

ANNUAL REPORT
ON
PERFORMANCE OF 100 kW_p ROOF TOP SOLAR POWER PLANT AT
MITS GWALIOR

(27th November 2019 to 5th December 2020)

Submitted To



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MITS Case Study

- The 100 kWp solar rooftop PV plant was installed in November last year and is running successfully since then at MITS Gwalior under Renewable Energy Service Company (**RESCO**) scheme of **MP Urja Vikas Nigam**, Bhopal and installed by and maintained by **Azure Power Rooftop Five Pvt. Ltd.** This plant is **Net-metered grid Connected with MPMKVV Co Ltd.**
- The cost of the plant is **Rs. 46.25 lakh** but after subsidy and RESCO scheme customer has to pay **Rs. 2.38 per unit.**
- The institute being an HT consumer has to pay **Rs. 7.10 per unit plus additional fixed/metering charges, duties and taxes to MPMKVV Co Ltd.**
- The chronological progress of the project is given below:

Date	Particulars
16.05.2016	Solar Light LED requirement is submitted to DTE
31.05.2016	100kW solar PV plant is submitted to DTE, MNRE interest form is submitted
24.06.2016	Solar site survey report is submitted
29.07.2016	Deployment report of solar plant emailed to MPUVM Madhya Pradesh
12.09.2016	MPUVM -MP Solar plant installation letter is received
01.09.2017	DTE Bhopal PPA issued for deployment of plant under RESCO model
11.10.2018	MPUVN Gwalior sanctioned and approved MITS Gwalior for 100 kW plant
15.10.2018	PPA signed with Azure Power Rooftop Five Pvt. Ltd
09.07.2019	Azure Power Rooftop Five Pvt. Ltd emailed layout SLD to MITS Gwalior for approval
20.07.2019	MPMKVV CO. Ltd Gwalior approved net metering and grid connectivity for plant
04.10.2019	Work Completion report signed
04.11.2019	Net metering agreement signed with MPMKVV Co Ltd
27.11.2019	First joint meter reading signed
27.11.2019	Project satisfaction certificate for 100kW solar PV plant issued
August 2020	Electrify bill is paid at Rs. 2.38 per unit after getting invoice from company.

Details of the Equipment Installed

S.N.	Particulars	Numbers	Capacity	Make
1	Solar Module	308 panels	@ 330Wp	Vikram Solar
2	Inverter	02	50 kW	Sungrow

- Regular maintenance is under AZURE Power Company.
- Extension of the power plant from same or other company is in process.
- The rooftop solar plant can be used for student internships, projects, dissertations & thesis work.
- Shadow analysis, structure design and tilting potential of solar PV plant can be studied along with its environmental effect.



