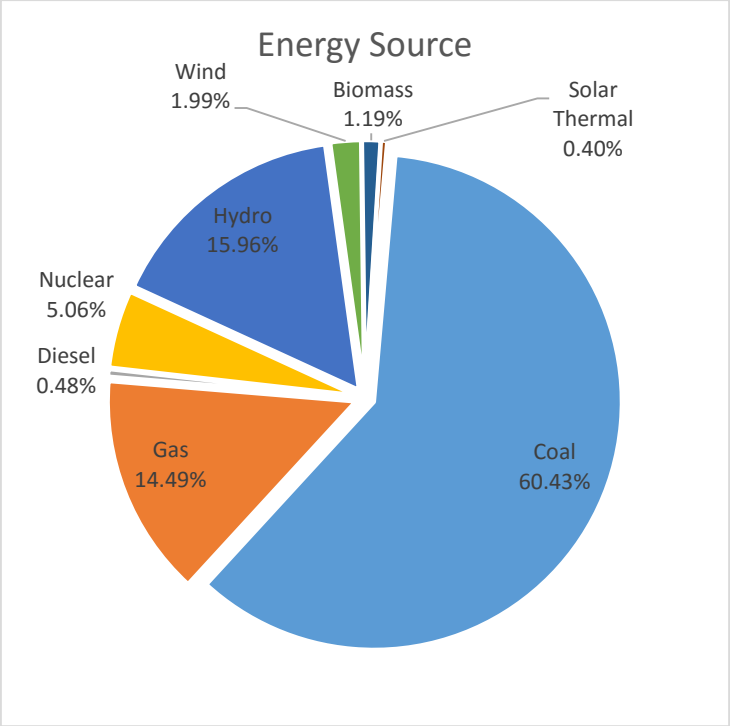


Fig: 1 Statistics about Indian power use

India imports more than a quarter of its fossil fuels

Indian energy demand grows by more than any other country in the period

Almost half of its fossil fuel demand have to be imported at current growth pace.

A staggering 69.2% of electricity production of India is attributed to fossils fuels.

Benefits of solar

Using solar energy equipment brings out the following benefits-:

- Saving of your monthly utility bills.
- Predictability on your electricity bills for years to come. You will be protected against the unprecedented rates of electricity rates because of your own power plant, which is also your local energy source.
- Financial rewards- Financial Support for grid connected to solar roof top projects by ministry of new & renewable energy (MNRE). Objective of the scheme is to promote the grid connected SPV rooftop and small SPV power plants in the residential, community, institutional, industrial and commercial establishments. MNRE has set target of achieving 300 MW through this scheme by 2017.

- Erasing your carbon footprint-: natural resources are burned in order to produce energy. India derives roughly 70% of its electricity by burning fossils fuels. By virtue of your energy consumption you too

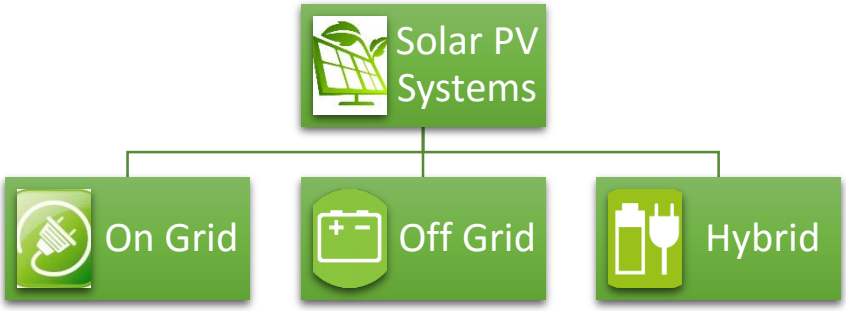
become a culprit in releasing carbon di oxide in environment, even if you do not burn fuels directly.

An average Indian is responsible for 1.8 tons of CO_2 per year i.e. approximately 1632 Kg/year, steadily increasing, at a pace of 55% just in the past decade.

