

# Low Cost Electrification Using Solar Energy

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**Abstract:** From a way breaking development, power has developed into a standout amongst the most critical variables helping us to continue human progress today. The whole world economy is subject to innovation today. However certain remote zones are denied of this fundamental pleasntry, either because of the absence of worry from the experts or because of the ignorance about reaping locally accessible assets. In this course the difficulties looked by one such zone are distinguished and the issue is explained by using exchange vitality source. This paper depicts how country jolt can be executed in a financially savvy way without trading off productivity. The region under examination is found most remote from the current power framework and the high use that must be acquired in its zap pulled back the specialist from this errand. Anyway the task group shaped under the Local Network of Kerala IEEE Students distinguished that the sun based vitality can be gathered in the region. All the task parameters were examined in detail and intensive research was done on the land and its occupants. Underground links were picked as the methods for transmission. The task actualized gave power to fundamental lighting gadgets. The venture can be seen from a worldwide viewpoint, as the qualities of the region chose are indistinguishable to comparative non zapped areas around the globe.

**Keywords:** Energy Conservation, Energy efficiency, Renewable energy, rural areas, solar energy.

## 1. Introduction

The power segment in India supplies the world's 6th biggest vitality shopper, representing 3.4% of worldwide vitality utilization by over 17% of worldwide populace. The vitality strategy of India is dominantly controlled by the legislature of India's, service of intensity, service of coaled service of new sustainable power source and managed locally by Public Sector Undertakings(PSUs) .About 70% of the power expended in India is created by warm power plants, 21% by business vitality request is met through the nation's tremendous coal holds. The nation has additionally put intensely as of late in sustainable power source usage, particularly wind vitality. In 2010, India's introduced breeze created electric limit was 13,064 MW. Moreover, India has submitted enormous sum insults for the development of different atomic reactors which would create no less than 30,000 MW. In July 2009, India divulged a \$19 billion intend to create 20,000 MW of sun based power by 2020. Because of the quick paced development of India's economy, the nation's vitality request has grown a normal of 3.6% per annum in the course of recent years. In December 2010, the introduced power age limit of India remained at 165,000 MW and per capita vitality utilization remained at 612 kWh. The

nation's yearly vitality generation expanded from around 190 billion kWh in 1986 to in excess of 680 billion kWh in 2006. The Indian government has set a humble focus to include around 78,000 MW of introduced age limit by 2012 which it is probably going to miss. The aggregate interest for power in India is relied upon to cross 950,000 MW by 2030. As indicated by an examination report distributed by city bunch worldwide markets, India is required to mean 113 GW of introduced limit by 2017. Further, inexhaustible limit may increment from 15.5 GW to 36.0 GW. In the private division, real limit increases are arranged in dependence control (35 GW) and (7 GW).

## 2. Overview

The India is both thickly populated and has high sun oriented insolation, giving a perfect mix to sunlight based power in India. Power is the life saver of any advancement of the country. At present the power necessity is being met by three primary sources viz., Thermal, Hydro and Nuclear. While Hydro and Nuclear have their characteristic constraints, Thermal Power is regularly faced by the test related with the accessibility of fuel. Presently warm power stations which meet the significant piece of the power request use coal as fuel. Customary energizes, for example, oil, gas and coal can't take care of the expanding demand for eternity. Notwithstanding the necessity of immense assets, the usage of all the more such undertakings utilizing traditional methods for power age will likewise include issues of developing ecological worry, with consumption of non-renewable energy sources. So as to cut down the reliance of limited non-renewable energy source for power age, it is important to investigate the reasonability of creating power locally utilizing sustainable power sources. Luckily, India lies in radiant locales of the world. Most parts of India get 4.7 kWh of sun based radiation per square meter every day with 300-325 bright days in a year. India has bounteous sunlight based assets, as it gets around 3000 hours of daylight consistently, comparable to more than 5,000 trillion kWh. India can without much of a stretch use the sun oriented vitality.

