

THE POTENTIAL ENVIRONMENTAL IMPACTS ASSOCIATED WITH SOLAR POWER

G.PREM KUMAR

Research Scholar
Shri JTT University
Rajasthan

ABSTRACT: *This paper is for the most part centers in conveying about the potential natural effects related with sun oriented force. The sun gives an enormous asset to creating perfect and economical power without harmful contamination or an Earth-wide temperature boost discharges. The potential ecological effects related with sunlight based force—land use and environment misfortune, water use, and the utilization of perilous materials in assembling—can shift extraordinarily relying upon the innovation, which incorporates two general classes: photovoltaic (PV) sun oriented cells or concentrating sun based warm plants (CSP). The size of the framework—going from little, circulated housetop PV clusters to huge utility-scale PV and CSP projects—additionally assumes a critical part in the degree of natural effect. Sun based advances from that point on have taken off in tallness in productivity and utilization among public. It is additionally broadly acknowledged that the dynamic Solar Energy Systems (photovoltaic, sun oriented warm) give huge natural advantages in contrast with the customary energy sources, adding to the maintainability of the human exercises.*

KEYWORDS: *Solar power, photovoltaic (PV) solar cells, concentrating solar thermal plants (CSP), Solar Energy Systems.*

INTRODUCTION:

In the current period with substantially more instruction, individuals are quite worried about the evil impacts of ordinary wellsprings of energy and give prime significance to the quick exhaustion of the traditional assets. Environmentally friendly power as a substitute is on the ascent, to decrease reliance on restricted

stores of petroleum derivatives and to moderate adverse consequences on climate. Among different types of sustainable power the age of power from daylight in the course of the last decade has been becoming dramatically worldwide because of its Eco cordial picture.

The appropriate response would be no. By and large, sunlight based energy innovations fall in to two general classifications:

- Solar warm frameworks and
- Photovoltaic power age

Each is seen better in ecological viewpoint analyzed than its regular archetype. Notwithstanding, they also have some prominent sick consequences for nature and with regards to enormous scope creation, it becomes critical.

it has been seen deductively by tests and explores that these marvels are firmly identified with petroleum product utilizes in light of the fact that they emanate ozone harming substances like carbon dioxide (CO₂) and methane (CH₄), which thwart the long-wave earthbound radiation escape into space, and, subsequently, the earth lower atmosphere becomes hotter. To stay away from additional effects of these

wonders, the two concentrative choices are either to further develop the petroleum product quality with decreases in their destructive discharges into the climate or, all the more fundamentally, to supplant petroleum product utilization however much as could be expected with harmless to the ecosystem, clean, and sustainable power sources. Among these sources, sun powered energy comes at the first spot on the list because of its bounty and more even appropriation in nature than some other sustainable power type, like breeze, geothermal, hydro, wave, and flowing energies.

Sun based energy advancements are fundamental parts of a supportable energy future. Energy from non-renewable energy sources might be modest and confirmations might have been given of the abundant supplies of oil and other petroleum derivatives, yet these energizes are limited in nature and a significant wellspring of ozone harming substance outflows. At the point when energy requests increment, energy creation and its adverse consequences on the climate increment just thus, ecological contamination turned into a worldwide danger. Accordingly, the significance of unpolluted energy sources, for example, sun powered energy has expanded lately. However, even sun based energy innovations have presented some degree of natural impacts.

LAND USE:

Contingent upon their area, bigger utility-scale sun powered offices can raise worries about land debasement and territory misfortune. Complete land region necessities shifts relying upon the

innovation, the geography of the site, and the power of the sun based asset. Assessments for utility-scale PV frameworks range from 3.5 to 10 sections of land for each megawatt, while gauges for CSP offices are somewhere in the range of 4 and 16.5 sections of land per megawatt.

Dissimilar to twist offices, there is less freedom for sunlight based activities to impart land to agrarian employments. Nonetheless, land impacts from utility-scale planetary groups can be limited by sitting them at lower-quality areas like earthy colored fields, deserted mining land, or existing transportation and transmission halls. More limited size sun based PV clusters, which can be based on homes or business structures, likewise have insignificant land use sway.

