RAYSTEEDS ENERGY

ELITE CHARIOT OF ENERGY & POWERFUL MOMENTUM

THE CHARIOT OF CLEAN & GREEN ENERGY

SHAPING THE ELEGANT LIFE OF SMART CITY WITH CLEAN AND GREEN TECHNOLOGY

ENGINEERING PROCUREMENT CONSTRUCTION INSTALLATION AND COMMISSIONING AND OPERATION & MAINTAINANCE OF GRID CONNECTED GROUND MOUNTED SOLAR POWER PLANT.

TECHNO-COMMERCIAL PROPOSAL GROUND MOUNTED GRID CONNECTED SOLAR POWER PLANT

We provide following end to end services for **"GROUND MOUNTED GRID CONNECTED SOLAR POWER PLANT"** as a complete package.

- Consultancy & Services in preparing tender documentation and Filing Technical bid as well as financial bid.
- Land search. Land Identification. Land survey for technical feasibility of solar project. Land survey for geographical feasibility including climatic factor. Land survey for strength including soil testing. And other related and unrelated feasibility study.
- Study of the electrical load requirement and captive consumption of the establishment at the site. Collection, verification and evaluation of solar radiation resource data and local meteorological data and calculation of energy yield based on analysis of direct and diffused solar radiation, seasonal and daily characteristic, load factor
- Providing support to facilitate for various approvals from Power Corporation including technical feasibility report and other related and unrelated NOC.
- Preparing draft for detailed project report including technical report and financial report.
- Project Funding support and project subsidy disbursement support.
- Simulation and results for system design, sizing, shading and other on Pvsyst.
- Complete Project **Engineering Procurement and Construction (EPC)**
- **Installation & commissioning**
- **Operation & maintenance.**

WE APPRECIATE YOUR GREATEST INITIATIVE & POSITIVE VISION OF CLEAN AND GREEN TECHNOLOGY TOWARDS BUILDING A BETTER TOMORROW THAT SUPPORT IN NATION SUCCESS IN-EFFICIENT ENERGY AND SUSTAINABLE DEVELOPMENT.

THANKS & REGARDS

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1.3 DISCLAIMER

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2. 0 INTRODUCTION

2. 1 ABOUT THE PROJECT:

This project is a utility-based Grid-connected ground-mounted solar power plant project. Tender has been invited by Nodal agency UREDA on behalf of UPCL for selection of power producer for a total capacity of 200MW with certain specific terms and conditions as written in RFP documents. Each power producer will sell electricity directly to UPCL for a period of 25 years with certain terms and conditions as defined in the PPA document. The project is specifically and purposefully defined to be commission on hilly area of Uttarakhand only. Hilly area parameter is defined by MSME Uttarakhand. Solar power plant will generate power and power corporation will pay to power producer based on the unit generated.

2.2 MAJOR OBJECTIVE OF PROJECT

- Direct sale of power to UPCL for 25 years.
- Greening the electricity grid by solar Energy
- Greenhouse emission.
- Self-employment by doing business in solar power generation.
- Employment to the people of Uttarakhand particularly in Hilly areas.
- Reverse migration to hilly Uttarakhand.
- utilization of barren and wasteland of Hilly Uttarakhand.

2.3 STAKEHOLDERS

The different stakeholders associated with these projects are.

1. **POWER PROMOTER / PRODUCER:**
   The independent power producer is invited by the tendering process by the nodal agency and then selected based on auction of technical and financial perspective. Later on, Independent power producer or promoter has to form a project company. Power producer will generate electricity from solar plants and sell it to power corporation.

2. **EPC CONTRACTOR:** EPC contractor is a solar company who provides all kinds of support from tender bidding, land allotment, making DPR, Funding support, project procurement and commissioning and moreover taking care of entire things from zero to everything related, unrelated to this project. They also take care of the operation and maintenance project of a solar power project.

3. **INVESTOR/LENDER:** Investor or lender is one who is providing funding for this project. Investors may be a bank, or NBFC, or any person, company or any financial institute, or public sector unit or maybe any international organization body.

4. **NODAL AGENCY:** Nodal agency is one who issued tender and invited applicants to participate. In this case, the Nodal agency is UREDA (Uttarakhand Renewable energy and Development agency). Ureda has called application, did technical and financial scrutiny and selected some applicant as a qualified applicant for this project.

5. **POWER CORPORATION:** Power Corporation is one who is actually purchasing electricity from a power generator. In this case, Uttarakhand power corporation (UPCL) is a power corporation that is signing PPA with a power generator for a period of 25 years.

6. **DIC UTTARAKHAND:** Directorate of Industry Corporation Uttarakhand is MSME department state-level office responsible for implementing policies and programs for industrial development in the state. Attached is the Uttarakhand solar policy and Uttarakhand MSME policy for your kind reference. They are also responsible for providing interest subsidy and capital subsidy and other benefits.

7. **DIPP:** Department of Industrial policy and promotion under the ministry of commerce and industry has special industry policy for the state of Uttarakhand and Himachal Pradesh, and is responsible for providing capital subsidy. Attached is the gazette of DIPP in this reference.

2.4 EPC CONTRACTOR
RAYSTEEDS ENERGY PRIVATE LIMITED

Ray-Steeds Energy Private Limited Company is registered with the **Ministry of corporate affairs Government of India** having its corporate identity number as **U74999UR2016PTC007094**, and has been recognized by the **Department of Industry Policy & Promotion** under **Prime minister startup India** program, headquartered in Dehradun, Uttarakhand and branch office in Varanasi Uttar. Raysteeds Energy is also registered under Ministry of small and medium enterprises and recognized by khadi village and Industrial Corporation. We are **SME & OEM Manufacturers and exporters** of all kind of solar energy products. We provide cost-effective and highly efficient solutions and consultancy for **"Engineering, Procurement, Construction, Installation and commissioning" of all kinds of Renewable Energy projects** that include solar energy, Bio-energy, waste management technology, cleanliness, climatic changes and smart city concepts. The company has its major commerce in solar power plants for commercial and domestic buildings and also for grid-connected ground-mounted solar power plant. In addition to this company deals in manufacturing, supply, installation and commissioning of led based solar street lighting, solar water pumping and solar home lighting system. The company has a comprehensive network of 'Energy Channel Partners'. Foremost the company works on the concept of the global village development model in order to associate development corridor of Indian village to global chain as well to attain the goal of the smart city concept of nation.

Raysteeds Energy is the principal company of **Raysteeds Group**, along with its sister companies which is **Raysteeds Drugs Pvt ltd**, a pharmaceuticals company and **Raysteeds Infotech Pvt Ltd,** a global company for software development and cloud-based security provider.

RAYSTEEDS ENERGY

The company is highly concerned about climatic change. With the potential motive of contribution to a clean and green environment, the entire steeds of ray-steeds is joining bricks of changes every day to make this wonderful earth more wonderful and clean. The name Ray-Steeds, grouping of Ray and Steeds resembles the horses of lord Sun representing power arrogance and speed. The company admires its two-fundamental principal which is Trust and Truth that integrate the factor of esteem customer satisfaction by providing the best innovative goods and services. The Company is a chariot driven by creative young minds, carrying the creative conceptions and Energy to light the Nation. Ray-Steeds Energy is a Team, a Passion, a Dream, and an innovative start-up company aim to contribute towards Nation success.

Our vision is to play a momentous role to ripen the clean and green world. To reduce carbon emission every day by installing more and more solar. Our vision is to make our society clean and green by advance waste management technology. We also aim to give a global platform to Indian Villages by global development model of our villages. We wish to encourage alternative energy as a basic need of people similar to water food and house. Our mission is to achieve national interest in renewable energy. We are potentially designing and developing major ideas and concepts for a smart city. We are not just a profit-oriented company but we are social as well, playing our role in various social developments.

2. 5 THE MAN BEHIND RAYSTEEDS GROUP-PRAKHAR SRIVASTAV

PRAKHAR SRIVASTAV

AUTHOR & SPEAKER | FOUNDER & CEO

PROFESSIONAL PROFILE

"A PASSIONATE WRITER, TRAVELER, & MOREOVER THE MAGNATE AND STRENUOUS BUSINESS LEADER"

SKILLS & QUALIFICATION

- VISIONARY, STRATEGIC, EXECUTION & LEADERSHIP
- BREVITY, COLLABORATION, APPROACHIBILITY, TRANSPARENCY & TRANSFORMATIVENESS.
- B.TECH MECHANICAL ENGINEERING (2012-2016) GRAPHIC ERA UNIVERSITY, DEHRADUN UTTARAKHAND.
- INTERMEDIATE & HIGH SCHOOL CSSS, AZAMGARH UTTAR-PRADESH.