On the other hand, solar has no carbon footprint other than the "Grey Energy" require to manufacture panels and other accessories. To top all this, you also save the inefficiency of the grid for all the power you utilize through your local energy source viz., solar

Potential of solar

Installing a full scale photo voltaic system is considered the best solar investment counting the fact that you can instantly neutralize your entire electricity bills and also reduce your carbon footprint. A grid tie solar PV system makes the most economic and environmental sense amongst the three options available:



On grid systems have the upper hand amongst the above mentioned because the tangible benefit that you expect directly impact your finances (unlike off grid system). They are more efficient and low cost as you eliminate the storage system (battery). Keeping it simple an on grid system gives you three fold advantages-:

BENEFITS

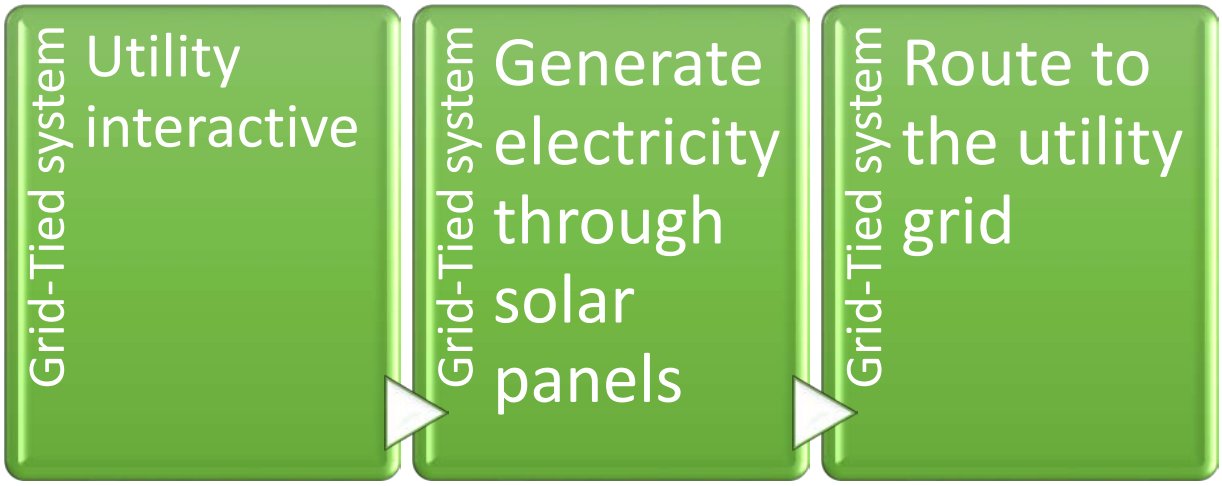
- LOWER UTILITY BILLS
- SIMPLICITY
- EASY MAINTENANCE: JUST KEEP THE MODULE CLEAN
- RELIABILITY: LONG LIFE (25 YEARS) AS NO MOVING PART IS INVOLVED.
- SUBSIDIES
- POLLUTION MITIGATION: LOWER YOUR CARBON FOOTPRINT
- PREDICTABILITY ON BILLS: IMMUNITY FROM RISING ENERGY COST
- PREDICTABILITY ON ENERGY USAGE: YOU ARE COVERED AGAINST INCREASING DEMAND.
- INTANGIBLE BENEFITS: APPRAISAL OF PROPERTY VALUE: NOW YOUR HOME COMES WITH A POWER SOURCE.

Firstly you have increased efficiency as batteries (storage facility) require constant charging. When fully charged a charge controller disconnects the system in off grid modules. In hybrid systems too, the efficiency of the battery, constant need of charging pulls down your optimum system performance.

Secondly, battery (storage device) is a maximum of 5 to 7 years add to that frequent maintenance, charging in efficiency, risk associated with a container that coverts chemical to electrical energy , security and safety concerns etc. your system life and safety both take a downward slide.

Thirdly, cost of the system is drastically reduced. Not only you reap more benefits with an on grid system, but you start saving on your money at a lower cost of equipment.