Today the legislature is empowering age of power from different sustainable power sources, for example, wind, sun based, little hydro, biomass by giving different monetary and money related motivating forces. This separated, the state governments are acquiring power from sustainable power source ventures at particular duty. So far 29,536 MW of sustainable power limit have been introduced in the nation,

which incorporates 19,933 MW from wind, 2079 MW from sun oriented, 3746 MW from little hydro and 3776 MW from bio vitality. The service of new and sustainable power source is giving different sustainable power source frameworks to decentralized age of power. Up until this point, 10,752 towns have been zapped utilizing different sustainable power source frameworks. About 2.55 lakh sun based road lights, 9.93 lakh sun based home helping frameworks, 9.39 lakh sunlight based lamps and 138 MW of decentralized sun powered power plants have been introduced. Legislature of India has independently set up a service called MNRE - Ministry of New Renewable Energy for the advancement of intensity age through sustainable power source. The Ministry has been encouraging the execution of wide range program's including tackling sustainable power/vitality( make utilization of one), sustainable power source to provincial regions for lighting, cooking and thought process control, utilization of sustainable power source in urban, modern and business applications and advancement of interchange fills and applications. MNRE has declared a large group of monetary motivating forces, for example, concessional custom obligations, exclusion of extract obligation and quickened deterioration for sun oriented PV based power plants. At the state level, advancement of sunlight based power age is being energized by neighborhood strategies that cover repurchase, haggling of the created power by state power sheets, other than different motivations. Thinking about the great capability of sun oriented power and furthermore the trust given by the focal and state government in using the plenteous sun based power in the territory of Tamil Nadu for power age, m/s total organization of science and innovation is proposing to set up 50KWp rooftop top sunlight based PV based power plant in Tamil Nadu state. This specialized proposition features the execution of 50 KW sun based PV based power age venture at Tamil Nadu state under Independent Power Producer (IPP) mode. The proposed power plant will have sunlight based PV modules, String inverters as the major components& different frill for the power creation. All the essential assistant offices of the power plant like plant checking framework, security equipment's, instrumentation, control framework and so forth., will be accommodated the power plant. The water prerequisite for the module cleaning and for different necessities can be met from bore-wells at site. The site choice for a sun powered power plant is prevalently controlled by sunlight based seclusion accessibility and framework availability for trading power. The plant and gear offices will be intended to conform to every single pertinent stipulation rules of statutory experts, for example, state and focal contamination control sheets, electrical inspectorate, monitor of production lines and so on. The net convey control accessible from 50KWp power plant is evaluated to be 89MWh per annum for crystalline modules. This report features the subtleties of the proposed power age plot, site offices, highlights of the principle plant, electrical frameworks departure of created control, ecological and security viewpoints, dissemination component, cost estimation,

chance moderation plan and venture reasonability. It additionally features the entire calendar for the task execution.

#### A. Thermal power

Current introduced limit of warm power (starting at 30-11-2010) is 108362.98MW which is 64.6% of aggregate introduced limit. Current introduced base of coal based warm power is 89,778.38 MW which comes to 53.3% of aggregate introduced base. Current introduced base of gas based warm power is 17,374.85 MW which is 10.5% of aggregate introduced limit. Current introduced base of oil based warm power is 1,199.75 MW which is 0.9% of aggregate introduced limit. Hydro control India was one of the spearheading nations in setting up hydro-electric power plants. The power plants at Darjeeling and Shimsha (Shivanasamudra) were set up in 1898 and 1902 separately and are among the first in Asia. The introduced limit starting at 30-9-2010 was roughly 37,328.40 MW. People in general part has a prevalent offer of 97% in this segment.