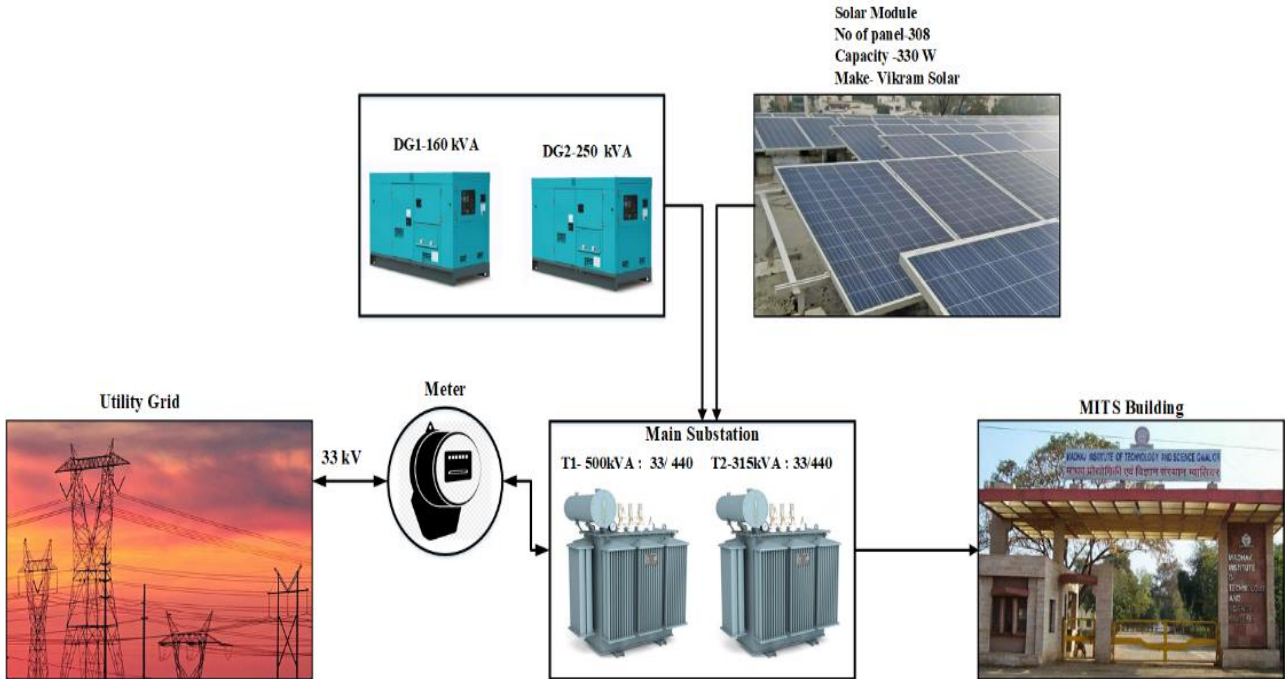


Fig. 1 Schematic diagram of MITS power supply system

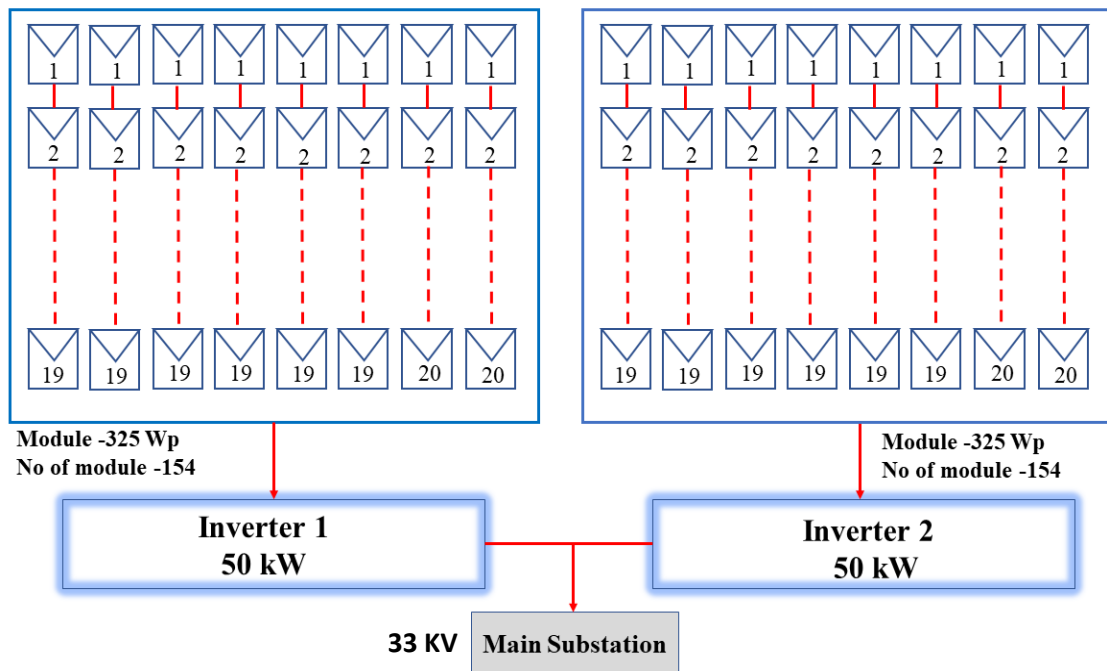


Fig.2 Schematic diagram of 100kWp rooftop solar power plant at MITS, Gwalior

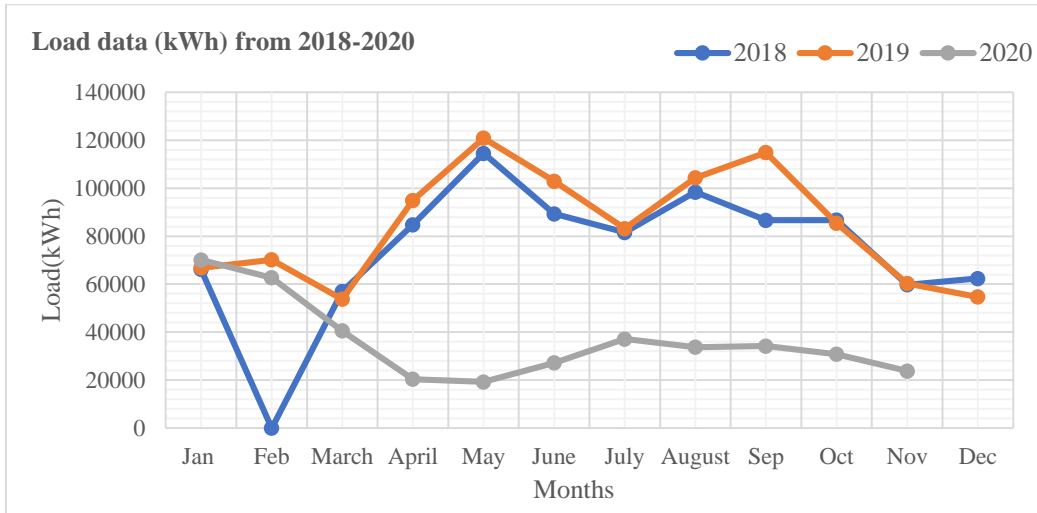


Fig. 3 Load data from 2018-2020

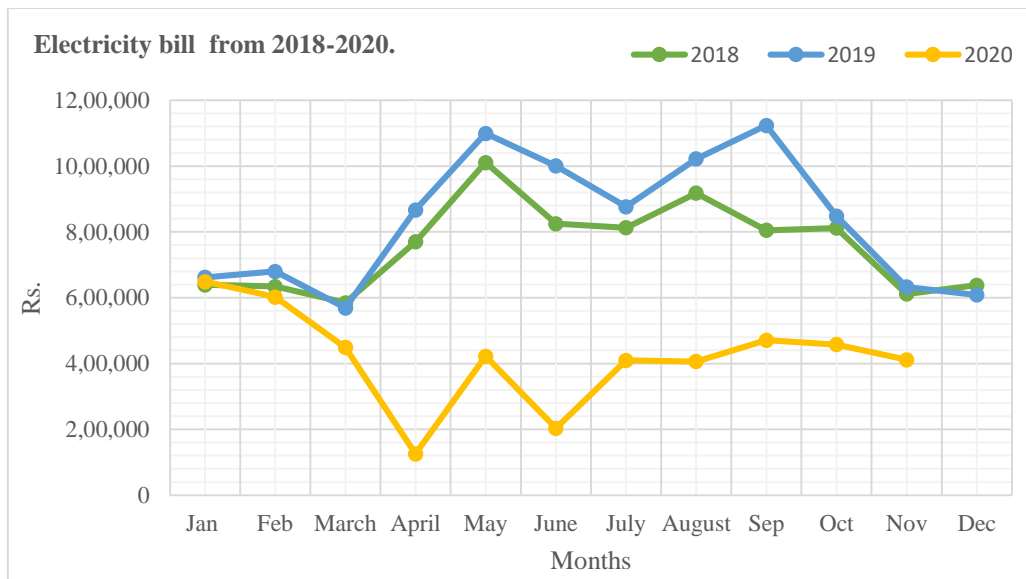


Fig.4 Electricity bill from 2018-2020

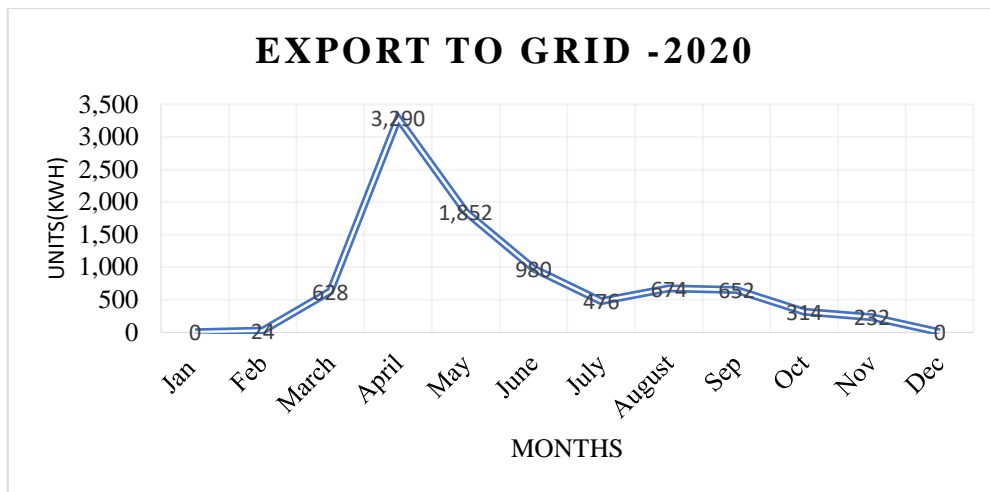