HOBBY

- WRITING
- READING
- SOCIAL WORK
- TRAVELING & PHOTOGRAPHY

LETS' TALK

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PROFILE & VALUE

- **AUTHOR & SPEAKER**
- **FOUNDER & CEO**
  RAYSTEEDS ENERGY PRIVATE LIMITED
- **FOUNDER & CEO**
  RAYSTEEDS DRUGS PRIVATE LIMITED
- **FOUNDER & CEO**
  RAYSTEEDS INFOTECH PRIVATE LIMITED

ACHEIVEMENT AWARDS & HONORS

- Featured among top 25 young CEO of country in 2018, published in CEOINSIGHT MAGAZINE.
- Author of Book TAMANNA-THE AMBITION OF DREAMS (A Mysterious fiction novel).
- THE TECHNOVERT-AGAAZ-13 AWARD
- SAE-NORTH INDIA CONVENTION AWARD
- Nominated for INNOVATOR OF THE YEAR by Uttarakhand council of Science and Technology at Uttarakhand State Science &Technology Congress 2014-2015
- Won National Go kart Racing Event-2015' 1st rank in North India and 5th in the country and received The most dynamically balanced vehicle award for elite karting-2015.
- Honoured by WORLD INTEGRITY CENTRE INDIA on world poetry day-2015 for poetry recital "SONG OF SPRING".
- Honoured by "AJMER POETS COLLECTIVE MANCH" during poetry spring evening.
- Honoured by "YOUTH PEACE FOUNDATION" on the occasion of Gandhi Jayanti for sponsoring cleanliness drive Events.
- Guest of honour on various occasion for guest lecture in various university.
- Guest of honour for sponsoring SUPRA SAE INDIA racing cars

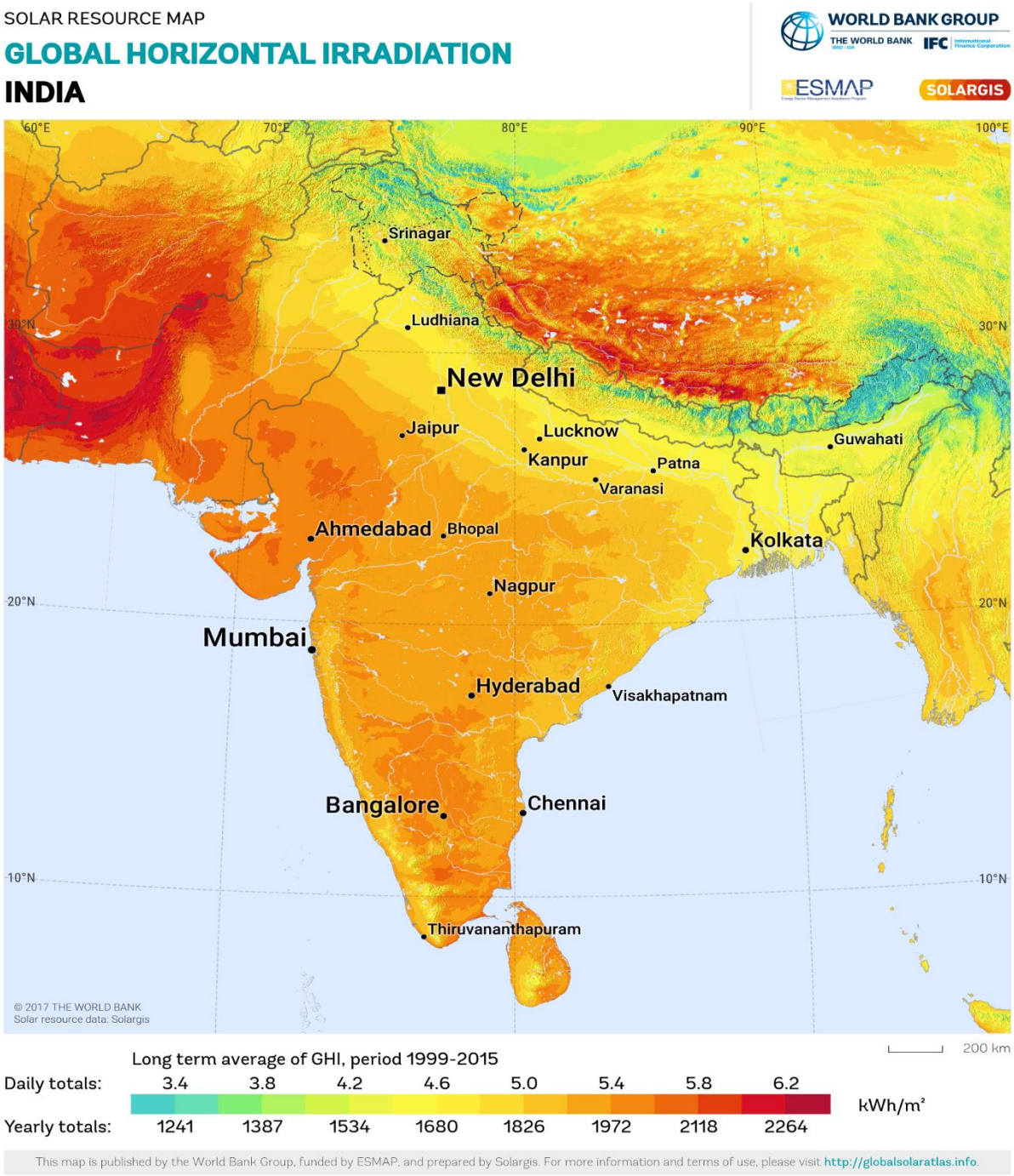
RESEARCH WORK & EVENTS

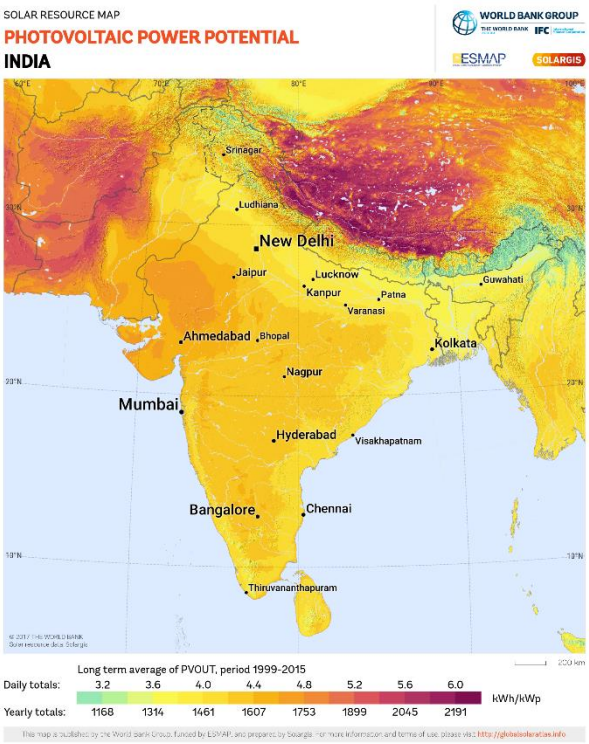
- Project & Training in Indian Railway, Diesel and locomotive workshop Varanasi, Ministry of Railway, Govt. of India.
- Project and training in Instruments Research & Development Establishment, DRDO Dehradun, Ministry of Defence, Govt. of India
- Presented and published Research paper in a NATIONAL CONFERENCE SPRES-2013 (Sustainable Power through Renewable Energy Resources) Jaipur.
- Presented and published Research paper in 4th International Conference on Applied Science, Environmental Engineering, and Clean Energy Technology for Sustainable Development and published in International journal of basic and applied engineering research.
- Presented and published Research paper in a NATIONAL CONFERENCE on Managerial Prospective,
- Issues and Challenges of Swachch Bharat Campaign at Guru Gobind Singh Indraprastha University, New Delhi.
- Eco-Battery (Patent fileno.-UCS&T/PIC/PATENT/2311081/2015-16)
- Generating Electricity Using Hanging Strap (Patent file no- UCS&T/PIC/PATENT/2311082/2015-16)
- Organizing Head of 'MARATHON LECTURE' for GUINNESS BOOK OF WORLD RECORD by Arvind Mishra for continuous lecturing of 139 hours 42 min 5 sec in March-2015
- Organizing Head of Unite Ideas-"Youth Summit Towards The Innovative And Clean India" And Taken Initiative Of Clean Dehradun Campaign" in Dehradun, May 2015
- Organizing Head of various mega events like "MENTOR & YOUTH-DEHRADUN 2013", UDAAN-2013 PRATIGYA-13 (A social initiative in Dehradun).
- Presented scenario of CLEAN DEHRADUN CAMPAIGN on world environment day organized by UNESCO center on world natural heritage management at Wild life institute of India, Dehradun, June-2015.
- Worked with an International Organization IYSERT (International Youth Society of Eco-friendly & Renewable Technology) as the "DIRECTOR OF OPERATION.
- Organised various cleanliness drive event in Dehradun as a part of CSR Program.