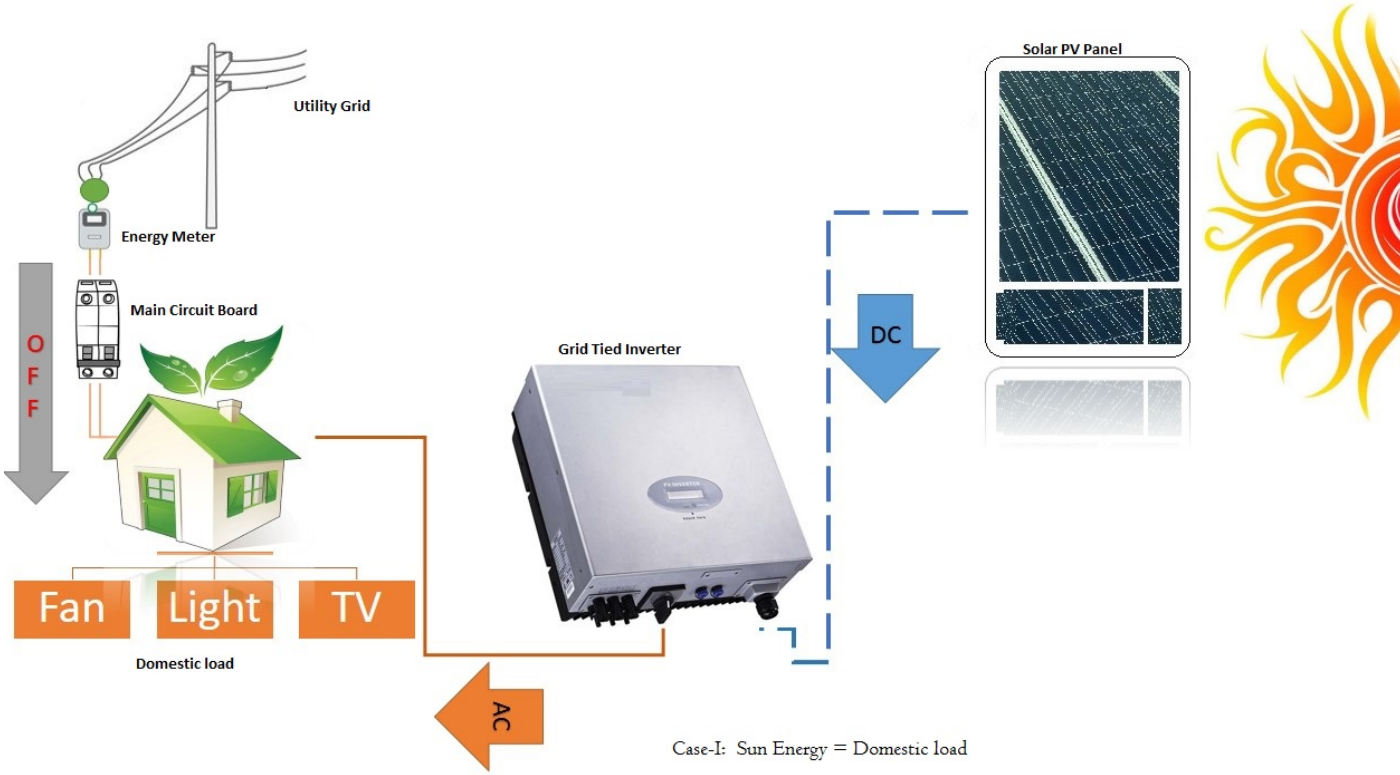
Basic grid tide system



Functions of an on grid system

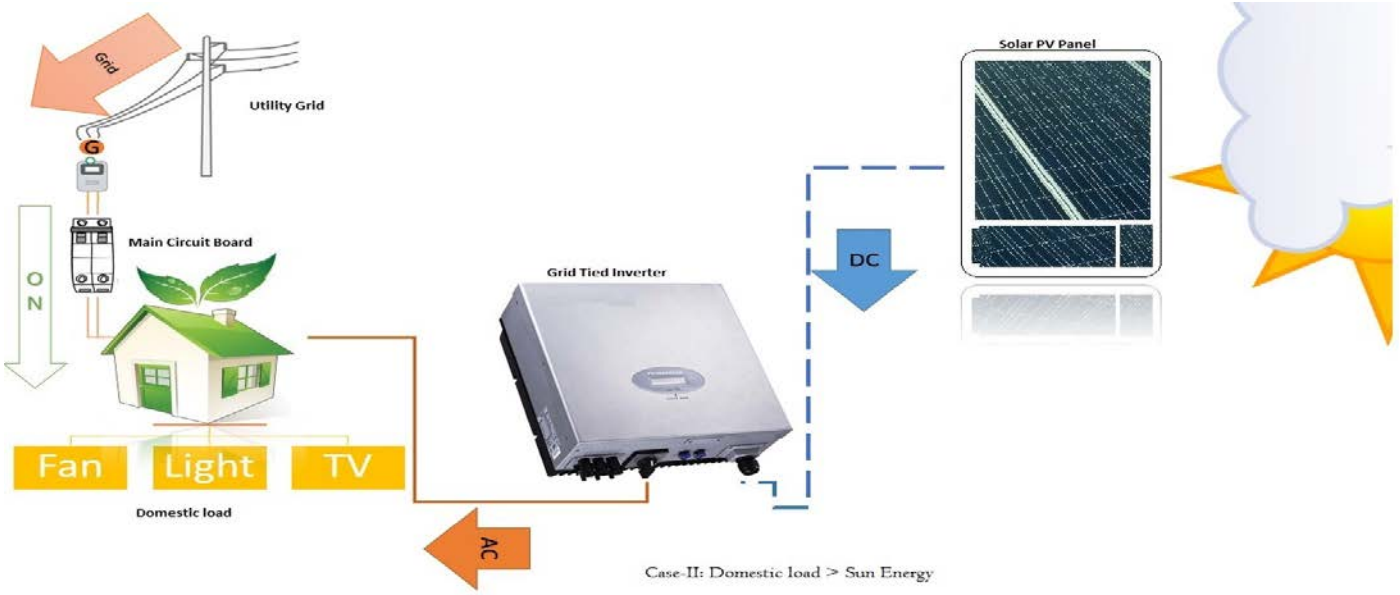
An on grid system can be explained with the help of four cases

Case I: Only sun energy: When the sun is enough to supply without the help of utility grid.



