

Annual Energy Audit Report (From Jan 2021 to Dec 2021)

Introduction:

The annual Energy audit report for the year 2021 has been prepared by compiling the quarterly reports.

The customized benchmark EPI for Academic Buildings including Air conditioning, Hostel without AC and entire campus has been worked out on the basis of GRIHA standard of EPI Bench mark.

Benchmark for EPI:

GRIHA have indicated certain Bench mark for institutional and residential buildings applicable to large area development (LD), which is relevant to IITGN Campus. IITGN falls in composite / warm and hot and dry region accordingly the relevant bench mark has been referred for this Energy Audit report. In the bench mark issued by GRIHA these are with reference to 40Hrs per week. (5 Days 8 Hrs. per day) 168 Hrs. per week (7 Days per week @ 24 Hrs. Occupancy). As the buildings in IITGN campus do not exactly fall in the above categories, customized EPI Benchmarks have been worked out based on GRIHA standard as mentioned in the table below.

Table for Bench Mark

	As per GRIHA		IITGN Academic area	IITGN Campus
Climate Classification	Day time Occupancy	24 hours Occupancy	Customized Benchmark based on GRIHA	Customized Benchmark based on GRIHA
	5 Days a week	7 Days a week	As per Annexure-02	As per Annexure-02
Commercial / Institutional/ Academic/ Hospital Buildings				
Composite/ Warm and Humid / Hot and Dry	140	450	244	191

EPI of IITGN Campus:

In order to work out the Energy Performance Index (EPI) of the campus, data of energy utilization of individual building and utilities of the campus building have been compiled quarterly and mean value worked out for the year of 2021 as mentioned above.

The supply data are based on the meter reading of HT incomer of IITGN in Main infra substation and solar power generation. The main supply at 11KV is received from Torrent and

step-down to 415 V through IITGN Transformers at various sub- stations for supply to building/ utilities.

The consumption data have been compiled by taking reading of energy meter of individual panel provided in various buildings and utilities.

Old and New Housing complexes receives power supply directly from Torrent Power through individual LT connection, the energy consumption of housing has not been considered to derive the EPI of the campus.

Central air conditioning facilities have been provided to existing and New Hostel buildings since April 2019. EPI of AC for hostel has been shown separately in this report. The hostel HVAC facilities in hostel building is restricted during night hours from 10 PM to 6 AM for 8 hrs only. (From April to mid-November only).

While accounting for total energy consumption of the campus the same in respect of utilities like WTP, STP etc. of Housing has been deducted on approximate prorate basis based on built up area of buildings. The energy consumption by shops and temporary connections shown in the table also has been deducted from total consumption.

This energy audit report explains combined effects due to increase in electrical Energy consumption of few new areas added during 2020-2021 and reduced activities of Institute due to COVID 2019.

Some New Constructed buildings of Phase-1B has been occupied from the dates given below.

SI No.	Name of Building	Month of Taking over
1	Guest house	09/2019
2	Hostel	
a	Block-1	04/2021
b	Block-2	07/2019
c	Block-3	11/2020
d	Block-4	11/2019
e	Block-5	10/2020
f	Block-6	08/2021
3	Central Arcade	10/2020
4	Research Park	09/2021
5	Open Air Theatre	02/2020

Thus buildings at S.N. 2a, 2f and 4 have been completed during 2021.

Due to increase in HVAC load and completion of additional buildings, contract demand has been raised from 1200 kW to 1800 kW from April-2021.

Electrical Energy consumption of Entire campus and Energy bill are shown in **Annexure-03** attached.

Energy Audit Report 2021
(Compiled from quarterly audit reports of 2021)

Energy Performance Index (EPI) Comparison with Benchmark (kWh/Sq. meter/year)

Climate Zone	Hot and Dry						
Year-2020-2021		1st quarter	2nd quarter	3rd quarter	4th quarter	Annual	
Building Type	Benchmark value	Jan-Mar 21 / Jan-Mar 20	April -June 21/ April - June 20	July-Sep 21/ July -Sep 20	Oct- Dec 21/ Oct-Dec 20	Jan-Dec 2021/ Jan-Dec 2020	Remarks for Benchmark
Academic buildings & Central Arcade	244	$\frac{81}{80}$	$\frac{106}{80}$	$\frac{99}{99}$	$\frac{89}{90}$	$\frac{94}{87}$	EPI in 2021 is slightly increased as Academic Building was less occupied in 2020.
Hostels	100	$\frac{32}{41}$	$\frac{33}{35}$	$\frac{27}{33}$	$\frac{30}{32}$	$\frac{30}{35}$	EPI is slightly decreased in 2021 due to occupation of new buildings increasing the built up area, but not fully occupied.
Hostels HVAC	-	$\frac{2}{0}$	$\frac{23}{24}$	$\frac{19}{28}$	$\frac{6}{11}$	$\frac{14}{21}$	EPI is slightly decreased in 2021 due to occupation of new buildings increasing the built up area, but were not fully occupied.
Utilities	-	$\frac{5}{6}$	$\frac{6}{5}$	$\frac{3}{5}$	$\frac{4}{7}$	$\frac{5}{7}$	Decreased of EPI due to increase of built up area.
Institute	191	$\frac{57}{69}$	$\frac{79}{78}$	$\frac{61}{81}$	$\frac{56}{75}$	$\frac{63}{77}$	Decreased of EPI due to increase of built up area.