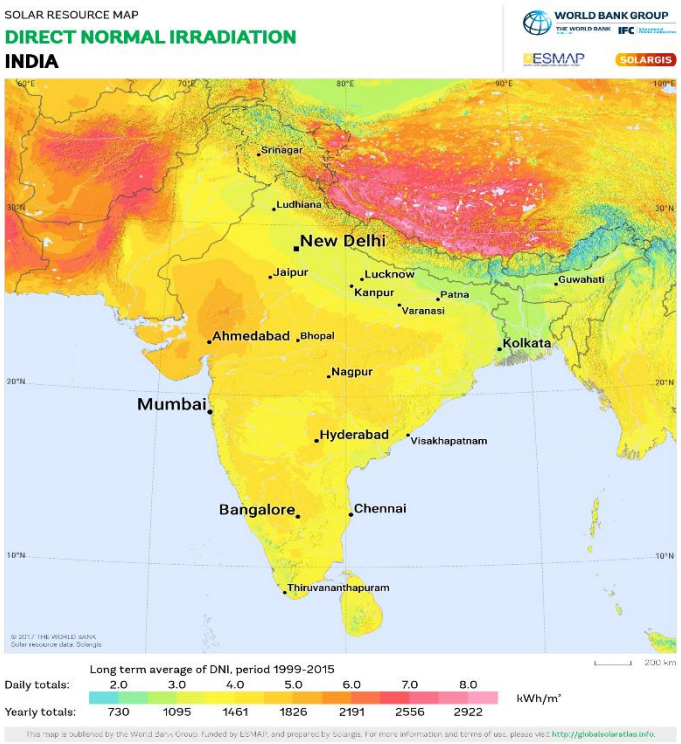
3.0 SOLAR RESOURCES ASSESSMENT.

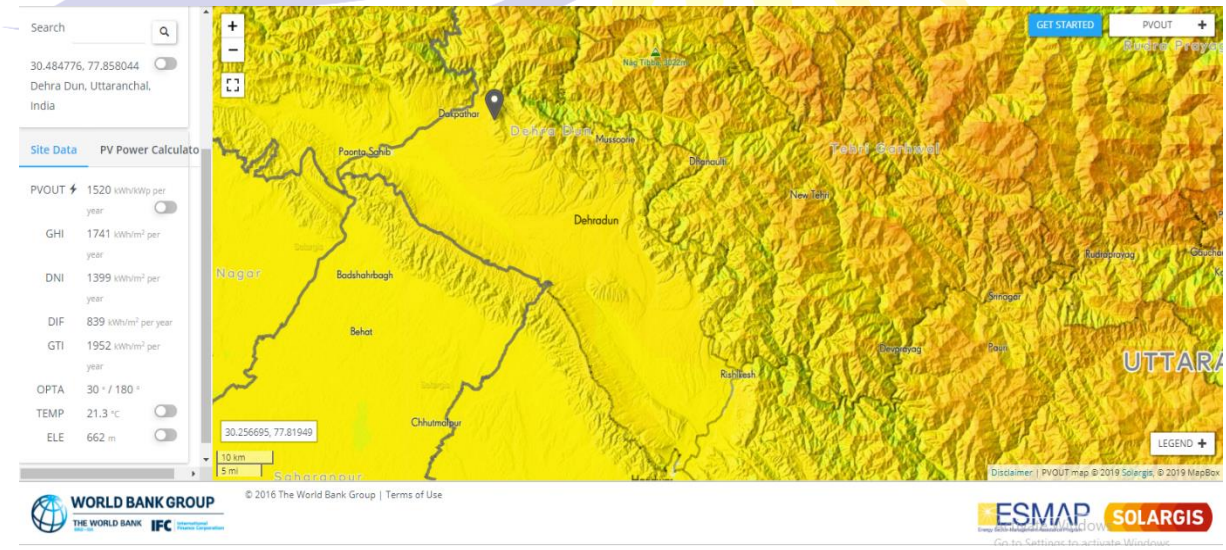
3.1 Solar Energy Potential in India

India being a tropical country is blessed with good sunshine over most parts, and the number of clear sunny days in a year is also attractive in the range of 250-300. The country receives solar energy equivalent to more than 5,000 trillion kWh per year. The daily average global radiation in India is around 5.0 kWh/ m2/ day in north-eastern and hilly areas to about 7.0 kWh/m2/ day in western regions. The global horizontal irradiance (GHI) map of India is given as Fig 4-1. As of Feb 2018, India has recorded photovoltaic installation above 20 GW mark.







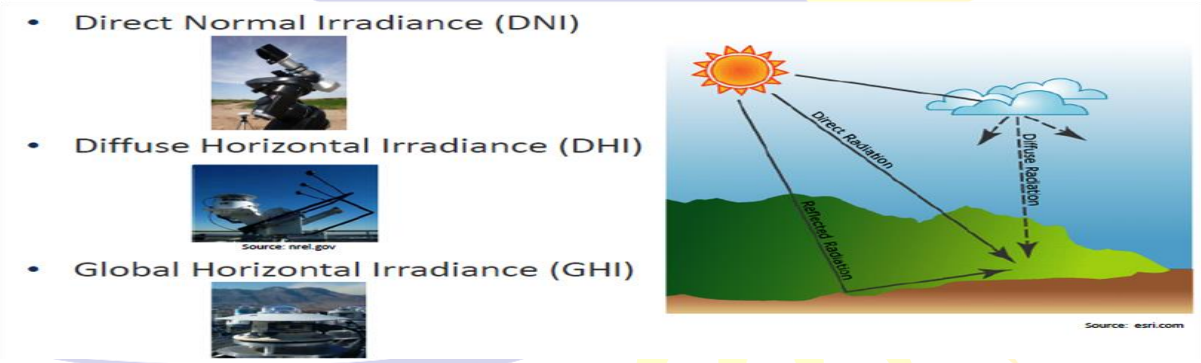


Direct Normal Irradiance (DNI) is the amount of solar radiation received per unit area by a surface that is always held perpendicular (or normal) to the rays that come in a straight line from the direction of the sun at its current position in the sky. Typically, you can maximize the amount of irradiance annually received by a surface by keeping it normal to incoming radiation. This quantity is of particular interest to concentrating solar thermal installations and installations that track the position of the sun.

Diffuse Horizontal Irradiance (DHI) is the amount of radiation received per unit area by a surface (not subject to any shade or shadow) that does not arrive on a direct path from the sun, but has been scattered by molecules and particles in the atmosphere and comes equally from all directions

Global Horizontal Irradiance (GHI) is the total amount of shortwave radiation received from above by a surface horizontal to the ground. This value is of particular interest to photovoltaic installations and includes both Direct Normal Irradiance (DNI) and Diffuse Horizontal Irradiance (DHI).

Global Horizontal (GHI) = Direct Normal (DNI) X cos(θ) + Diffuse Horizontal (DHI)