Fig.5 Monthly power export from rooftop solar plant to grid

Table 1 Solar Energy Generation

Dates	Solar generation(kWh)	Average daily units (kWh)
27 Nov 2019-14 Jan 2020	9574.320	199.45
14 Jan 2020-31 Aug 2020	92122.5	402.28
31 Aug 2020-30 Sept 2020	12313.5	410.45
30 Sept 2020 -31 Oct 2020	9380.4	302.59
31 Oct 2020-30 Nov 2020	6768.6	225.62
30 Nov 2020-05 Dec 2020	1372.2	274.44

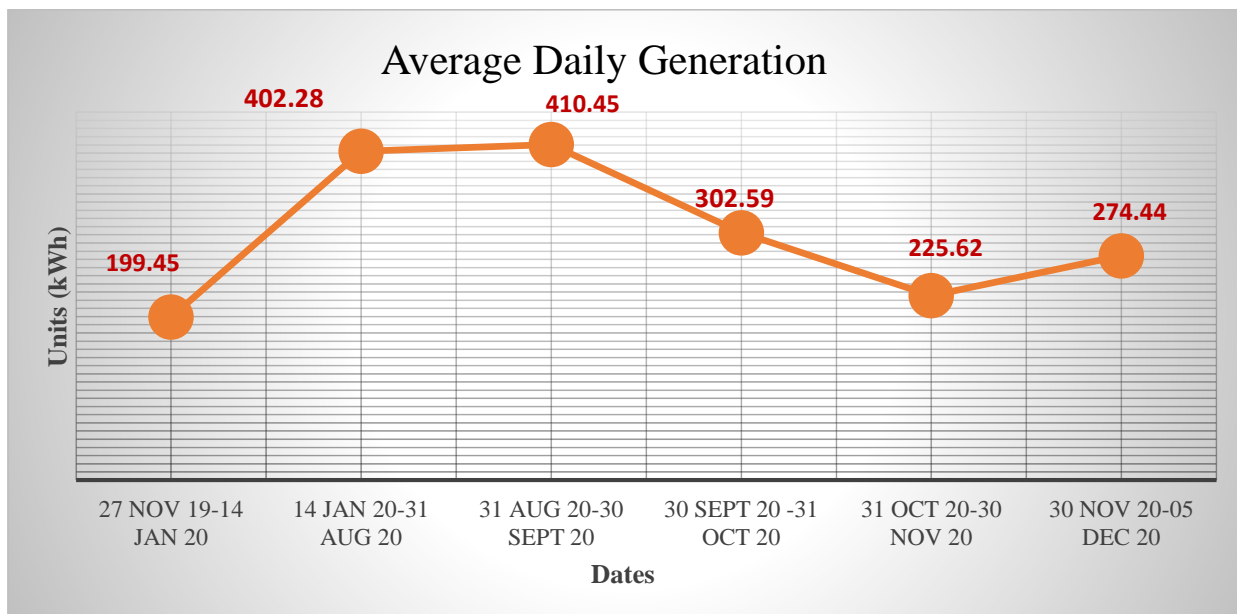


Fig.6 Average daily generation by 100kWp Rooftop Solar Power Plant at MITS (27th Nov 2019 to 5th Dec 2020)

Table 2 Solar units consumed / exported to grid till 5-12-2020

Total generation (kWh)	Consumed(kWh)	Exported to grid (kWh)
1,31,601	1,22,063	9538

Table 3 Cost saving due to Solar Plant Scenario-I
(January-December 2020): **WITH COVID-19**