1st Quarter 2021

Quarterly Energy Audit comparison Report

**Energy performance Index (EPI) comparison with benchmark (kWh/Sq.
meter/year)**

Climate Zone	Building type	Benchmark Value	Jan - Mar 2021	Remarks for benchmark
Hot and Dry	Academic buildings	244	81	Customized Bench mark Value based on GRIHA Standard
Hot and Dry	Hostels	100	32	GRIHA
Hot and Dry	Hostels HVAC	-	2	
Hot and Dry	Utilities	-	5	
Hot and Dry	Institute	191	57	Customized Bench mark Value based on GRIHA Standard

Annexure-01

Energy consumption of Chiller plant bifurcation of Hostel and Academic			
Month	Consumption of Power of Chiller Plant during Jan-Mar 2021 in kWh	Consumption of Chiller Plant for Hostels 40% Approx.	Remarks
	A	B=40% of A	
JAN	84,975	0	Ac plant started on 15-03-2021 therefore 20% total HVAC consumption considered for hostel.
FEB	93,383	0	
MARCH	183,439	36687.8	
TOTAL	361,797	36688	

EPI of Academic Buildings & Central Arcade (kWh/Sq. Meter/Year)

JAN-21 to MAR-21					
Sl. No	Combinations	Unit	Quarterly	Yearly	Remarks
1	Power consumption of Academic Building 01 to 09 =(A)	kWh / Year	585,297	2,341,188	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year	361,797	1,447,188	Table-01
3	Less Hostel Consumption for AC (C)	kWh / Year	36,688	146,752	Annexure-01
4	Total (D) = (A+B-C)	kWh / Year	910,406	3,641,624	
5	Built-up Area (E)	Sq. Meter	45,200	45,200	
6	EPI (F= D/E)	(kWh/Sq. Meter/Year)	20.14	80.57	81

EPI of Hostel & Guest House Buildings (kWh/Sq. Meter/Year)

JAN-21 to MAR-21					
SL No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption inside Buildings =(A)	kWh / Year	552,870	2,211,480	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year			
	Total C= (A+B)		552,870	2,211,480	
3	Built-up Area (D)	Sq. Meter	69,064	69,064	Hostel-2,3,4 & 5 + Guest house = Area 23,316 + 9805 SQM
4	EPI (E= C/D)	(kWh/Sq. Meter/Year)	8.01	32.02	32

EPI of Hostel HVAC (kWh/Sq. Meter/Year)

JAN-21 to MAR-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption inside Buildings =(A)	kWh / Year	-	-	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year	36,688	146,752	Annexure-01
3	Total C= (A+B)		36,688	146,752	
4	Built-up Area (D)	Sq. Meter	59,259	59,259	Hostel-2,3,4 & 5=Area 23316 SQM
5	EPI (E= C/D)	(kWh/Sq. Meter/Year)	0.62	2.48	2

EPI of Utilities (kWh/Sq. Meter/Year)

JAN-21 to MAR-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption of treatment plant =(A)	kWh / Year	102,191	408,764	Table-01
2	Power consumption for Street lights =(B)	kWh / Year	69,069	276,276	Table-01
3	Total (C= A+B)	kWh / Year	171,260	685,040	
4	Deduct energy consumed by bulk services in Housing Pro rata Basis (D)	kWh / Year	30,049	120,196	(49270 /167557) x Energy consumed for bulk service
5	Total (E= C-D)	kWh / Year	141,211	564,844	
6	Built-up Area (F)	Sq. Meter	118,287	118,287	Excluding Housing area
7	EPI (G= E/F)	(kWh/Sq. Meter/Year)	1.19	4.78	5

EPI of Whole Campus (kWh/Sq. Meter/Year)

JAN-21 to MAR-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Total Power consumption Buildings =(A)	kWh / Year	1,728,083	6,912,332	Table-01
	Deductions				
2	Deduct energy consumed by bulk services in Housing (B)	kWh / Year	30,049	120,196	(49270 /167557) x Energy consumed for bulk service
3	Power consumed by Shops (C)	kWh / Year	17,864	71,456	Table-01
4	Power consumed by Temporary connections (D)	kWh / Year	3,331	13,324	Table-01
5	Total Deductions (E= B+C+D)	kWh / Year	51,244	204,976	
6	Total (F= A-E)	kWh / Year	1,676,839	6,707,356	
7	Built-up Area (G)	Sq. Meter	118,287	118,287	Includes New Hostels (2, 3, 4 &5), Guest House & Amphitheater.
8	EPI (H= F/G)	(kWh/Sq. Meter/Year)	14.18	56.70	57

TABLE -01
Summary Sheet of Power Supply and Consumption.

