



Rotary Club of Poona Midtown

RI District 3131 CC: 15537 RI Zone: 4

Email: president1718rcpoonamidtown@gmail.com, mhasakar@gmail.com,

Rtn. Abhijit Mhasakar, President Elect 17-18

Secretariat – c/o. Prompt Engineers

Shree Ram Co-operative Housing Society Ltd., Plot No. 17, C.T.S. No. 1229,
S.N.42 + 43 United Western Society, Karvenagar, Pune – 411 052, Maharashtra, India

Phone: **+91 98220 30294, +91 94049 30294, +91 020 25445715**

Solar PV Power Plant

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Introduction

India is densely populated and has high solar insolation, an ideal combination for using solar power in India. India is already a leader in wind power generation. In the solar energy sector, some large projects have been proposed, and a 35,000 km² area of the Thar Desert has been set aside for solar power projects, sufficient to generate 700 GW to 2,100 GW. Also India's Ministry of New and Renewable Energy has released the JNNSM Phase 2 Draft Policy, by which the Government aims to install 10GW of Solar Power and of this 10 GW target, 4 GW would fall under the central scheme and the remaining 6 GW under various State specific schemes.

The Electricity Act, 2003, paves way for an innovative approach to solve our country's power problems. It has paved the way for a competitive environment; open access to existing transmission and distribution network to transmit electricity across regions; de-licensing of generation, captive power and dedicated transmission lines; licensing of distribution and supply companies and the restructuring of State Electricity Boards.

The Ministry of Power has mandated to promote cogeneration and renewable sources for Power generation under Nodal agencies and hence it will play a major role in mainstreaming renewable energy sector. The advantage or renewable resources includes their capacity to produce energy without producing carbon- based warming and polluting agents into the atmosphere. The financial cost of its applications is not always cheap but if the environmental costs of using fossil are accounted for, renewable energy wins



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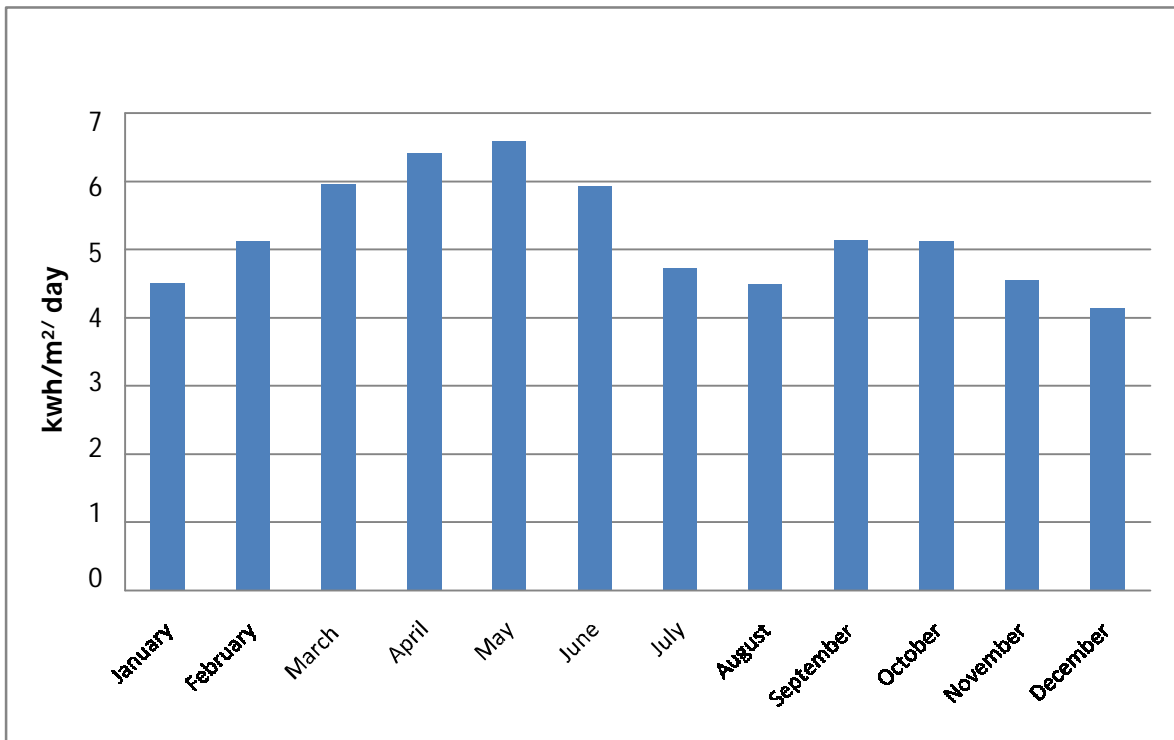
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hands-down. There are also indirect savings on health and its costs as there are no harmful emissions.