WATER USE:

Solar PV cells do not use water for generating electricity. However, as in all manufacturing processes, some water is used to manufacture solar PV components.

Concentrating solar thermal plants (CSP), like all thermal electric plants, require water for cooling. Water use depends on the plant design, plant location, and the type of cooling system.

CSP plants that use wet-re circulating technology with cooling towers withdraw between 600 and 650 gallons of water per megawatt-hour of electricity produced. CSP plants with once-through cooling technology have higher levels of water withdrawal, but lower total water consumption (because water is not lost as steam). Dry-cooling technology can reduce

water use at CSP plants by approximately 90 percent. However, the tradeoffs to these water savings are higher costs and lower efficiencies. In addition, dry-cooling technology is significantly less effective at temperatures above 100 degrees Fahrenheit.

HAZARDOUS MATERIALS:

The PV cell fabricating measure incorporates various risky materials, the vast majority of which are utilized to clean and refine the semiconductor surface. These synthetic substances, like those utilized in the overall semiconductor industry, incorporate hydrochloric corrosive, sulfuric corrosive, nitric corrosive, hydrogen fluoride, 1,1,1-trichloroethane, and $\text{CH}_3)_2\text{CO}$. The sum and sort of synthetic compounds utilized relies upon the kind of cell, the measure of cleaning that is required, and the size of silicon wafer. Laborers additionally face hazards related with breathing in silicon dust. Accordingly, PV makes should follow U.S. laws to guarantee that laborers are not hurt by openness to these synthetics and that assembling byproducts are discarded appropriately.

Slender film PV cells contain various more harmful materials than those utilized in customary silicon photovoltaic cells, including gallium arsenide, copper-indium-gallium-diselenide, and cadmium-telluride. If not dealt with and discarded appropriately, these materials could present genuine natural or general wellbeing dangers. Notwithstanding, producers have a solid monetary impetus to guarantee that these profoundly important and frequently uncommon

materials are reused as opposed to discarded.

LIFE-CYCLE GLOBAL WARMING EMISSIONS:

While there are no global warming emissions associated with generating electricity from solar energy, there are emissions associated with other stages of the solar life-cycle, including manufacturing, materials transportation, installation, maintenance, and decommissioning and dismantlement. Most estimates of life-cycle emissions for photovoltaic systems are between 0.07 and 0.18 pounds of carbon dioxide equivalent per kilowatt-hour.

Most estimates for concentrating solar power range from 0.08 to 0.2 pounds of carbon dioxide equivalent per kilowatt-hour. In both cases, this is far less than the lifecycle emission rates for natural gas (0.6-2 lbs of $\text{CO}_2\text{E}/\text{kWh}$) and coal (1.4-3.6 lbs of $\text{CO}_2\text{E}/\text{kWh}$).

LITERATURE REVIEWS:

Apricus, (2006), Buildings' in EU burn-through 40% of the essential energy prerequisites. This is the fundamental explanation the Energy Performance of Buildings Directive was executed though the recast of the Directive, indicates that the structures raised after 2020 ought to be of almost zero energy utilization, a necessity that accepts broad utilization of renewables. This new job of renewables suggests that notwithstanding photovoltaics, sun based warm frameworks (STS) will likewise play a principle part to play. The essential utilization of STS is to meet the structure

warm loads, after the customary standard structure energy saving measures are applied, similar to warm protection, twofold coating, and so forth STS are regularly mounted on building rooftops as extra parts with no endeavor to fuse them into the structure envelope. In this manner tasteful difficulties, space accessibility issues and envelope uprightness issues should be thought of. The motivation behind this paper is to give an overview of potential utilizations of STS reconciliation on the structure rooftops and exteriors. Subtleties of certain undertakings currently a work in progress are likewise introduced.

Boyle G., Ed. (1996), The developing interest in "renewables" has been provoked to a limited extent, by expanding worry over the contamination, asset consumption and conceivable environmental change ramifications of our proceeding with utilization of ordinary fossil and atomic fills. In any case, ongoing mechanical advancements have likewise worked on the expense adequacy of large numbers of the renewables, making their monetary possibilities look progressively alluring. It depicts the accomplishment and progress made in hydropower, biomass change, geothermal, sun oriented warm innovation, wind energy transformation and the expanding utilization of photovoltaics. It is clear that a worldwide temperature alteration is setting in and will change the environment just as the landscape of numerous nations except if uncommon measures are taken.