	Supply											Consumption
Month	Torrent Power	Solar Power	Total	Hostels& Guest house	Academic Area	Chiller Plant	Street light	WTP STP WSC SPS CWPS	Shops	Temporary Connections to Construction agencies	Sports Complex	Total
	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
Jan.21	448,691	53,492	502,183	153,626	188,357	84,975	23,515	30,806	4700	1,020	1,749	488,748
Feb.21	467,671	55,250	522,921	171,543	173,512	93,383	20,075	31,444	4814	1,230	572	496,573
Mar.21	630,868	72,111	702,979	227,701	223,428	183,439	25,479	39,941	8350	1,081	4,284	713,703
Total	1,547,230	180,853	1,728,083	552,870	585,297	361,797	69,069	102,191	17,864	3,331	6,605	1,699,024
	Transmission loss											1.68%

2nd Quarter 2021

Quarterly Energy Audit comparison Report

Energy performance Index (EPI) comparison with benchmark (kWh/Sq. meter/year)					
Climate Zone	Building type	Bench mark value	Jan 21 to Mar 21	April 21 to June 21	Remarks for benchmark
Hot and Dry	Academic buildings	244	81	106	Customized Bench mark Value based on GRIHA Standard
Hot and Dry	Hostels	100	32	33	GRIHA
Hot and Dry	Hostels HVAC	-	2	23	
Hot and Dry	Utilities	-	5	6	
Hot and Dry	Institute	191	57	79	Customized Bench mark Value based on GRIHA Standard

EPI of Academic Buildings & Central Arcade (kWh/Sq. Meter/Year)

April-21 to June-21					
SI No	Combinations	Unit	Quarterly	Yearly	Remarks
1	Power consumption of Academic Building 01 to 09 =(A)	kWh / Year	676,983	2,707,932	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year	864,466	3,457,864	Table-01
3	Less Hostel Consumption for AC (C)	kWh / Year	345,786	1,383,144	Annexure-01
4	Total (D) = (A+B-C)	kWh / Year	1,195,663	4,782,652	
5	Built-up Area (E)	Sq. Meter	45,200	45,200	
6	EPI (F= D/E)	(kWh/Sq. Meter/Year)	26.45	105.81	106

EPI of Hostel & Guest House Buildings (kWh/Sq. Meter/Year)

April-21 to June-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption inside Buildings =(A)	kWh / Year	567,225	2,268,900	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year			
	Total C= (A+B)		567,225	2,268,900	
3	Built-up Area (D)	Sq. Meter	69,064	69,064	Hostel-2,3,4 & 5 + Guest house = Area 23,316 + 9805 SQM
4	EPI (E= C/D)	(kWh/Sq. Meter/Year)	8.21	32.85	33

EPI of Hostel HVAC (kWh/Sq. Meter/Year)

April-21 to June-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption inside Buildings =(A)	kWh / Year	-	-	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year	345,786	1,383,144	Annexure-01
3	Total C= (A+B)		345,786	1,383,144	
4	Built-up Area (D)	Sq. Meter	59,259	59,259	Hostel-2,3,4 & 5=Area 23316 SQM
5	EPI (E= C/D)	(kWh/Sq. Meter/Year)	5.84	23.34	23

EPI of Utilities (kWh/Sq. Meter/Year)

April-21 to June-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption of treatment plant =(A)	kWh / Year	105,340	421,360	Table-01
2	Power consumption for Street lights =(B)	kWh / Year	95,255	381,020	Table-01
3	Total (C= A+B)	kWh / Year	200,595	802,380	
4	Deduct energy consumed by bulk services in Housing Pro rata Basis (D)	kWh / Year	30,975	123,900	(49270 /167557) x Energy consumed for bulk service
5	Total (E= C-D)	kWh / Year	169,620	678,480	
6	Built-up Area (F)	Sq. Meter	118,287	118,287	Excluding Housing
7	EPI (G= E/F)	(kWh/Sq. Meter/Year)	1.43	5.74	6

EPI of Whole Campus (kWh/Sq. Meter/Year)

April-21 to June-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Total Power consumption Buildings =(A)	kWh / Year	2,404,875	9,619,500	Table-01
	Deductions				
2	Deduct energy consumed by bulk services in Housing (B)	kWh / Year	30,975	123,900	(49270 /167557) x Energy consumed for bulk service
3	Power consumed by Shops (C)	kWh / Year	21,252	85,008	Table-01
4	Power consumed by Temporary connections (D)	kWh / Year	3,329	13,316	Table-01
5	Total Deductions (E= B+C+D)	kWh / Year	55,556	222,224	
6	Total (F= A-E)	kWh / Year	2,349,319	9,397,276	
7	Built-up Area (G)	Sq. Meter	118,287	118,287	Includes New Hostels (2, 3, 4 &5), Guest House & Amphitheater.
8	EPI (H= F/G)	(kWh/Sq. Meter/Year)	19.86	79.44	79

TABLE -01
Summary Sheet of Power Supply and Consumption.

