Best Practices

(solar system in govt.college.kekri)

Several new parameters are emerging for a good nation e.g. air quality, noise pollution,energy production ,commitment for preservation of environment and to adopt renovation. Production of solar energy is one such thrust and india has set a target of 280 GW by the end of 2030. India is doing a lot of research work on energy resourceh and on non renewable resources to meet 500 GW by 2030.Energy resources can be defined as materials or elements that can be used to produce energy.This energy can be in the form of electricity, heat, or mechanical energy.Energy resources can be divided into two categories, namely, renewable and non-renewable.Non-renewable resources, such as fossil fuels, are exhaustible and cannot be replaced once they have been used up. It takes millions of years to form again e.g. fossil fuels, uranium & plutonium, etc.Renewable resources, on the other hand, are replenishable and include sources like solar, wind, and hydro.

Solar Energy

Solar energy is defined as the transformation of energy that is present in the sun and is one of the renewable energies. Once the sunlight passes through the earth's atmosphere, most of it is in the form of visible light and infrared radiation. Solar cell panels are used to convert this energy into electricity.Solar energy is a powerful source of energy that can be used to heat, cool, and light homes and businesses. It is more sustainable alternative to traditional fossil fuels.

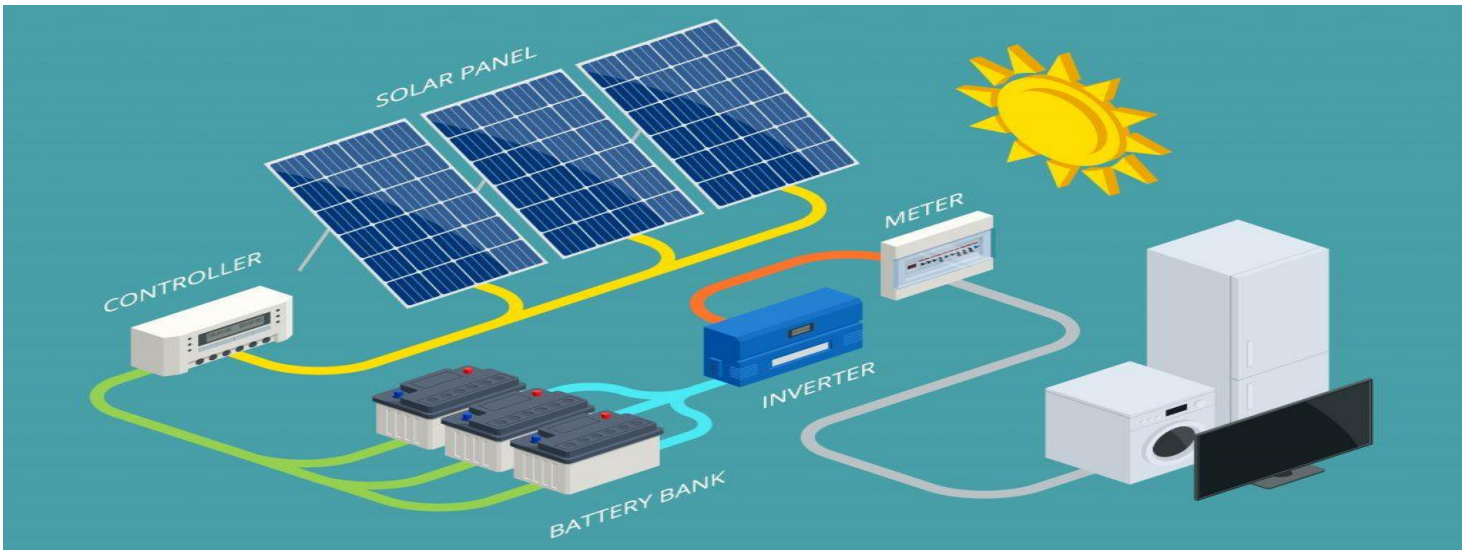
Advantages of solar energy are:

- Clean: It is considered to be the cleanest form of energy as there is no carbon dioxide emission like in the case of fossil fuels which is one of the causes of global warming.
- Renewable: There is ample energy available on earth as long as the sun exists.
- Reliable: The energy can be stored in the batteries, so there is no unreliability.
- Free energy because it can be trapped easily.

