

“500 KW Grid Connected SPV Plant at Integral University Lucknow: Design Study”

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Abstract: The plant under study is 500 KW Grid connected SPV Plant at Integral University Lucknow. The whole plant is divided into four parts at four different roof tops of different buildings in the campus of the university. The capacity & type of plant, Modules, Inverters, Cables, Junction Box, Mounting Structures, Earthing & Earth Pits & Configuration for all of them are studied here.

Keywords: Capacity, Tilt, Orientation, Medical Phase I, Modules, Cables, String, Inverter.

INTRODUCTION

Integral University Lucknow has joined in hand with Solar Target of India under “Target 2020”. For this the University has adopted a project called “Green University Project” under which it installed a sum of 500 KW SPV roof top plant in the campus in four parts at four different buildings namely 198 KW at Academic Block, 111 KW at Civil Block, 91 KW at BNLT Block and 100 KW at Integral Hospital of the university. The various design study parameters are Type and Capacity of the Plant, Number, Type and Specifications of the Modules and Inverters, Tilt & Orientation, Configurations, Cables, Earthing and Earth pits, Junction Boxes and Mounting Structures of which Type, Capacity, Location, Inverters, Tilt, Orientation, Cables, Inverters & Configuration for each roof are given here and the results are summarized for the whole plant.

MEDICAL PHASE I

- **Capacity : 100 KW AC** (from 400 modules x 320 W_p each = 128 KW Photovoltaic DC)
- **Tilt and Orientation of Modules:** 15⁰ facing the South.
- **Cables :** Single core 6 sq. mm DC string copper conductor, Four core 10 sq. mm DC main copper conductor, Three phase 70 sq. mm AC copper conductor.
- **Inverter :** Schneider Electric Pvt. Ltd., Germany, 25 KVA x 4
- **Earth Pits :** 09
- **Lightening Arrestor :** 01
- **AC Combiner :** 01
- **Module :**

Company : Vikarm Solar Pvt.Ltd, Kolkata, India.

Model : “Eldora VSP.72.320.03.04”.

It is a 72 cells, 320 W_p, Polycrystalline Solar PV module.

Specifications:

Rated Peak Power	(P _{mpp})	:	320 W
Open circuit voltage	(V _{oc})	:	46.00 V
Short circuit current	(I _{sc})	:	9.03 A
Maximum power point voltage (rated voltage)	(V _{mpp})	:	37.70 V
Maximum power point current (rated current)	(I _{mpp})	:	8.50 A
Fill factor	(FF)	:	77.04 %
Efficiency	(%)	:	16.49 %
Maximum system operating voltage		:	1000V

Total number of modules : 400

Number of Strings : $400/20 = 20$ Strings
(1 String has 20 series connected modules)

- **Configuration** : 5 Strings (100 Modules) into one Inverter (20 Strings into 4 Inverters)
Maximum 8 Strings per Inverter are allowed into these 25 KVA Inverters.

ACADEMIC BLOCK

- **Capacity** : 198 KW AC (from 720 modules \times 320 W_p each = 230.4 KW Photovoltaic DC)
- **Tilt and Orientation of Modules** : 15° facing the South.
- **Cables** : Single core 6 sq. mm DC string copper conductor, Four core 35 sq. mm DC main copper conductor, Three phase 150 sq. mm AC copper conductor.
- **Inverter** : Schneider Electric Pvt. Ltd., Germany, 66 KVA \times 3
- **Earth Pits** : 09
- **Lightening Arrestor** : 01
- **AC Combiner** : 01
- **Module** : Same model & same specifications
Total number of modules : 720
Number of strings : $720/20 = 36$ Strings
- **Configuration** : 12 Strings (240 Modules) into one Inverter (36 Strings into 3 Inverters)
Maximum 14 Strings per Inverter are allowed into these 66 KVA Inverters.



Figure : Academic Block view of Integral university Lucknow under installation process

BNLT BLOCK

- **Capacity** : 91 KW AC (from 340 modules \times 320 W_p each = 108.8 KW Photovoltaic DC)
- **Tilt and Orientation of Modules** : 15° facing the South.
- **Cables** : Single core 6 sq. mm DC string copper conductor, Four core 10 sq. mm DC main copper conductor, Three phase 70 sq. mm AC copper conductor.
- **Inverter** : Schneider Electric Pvt. Ltd., Germany, 66 KVA \times 1, 25 KVA \times 1
- **Earth Pits** : 09
- **Lightening Arrestor** : 01
- **AC Combiner** : 01

- **Module** : Same model & same specifications
Total number of modules : 340
Number of strings : $340/20 = 17$ Strings
- **Configuration**: 12 Strings (240 Modules) into 66 KVA Inverter & 5 Strings (100 Modules) into 25 KVA Inverter (17 Strings into 2 Inverters)
Maximum 14 Strings per Inverter are allowed into 66 KVA Inverter and maximum 8 Strings per Inverter are allowed into 25 KVA Inverter.

CIVIL BLOCK

- **Capacity** :111 KW AC(from 417 modules x 320 W_p each =133.44KW Photovoltaic DC)
- **Tilt and Orientation of Modules** : 15° facing the South.
- **Cables** : Single core 6 sq. mm DC string copper conductor, Four core 10 sq. mm DC main copper conductor, Three phase 95 sq. mm AC copper conductor.
- **Inverter** : Schneider Electric Pvt. Ltd., Germany, 66 KVA x 1, 25 KVA x1, 20 KVA x 1
- **Earth Pits** : 06
- **AC Combiner** : 01
- **Module** : Same model & same specifications
Total number of modules : 417
Number of strings : $417/20 = 21$ Strings (18 of 20 and 3 of 19 modules each)
- **Configuration**: 12 Strings (240 Modules) into 66 KVA Inverter, 5 Strings (100 Modules) into 25 KVA Inverter & 4 Strings ($20+19+19+19 = 77$ Modules) into 20 KVA inverter (Total 21 Strings into 3 Inverters).
Maximum 14 Strings per Inverter into 66 KVA Inverter, 8 Strings per Inverter into 25 KVA as well as 20 KVA Inverter are allowed.

CONCLUSION

The design study of the plant in parts have been studied and the following conclusions were drawn

- The capacity of each roof is different according to its roof area i.e 100 KW at Medical Phase I, 91 KW at BNL Block, 111 KW at Civil Block and 198 KW at Academic Block
- The total capacity of the whole plant is $100+91+111+198 = 500$ KW AC
- The modules used at all these buildings are same but their numbers vary i.e 400 at Medical Phase I, 340 at BNL Block, 417 at Civil Block and 720 at Academic Block.
- A total of $400+340+417+720 = 1877$ modules are used.
- The modules used are 320 W peak rated modules.
- The tilt on each module is 15 degrees and orientation is South facing.
- The inverters used are of same company but different ratings accordingly i.e 66 KVA, 25 KVA, 20 KVA Inverters used separately or in combination.
- Earthings, lightning arrestors and earth pits are provided as per the need for safety.

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