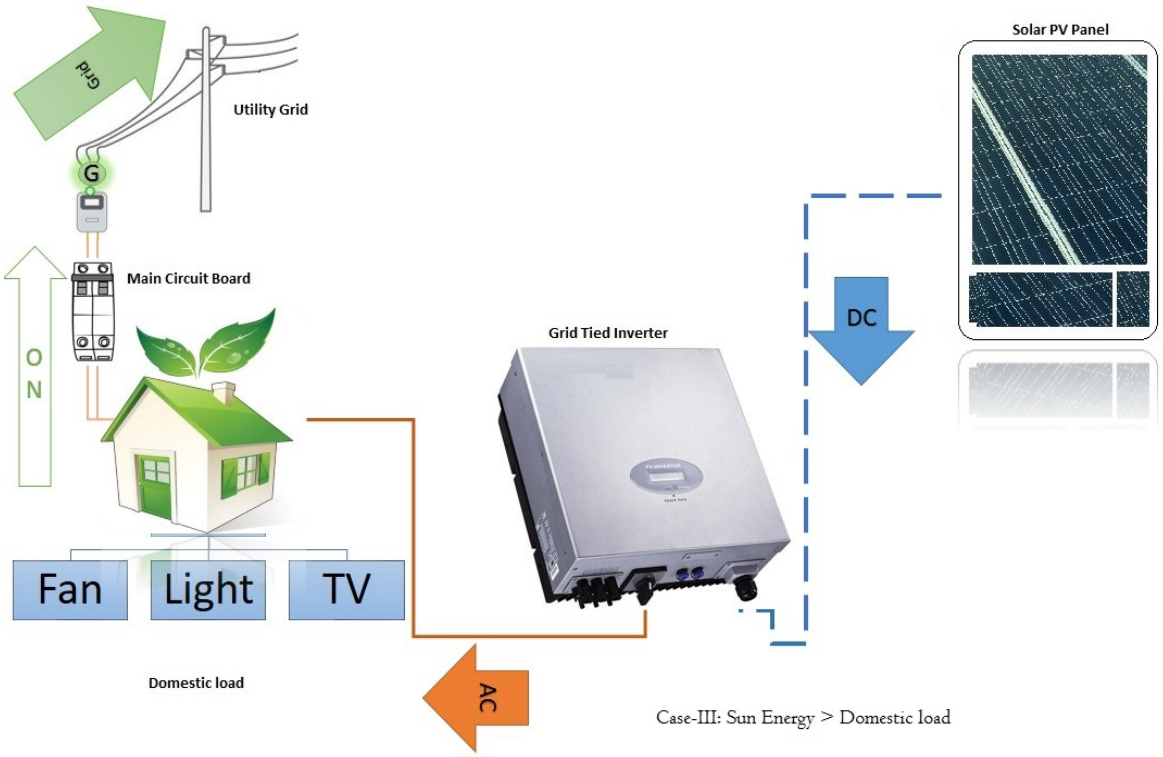
Case-I: Sun Energy = Domestic load

Case II: Sun and Grid: In some situation sun energies may not be enough for your house therefore electricity from the grid is utilized to compensate for the increased usage, example cloudy or rainy day.