Average Direct Normal Irradiance

Source: NREL

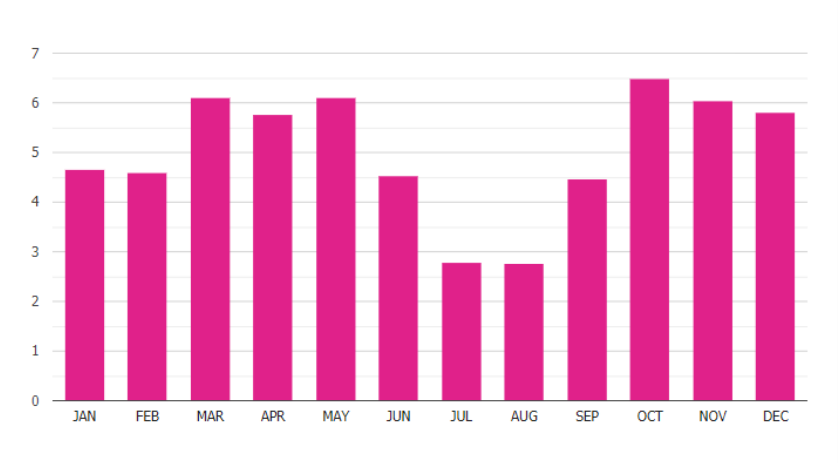
Dehradun, Uttarakhand

Latitude : 30.35 Longitude : 78.05

Annual Average : **5.01** kWh/m^2/day

Monthly Average

JAN	4.67
FEB	4.59
MAR	6.10
APR	5.77
MAY	6.11
JUN	4.53
JUL	2.79
AUG	2.76
SEP	4.47
OCT	6.50
NOV	6.05
DEC	5.80



Average Global Horizontal Irradiance

Source: NREL

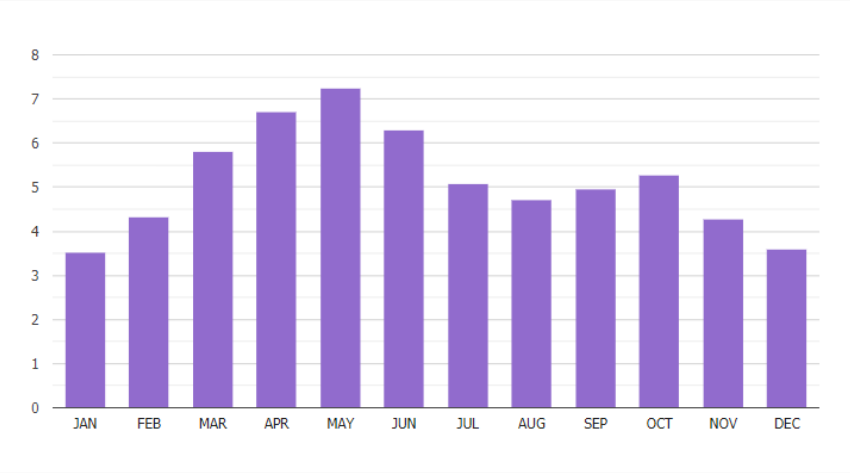
Dehradun, Uttarakhand

Latitude : 30.35 Longitude : 78.05

Annual Average : **5.15** kWh/m^2/day

Monthly Average

JAN	3.53
FEB	4.32
MAR	5.80
APR	6.70
MAY	7.24
JUN	6.30
JUL	5.08
AUG	4.72
SEP	4.97
OCT	5.28
NOV	4.29
DEC	3.59



4.0 GROUND MOUNTED GRID CONNECTED SOLAR POWER PLANT

A grid-connected ground-mounted photovoltaic power system, or grid-connected PV power system is an electricity generating solar PV plant that is connected to the utility grid. A grid-connected PV system consists of solar panels, one or several inverters, a power conditioning unit and grid connection equipment. Ground-mounted plants are installed on grounds and are mainly centralized form of power generation. Grid-connected Ground-mounted PV systems always have a connection to the public electricity grid.

4.1 Advantages of grid-connected solar power plant?

- Contribute a lot of clean and green environment than generation from coal, thermal and hydro.
- A photovoltaic power system is carbon negative over its lifespan.
- The utility grid is a virtual battery

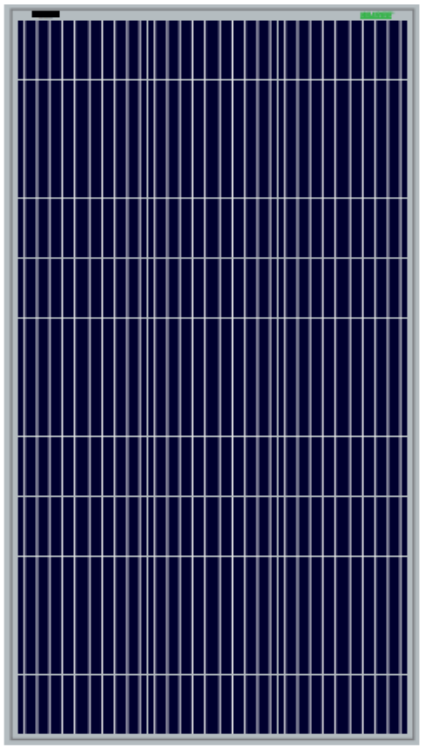
4.2 Major components of Ground-mounted Grid-connected solar power plant.

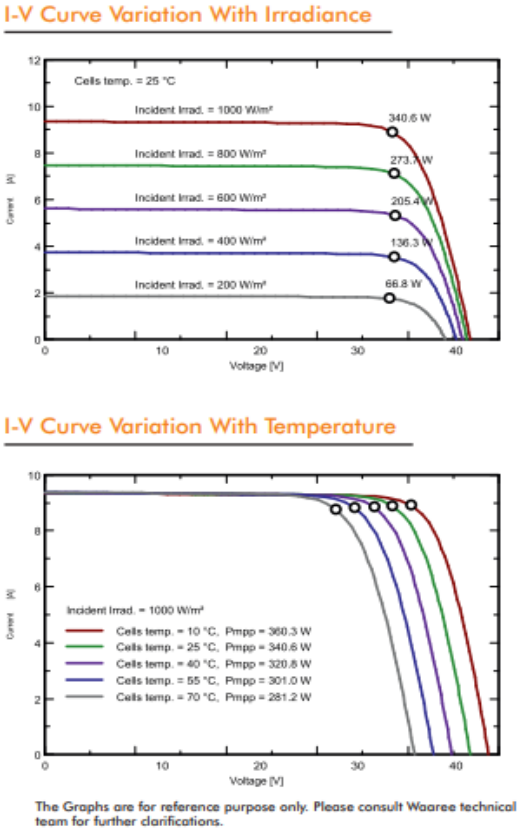
4.2.1 Solar Module:

Solar modules use light energy that is photons from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin film-cells

Key features

- Superior module efficiency
- Positive power tolerance
- PID resistant modules
- Glass with anti-reflective coating
- Sustain heavy wind and heavy snow

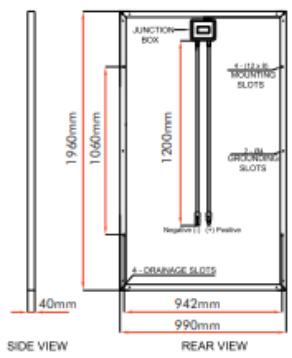




Electrical Characteristics

MODELS	Pmax (W)	Vmp (V)	Imp (A)	Isc (A)	Voc (V)	Module Eff. (%)
WS-300	300	37.05	8.10	8.65	46.10	15.46
WS-305	305	37.20	8.20	8.80	46.20	15.72
WS-310	310	37.35	8.30	8.90	46.30	15.98
WS-315	315	37.50	8.40	9.00	46.40	16.23
WS-320	320	37.65	8.50	9.15	46.50	16.49
WS-325	325	37.80	8.60	9.20	46.60	16.75
WS-330	330	37.95	8.70	9.25	46.70	17.01
WS-335	335	38.10	8.80	9.30	46.80	17.26
WS-340	340	38.25	8.90	9.35	46.90	17.52
WS-345	345	38.55	8.95	9.40	47.00	17.78
WS-350	350	38.90	9.00	9.45	47.10	18.04

Design Specifications



Mechanical Characteristics

Length x Width x Thickness (L x W x T) - mm	1960 x 990 x 40
Mounting Holes Pitch (Y) – mm	1060
Mounting Holes Pitch (X) – mm	942
Weight (kg)	22.5
Solar Cells per Module (Units) / Arrangement	72 / (12*6)
Solar Cell Type	Poly crystalline Silicon
Front Cover (Material / Thickness)	Tempered & Low Iron Glass, 3.2/4mm
Encapsulate	Ethylene Vinyl Acetate
Frame Material	Anodized Aluminum Alloy
Junction Box	IP67 rated enclosure with 3 bypass diodes Rated voltage : 1500VDC
Connector	MC4 compatible or IP67 rated
Cable	4 mm^2 cross section, 1200 mm long
Fire safety class	C
Application class	A
Safety class	II

Temperature Coefficients And Operating Conditions

Temperature coefficient of Current α (%/°C)	0.0051
Temperature coefficient of Voltage ß (%/°C)	-0.2775
Temperature coefficient of Power γ (%/°C)	-0.3859
NOCT (°C)	46 ± 2
Operating Temperature Range (°C)	-40 to 85
Maximum System Voltage (IEC& UL)	1500VDC

4.2.2 Solar Inverter

The solar inverter is the heart of the PV System. The energy produced by solar panels will be converted into electrical energy (DC), which in turn need to be converted into acceptable form (AC) to run electrical devices.

Key Features

- High DC input voltage up to 1500Vdc
- Excellent efficiency performance, 99.2% peak & 98.6% CEC
- Capable of landing up to 20 strings via fused inputs
- Electrolytic Capacitor Free, >20 years life
- IP65 protection level
- Optional type 1 or type 1+2 SPD
- Integral DC disconnect
- Integral type 2 SPD at AC & DC side
- String monitoring
- Operating temp. range -25°~60°C

Benefits with M125HV

All-in-one Design:
String fuses, surge protection devices and DC switch are integrated into the design.

String Monitoring Function:
The string monitoring function can precisely record real-time current value up to 20 strings via communication interface.

High Durability Design:
Based on electrolytic capacitor free design and IP65 protection level, inverter can increase the lifetime and long term reliability.

Installation Flexibility:
According to different installation environment, M125HV supports wall mount bracket/stand to do vertical installation.