Different, (1996), Solar energy frameworks give huge ecological advantages in contrast with the customary energy sources, accordingly contributing ,to the practical improvement of human

exercises. Some of the time nonetheless, their wide scale arrangement needs to confront likely regrettable ecological ramifications. These potential issues appear to be a solid hindrance for a further dispersal of these frameworks in certain buyers. Particularly on account of the focal sunlight based innovations—clamor and visual interruption ,ozone depleting substance outflows ,water and soil contamination, energy utilization ,work mishaps, sway on archeological locales or on touchy environments ,negative and positive financial impacts.

Fernandez-Baco,et al (1998), Seasonal and every day varieties in chlorophyll (Chl) fluorescence were examined in two agent types of Mediterranean prairies, *Tuberaria guttata* (a yearly) and *Chamaemelum nobile* (a lasting), to survey physiological reactions to climatically prompted stresses during the developing season. The photochemical productivity of photosystem (PS) 2 in dim adjusted leaves was estimated by the Chl fluorescence proportion F_v/F_p . This proportion diminished dynamically from December to July, as the impacts of expanding sunlight based radiation and summer dry season turned out to be more extreme. The occasional decrease was noticed especially as a downturn of morning and early afternoon esteems, when photoinhibition was more obvious. In the two species, the degree of this diurnal wretchedness expanded with late morning irradiance all through winter and spring. After nightfall, there was finished recuperation to ideal qualities. Towards the finish of the existence cycle, expanded irradiance didn't influence the noontime decrease further however F_v/F_p estimations in the first part of the day and evening never recaptured

their ideal qualities, demonstrating the collection of photodamage in the response communities of PS2. The half-ascent season of F_p ($T_{1/2}$), used to gauge the size of the plastoquinone pool, showed minimal every day variety in C.

METHODOLOGY:

SOLAR ENERGY SYSTEMS

SOLAR COLLECTORS

There are basically three types of collectors: flat-plate, evacuated-tube, and concentrating. Flat-plate collectors are the most commonly used types.

1. Flat-plate collectors: The basic working principle of these collectors is based on the conversion of the solar energy to the thermal energy. Flat-plate collectors are made of a glass cover as a transparent material, an absorbing plate, and a body. Radiation passed through the glass plate is absorbed by the solar plate. This plate is covered with paints or special surfaces for high absorbing properties. Almost 90% of the solar radiation felt on the surface are absorbed by these plates. The remaining are radiated back as thermal radiation and convective losses.

2. Concentrating collectors: These collectors are used to obtain higher enthalpy water or other processing fluids. Usually temperatures above 140°C cannot be obtained by flat-plate solar collectors, and concentrating collectors are utilized above 140°C. Concentrating collectors are made of two components, namely, the optical system and the receiver. The function of the optical system is to direct and focus the solar rays to the receiver. The function of the receiver is to absorb the solar rays and convert it to the thermal

energy. The receiver is made of absorber, protection, and isolation parts. The ratio of open space for solar rays to the receiver space where the solar rays will be absorbed is called the condensing ratio. Concentrating collectors can be classified according to their condensing ratios (Atagunduz, 1989):

- flat receiver and flat reflectors
- pipe or spherical-shaped receiver and parabolic reflectors
- pipe or spherical-shaped receiver and flat, moving reflectors in separate rows
- pipe or spherical-shaped receiver and flat, single-moving reflectors. \

3. Evacuated-tube collectors: Evacuated tubes are the absorber of the solar water heater. They absorb solar energy converting it into heat for use in water heating. Evacuated tubes have already been used for years in Germany, Canada, China, and the UK.

There are several types of evacuated tubes in use in the solar industry (Apricus, 2006).

Solar Heating:

1. Active heating systems: There are examples of solar active heating systems, like heating the water by solar collectors and the transmission of heated water to the existing central heating installation, and thus the transportation of heated air for needed areas.