Month	Units consume(kWh)	Solar units generated (kWh)	Grid (kWh)	Bill Paid to Solar (Rs.)	Total Expenditure (Rs.)	Amount saved (Rs.)
Jan-20	70,094	6182.95	63,911	14,529.93	648,792.00	43,084.85
Feb-20	62,688	11263.84	51,424	26,470.02	602,308.00	82,166.04
March-20	40,548	12470.68	28,077	29,306.10	449,015.00	108,892.97
APR-20	20,380	12068.4	8,312	28,360.74	125,354.00	45,876.92
MAY-20	19278	12470.68	6,807	29,306.10	422,236.00	243,849.59
JUNE-20	27236	12068.4	15,168	28,360.74	203,469.00	61,806.29
JULY-20	37130	12470.68	24,659	29,306.10	409,272.00	108,220.20
AUG-20	33742	12470.68	21,271	29,306.10	406,085.00	120,884.92
SEPT-20	34218	12313.5	21,905	28,936.73	471,006.00	140,663.36
OCT-20	30832	9380.4	21,452	22,043.94	451,496.00	115,400.64
NOV-20	24046	6768.6	17,277	15,906.21	406,961.00	95,438.48
DEC-20	21,889	8507.64	13,381	19,992.95	2,48,948.02	1,25,572.7664

Table 4 Cost saving due to solar plant Scenario-II
(January-December 2020) **WITHOUT COVID-19**

Month	Units consume (kWh)	Solar units generated (kWh)	Grid (kWh)	Bill Paid to MPSEB(Rs.)	Bill Paid to Solar (Rs.)	Total Expenditure (Rs.)	Amount saved (Rs.)
Jan	66,819	6182.95	60,636	600660.711	14,529.93	615,190.64	46,782.36
Feb	70,197	11263.84	58,933	570472.989	26,470.02	596,943.01	83,198.99
March	53,754	12470.68	41,283	436777.526	29,306.10	466,083.62	103,107.38
Apr	94,899	12068.4	82,831	756243.378	28,360.74	784,604.12	82,108.88
May	120900	12470.68	108,429	985622.519	29,306.10	1,014,928.62	84,469.38
June	102957	12068.4	90,889	882528.306	28,360.74	910,889.05	89,483.95
July	83193	12470.68	70,722	744706.03	29,306.10	774,012.13	102,373.87
Aug	104349	12470.68	91,878	899488.753	29,306.10	928,794.85	93,221.15
Sept	114849	12313.5	102,536	1002797.19	28,936.73	1,031,733.92	91,873.09
Oct	85416	9380.4	76,036	755033.508	22,043.94	777,077.45	71,335.55
Nov	60315	6768.6	53,546	561166.272	15,906.21	577,072.48	55,462.52
Dec	54724	8507.64	46216.36	513463.76	19992.954	533456.7136	74814.2864

Table 5. Cost saving due to Rooftop Solar Plant at MITS

Scenario	Total Units Consumed	Saving in Electricity Bill
(I) With COVID-19	4,22,081	12,91,857.018
(II) Without COVID-19	10,12,372	9,78,231.40