All over we can say that solar energy has become more efficient, affordable, and accessible to people all over the world.

Disadvantages of solar energy:

- The production is low during winters and on rainy days.
- Installation and the initial cost of the materials are expensive.
- Space consumption is more.



solar energy is not only a truly **reliable and lasting energy source** but also a very **cost-effective and efficient** one, if the chosen types of solar panels and the environment are perfectly matched to one another. Such promising prospects have grown in an industry that has put a lot of effort into developing efficient techniques to **generate, use, and store the sun's energy** by using different types of **solar panels** and converting the sunlight into valuable electricity.

Single photovoltaic Module/Panel is an assembly of connected solar cells that will absorb sunlight as a source of energy to develop electricity.A group of PV modules (also called PV panels) is wired into an extensive array called PV array to gain a required current and voltage.Most home solar systems include an inverter, which changes the DC electricity to alternating current (AC) electricity—the kind needed to power your home. Solar batteries can store unused energy for use at night or during an outage.Solar panels are used for generating green electricity. Several decades of research, work, and development have lead to the **wide range of different types of solar panels** now available on the market for solar panels. Some helpful information about the **most common** and **special types of solar panels**.

Distinguishing between different types of solar panels often means differentiating between

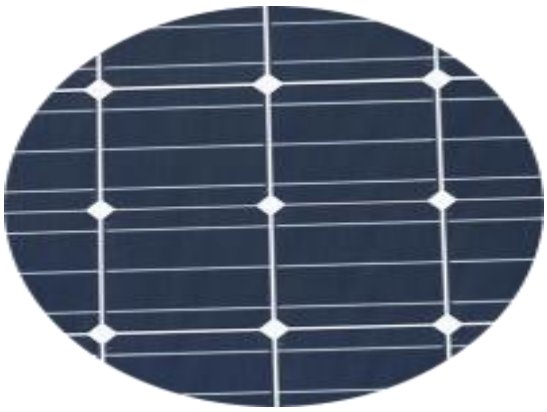
- **single-junctions** and **multi-junctions** solar panels—or **first, second, or third generations**. Single-junction and multi-junctions differ in the number of layers on the solar panel that will observe the sunlight,
- whereas the **classification by generation** focuses on the **materials and efficiency** of the different types of solar panels.

1st Generation Solar Panels

These are the **traditional types of solar panels** made of (1) monocrystalline silicon & (2) polysilicon and are **most commonly used** in conventional surroundings.

(1) Monocrystalline Solar Panels (Mono-SI)-

This type of solar panels (made of monocrystalline silicon) is **the purest one**. You can easily recognise them from the **uniform dark look** and the **rounded edges**. The silicon's high purity causes this type of solar panel has one of the highest **efficiency rates**, with the newest ones **reaching above 20%**.**Monocrystalline panels** have a high power output, occupy less space, and last the longest. Of course, that also means they are the most expensive of the bunch. Another advantage to consider is that they tend to be slightly less affected by high temperatures compared to polycrystalline panels.

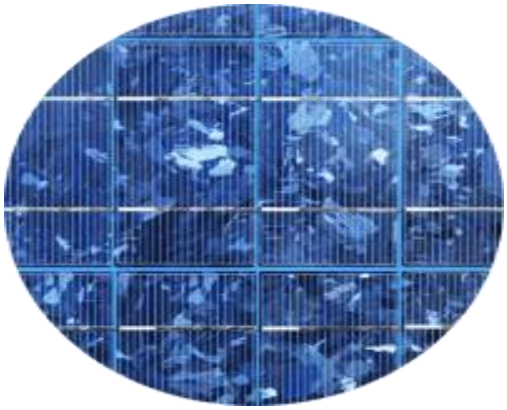


When sunlight falls on the monocrystalline solar modules, the cells absorb the energy and create an electric field through a complicated process. Hence it comprises of voltage and current which is directly used to run DC.