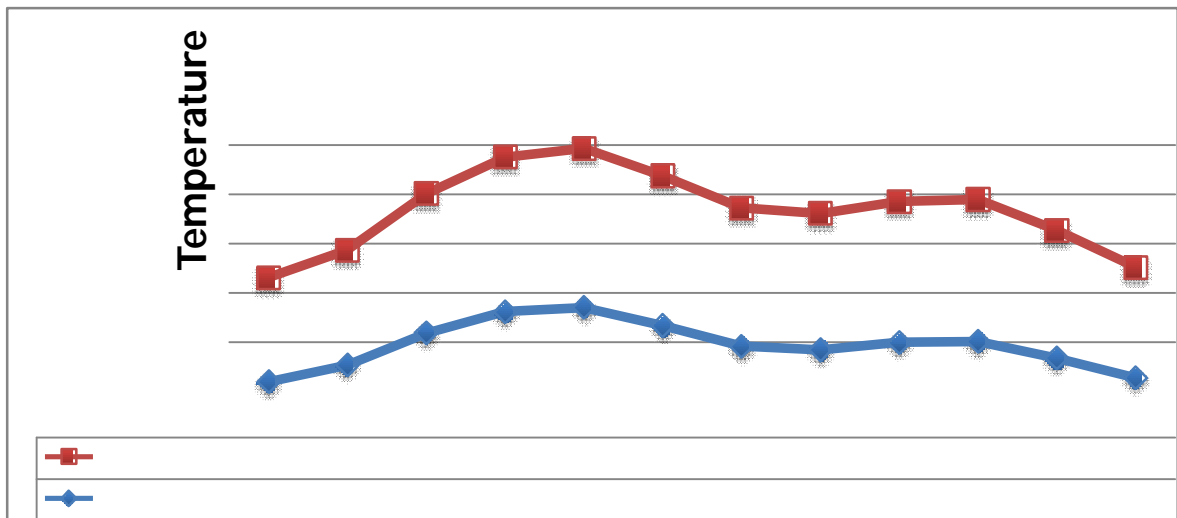
In the above backdrop, we have decided to set up Solar Power Plant in various schools, orphanages, special children schools and premises of NGO's working for charity. We have planned to generate 1 MW power in all. This Detailed Project Report (DPR) brings out all technical details and overall costs justifying the selection of the project. The total power generation is envisaged to be 1000KW from Solar Photovoltaic Cell. It is a very important document that is required for Environmental Impact Assessment (EIA) studies, fixation of tariff, finalizing Power Purchase Agreement (PPA) and also for submission to Financial Institutions for obtaining project funding. The total project cost is expected to be **Rs 7.5 Crores (USD 1.12 Millions)** and the average cost of generation is expected to be **Rs. 7.5/kWh. We propose to undertake project worth Rs. 75,00,000.00 as a module of 100KW.**

For this project, poly-crystalline technology based 3rd generation Solar PV modules will be used. These technologies are the best in the industry. So, It is clear that this project is not compromising with the quality of the materials and or the components which obviously led this project to success.

Solar Irradiation



Air & Earth Temperature



| | Jan | Feb | March | April | May | June | July | August | Sept | Oct | Nov | Dec |
|-----------|------|------|-------|-------|------|------|------|--------|------|------|------|------|
| Air Temp. | 21.1 | 23.3 | 28.3 | 31.4 | 32.3 | 30.4 | 28.1 | 27.7 | 28.6 | 28.8 | 25.9 | 22.4 |
| Earth | 23 | 26.4 | 32.9 | 37.2 | 38.1 | 34.4 | 30.2 | 29.5 | 31 | 31.2 | 27.8 | 23.8 |