2. Passive heating systems: Passive heating systems using solar energy operate as a ray trap. Solar radiation enters a covered volume through glass and similar transparent materials and is absorbed by some absorbing surfaces. The heated

surfaces radiate energy by radiation, but these heat rays cannot pass through the glass surface where sun rays can get through. Thus, the heat energy carried by the solar rays is kept inside (Atagunduz, 1989).

Drying Using Solar Energy:

The drying process can be defined as the removal of water from a solid substance by evaporation. When the energy needed by this process is supplied by solar energy, this is called "drying using solar energy." Solar drying is one of the oldest solar applications of mankind. The simplest solar dryer, at zero cost, is a black asphalt road on which people spread their grains to increase the natural (solar) drying process (NREL, 2002).

Electrical Energy Converters:

1. Solar cells: Solar cells are systems that convert solar rays to electrical power. Radiation energy radiated as electromagnetic waves that reach the surfaces of the solar cells cause a photo-electromotive power with the help of the forming of electron/deflection pairs during the P-N transition of the semi-conductive crystals. These pairs get separated in the electrical area during the P-N transition and thus cause a current in the circuit that was connected to the semi-conductive crystal.

2. Thermal solar power systems: In these systems, solar radiation is concentrated by some concentrators and boiled to a working fluid that goes to a thermal cycle and work created through the thermal cycle is converted to electricity by a electrical generator. Another form of thermal solar power system can convert

solar energy to a hydrocarbon fuel, and stored hydrocarbon fuel can be reconverted to electrical energy by an internal combustion engine generator set-up.

PHOTOVOLTAIC (PV) POWER GENERATION:

(I) Environmental advantages: Significant outflow decreases can be cultivated through PV power (PVe) creation since PVs don't produce commotion or substance poisons during their typical activity. Moreover, PV cells help the expansion of soil mugginess and further develop verdure arrangement in dry/dry regions.

(ii) Social effects: Some immediate advantages are identified with lighting for homegrown and local area exercises and fundamentally to the chance to rural and borderland's habitants to approach PCs, lighting, radio and telephone. Consequently PVe works on the personal satisfaction and diminishes relocation. Full-and low maintenance occupations creation during establishment and upkeep works on nearby miniature financial matters and drives to neediness mitigation.

(iii) Land use: The effect of land use on normal environments is relied upon explicit factors like the geology, the region and the sort of the land covered by the framework, the separation from spaces of regular magnificence or touchy biological systems and the biodiversity. The effects and the alteration on the scene are probably going to come up during development stage, by exercises, for example, earth developments and by transport developments . Additionally a use of a framework in once-cultivable land

is feasible to save soil useful regions. Consequently the siting in bone-dry regions is suggested.

(iv) Visual effect: Visual interruption is exceptionally subject to the edge plan and the environmental elements of the PVs. Clearly, for a framework almost a space of normal magnificence, the visual effect will be essentially high.

(v) Effect on building: PV is a feasible innovation in a metropolitan climate, to supplant the current structure's cladding materials. Likewise, PV boards can be straightforwardly utilized into the façade of a structure rather than mirrors.

(vi) Accidental deliveries and word related wellbeing: Emissions into soil and groundwater might be brought about by lacking stockpiling of materials. In enormous scope establishes an arrival of these dangerous materials is probably going to happen because of strange plant tasks, harmed modules or fire and in this manner to represent a little danger to public and word related wellbeing . The expanded expected risk of electric shock from the immediate flow delivered by frameworks, should be considered particularly by undeveloped clients.

(vii) Air contamination: The outflows related with transport of the modules are minor in contrast with those related with fabricate. Transport outflows were still just 1% of assembling related emanations .

(viii) Depletion of regular sources and energy utilization: The creation of current age poly-and mono-glasslike modules is somewhat energy concentrated. Other roundabout effects incorporate the

necessity of huge amounts of mass materials and little amounts of scant (In/Te/Ga) and additionally harmful (Cd) materials. Choices for energy request decrease should consistently be considered alongside the appraisal of PV applications.