- The panel cells have a pyramid pattern that offers a larger surface area to collect more energy from the sun's rays.
- It reduces reflection and thereby increases absorption; the cells are coated with silicon nitride.
- These panels have life span up to 25-30 years.
- They are useful in exhibiting more excellent heat resistance.
- The produced electricitMonocrystalline solar panels efficiency is 18-24 % with the highest conversion amongst all other commercial Solar PV technology.y is collected through metal conductors printed into cells.
- **Power capacity:** 300 watts and up

(2) Polycrystalline Solar Panels (Poly-SI)

This type of solar panels has squares, its angles are not cut, and it has **a blue, speckled look**. They are **made by melting raw silicon**, which is a **faster and cheaper** process than that used for monocrystalline panels.This leads to a lower final price but also lower **efficiency (around 15%)**, lower space efficiency, and a **shorter lifespan** since they are affected by hot temperatures to a greater degree.



However, the differences between mono- and polycrystalline types of solar panels are not so significant and the choice will strongly depend on your specific situation. The first option offers slightly higher space efficiency at a slightly

higher price but power outputs is basically the same.Polycrystalline solar modules are solar modules that consist of several crystals of silicon in a single PV cell.

Polycrystalline PV panels cover 50% of the global production of modules.Made of multiple photovoltaic cells and each cell contain silicon crystals that function as a semiconductor device. As the photons from the sunlight fall on the PN junction, it imparts energy to the electrons to flow as electric current.

- Polycrystalline silicon is the most consolidated and tested photovoltaic technology.
- The conversion efficiency in diffused light conditions (e.g. on a cloudy day) is better than in monocrystalline modules.
- Poly-crystalline cells are slightly cheaper than monocrystalline ones.
- Poly-crystalline is having 25 years of life span.
- **Power capacity:** 240–300 watts
- it is less consistent to produce electricity compared to monocrystalline solar panels and less expensive and affordable.
- Polycrystalline solar panels efficiency is 14-16 % of solar PV technology.

2nd Generation Solar Panels

These cells are different types of **thin film solar cells** and are mainly used for photovoltaic power stations, integrated in buildings or smaller solar systems.

(1) Thin-Film Solar Cells (TFSC)

Thin-film is a second-generation and in third types of solar panels in India to be used mostly. If there's one product that has the opportunity to benefit from the tariffs on crystalline silicon solar modules, it's the thin-film module.Different varieties of Material used in the manufacturing of that material is commonly Cadmium Telluride. Thin-film solar panels are manufactured by placing one or more films of photovoltaic material (such as silicon, cadmium or copper) onto a substrate. These types of solar panels are the **easiest to produce;** a **less expensive** option and economies of scale make them cheaper than the alternatives due to less material being needed for its production.

They are also **flexible**which opens a lot of **opportunities for alternative applications**—and is less affected by high temperatures. The main issue is that they take up a lot of space, generally making them **unsuitable for residential installations**. Moreover, they carry the **shortest warranties** because their lifespan is shorter than the mono- and polycrystalline types of solar panels. However, they can be a good option to choose among the different types of solar panels where a lot of space is available.Power capacity and efficiency of the panels are less as compared to Polycrystalline and Monocrystalline panels. Market share of the thin-film solar panels has nearly 21% behind Monocrystalline and polycrystalline solar panels.

It is a good option for projects with lesser power requirements but needs for lightweight and portability.