Delta Commercial Series

Model	M125HV
DC Input	
Occasionally Max. voltage	1600V
Operating voltage range	860~1500V
MPP voltage range	860~1450V *
Rated voltage	1050V
MPP tracker	1
Max. operating current	150A
Max. allowable array Isc	320A
String fuse provisioned	20A/1500V PV fuses
Connection	20 pairs of UTX connectors
Surge Protection	Type 2 SPD (option type 1, type 1+2)
DC Switch	Yes
String current monitoring	Yes
AC Output	
Max. output power	125kW/140kVA
Max. output current	135A
Grid configuration	3P/PE
Operating voltage range	384V~690V
Operating frequency range	50/60Hz ±5Hz
Power factor	0.8 ind ~ 0.8 cap adjustable (1~0.9 at maximum power)
Surge Protection	Type 2 SPD (option type 1, type 1+2)
THD	<3%
Connection	Ring terminal lug with Terminal block (Max. 185mm^2 Cu or Al wire)
Night time consumption **	<3.5W
Efficiency	
Peak efficiency	99.2%
EU efficiency	98.6%
Information	
Communication	RS-485 (Delta/ Sunspec)
Indicator	LED (Grid, Alarm, COMM.)
Regulation	
	Enedis-PRO-RES_64E, IEC 62109-1/-2, IEC 61439-2 UTE C 15-712-1, EN 61000-6-2, NB/T 32004: 2013 VDE AR-N 4110, EN 61000-6-3, GB/T 19964: LVRT
General Data	
Smart inverter functionality	Voltage/Frequency Ride through, Volt/Var, Volt/Watt, Power curtailment, Frequency/Watt
Operating temp. range	-25°~60°C (>50°C de-rating)
Operating elevation	<3000m
Cooling	Forced air cooling with Smart fan control
Dimension (W x H x D, mm)	900 x 663 x 334
Weight (kg)	80

4.2.3 BALANCE OF SYSTEM

S.NO	LIST OF COMPONENTS		LIST OF COMPONENTS
1.	Module mounting structure		Lightning Arresters of suitable ratings
2.	Array junction box		Control and power cables
	SOLAR DC CABLE		Surge Protection devices and fuse
	Connection accessories – lugs, ferrules, glands etc.		Earth cables, flats and earthing pits
	AC Cable		Equipment and Control cum office Building
	WMS and data logger		Rubber Mats for specific kV ratings
	Sand Buckets		CO2 Extinguisher
	Fire – fighting automation and signboards		Metering Equipment (Meters, and associated CT and PT"s)
	Protection Equipment		Module cleaning system
	Danger plates etc.		Balance equipment other than specified above
	MC4 CONNECTORS		

5.0 PROJECT SCHEDULE GAANT-CHART

Below is the project schedule datasheet starting from preparing the tender to commissioning the project. The below table is the summary of Major task. These tasks have also been specified in increasing order and have been set with percent of completion. This Gaant chart is giving approx. idea of project duration. Such kind of GAANT chart help in project execution in better ways.

S.NO	TASK	Percent completion	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
week			Sep-13	14-18	18-22	22-26	27-31	31-35	35-40	40-44	44-48	48-52	1 2 3 4 5	5 6 7 8 9	9 10 11 12 13 14	14 15 16 17 18	18 19 20 21 22	23 24 25 26 27
1	TENDER DOCUMENTATION	5																
2	TENDER PARTICIPATION	10																
3	WAITING TIME	10																TOUGH WORK
4	RESULT	15																
5	PROJECT COMPANY	17																
6	LAND IDENTIFICATION	25																EXTRA TIME
7	TFR-UPCL	27																
8	LAND CONVERSION	30																
9	PPA UPCL	33																EASY WORK
10	DPR	40																
11	PROJECT FUNDING	60																
12	ALL KIND OF APPROVAL	62																
13	DESIGN & ENGINEERING	65																
14	PROCUREMENT	70																
15	SHIPMENT	72																
16	PLANT CONSTRUCTION	90																
17	TRANSMISSION LINE	95																
18	COMMISSIONING	98																
19	EXPORT TO UPCL	100																
		100																

6.0 RELATED INFRASTRUCTURE FOR SOLAR POWER PLANT.

This project involves all the solar project related work along with establishment works, planning work, infrastructure, fencing, security, earthworks, and grid line works.
Following are basic infrastructure needed.

S. NO	BASIC INFRASTRUCTURE PARTICULAR	DESCRIPTION	IMAGES
1.	Road connectivity	Road connectivity to the project site is important for project material transportation and installation work.	
2.	Water supply system	Water is needed from project installation to operation and maintenance till 25 years.	
3.	Stormwater drainage	To Discharge the rainwater, water drainage system is importantly required for the system.	

4.	Power evacuation infrastructure.	11KVA/33KVA grid line is required to evacuate power from the solar system.	
5.	Pooling substation	Substation is part of electrical generation, transmission, and distribution system. substation transform voltage from high to low or reverse.	
6.	Cable corridors	Cable corridor for safe transmission of line.	
7.	Project boundary fencing	Project boundary fencing for security purpose	
8.	Street lights	Street light for night vision and security concern.	
9.	Control room	Control room for entire electrical operation.	

10	Monitoring device	Monitoring device to measure the working of the plant every day.	
11	Internal pathways	Internal pathways for internal movement.	
12	Fire fighting system	Fire fighting system in case of emergency.	
13	Water pipeline across modules for cleaning	Water pipeline across the entire solar plant for module cleaning.	
14	CCTV Camera	Cctv camera for security purpose.	
15	Weather monitoring devices	Weather monitoring device to monitor wind speed, temperature, humidity and many other.	

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7.0 OPERATION & MAINTAINANCE

Once the PV solar plant has been built, it needs to be efficiently operated and carefully maintained. Compared to other power generating technologies, solar PV power plants have low maintenance and servicing requirements. Solar project maintenance can help maximize uptime and extend the life of the plant. The delivery of solar power without any disruption maintains the stream of economic value generated by each kilowatt-hour of production, and proper service is a critical component to ensuring optimal performance while minimizing the risks of downtime.

7.1 Issue in operation & Maintenance:

- All cells degrader over time, so it's important to take proper operation & maintenance.
- Grounding & Lightning protection
- Component failures: solar panel, inverter, and BOS.
- Panel cracking
- Visual discoloration: that reduces the amount of sunlight that penetrates into a solar cell. As a result, solar cells are less exposed to solar irradiation and generate less energy. The reason it leads to loss of efficiency is because different color panel changes the wavelength of light that can be absorbed.
- Hotspots. Temp effect.
- Layer of the panel being covered with multiple things like dust water droplets, bird shit, and many others.
- Inverter failures.
- Structural integrity
- Weather conditions
- Other issues like tightening the cable, replacing blown fuses, repairing lightning damage, repairing equipment damaged and rectifying SCADA faults.

7.2 What we offer in operation & maintenance.

- Module cleaning
- Water drainage
- Vegetation management
- Retro-commissioning (identifies and solve problems that have developed during the course of PV system life)
- Wildlife prevention
- Upkeep of data acquisition and monitoring system
- Upkeep of power generating system (Inverter servicing, BOS and other)
- Site maintenance (security, road, fencing, and environmental compliances, snow removal)
- On-site monitoring
- Non-critical reactive repair (addresses production degradation issues)
- Critical reactive repair (high priority, addresses production losses)
- Warranty enforcement
- Spare part and inventory management
- Insurance enforcement
- Trending and analytics for continuous improvement.

7.3 OPERATION & MAINTAINANCE SCHEDULE

S.NO	PARTICULAR	CHECK POINTS	D	W	M	Q	Y
1	SOLAR GENERATION	CLEANING SOLAR PANEL					
2		CHECK MODULE AGAINST CRACKS AND GLASS BROKEN					
3		Check the tightness of Connecter and Cable connection					
4		Waterlogging, vegetation growth, dirt, bird nests and vermin around the mounting area					
5		Site access routes and walkways					
6		Dirt/debris/bird droppings					
7		Damage- weather and vermin [visual] Front and back					
8		Degradation/browning [Visual]- Front and back					
9		Blackened/burnt cells [Visual]					
10		Terminal box- water tightness					
11		Tightness of terminals					