Array Sizing Details

| Solar PV Array Sizing & Connection Details | |
|--|-------------|
| Conditions | At STC(25C) |
| Suggested array Size | 1048KWp |
| Actual solar PV array size | 1048KWp |
| Watt Peak of each SPV module | 240W |
| Total nos. Of SPV module required | 4368 |
| Total nos. Of strings | 208 |
| Nos. Of SPV modules in each string | 21 |
| SPV connection in each string | Series |
| String voltage (VMPP) | 645V |
| String current (ISC/IMPP) | 8.59A/7.81A |
| Connection of strings | Parallel |
| Array voltage (VOC/VMPP) | 760V/645V |
| Array current (ISC/IMPP) | 1786A/1630A |

| Inverter Type | String Inverter (MPPT) |
|--|------------------------|
| Quantity | 52 |
| INPUT (DC) | |
| Max. Power | 24KW |
| Max absolute Input Voltage | 1000V |
| Start Voltage | 350V |
| Nominal MPP voltage range Max Input Current per string | 490V-850V |
| Max.Input Current | 41.8A |
| DC Isolator | Yes |
| Nos. of Independent MPP inputs/strings per MPP inputs | 1 |
| OUTPUT (AC) | |
| Rated Output Power | 20KW |
| Max. Apparent AC Power | 20KVA |
| Power Threshold | 20W |
| Nominal AC Voltage/range | 3/N/PE;230/460V |
| AC Power Frequency/ range | 50Hz |
| Max. output current | 3*29.2A |
| Power factor at rated power | 1 |
| Feed-In phases/connection phases | 3-Mar |
| Efficiency | |
| Max. Efficiency | 98.20% |
| Protection Details | |
| DC Disconnect | Available |
| DC Surge Arrester | Available |
| Protection Class | PCL I |

| | |
|--|--------------------------|
| Total harmonic distortion | <1.8% |
| Operating Temperature range | |
| Noise Emission | <45db |
| Self Consumption | <20W |
| Protection type | |
| Cooling option | Natural convection |
| Remote Monitoring System User Interference & Communication | Ethernet, RS485 |
| Electrically Isolated relay output | Available |
| Status Display | Available |
| Inverter to inverter communication | Available |
| Anti-islanding protection | Available |
| Inverter connection details | |
| Total nos. of inverter | 52 |
| Nos. of strings per inverter | 4 |
| Connection of strings/inverter | Parallel |
| Inter-inverter connection | Parallel into Cu Bus bar |
| Inter-Inverter isolator | Provided |

Performance Summery

| Overall Power Plant performance Summery | |
|---|------------------|
| Total no. of PV modules | 4368 (240Wp) |
| Total nos. of Inverters | 52 (20KW) |
| Max DC input per Inverter | 21KW |
| Nominal PV power | 1048KWp |
| Max. PV power output | 1000KWdc |
| Nominal AC power | 1000KWac |
| Max operating power @STC | 950KWac |
| Max operating power @Ambient Temp. | 1000KWac |
| Plant production | 1655MWh/year |
| Specific production | 1600KWh/KWp/Year |
| Normalized production | 4.2Kwh/Kwp/day |
| Array losses | 0.87Kwh/Kwp/day |
| Overall losses | 0.2Kwh/Kwp/day |
| Performanceratio | 0.80 |

Time line of the project

We have identified more than 100 schools / institutes as mentioned above. The detailed list will be shared in due course of time. We are attaching herewith confirmation letters received from some schools, for your reference.

We propose to start the execution of this project from Jan. 2017 and
Propose to complete the project in next 9 months.

Operation & Maintenance of Plant



Why do we need an O&M for Solar PV power plant?

As every plant needs a regular maintenance work to make it functional & in well-condition, so in this case also, a PV power plant also requires a sound & efficient operation & management team to perform all the work after plant commissioning.

Operation and maintenance of the system is very crucial for long life of solar power pack. Solar Power pack is a static system having very low maintenance. For Solar Panels, only routine cleaning process is required. Solar Power Conditioning will require maintenance time to time. The manufacturer will take AMC after the warranty period.