Case-II: Domestic load > Sun Energy

Case III: Sun and excess energy: In case of you have solar energy it will turn the meter backward to the utility grid with the help of a special meter.



Case-III: Sun Energy > Domestic load

Case IV: Grid energy at night: We don't have energy coming from sun at night hence all the energy is provided by the utility bill.

Common terminology

Load: Any device that uses electricity. An inverter is a load, as is a washing machine or a light bulb.

The output of a solar PV system is listed in watts-peak, which means the maximum amount of power it can handle.

Volt: The unit of force, or electrical pressure, that causes electrons to flow through a conductor.

AC: Alternating current. The flow of electricity goes in both directions, back and forth, and in household electrical systems it flows back and forth 50 times per second (referred to as Hertz, or Hz).

DC: Direct current, where the flow of electricity is in only one direction. The output of a solar panel is DC. Since your home uses AC, this DC current must be converted into AC to be useable, and this is what an inverter accomplishes.

Ampere: The amount of current that is flowing, due to the presence of a voltage. Amps are denoted by I.

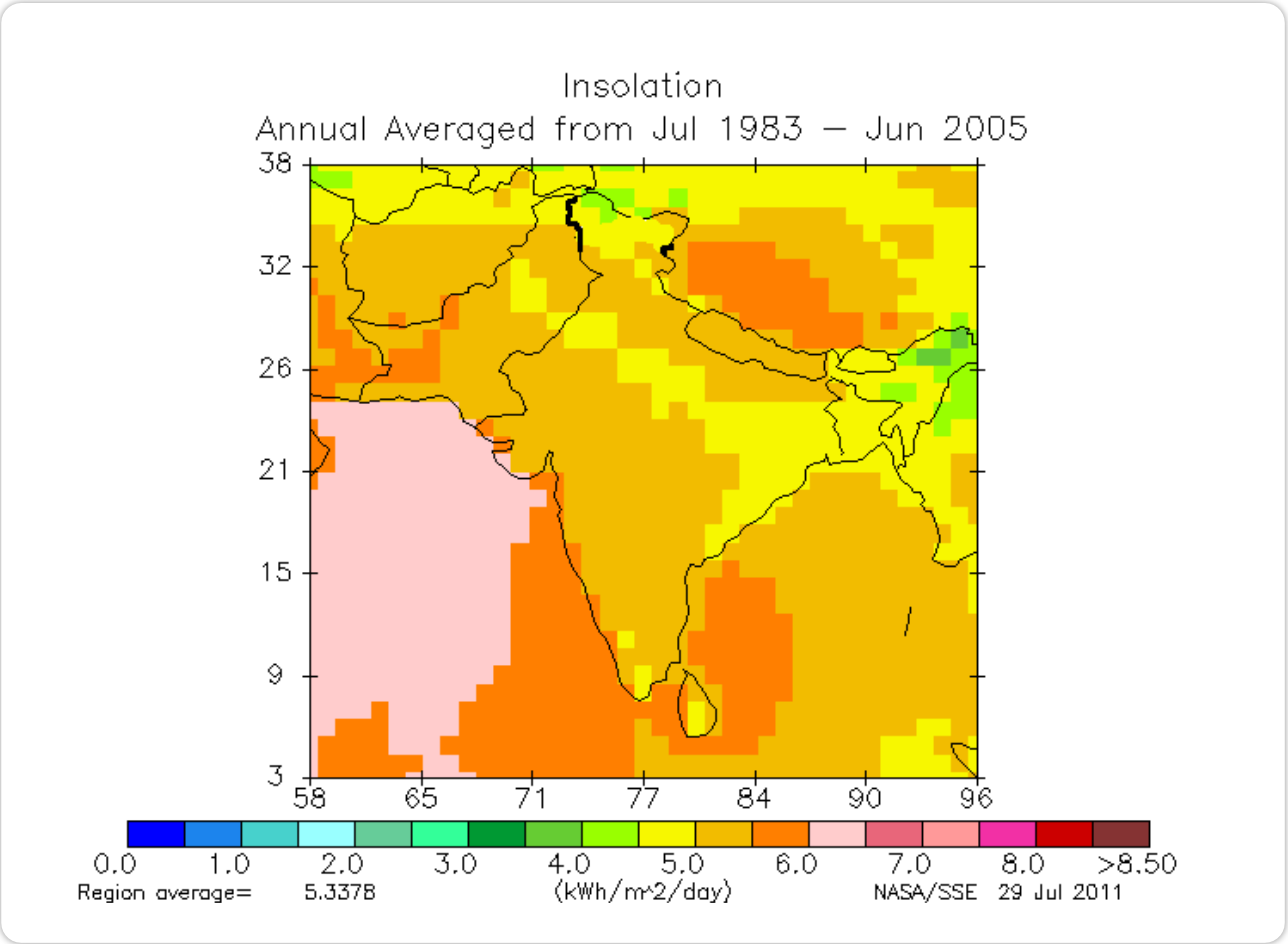
Resistance (denoted by R): The amount of opposition to electrical flow. The higher the resistance, the lower the current for a given voltage.