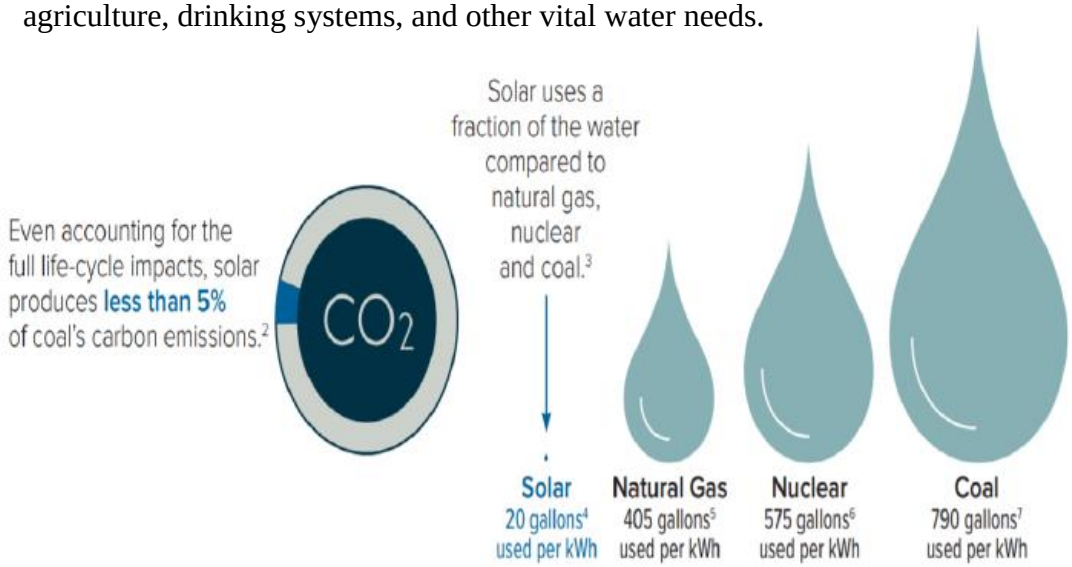
12		Corrosion/crack/bends at metallic surface and joints					
13		Loose bolts and nuts[torque meter					
14		EARTHING & LP : Tightness of joints & continuity till grounding [Check for rust/corrosion]					
15		Lightning Protection Rod [Check for damage/loose connection to earth]					
16	ARRAY & DCDB	CABLE TRACING CONDUIT DAMAGE					
17		CABLE TIE AND MC4 CONNECTORS					
18		Junction Box board -Switches and Brakes normal position					
19		protection devices-surge protection					
20		board lock-inside and outside damage.					
21		lugs and connection					
22		thermography					
23		clamps assessment (current and voltage of individual string)					
24	INVERTOR	operational indicators					
25		air filter-dust trash or any blockage					
26		burns inside, dust or connection tightness.					
27		thermography hotspot					
28	ACDB	board lock-inside and outside damage and lugs					
29		connection tightness and fuses					
30	MONITORING	DATA LOGGER MONITORING					
31		NET-METERING/GROSS METERING					
32		INVERTER READING CHECK					
33		WEATHER READING					
34		SPARE AND INVENTORY CHECK					
35		INTERNAL AUDIT					

8.0 ENVIRONMENTAL AND SOCIOLOGICAL IMPACT

Even though a solar power farm looks like a development that has a vast impact on the environment and is a step towards a sustainable future but there is more to it than just the environmental aspect. It affects the life of habitats of the location where such a plant is set up. Moreover, there are ways it can have a negative impact and corrective measures should be taken to minimize the negative impact it can have on the environment and the society. The implementation and operation of the solar farm must be assessed with respect to its socio-economic and environmental issues and any negative impact mitigated

8.1 Positive Impact of Solar Parks

- Solar Park has positive environmental impacts when compared to conventional energy, for instance, reduction of greenhouse gas emissions (CO2, N2O, CH4, etc.), and prevention of toxic gas emissions (SO2, particulates).
- Solar energy systems used in Solar Park are silent because they don't have a loud moving part. Hence, there is no any sort of disturbing noise pollution coming out from Solar Park
- **Solar reduces the need for finite resources**: Solar energy is renewable and once completed, it will not need any finite resource for its functioning, unlike conventional based power plants. Thus, having a positive impact on the environment.
- **Solar reduces water pollution:** While all manufacturing processes require some water, solar PV cells don't need water to generate electricity. This is one of the biggest, yet least talked about environmental benefits of solar. Traditional biomass and geothermal power plants, such as natural gas and coal-fired facilities, require massive amounts of water to facilitate their vital cooling requirements. With solar energy there is no pollution of local water resources, nor does their operation (which again requires NO water) strain local supplies through the competition with agriculture, drinking systems, and other vital water needs.



8.2 Negative Impact of Solar Park

- **Land Use:** Depending on their location, large utility-scale solar facilities can raise concerns about land degradation and habitat loss.
- **Hazardous Materials**: PV panel production is energy-intensive and causes depletion of some natural resources because bulk semiconductor material is needed in high quantities.
- During the construction, soil is removed alongside its flora and fauna. Inherent biological soil crusts are turned over and the soil becomes vulnerable to soil erosion.

8.3 Conclusion:

Every solar panel that is built and successfully used in Solar Park as a substitute for fossil fuels is reducing the amount of pollutants released into the atmosphere. Overall, using solar energy as a substitute for fossil fuels will have a positive impact on the environment. Thus, Solar Park has a net positive impact on the environment compared to conventional based power stations.

8.4 Socio-economic Impact of Solar Park:

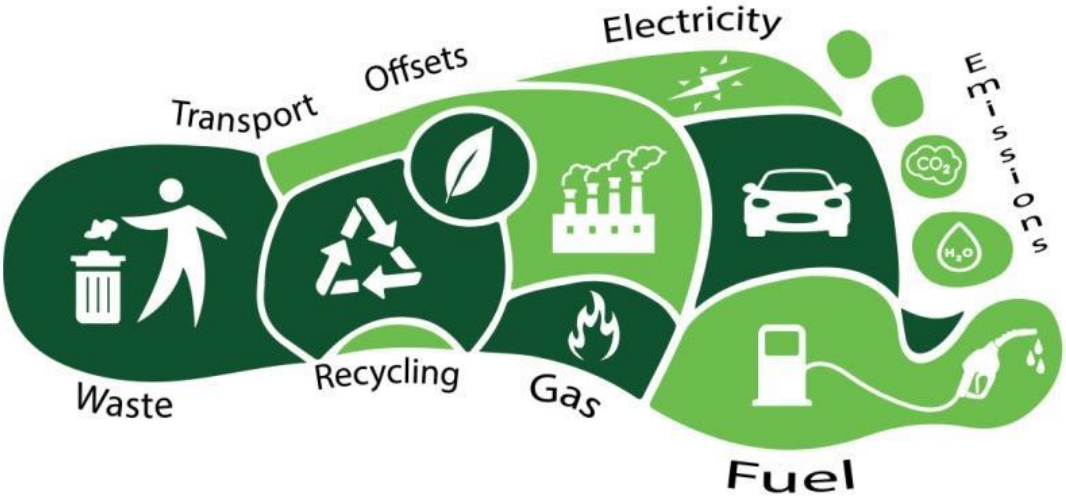
Renewable energy provides substantial benefits for our climate, our health and our economy

- **Job Creation:** Compared with fossil fuel technologies, which are typically mechanized and capital intensive, the renewable energy industry is more labor-intensive. This means that, on average, more jobs are created for each unit of electricity generated from renewable sources than from fossil fuels.
- **Prosperity for nearby businesses:** In addition to the jobs directly created in the renewable energy industry, growth in renewable energy industry creates positive economic "ripple" effects. For example, industries in the renewable energy supply chain will benefit, and unrelated local businesses will benefit from increased household and business incomes.
- **Air Quality Improvement:** Generating electricity from renewable energy rather than fossil fuels offers significant public health benefits. The air and water pollution emitted by coal and natural gas plants are linked to breathing problems, neurological damage, heart attacks, and cancer. Replacing fossil fuels with renewable energy has been found to reduce premature mortality and lost workdays, and it reduces overall healthcare costs.
- **Sustainable Source of Energy:** By tapping from the free source of energy which is the sun, the electricity production from other sources such as fossil fuel can be reduced. Fossil fuel is exhaustive and one day will be completed depleted. This will jeopardize future generation needs. By encouraging the use of renewable sources of energy such as the sun, the dependency on fossil fuel can be reduced and the available stock can be used for a longer time.

- **Reliable Energy System:** Energy from solar power is less prone to large scale failure because they are modular and not centralized. They are spread over a large geographical area. A problem in one location will not cut off power over an entire region or country. The modular system has the advantage of staying operational even if some of the equipment in the system is damaged.
- Renewable source of energy is more resilient than coal, crude oil or natural gas power plants because they can resist disruptive events.