#### B. Nuclear power

Right now, twenty atomic power reactors create 4,780 MW Renewable vitality in India is a division that is as yet undeveloped. India was the principal nation on the planet to set up a service of nonconventional vitality assets, in mid 1980s. Anyway its prosperity has been exceptionally spotty. As of late India has been falling behind different countries in the utilization of sustainable power source (RE). The offer of RE in the vitality segment is under 1% of India's aggregate vitality needs. Sustainable power source in India goes under the domain of the service of new and sustainable power source

#### C. Solar power

For sun based power ventures, adequate to create 700 to 2,100 Giga watts. The Indian sun based advance program, bolstered by the unified countries condition program has won the lofty vitality globe world honor for supportability for setting up a purchaser financing program for sun based home power frameworks. Over the range of three years in excess of 16,000 sunlight based home frameworks have been financed through 2,000 bank offices, especially in country regions of south India where the power matrix India is thickly populated and has high sun oriented insolation, a perfect mix for utilizing sun oriented power in India. A great part of the nation does not have an electrical matrix, so one of the main utilizations of sun powered power has been for water siphoning, to start supplanting India's four to five million diesel fueled water siphons, each expending about 3.5 kilowatts, and off network lighting. Some substantial activities have been proposed, and a 35,000 km<sup>2</sup> territory of that desert has been put aside does not yet broaden. Declared in November 2009, the legislature of India proposed to dispatch its Jawaharlal Nehru National Solar Mission under the national activity plan on environmental change with plans to create 1,000 MW of intensity by 2013 and up to 20,000 MW network based sunlight based power, 2,000 MW of off matrix sun

oriented power and cover 20 million sq. meters with authorities before the finish of the last period of the mission in 2020.

**D. Wind power**

The improvement of twist control in India started during the 1990s, and has fundamentally expanded over the most recent couple of years. In spite of the fact that a relative newcomer to the breeze business contrasted and Denmark or the US, a blend of local strategy bolster for wind control and the ascent of Suzlon (a main worldwide breeze turbine producer) have driven India to end up the nation with the fifth biggest introduced wind control limit on the planet. As of June 2010 the introduced limit of twist control in India was 12009.14 MW, principally spread crosswise over which is appeared table beneath.

Tamil Nadu	(4132.72 MW),
Maharashtra	(1837.85 MW),
Karnataka	(1184.45 MW),
Rajasthan	(670.97 MW),
Gujarat	(1432.71 MW),
Andhra Pradesh	(122.45 MW),
Madhya Pradesh	(187.69 MW),
Kerala	(23.00 MW),
West Bengal	(1.10 MW),
Other states	(3.20 MW),

It is estimated that 6,000 MW of additional wind power capacity will be installed in India by 2012. Wind power accounts for 6% of India's total installed power capacity, and it generates 1.6% of the country's power.

**3. Circuit description**

**A. System design**

The overview result demonstrates that the main wellspring of vitality that can be saddled to produce power is the sun oriented power. There isn't sufficient bio mass created in the site, and subsequently a biogas plant can't be executed. Daylight is accessible at one specific territory at the plot of five houses, so sun based board get together was made at a place where daylight is accessible and afterward circulated. Singular boards could be given in the staying three houses as enough daylight was accessible. For transmission underground links were utilized so as to avert harm and lessen support cost. Electrical load incorporates each house will have 2 minimal fluorescent lights for lighting reason.

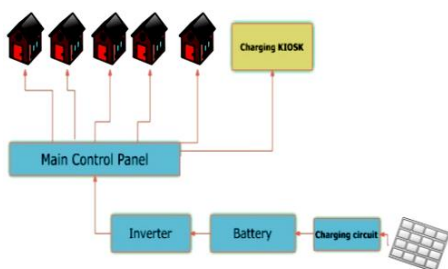


Fig. 1. Block diagram of system

**B. System components**

The parts engaged with the conveyed framework were principle sun based board, charge controller, inverter, battery, circulation board, UG links and light focuses .The general framework voltage was settled at 24 V thinking about the productivity and cost. The sun based boards comprises of one or modules wired together to produce an explicit voltage and current, contingent on the interest. The yield of the board will be an immediate current supply contingent on the rating of the board utilized. Battery is utilized for the capacity of the power produced from the board. Battery utilized was lead corrosive sort. Considering the cost factor and accessibility factor lead corrosive battery is favored. Inverter changes over direct current delivered from the boards to rotating current. The contribution of the inverter would be immediate current at a voltage of 24 volts and yield would be at 230 volts (ac).