(ix) Waste administration: For the situation of independent frameworks the impacts on strength of synthetic substances remembered for the batteries ought to likewise be considered. Also a lot of energy and crude materials is needed for their creation. A battery-reusing plan can help. As it ordinarily goes for development exercises, there will be little commotion during activity of electrical hardware.

Hazard classification of chemicals typically used in pv module manufacturing:

A variety of acids or corrosive liquids are used in fairly large quantities during the manufacturing process. These acids or corrosive liquids include hydrochloric acid, sulfuric acid, nitric acid, and hydrogen fluoride. These chemicals are primarily used for the cleaning of wafers or to remove impurities from raw semiconductor materials. Solvents including 1,1,1-trichloroethane and acetone are also used in large quantities in the various cleaning steps conducted during the production processes. Etching compounds such as sodium hydroxide can also be used in relatively large quantities. The amount of a given chemical used will vary depending upon numerous factors including the type of cell being produced, the amount of material processing required, and the amount of wafer cleaning required. The manufacturing of solar cells involves the use of multiple chemicals classified as hazardous, including highly

explosive and toxic gases. A list of such hazardous materials and a description of each material is given in Table.

Technologies/techniques to mitigate the environmental impacts:

Almost all the negative environmental impacts can be faced:

PVs can be used in isolated areas, avoiding

- ecologically sensitive areas or archeological sites.

The integration in large commercial buildings (facades, roofs) it is also recommended as well as the use as sound isolation in highways or nearby hospitals, on condition of proper sitting and frequent maintenance. Careful system design and production of cells in

- Variable shapes, which can be easily integrated in buildings as architectural elements and replace mirrors or metallic areas used to decorate modern buildings. Furthermore the PV use as a cladding material for commercial buildings is showing their architectural possibilities. Referring to construction activities, site restoration is needed to alleviate visual impacts. Color can be used to assemble the PV modules in large-scale systems. Occupational accidents can be averted by good
- Working practices and by the use protective sunglasses and clothing during construction, maintenance and decommission stage .Integrated PVE schemes help to regenerate rural areas.

Material	DOT Hazard Classification*
Arsenic	Poison
Arsine	Highly Toxic Gas
Cadmium	Poison
Diborane	Flammable Gas
Diethyl Silane	Flammable Liquid
Diethyl Zinc	Pyrophoric Liquid
Dimethyl Zinc	Spontaneously Combustible
Hydrochloric Acid	Corrosive Material
Hydrofluoric Acid	Corrosive Material
Hydrogen	Flammable Gas
Hydrogen Selenide	Highly Toxic Gas
Hydrogen Sulfide	Flammable Gas
Indium	Not Regulated
Methane	Flammable Gas
Molybdenum Hexafluoride	Toxic and Corrosive Gas
Oxygen	Gaseous Oxidizer
Phosphine	Highly Toxic and Pyrophoric Gas
Phosphorus Oxychloride	Corrosive Material
Selenium	Poison
Silane	Pyrophoric Gas
Silicon Tetrafluoride	Toxic and Corrosive Gas
Tellurium	Not Regulated
Tertiarybutyl Arsine	Pyrophoric and Highly Toxic Liquid
Tertiarybutyl Phosphine	Pyrophoric Liquid
Tetramethyl Tin	Pyrophoric and Highly Toxic Liquid
Trimethyl Indium	Pyrophoric Solid
Trimethyl Aluminum	Pyrophoric Liquid
Trimethyl Gallium	Pyrophoric Liquid
Tungsten Hexafluoride	Toxic and Corrosive Gas

SOLAR THERMAL ELECTRICITY:

A. Environmental impacts Intermittent

- Low energy density
- Does not produce electricity
- Supplemental energy source or storage required for
- long sunless stretches Expensive compared to conventional water heaters
- Construction/installation costs can be high
- Harder to compete against very cheap natural gas

- Some people find them visually unattractive
- Manufacturing process can create pollution
- Installers not available everywhere
- Generally not practical to store or sell excess heat
- Produce low grade energy (heat vs. electricity)
- Limited scalability
- Dependent on home location and orientation

Technologies/techniques to mitigate the environmental impact:

Most potential impacts of STE systems can be avoided or mitigated by:

Proper siting (away from densely populated areas and not in protected areas or areas of significant natural beauty).