- Thin-film panels have 30% less than crystalline panels due to the module itself and its installation process.
- It is easy to handle.
- More flexible compared to conventional solar technology.
- You can get up quickly in thin wafer sheets.
- The efficiency of the thin-film solar panels is 18-21 % varies in laboratories and on-field differently.Thin-film technologies have produced a maximum efficiency of 20.3%, with the most common material amorphous silicon at 12.5%.
- **Power capacity:** No standard measure, since thin-film panels aren't uniform in size, but generally less output than crystalline panels.

(2) Amorphous Silicon Solar Cell (A-Si)

Just to give a brief impression of what "thin" means, in this case, we're talking about a thickness of **1 micrometre** (one millionth of a metre). With only 7% efficiency rate, these cells are **less effective** than crystalline silicon ones—that have efficiency rate of circa 18%—but the advantage is the fact that the A-Si-Cells are relatively low in cost.Amorphous silicon panels are one of the types of solar panels in India. They are the small silicon panels that are mostly used in power exterior lighting in homes. This is the product of thin and flexible material. Which makes the perfect solar panel to install outside lighting? It is used in first and second-generation solar cell panels. The amorphous silicon solar cell is among the different types of solar panels, the one that is used mainly in such pocket calculators. This type of solar panel uses a **triple layered technology**, which is the best of the thin film variety.An Amorphous Silicon Panel is not capable of producing power for the entire home or some part of the home. Because it is 10 % less efficient than polycrystalline panels.

3rd Generation Solar Panels

3rd generation solar panels include a variety of thin film technologies but most of them are still in the **research or development phase**. Some of them generate electricity by using organic materials, others use inorganic substances (CdTe for instance).

Biohybrid Solar Cell

The Biohybrid solar cell is one of the types of solar panels, that is still in the research phase. It has been discovered by an expert team at Vanderbilt University. The idea behind the new technology is to take advantage of the **photosystem 1** and thus **emulate the natural process of photosynthesis**. In case you want to learn more about how the biohybrid solar cell works in detail, read more about it in **the American Journal of Optics and Photonics**. It explains more detailed how these cells work. Many of the materials being used in this cell are similar to the traditional methods, but only by combining the multiple layers of photosystem 1, the conversion from chemical to electrical energy becomes much more effective (up to 1000 times more efficient than 1st generation types of solar panels).

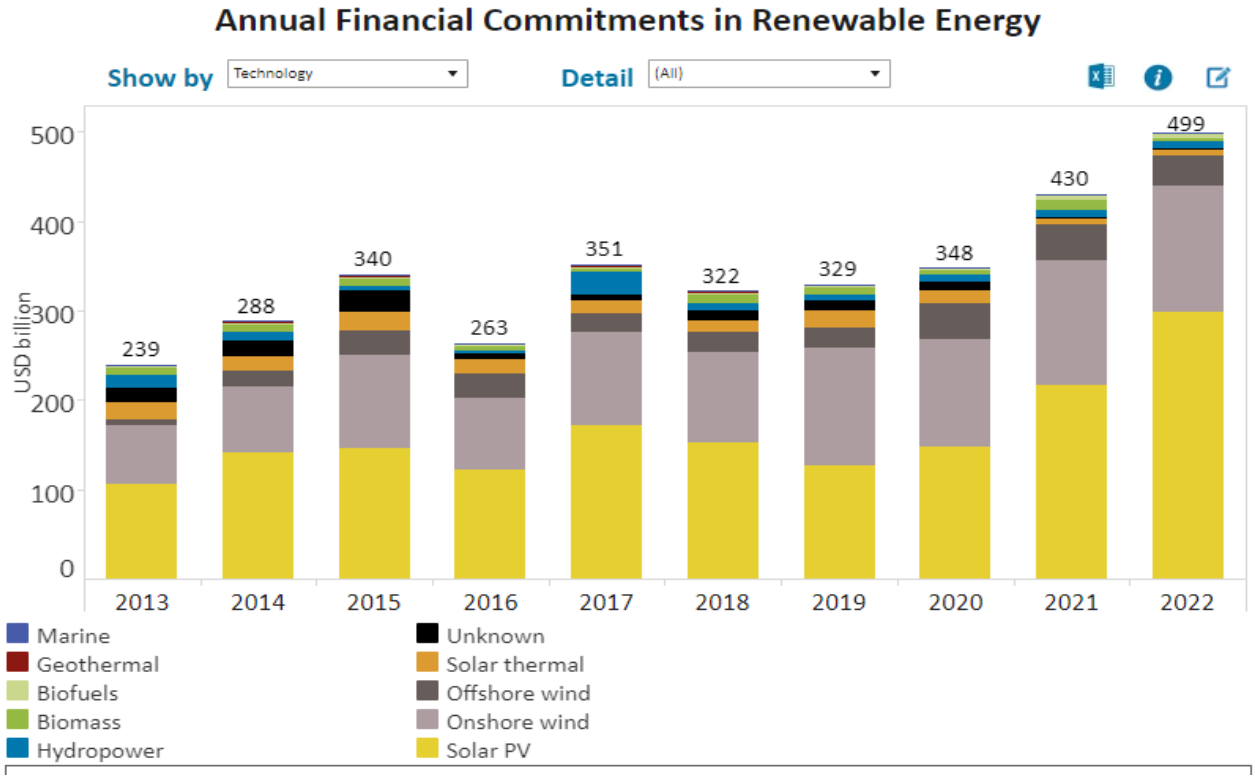
Cadmium Telluride Solar Cell (CdTe)