**1) Main control panel**

It comprises of an isolator and Miniature Circuit Breakers (MCB). The yield from the inverter is sustained into the principle control board. It is then partitioned into various lines through MCBs.

**2) Wiring of each House**

Each house will have two CFL globules of 15 Watts each. A typical charging station for all the charging reason in the site has been arranged. The fundamental preferred standpoint of giving such a station is to moderate power. There would be a control circuit which cuts the supply when the current surpasses a predefined esteem. This could be more precise than the MCB. The fundamental square graph is as appeared in the chart. The circuit comprises of an electronic circuit that is utilized to control the current. The current from the supply line is detected by a present sensor and it is contrasted in the comparator and a predefined estimation of current. At the point when the information current surpasses this reference esteem, transfer activates and the supply is cut off. The station will have three fitting focuses for the charging of mobiles, radio and so forth.

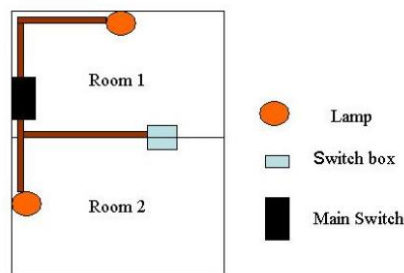


Fig. 2. Wiring of each House

**C. Existing solar PV technology**

As indicated by the crystalline structure formless, poly-crystalline and mono-crystalline sunlight based cells are known. As indicated by innovative techniques utilized by generation sun based cells can be isolated into silicon sunlight based cells, delivered from Si wafers, and thin-film sun oriented

cells created with vacuum advancements. Fundamental highlights from various sun based cell types can be found beneath.

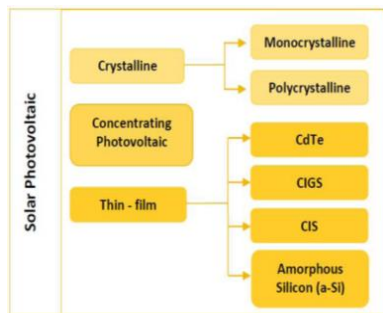


Fig. 3. Block Diagram of Solar Photovoltaic

#### D. Light-absorbing materials

Every sunlight based cell require a light engrossing material contained inside the cell structure to ingest photons and produce electrons by means of the photovoltaic impact. The materials utilized in sunlight based cells will in general have the property of specially retaining the wavelengths of sun powered light that achieve the earth surface in any case, some sun powered cells are improved for light ingestion past Earth's air also. Light retaining materials can regularly be utilized in various physical designs to exploit distinctive light retention and charge partition instruments. Photovoltaic boards are typically made of either silicon or thin film cells. Numerous as of now accessible sun oriented cells are arranged as mass materials that are along these lines sliced in to wafers and treated in a "top down" technique for combination (silicon being the most pervasive mass material). Different materials are arranged as thin-films (inorganic layers, natural colors, and natural polymers) that are stored on supporting substrates, while a third gathering are designed as Nano precious stones and utilized as quantum spots (electron-restricted Nanoparticles) inserted in a supporting grid in a "base up". Silicon remains the main material that is all around looked into in both mass (additionally called wafer based) and thin-film setups. There are numerous new options in contrast to silicon photocells. Exclusive nanoparticle silicon printing forms guarantees a significant number of the photovoltaic highlights that traditional silicon can never accomplish. It very well may be printed reel-to-reel on hardened steel or other high temperature substrates. Be that as it may, the vast majority of the work on the up and coming age of photovoltaic is coordinated at imprinting onto minimal effort adaptable polymer film at last on basic bundling materials. The principle contenders are as of now CIGS, CdTe, DSSC and natural photovoltaic. Following is a present rundown of light retaining materials, recorded by setup and substance name.