8.5 Carbon footprints:

Carbon footprint can be defined as the total amount of greenhouse gases produced to, directly and indirectly, support human activities and is usually expressed in equivalent tons of carbon dioxide (CO2)



The main influences on carbon footprints include population, economic output, and energy and carbon intensity of the economy. These factors are the main targets of individuals and businesses in order to decrease carbon footprints. Production creates a large carbon foot-print, scholars suggest that decreasing the amount of energy needed for production would be one of the most effective ways to decrease a carbon footprint. This is due to the fact that Electricity is responsible for roughly 37% of Carbon Dioxide emissions

Produces 45000 Unit of Electricity. (Kwh)	***Equivalent to 20 ton of CO_2 Emission avoided***	***Equivalent to planting 3000 trees.***	***Equivalent to Save 22.5 Lac @5 ₹/Unit***

9.0 PROJECT RISK-ASSESSMENT

Among the hundreds and thousands of positive aspects, there might be a possibility of always having some risk associated with the project. Although that may be very small but we could not neglect it in identifying the risk before starting the project. Here we are identifying all the possible risks associated with grid-connected ground-mounted solar power project. Risk management is best practice while the project is underway to ensure less surprise occurs while the project is underway. However, we cannot predict the future but we can make use of a simple risk management process to predict the uncertainty and minimize the happenings.

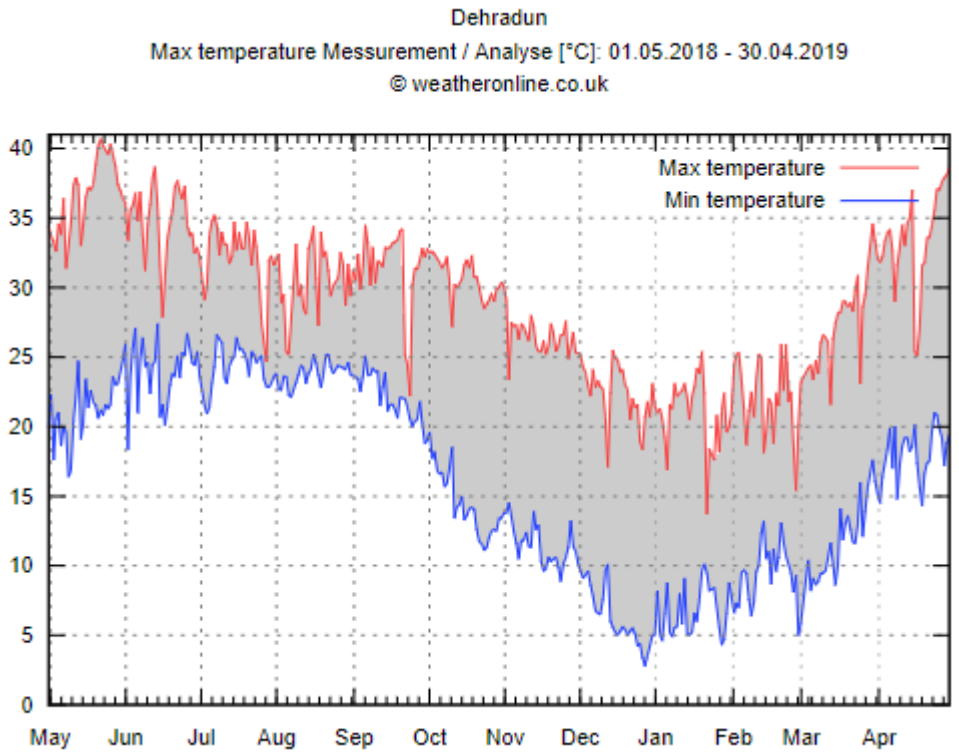
S.NO	Type of risk	Risk Probability	Result of risk	Risk Ratings
PROJECT DEVELOPMENT RISK				
1	PROJECT DELAY	MEDIUM	HIGH	HIGH
2	local residents opposing issue	LOW	LOW	LOW
3	Identification of Feasible site	LOW	MEDIUM	MEDIUM
4	Land Finalisation	MEDIUM	HIGH	HIGH
5	Land conversion into commercial	LOW	MEDIUM	HIGH
6	Getting TFR report from UPCL	MEDIUM	MEDIUM	MEDIUM
7	Project Funding	MEDIUM	HIGH	HIGH
8	Delay in getting NOC from Gov body	LOW	LOW	MEDIUM
PROJECT BUSINESS & OPERATION RISK				
10	Change in Gov Policy	LOW	HIGH	LOW
11	Design Risk	LOW	MEDIUM	LOW
12	Technology Risk	LOW	MEDIUM	MEDIUM
13	Force Majeure events	LOW	LOW	LOW
14	Border Area Risk	LOW	LOW	LOW
15	Operation and Maintenance risk	LOW	MEDIUM	MEDIUM
16	Theft Risk	LOW	HIGH	MEDIUM
17	Availability of water	LOW	MEDIUM	LOW
18	Natural calamity Risk	MEDIUM	HIGH	HIGH
19	Project cost increasing risk	LOW	LOW	LOW
20	social acceptance risk	LOW	LOW	LOW
TECHNICAL RISK				
20	Low sunlight Risk	LOW	LOW	LOW
21	high rain throughout year risk	LOW	MEDIUM	LOW
22	solar panel failure risk	LOW	HIGH	LOW
23	Inverter failure Risk	LOW	HIGH	LOW
24	Lightning arrestor failure risk	LOW	HIGH	MEDIUM
25	other BOS failure Risk	LOW	MEDIUM	MEDIUM

10.0 SITE DETAILS

The proposed Site location is in the _____**Uttarakhand India**. Details of sites is as specified in the Annexure-I. Connectivity and other details are also specified in Annexure-I.

10.1 CLIMATIC & METROLOGICAL CONDITION OF SITE

TEMP: Max and Min temperature of the region is described in the graph below.



WIND SPEED: Wind speed data for 2018 and 2019 for a particular location is specified in the table below.

Analysis(Month) Analysis(Year)

Start: January 2019 — End: December 2019 go

Wind-force per Day (January 2019 - December 2019)

Jan	Feb	Mar	Apr	May	Jun	
2.7	2.3	2.9	2.4	2.9	2.2	[km/h]
100	89	74	100	100	100	Data availability[%]

Jul	Aug	Sep	Oct	Nov	Dec	
1.6	1.6	1.7	1.5	****	****	[km/h]
100	100	100	54	0	0	Data availability[%]

Averaged Value (January 2019 - December 2019) : **2.2 km/h**

Analysis(Month) Analysis(Year)

Start: January 2018 — End: December 2018 go

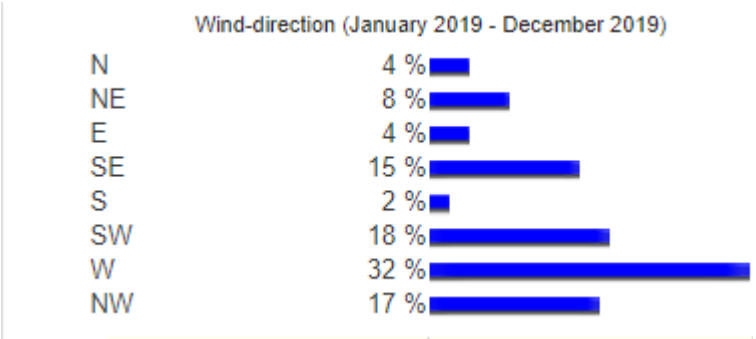
Wind-force per Day (January 2018 - December 2018)

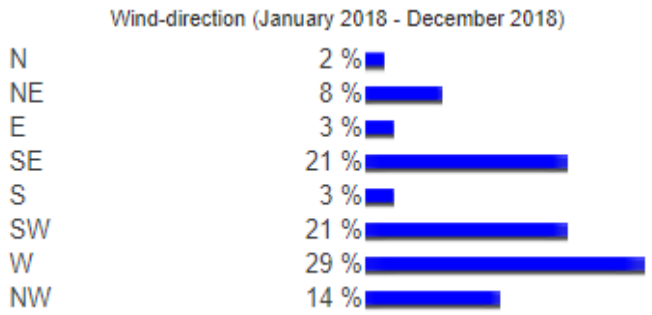
Jan	Feb	Mar	Apr	May	Jun	
1.5	2.2	2.4	3.5	2.6	2.3	[km/h]
96	100	100	100	100	100	Data availability[%]

Jul	Aug	Sep	Oct	Nov	Dec	
2.1	1.8	1.6	2.0	2.3	1.8	[km/h]
100	100	100	100	100	100	Data availability[%]

Averaged Value (January 2018 - December 2018) : **2.2 km/h**

Wind direction for the particular location is specified below





Precipitation is rain, snow, sleet, or hail — any kind of **weather** condition where something's falling from the sky. Following is average data of the last 10 years, and furthermore with the latest data of 2019.