Among the collection of different types of solar panels, this photovoltaic technique uses **Cadmium Telluride**, which enables the production of solar cells at relatively low cost and thus a **shorter payback time** (less than a year). Of all solar energy technologies, this is the one requiring the least amount of water for production. Keeping the short energy payback time in mind, **CdTe solar cells will keep your carbon footprint as low as possible**. The only disadvantage of using Cadmium Telluride is its characteristic of being **toxic**, if ingested or inhaled. In Europe especially, this is one of the greatest barriers to overcome, as many people are very concerned about using the technology behind this type of solar panel.

Concentrated PV Cell (CVP and HCVP)

Concentrated PV cells generate electrical energy just as conventional photovoltaic systems do. Those **multi-junction** types of solar panels have an **efficiency rate up to 41%**, which, among all photovoltaic systems, is the highest so far.

The name of such CVP cells is related to what makes them so efficient, compared to other types of solar panels: **curved mirror surfaces, lenses** and sometimes even **cooling systems** are used to bundle the sun rays and thus increase their efficiency. By this means, CVP cells have become one of **the most efficient solar panels**, with a high performance and efficiency rate of up to 41%. What remains is the fact, that such CVP solar panels can only be as efficient if they face the sun in a perfect angle. In order to reach such high efficiency rates, a **solar tracker** inside the solar panel is responsible for **following the sun**. If you would like to know more about the different types of solar panels and other green energy options, simply fill in the non-binding form at the top and take advantage of our simple and obligation free service. Greenmatch can provide you with up to 4 quotes from trusted and high quality suppliers.