#### E. Selection of technology

In the previous section the various technologies available for PV are explained in detail. From the above available technologies customer would like to have detail technical

proposal for the following three technologies.

- Crystalline Silicon
- Thin Film
- Concentrating PV (CPV)

#### 1) Crystalline silicon PV

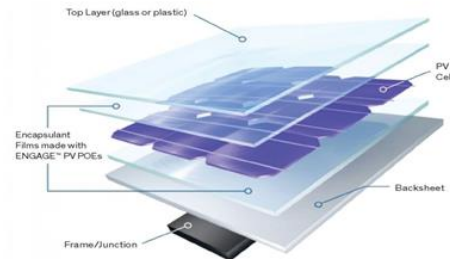


Fig. 4. Block diagram of Crystalline Silicon PV

Advantages and disadvantages of Crystalline Silicon PV Technology.

- *Longevity:* Crystalline solar panels are first generation solar technology and have been around a long time, providing evidence of their durability and longevity.
- *Efficiency:* PV panels made from crystalline solar cells are able to convert the highest amount of solar energy into electricity of any type of flat solar panel.
- *Embodied Energy:* While thin-film solar panels offer a lower level of embedded energy per panel, the fact that more panels are needed somewhat negates this aspect, especially given the extra mounting rails sometimes needed.
- *Environmental Friendly:* Crystalline solar panels are not hazardous to the environment. Some thin film solar products uses cadmium telluride (CdTe) Cadmium is a heavy metal that accumulates in plant and animal tissues. Cadmium is a 'probable carcinogen' in humans and animal.

#### 2) Thin film

- Better performance in weak sunlight environment
- Silicon thin film PV with high absorption coefficient also brings the benefit of module installation against any direction of sunlight.
- Better performance at high ambient temperature Silicon thin film PV with low temperature coefficient has much better capability in hot environment.
- More resistant against Shading.
- Silicon thin film PV outputs power robustly even in shading condition. Oppositely, crystalline silicon PV doesn't work well due to some cells without output.
- High energy yield.

#### 3) Concentrated photovoltaic (CPV)

- Commercially available over 16 billion kWh of operational experience; operating temperature potential up to 500°C (400°C commercially proven)
- Commercially proven annual net plant efficiency of

- 14% (solar radiation to net electric output)
- Commercially proven investment and operating costs
- Modularity
- Good land-use factor
- Lowest materials demand
- Hybrid concept proven
- Storage capability

#### F. Optimal plant design

The aggregate territory required for introducing the 50KWp sun oriented Power Plant is around 7500 delicate. For an entire solid framework and to guarantee high vitality yield from the plant, inventive parts with most recent innovation are chosen. The inverter that is chosen is of high effectiveness over a wide scope of load. The inverter works in abundance of 95.0% productivity. We have comprehended the observing framework prerequisite for such an expansive power plant and have proposed our cutting edge checking and investigation focal framework. Hardly any highlights are displayed as pursues screens the execution of the whole power plant (string shrewd checking, intersection boxes, inverters, and so forth.) assesses, amount of DC control and AC control created. Measures quick light dimension and temperature at site. It likewise measures the module back surface temperature. Alarms if there should arise an occurrence of mistake to encourage acknowledgment and amendment of the blame with least down time. Envisions ostensible status of the associated parts through control focus PC programming logs framework information and mistake messages for further handling or putting away stores and pictures vitality yield information in the entrance from where the information can be gotten to remotely. We have embraced the best building practice for finish link directing in the power plant by utilizing insignificant link length while interfacing in arrangement string, utilizing ideal size links to guarantee the whole plant link misfortunes are least. The intersection boxes proposed are totally prewired to guarantee simplicity of establishment, support and takes out any establishment bothers. These intersection boxes join the DC control from strings as well as screen each string execution and feed similar information to the focal observing framework.