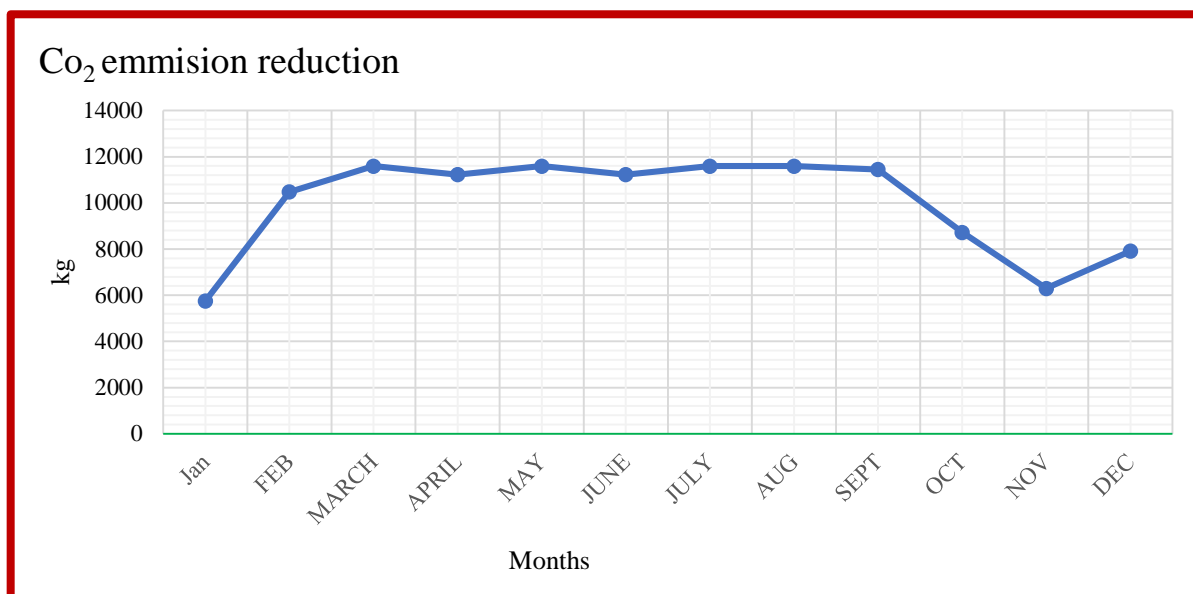


Fig. 7 Annual reduction in CO₂ emission due to the 100kWp Rooftop Solar Plant at MITS

Table 6 Reduction in CO₂ Emission in 2019-2020

Total annual reduction in Co₂ emission	1,19,445.9 Kg
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Table 7. Power Factor Incentive/Penalty (Year 2018)

Month/Year	POWER FACTOR	INCENTIVE (Rs.)	PENALTY (Rs.)
Jan-2018	0.9602	9110.00	00
Feb-2018	0.9635	9017.00	00
MARCH-2018	0.9592	3923.19	00
APRIL-2018	0.9705	17544.25	00
MAY-2018	0.9682	15761.4	00
JUNE-2018	0.9607	12271.40	00
JULY-2018	0.9581	5459.16	00
AUG-2018	0.9590	6751.18	00
SEPT-2018	0.9586	5988.02	00
OCT-2018	0.9628	12294.34	00
NOV-2018	0.94	00	00
DEC-2018	0.9515	4418.00	00
TOTAL ANNUAL INCENTIVE/PENALTY		Rs. 1,02,537.94	Rs. 0.0

Table 8. Power Factor Incentive/Penalty (Year 2019)

Month/Year	POWER FACTOR	INCENTIVE	PENALTY
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Jan-2019	0.9578	4721.00	00
Feb-2019	0.9630	9919.76	00
MARCH-2019	0.9563	3798.08	00
APRIL-2019	0.9668	13430.00	00
MAY-2019	0.9635	16687.23	00
JUNE-2019	0.9552	6661.23	00
JULY-2019	0.9538	5405.07	00
AUG-2019	0.963	10861.56	00
SEPT-2019	0.9704	24790.21	00
OCT-2019	0.9727	19502.42	00
NOV-2019	0.9743	13623.36	00
DEC-2019	0.9648	8329.81	00
TOTAL ANNUAL INCENTIVE/PENALTY		Rs. 1,37,729.734	Rs. 0.0

Table 9. Power Factor Incentive/Penalty (Year 2020)

Month/Year	POWER FACTOR	INCENTIVE	PENALTY
Jan-2020	0.9774	15140.30	00
Feb-2020	0.9667	9023.62	00
MARCH-2020	0.9251	00	00
APRIL-2020	0.873	00	3686.31
MAY-2020	0.8545	00	6264.65
JUNE-2020	0.89	00	1887.81
JULY-2020	0.9275	00	00
AUG-2020	0.9207	00	00
SEPT-2020	0.9386	00	00
OCT-2020	0.8874	00	2200.35
NOV-2020	0.8567	00	6867.96
TOTAL		Rs.24,163.92	Rs. 20,907.08
DEC-2020			

CONCLUSION


1. The 100kWp rooftop solar power plant at MITS has generated about 1,31,601 units out of which 1,22,063 units have been consumed by the institute and about 9538 units have been exported to the grid during 27-11-2019 to 5-12-2020.
2. The rooftop solar plant is found to generate approximately 25-30% of its capacity during November – February and about 45-60% during March-October.
3. **The saving in annual electricity bill due to the installation of the solar power plant during November 2019 to December 2020 is around Rs. 12,91,857.018.**
4. As the demand during the past one year has been less due to COVID-19, a need was felt to compute the approximate saving under normal operating condition of the institute (without COVID-19).

5. It is found that under normal operating load, the annual saving is expected to be around Rs. 9,78,231.40.
6. It is expected that about 1,19,445.9 Kg of CO₂ emission has been reduced from the atmosphere in one year due to the installation of the 00 kWp roof top solar power plant in the campus.

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