GOVT COLLEGE KEKRI SOLAR IMPORT EXPORT ANALYSIS

Date	Import (Kwh/KvAh)	Export(Kwh/KvAh)	Net Differnce (Kwh/KvAh)
01-01-2019	15	16	01
01-02-2019	34	37	03
01-03-2019	9.19	39.4	30
01-03-2019	11.2	40.6	29.4
01-04-2019	27	158	131
01-04-2019	26	157	131
01-05-2019	46	267	221
01-05-2019	48	269	221
01-06-2019	91	356	265
01-06-2019	94	358	264
01-07-2019	150	416	266
01-07-2019	154	418	264
01-08-2019	184	485	301
01-08-2019	188	488	300
01-09-2019	239	554	306
01-09-2019	244	549	305
01-10-2019	289	609	320
01-10-2019	294	613	319
01-11-2019	314	706	392
01-11-2019	320	711	391
01-12-2019	331	841	450
01-12-2019	337	787	450
01-01-2020	346	866	520
01-01-2020	352	873	521
01-02-2020	360	959	599
01-02-2020	367	966	599
01-05-2020	435	1170	735
01-05-2020	443	1179	736
01-06-2020	479	1170	691
01-06-2020	489	1179	690
01-07-2020	523	1170	647
01-07-2020	534	1179	645
01-08-2020	568	1175	607
01-08-2020	580	1184	604
01-09-2020	587	1259	672

01-09-2020	599	1269	670
01-10-2020	611	1356	745
01-10-2020	623	1366	743
01-11-2020	638	1453	815
01-11-2020	646	1464	818
01-12-2020	657	1454	797
01-12-2020	670	1466	796

Date	Import (Kwh/KvAh)	Export(Kwh/KvAh)	Net Differnce (Kwh/KvAh)
01-01-2021	686	1454	768
01-01-2021	699	1466	767
01-02-2021	759	1454	695
01-02-2021	773	1466	693
01-03-2021	785	1454	669
01-03-2021	799	1466	667
01-04-2021	822	1454	632
01-04-2021	839	1466	627
01-05-2021	854	1518	664
01-05-2021	873	1530	657
01-06-2021	877	1629	752
01-06-2021	896	1641	745
01-07-2021	908	1685	777
01-07-2021	929	1698	769
01-08-2021	1023	1685	663
01-08-2021	1046	1698	652
01-09-2021	1107	1685	578
01-09-2021	1132	1698	566
01-10-2021	1182	1687	505
01-10-2021	1209	1700	491
01-11-2021	1211	1770	559
01-11-2021	1239	1784	545
01-12-2021	1232	1846	614
01-12-2021	1261	1860	599
01-01-2022	1249	1916	667
01-01-2022	1279	1931	652
01-02-2022	1271	1991	720
01-02-2022	1303	2007	704
01-03-2022	1286	2083	797
01-03-2022	1318	2100	782
01-04-2022	1301	2204	903
01-04-2022	1334	2221	887
01-05-2022	1322	2283	961
01-05-2022	1355	2301	946
01-06-2022	1342	2379	1037
01-06-2022	1376	2398	1021
01-07-2022	1358	2467	1109
01-07-2022	1393	2486	1092
01-08-2022	1431	2477	1046
01-08-2022	1468	2496	1028
01-09-2022	1483	2413	1030
01-09-2022	1520	2532	1012

Date	Import (Kwh/KvAh)	Export(Kwh/KvAh)	Net Differnce (Kwh/KvAh)
01-10-2022	1530	2568	1038
01-10-2022	1568	2588	1020
01-11-2022	1565	2650	1085
01-11-2022	1604	2671	1067
01-12-2022	1596	2661	1065
01-12-2022	1637	2682	1047
01-01-2023	1629	2661	1032
01-01-2023	1669	2682	1013
01-02-2023	1674	2661	987
01-02-2023	1714	2682	968
01-03-2023	1706	2661	955
01-03-2023	1747	2682	935
01-05-2023	1779	2779	1000
01-05-2023	1820	2801	981


2022.01.04 10:52


2022.01.04 10:58

Solar plant of 20 Kw was Installed On 31st Aug 2018. Net Metering With Gird Of A.V.V.N.Ltd Started in function form 1st jan 2019. Institution Import 40820 Kwh (Units) And Export 59740 Kwh (Units) till the end of Sep 2023. Institution have saved 6 Lakh during 5 Years and this Solar Plant Of 20 kw would be free of cost in future .Each corner and building of college would be lighted without paying any cost in future by the blessing of God SUN who is supposed to be friend of human and nature.