#### G. Major Components of the power plant

As the Customer might want to investigate the different alternative of the sun powered PV innovation, the plan group might want to propose the best parts that are accessible in the. The following are the major components that would be discussed in the following section.

- Solar Modules
- Crystalline Modules – Multi & Mono
- Inverter
- String Inverter
- Module Mounting Structure
- Balance of System
- Junction boxes

- Cables
- Monitoring System
- Earthing & Lightning Protection

#### H. Basic system description

Sun powered photovoltaic power generator comprises of sun based modules in arrangement and parallel associations, these proselyte sunlight based radiations into DC electrical power at the foreordained scope of voltages at whatever point adequate sun based radiation is accessible. The individual crystalline sun powered cells are associated together in a module (in arrangement association), which are hermetically fixed to make due in tough climate conditions and guarantees ideal execution amid its ling life. So as to accomplish a higher framework voltage, modules are introduced in succession course of action, called a string. A higher framework voltage has the benefit of lesser establishment work, higher effectiveness of the whole plant and use of littler cross segment links. Determined no. of strings is associated in parallel by links in Junction Boxes. Yields from numerous such intersection encloses are associated parallel in the Main Combiner Box (MCB). This principle combiner box yield is bolstered to the focal inverters/Power Control Unit (PCU) to modify sun based produced DC control in to customary 3 stage AC control. Power from inverters will be nourished to LV board.

#### I. Operation philosophy

Sun powered boards mounted in the field create DC electric power. The DC electric power created by the sun based boards can't be encouraged straightforwardly in to the utility matrix. The inverters upset the immediate current yield from the sun oriented exhibit into matrix consistent AC voltage, bolsters it in to the utility lattice framework with legitimate assurance and control. The framework associated inverter (GCI) scope of inverters accompanies worked in transformer that guarantees galvanic confinement of the DC side from the AC arrange. This is an essential necessity for some utilities to allow association of sun oriented boards on to the lattice. The framework naturally begins up toward the beginning of the day and starts to send out capacity to the matrix, gave there is adequate sun powered vitality and the network voltage, recurrence is inside the range. In the event that the network leaves go the inverter will be promptly separated and reconnected consequently at a pre-decided time after the framework returns inside range. This section examines in detail the specialized parts of the segments that will be utilized in the power plant. As demonstrated coming up next are the real segments of the power plant.

#### J. Protection system

##### 1) Earthing

The exhibit structure of the PV yard will be grounded legitimately utilizing sufficient number dread thing units. All metal packaging/protecting of the plant will be altogether grounded to guarantee wellbeing of the power plant.

## 2) Lightning protection

The SPV power plant shall be provided with lightning & over voltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances etc. Metal oxide variators shall be provided inside the array junction boxes. In addition, suitable SPDs also shall be provided in the Inverter to protect the inverter from over voltage.

## K. Meeting challenges

Sun based vitality was observed to be the main potential wellspring of vitality. High framework voltage was favored thinking about the framework effectiveness. Be that as it may, the expense of the inverter was the restricting component. TV, fans and so on were dodged from the heap. The use of these devices can't be controlled and this may prompt enormous wastage of intensity. Nearness of trees was a constraint in giving an overhead link and getting legitimate daylight. So in the circulated framework, the board was at an area and after that disseminated. For transmission, UG links were utilized. The batteries require substitution and the neighborhood government was allocated the duty it with the occupants paying them month to month. A social test was the absence of information, neighborhood people was given adequate directions on the essential tasks of the framework.

## 4. Conclusion

In Solar vitality is a potential cutting edge vitality framework for charge of territories like ones where this venture was

executed. The locale can be considered as normal for regions where it was hard to create control by different methods on the record of greater expense. In the regions that are extensively far from the lattice the framework can be more savvy and pragmatic. The surprising expense of foundation of the matrix framework might be handled by utilizing sunlight based vitality. At the point when the solid power is found as a test to the creating and immature nations, minimal effort jolt utilizing sun oriented vitality is an extremely compelling technique.

## 5. Acknowledgment

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