Start: January 2018 — End: December 2018 — go

Accumulated Precipitation (January 2018 - December 2018)

Jan	Feb	Mar	Apr	May	Jun	
25.0	6.0	12.0	23.5	17.1	148.8	[mm]
96	100	96	100	100	93	Data availability[%]

Jul	Aug	Sep	Oct	Nov	Dec	
446.4	901.3	208.6	6.0	5.7	1.6	[mm]
90	96	96	96	96	90	Data availability[%]

Accumulated Value (January 2018 - December 2018) : **1802.0 mm**

Start: January 2019 — End: December 2019 — go

Accumulated Precipitation (January 2019 - December 2019)

Jan	Feb	Mar	Apr	May	Jun	
10.8	57.4	28.5	27.0	10.0	88.0	[mm]
96	93	93	96	90	100	Data availability[%]

Jul	Aug	Sep	Oct	Nov	Dec	
267.8	405.8	364.7	6.2	****	****	[mm]
93	96	96	54	0	0	Data availability[%]

Accumulated Value (January 2019 - December 2019) : **1266.2 mm**

Start: January 2009 — End: December 2019 — go

Days with Precipitation > 0.1mm (January 2009 - December 2019)

Jan	Feb	Mar	Apr	May	Jun	
4.1	5.7	5.2	4.8	6.0	12.1	[days]
96	97	97	97	97	94	Data availability[%]

Jul	Aug	Sep	Oct	Nov	Dec	
26.0	25.9	17.0	3.5	1.2	1.9	[days]
94	95	97	98	98	96	Data availability[%]

Averaged Value (January 2009 - December 2019) : **113.3 days**

Start: January 2019 — End: December 2019 — go

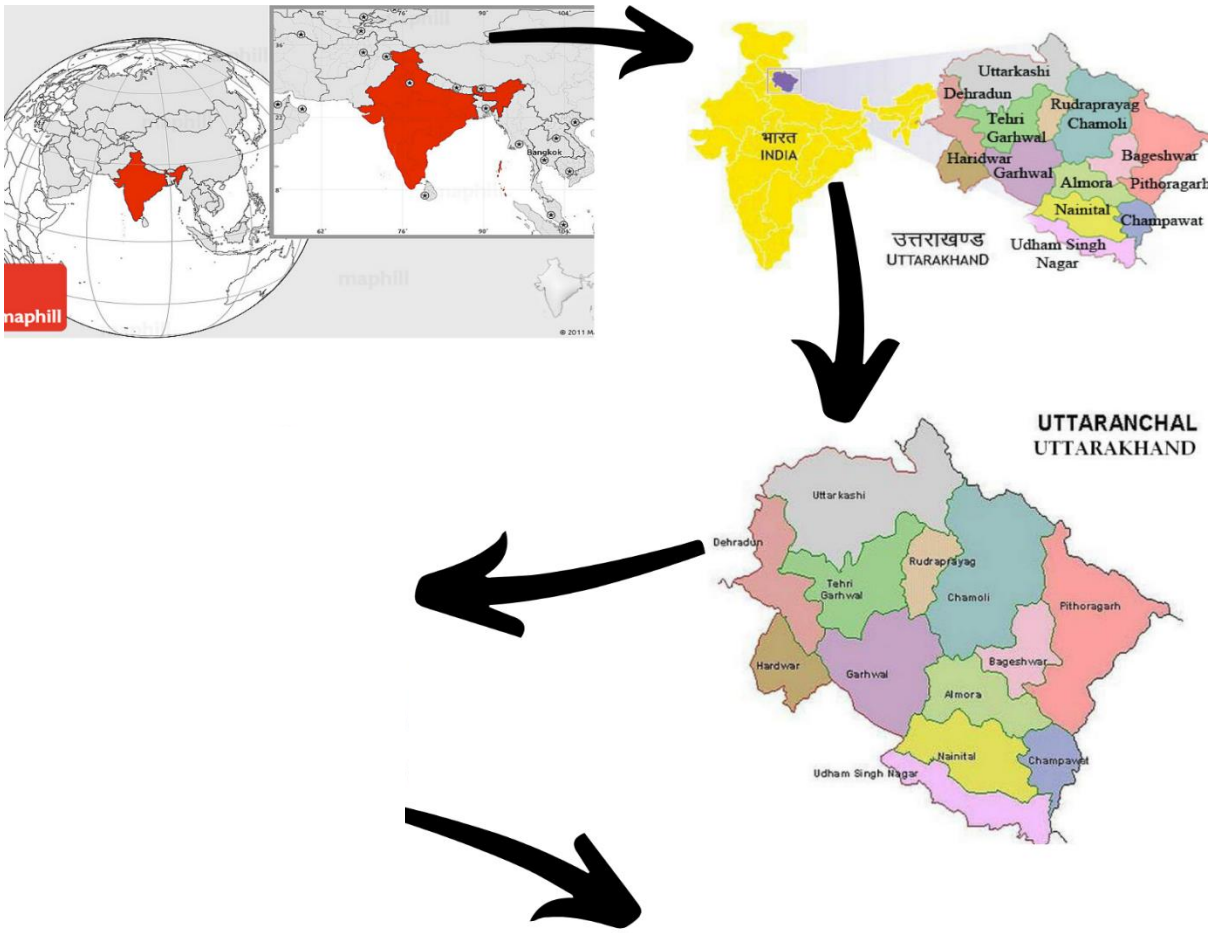
Days with Precipitation > 0.1mm (January 2019 - December 2019)

Jan	Feb	Mar	Apr	May	Jun	
4.0	9.0	6.0	3.0	4.0	8.0	[days]
96	93	93	96	90	100	Data availability[%]

Jul	Aug	Sep	Oct	Nov	Dec	
22.0	23.0	20.0	2.0	****	****	[days]
93	96	96	54	0	0	Data availability[%]

Averaged Value (January 2019 - December 2019) : **101.0 days**

10.2 SITE MAP:-


Bangkok
maphill
भारत
INDIA
Uttarkashi
Dehradun
Rudraprayag
Tehri Garhwal
Chamoli
Haridwar
Garhwal
Bageshwar
Almora
Pithoragarh
Nainital
Champawat
उत्तराखण्ड
UTTARAKHAND
Udham Singh Nagar
UTTARANCHAL
UTTARAKHAND
Uttarkashi
Dehradun
Rudraprayag
Tehri Garhwal
Chamoli
Pithoragarh
Hardwar
Garhwal
Bageshwar
Almora
Nainital
Champawat
Udham Singh Nagar

12.0 PROJECT OVERVIEW:

12.1 11.1 PROJECT DETAILS

S.NO	PARTICULAR	DESCRIPTION
1	PROJECT TITLE	
2	PROJECT CAPACITY	
3	TARIFF RATE	
4	NAME OF PROMOTER	
5	MOBILE NUMBER OF PROMOTER	
6	EMAIL-ID OF PROMOTER	
7	ADDRESS OF PROMOTER	
8	DPR	REFER TO TECHNO-COMMERICIAL PROPOSAL

11.2 GEOGRAPHICAL LOCATION OF SITE

S.NO	PARTICULAR	DESCRIPTION
1	SITE ADDRESS	
2	SITE LOCATION	
3	CATEGORY AS PER STATE MSME	
4	TEHSIL	
5	DISTRICT	
6	LATITUDE	
7	LONGITUDE	
8	ELEVATION	
9	TOTAL SITE AVAILABLE AREA	
10	TOTAL SITE REQUIRED AREA	
11	SITE MAP	ATTACHED.
12	NEAREST LOCAL ROAD DISTANCE	
13	NEAREST STATE HIGHWAY	
14	NEAREST NATIONAL HIGHWAY	
15	NEAREST RAILWAY STATION	
16	NEAREST AIRPORT	
17	PORT CONNECTIVITY	

12.0 ANNEXURE-I

Annexure-I contains the following major segments, and details of Annexure-I is kept in a separate file.

12.1 Annual Estimated Energy for each month
12.2 Grid system presizing.
12.3 Grid-connected system: loss diagram
12.4 Balance and main result
12.5 Other related reports

13.0 ANNEXURE-II.

Annexure-II contains the following major segments, and details of Annexure-II is kept in a separate file.

13.1 REVENUE MODEL SUMMARY.
13.2 SUMMARY OF ESTIMATED CAPITAL AND OPERATING COST
13.3 DETAILS OF MEANS OF FINANCING
13.4 DETAILS OF COST OF PROJECT
13.5 DETAILS OF LAND COSTING AND ANALYSIS
13.6 PROJECTED BALANCE SHEET OF 7 YEAR/10YEAR/15YEAR/25 YEAR
13.7 PROFITABILITY STATEMENT
13.8 PROJECTED CASH FLOW STATEMENT
13.9 DETAILS OF GROSS RECEIPT.
13.10 PROJECTED EXPENSE ANALYSIS REPORT
13.11 SHARE CAPITAL ACCOUNT
13.12 DETAILS OF DEPRECIATION ON FIXED ASSETS
13.13 REPAYMENT SCHEDULE AND INTEREST ON MEANS OF FINANCING
13.14 PAYABLE REPORTS
13.15 RECEIVABLE REPORTS
13.16 WORKING CAPITAL PROJECTION REPORTS
13.17 DEBT EQUITY RATIO