Improvement of technology (e.g., use of air as the heat-transfer medium in central tower systems, 'advanced' noiseless Stirling engines).

Cultivation of photo-sensitive mosses or bushes in the area where shaded by the reflectors.

Exploitation of warm water in the nearest industry in the production stream

Training of workers, familiarization with the system

Re establishment of local flora and fauna, giving the environment enough time to come up again to its previously state.

Good operating practices and compliance with existing safety regulations.

CONCLUSIONS:

SETs give huge financial advantages. Then again, it should be understood that no man-created undertaking can totally keep away from some effect on the climate, neither can SET establishments. Potential ecological weights are related with loss of convenience, rely upon the size and nature of the undertaking and are regularly site explicit. In any case, unfriendly impacts are for the most part little and can be limited by fitting moderation measures, advancements or procedures that might include the utilization of air discharge or scent control hardware, plan devices for ideal plan and siting of the establishments, best practice rules, further developed bits of gear, (for example, gearless or grease free engines), or, totally inventive plan (e.g., shut cycle plants, lowered plants, and so on) It is up to the elaborate components (financial backers, engineers, and allowing specialists) to settle on the suitable choices by bringing ecological issues into genuine thought. There are random safeguards that could be taken to limit the ecological effects of the sun powered energy frameworks. As a result of the harmful substances utilized in the sunlight based cell modules, it will be savvy to expand the module proficiency and life expectancy, and examination the conceivable outcomes of reusing.

REFERENCES:

1. Rossa B. and Dieter J. von Willert (1999) 'Physiological characteristics of geophytes in semiarid Namaqualand, South Africa' *Plant Ecology*, Vol.142, p. 121-132, June 1999, Kluwer Academic Publishers.

2. Boyle G., Ed. (1996) 'Renewable Energy. Power for a Sustainable Future' The Open University, Oxford Press, London.
3. Johansson T. B., Ed., Laurie Burnham, ex. Ed (1993) 'Renewable energy. Sources for Fuels and Electricity', Island Press.
4. Tsoutsos T. (2001) 'Environmental Impact Assessment for Energy Projects', educational notes, Environmental Department, Technical University of Crete, Chania.
5. Various, (1996) 'Environmental Impacts from the Use of Solar Energy Technologies', THERMIE-B STR/1000/96/HE project.
6. ETSU (1996) 'The Environmental Implications of Renewables', Interim report for the UK Department of Trade and Industry, DTI, UK.
7. OECD/IEA (1998) 'Benign Energy? The Environmental Implications of Renewables', International Energy Agency, Paris.
8. Theodoratos P.C. and Karakasidis N.G. (1997) 'Hygiene - Occupational Safety and Environmental protection', Ion, (in Greek).
9. EC (1999) Evaluation of the PREP Component: 'PV Systems for Rural Electrification in Kiribati & Tuvalu', (Reference: Final Report – Issue 1 (7 ACP RPR 175), March 1999 For the European commission DGVII Development.
10. Fernandez-Baco et al (1998) 'Diurnal and seasonal variations in chlorophyll a fluorescence in two Mediterranean-grassland species under field conditions' PHOTOSYNTHETICA, Vol.35 (4), p.535- 544.
11. Al, S. 1995. Visual impacts of the solar collectors and water tanks. Second National Congress of Engineering of Installation Announcement Book, Vol. 2, Chamber of Mechanical Engineers Press, No: 176/1, Izmir (in Turkish).
12. Apricus. A new era in solar hot water. Retrieved December 11, 2006, from http://www.apricus.com/html/evacuated_tubes.htm
13. Atagunduz, G. 1989. Fundamentals of the Solar Energy and Its Applications. Solar Energy Institute Publication No. 2. Bornova, Izmir: Ege University Press (in Turkish)
14. Tsoutsos, T., Frantzeskaki, N., and Gekas, V. 2005. Environmental impacts from the solar energy technologies. Energy Policy 33:289–296.