Financial Analysis & feasibility

A) Offer for 1 kWp and 1.5 kWp On-Grid Roof-top Solar Power Plant

| SR. No | Description | For 1 kWp | For 1.5 kWp |
|--------|--|--------------------|----------------------|
| 1 | Solar PV Module (Polycrystalline) | 250 Wp, 04 Nos | 250 Wp, 06 Nos |
| 2 | Solar Grid Tie Inverter | 1 kVA, 1 Phase | 1.5 kVA, 1 Phase |
| 3 | Copper Cables DC Cables(Max 20m), AC Cables up to Control Panel(Max 20m) | INCL | INCL |
| 4 | DC Distribution Box | 1 No | 1 No |
| 5 | AC Distribution Box | 1 No | 1 No |
| 6 | Lightning Arrester | INCL | INCL |
| 7 | Special Earthing | INCL | INCL |
| 8 | Installation Accessories (Third Party) | INCL | INCL |
| 9 | Fabrication (Third Party) | Rs.8,000/- | Rs.12,000/- |
| 10 | Installation Charges (Third Party) | INCL | INCL |
| 11 | Transportation (Third Party) | Rs.2000/- | Rs.2000/- |
| 12 | Net Meter Arrangement | Customer's Scope | Customer's Scope |
| | Cost for 3/5/6 kWp Rooftop solar Power Plant | Rs.95,000/- | Rs.1,50,000/- |

**Required South Facing Shadow Free Space: 100 Sq. feet for 1 kWp
150 Sq. feet for 1.5 kWp**

Net Meter Procedure and Charges :(Customer's Scope)

| Sr. No | Particulars | Amount | Remark |
|--------|---------------------------------|-----------|-------------|
| 1. | Application Submission | Rs.500/- | 1 Visit |
| 2. | Sr. Engg at Site Visit | Rs.1000/- | 2 Visits |
| 3 | Report Submission | Rs.1000/- | 2 Visits |
| 4 | Net Meter Charges | At Actual | Three Phase |
| 5 | Generation Meter Charges | At Actual | Three Phase |
| 6 | Meter Testing Charges By MSEDCL | At Actual | 1 Visit |
| 7 | Extra Visits | Rs. 500/- | Each |

1 MW Solar Grid Tied Power Plant

| | | |
|--------------------------------|-----------------|--------|
| Plant capacity | 1000 | KW |
| Plant Cost | 75000000 | Rs |
| Unit Rate | 8 | Rs |
| Generation per Annum | 1650000 | Units |
| Escalation rate in electricity | 8% | Yearly |
| Bank FD Interest rate | 7% | Yearly |

Saving from Solar Plant for 10 years

| Year | Electricity saving(Rs.) |
|--------------|-------------------------|
| 1st year | 13200000 |
| 2nd year | 14256000 |
| 3rd year | 15396480 |
| 4th year | 16628198 |
| 5th year | 17958454 |
| 6th year | 19395131 |
| 7th year | 20946741 |
| 8th year | 22622480 |
| 9th year | 24432279 |
| 10th year | 26386861 |
| Total | 191222625 |

FINANCIAL OVERVIEW:

Solar Power Plant has high potential power in money savings as a Bill of electricity and Income-Tax credit. It also offers Hedging against increase in rate of electricity.

| Sr. No. | Financial Parameters | Value(Rs.) | Unit |
|-------------------------|--|----------------|------|
| 1. | Plant Cost | 7,50,00,000.00 | INR |
| | 1. Solar Panels | | |
| | 2. Grid Tied Inverters | | |
| | 3. Mounting Structure | | |
| | 4. Array Junction Boxes | | |
| | 5. String Combiner Boxes | | |
| | 6. Monitoring System | | |
| | 7. Cables | | |
| | 8. Misc. BOS | | |
| 9. Installation Charges | | | |
| | ELECTRICITY SAVING | | |
| 2. | Bill Savings for First Year (1655000*8) | 13200000.00 | INR |
| 3. | Bill Savings for second Year (8% increment on electricity rate) | 14256000.00 | INR |
| 4. | Bill Savings for Third Year (8% | 15396480.00 | INR |
| 5. | Bill Savings for fourth Year (8% | 16628198.00 | INR |
| 6. | Total BILL Saving up to 5 years | 5,94,80,678.00 | INR |

| Most suitable vendors/suppliers of the project components | |
|--|--------------------|
| Solar PV modules | Vikram Solar |
| | Waaree Energies |
| | Sova Power |
| | Canadian Solar |
| | Shivam |
| Inverter | Power One |
| | SM A |
| | Smart Power |
| | Refusol |
| | Delta |
| | Schneider Electric |
| | Schneider Electric |
| Switch gear | Megawin |
| DC Disconnect | Schneider Electric |
| Circuit breaker | Megawin |
| | ABB |
| SCADA/RMS | Draker |
| Cables | Polycab |
| | Havells |
| | Finolex cables |
| | RR Kabels |
| | Anchors |



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Assumption & Consideration

Shading consideration: No shading has been considered at the site during the calculation design. So it is advised that at the time of execution, please check whether there is any kind of obstacle in the site which may cause partial/full shading on PV strings and/or PV array. If the shading occurs, then the estimated power generation will not match the actual power generated.