Watt: A unit or power, and is equal to Voltage times Current, or I X V. It's an instantaneous measurement; power can vary from second to second, as you switch the various loads in your home off and on. The output of a solar PV system is listed in watts-peak, which means the maximum amount of power it can handle.

Watt-hour: A unit of energy, and this is what your solar system produces over a period of time. Your utility bill charges you for how many kWh you use per month.

Solar Potential in India:

- Total Solar Power in GWp: 748.98 GWp
- In Madhya Pradesh, 61.66 GWp
- India's solar power potential estimated at 749 GW while the tapped solar power output is still under one percent. Study by Deloitte and Confederation of Indian Industry (CII) - 24 Aug 2015.
- Solar Resources Bhopal: (23°15'N 77°25' E) - 1729 kWh/m2/year approx.
- The global solar radiation over India varies from 4-5.5 Kwh/sq m/day.



Working with a contractor

A meticulously designed Photo Voltaic system entails a lot of details. As it is said “the devil is in details”. For example even the in correct wire size of the system affect the performance. You lose energy in the wires which translate to decreased kWh unites (loses of the system increased). Safety also plays a major role handling high DC voltages and power, power conditioning units require expertise and often counter intuitive experience.

Blatant exposer to sun in the Indian subcontinent (where 300+ sunny days & summer temperature of over 41*C) creates difficult engineering problems.

Continues exposure is bound to degrade the quality of metal and plastics. What it implies is at the electrical connection which ranges from tiny wire connects to general signal phase or three phase circuit breakers (DPST- dual pole signal throw switch) must be carried out with apprehension and utmost care.

Weather has a habit of being unpredictable, India has a very varied weather conditions and that can sometimes work against your installation. Your system may start to show corrosion or safety hazards and may even become dangerous.

Bottom line is choosing an overall good contractor who understands all these technical ins and outs is immensely significant to the success of your solar rooftop PV system installation.

A good contractor doesn’t make wild claims like offering same output at half the price or roof area other than the standard (you can check the standards at MNRE website) Or, providing energy saving devices connected to your

Suggestion: It is not always about the price. Reliability and system performance does matter. Keep in mind the nature of electricity. You can’t see it but it is one of the purest form of energies.

switch boards so that you use half the power from the grid to achieve the same result that you would with an on grid system.

Albeit, the solar power industry is changing daily and so is the technology.

Conclusion

Solar energy is the emerging source of renewable and sustainable power which through the grid tie installation, allows you to exploit every ounce of sunlight that hits your panel.

Where other systems sits idle (like a solar water heater or an off grid system) your inter tie system constantly generates even when you are not using any appliances. It has become such an important concept that the central government through the ministry of new and renewable energy (MNRE) has started legislating the state electricity boards to allow the solar producing customers tie to their grid and provide incentive either in form of energy credits or in form of financial credits. Energy credits in form net-metering is proving to be the most popular as it allow the state electricity boards to fulfill their renewable purchase obligations(RPO) easily and the customers with all the benefits of grid tie systems.

Using SSESPL

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