Load Factor: It is assumed that the produced power from the PV plant will be fed to the local utility grid. So, while designing the system, no unbalanced load considered in 3 phase configuration.

Site consideration: this design has been done by considering the PV modules & array will be roof-mounted.

Cost Estimation: 1MW Solar PV power plant cost estimation has done considering the current PV market scenario (June-July-2016), so after few months the cost may vary according the market.

Design Criteria: While designing & estimating the technical components & solutions, all the required/applicable standard design codes have been considered. Mainly the IEC (International Electro-technical Commission) Codes, IS codes from BIS have been considered thoroughly.



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 ROTARY CLUB OF POONA MIDTOWN 

SOLAR POWER PROJECT QUESTIONNAIRE

Thank you for your interest in saving the environment by associating with Rotary Club of Poona Midtown. We will help you reduce your power bill by installing Solar Power System in your institution. To help us get to know your requirements and design the best system suitable to your need, please complete this form and return it to us.

Name of the Institution: Matoshri Old Age Home

Address: Near Rajaram Bridge
Near Vitthal Mandir
Karvenagar
Pune - 411052

Contact Person: MR. Deshpande Prakash - (Manager)

Contact No. - Landline: 020-25412375 Mobile: _____

Strength of your institution: Boys: 100 Nos old people Girls: _____ Staff: 13

Average Monthly Power Consumption: 12 Nos Boys + Girls.
1850 Units / Mo

Area of Terrace: Length Roof Top Width Ground floor

Area: Installation is available. no. of Floors: _____

Signature: [Signature] Seal _____

Date: 07/09/2016

Solar Power Plant Capacity : 20 KW
25

स्थापनापक
रत्ना श्री शिवराव प्रतिष्ठान
मालोश्री वृद्धाश्रम
करवेनगर, पुणे-४११०५२
☎ : २५४९ २३७५



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Name of the Institution: The Poona Girl's Blind School

Address: Opp. to Gandhibhavan
Dahanukar Colony, Kothrud,
Pune - 411038.

Contact Person: Archana Sarnobat (Madam)

Contact No.- Landline: 020-25384589 Mobile: 9011017873

Strength of your institution: Boys: — Girls: 160 Staff: 40

Average Monthly Power Consumption: 2000 Units for Main Building
for Hostel.

Area of Terrace: Length _____ Width _____

Area: _____ no. of Floors: 4+1

Signature: Archana S

Date: 6-9-2016

ARCHANA SARNOBAT
Seal **Administrative Officer**
The Poona School & Home
For The Blind Trust
Kothrud, Pune - 411 038

Solar Power Plant Capacity : 20 KW
 25KW



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Conclusion

I'd like to thank you for reading the whole paper. Hope you have got clear view on design & estimation of 1MW utility scale Solar PV Power Plant. Though I have discussed about the technical part as well as the financial part in detail, I might have been forgot to add anything more important. So, you are most welcome to give your valuable feedback & suggestion on this report.

Further, we propose to install this power plant at various locations for schools and institutions as mentioned above. Though the consolidated project cost may be more than our Global Grant limit. However we can think of lowering the budget and limited to the tune of INR75,00,000.00 i.e. about **USD100,000**. In that case we may start this project with limited no. of locations as per budget and can follow in coming years.

Now we are awaiting your suggestions, recommendations, and confirmation regarding the project. so that we can upload the project on RI site and can be Partner in service as per RI guide lines and procedure.

We can start this project with minimum funds of Rs. 3,50,000.00 i.e. about USD 5,000

Awaiting your favourable reply
Thanking You, we remain
Yours in Rotary

Rtn .Abhijit Mhasakar

MyWhatsapp no.: +91 9822030294