	Supply			Consumption								
Month	Torrent Power	Solar Power	Total	Hostels & Guest house	Academic Area	Chiller Plant	Street light	WTP STP WSC SPS CWPS	Shops	Temporary Connections to Construction agencies	Sports Complex	Total
	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
Apr.21	730,380	66,687	797,067	231,842	225,247	271,895	29,216	38,950	6596	1,606	10,774	816,126
May.21	730,590	59,496	790,086	179,995	218,954	288,130	28,847	34,070	6202	924	10,471	767,593
Jun.21	759,570	58,152	817,722	155,388	232,782	304,441	37,192	32,320	8454	799	18,213	789,589
Total	2,220,540	184,335	2,404,875	567,225	676,983	864,466	95,255	105,340	21,252	3,329	39,458	2,373,308
	Transmission loss											1.31%

Annexure-01

Energy consumption of Chiller plant bifurcation of Hostel and Academic

Month	Consumption of Power of Chiller Plant during Jan-Mar 2021 in kWh	Consumption of Chiller Plant for Hostels 40% Approx.	Remarks
	A	B=40% of A	
April	271,895	108758	Ratio of 40% considered with total HVAC consumption.
May	288,130	115252	
June	304,441	121776.4	
TOTAL	864,466	345786	

3rd Quarter 2021

Quarterly Energy Audit comparison Report

Energy performance Index (EPI) comparison with benchmark (kWh/Sq. meter/year)

Climate Zone	Building type	Benchmark value	Jan-Mar 2021	April-June 2021	July-Sep 2021	Remarks for benchmark
Hot and Dry	Academic buildings & Central Arcade	244	81	106	99	Customized Benchmark Value based on GRIHA Standard. Sports complex, Research park, is not occupied so far.
Hot and Dry	Hostels	100	32	33	27	GRIHA All Hostels are not in use also New hostels are not fully occupied
Hot and Dry	Hostels HVAC	-	2	23	19	All Hostels are not in use also New hostels are not fully occupied.
Hot and Dry	Utilities	-	5	6	4	New Areas added which is not fully occupied
Hot and Dry	Institute	191	57	79	61	Customized Benchmark Value based on GRIHA Standard

EPI of Academic Buildings & Central Arcade (kWh/Sq. Meter/Year)

July-21 to Sep-21					
SI No	Combinations	Unit	Quarterly	Yearly	Remarks
1	Power consumption of Academic Building 01 to 09 & Central Arcade =(A)	kWh / Year	750,132	3,000,528	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year	854,296	3,417,184	Table-01
3	Less Hostel Consumption for AC (C)	kWh / Year	341,718	1,366,872	Annexure-01
4	Total (D) = (A+B-C)	kWh / Year	1,262,710	5,050,840	
5	Built-up Area (E)	Sq. Meter	51,043	51,043	
6	EPI (F= D/E)	(kWh/Sq. Meter/Year)	24.74	98.95	99

EPI of Hostel & Guest House Buildings (kWh/Sq. Meter/Year)

July-21 to Sep-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption inside Buildings =(A)	kWh / Year	545,800	2,183,200	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year			
	Total C= (A+B)		545,800	2,183,200	
3	Built-up Area (D)	Sq. Meter	80,071	80,071	Hostel- 1, 2,3,4,5 &6 + Guest house = 80071 SQM
4	EPI (E= C/D)	(kWh/Sq. Meter/Year)	6.82	27.27	27

EPI of Hostel HVAC (kWh/Sq. Meter/Year)

July-21 to Sep-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption inside Buildings =(A)	kWh / Year	-	-	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year	341,718	1,366,872	Annexure-01
3	Total C= (A+B)		341,718	1,366,872	
4	Built-up Area (D)	Sq. Meter	70,266	70,266	New Hostel- 1,2,3,4,5 &6 + Old hostels Total= 34,323+35943= 70266 SQM
5	EPI (E= C/D)	(kWh/Sq. Meter/Year)	4.86	19.45	19

EPI of Utilities (kWh/Sq. Meter/Year)

July-21 to Sep-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption of treatment plant =(A)	kWh / Year	94,499	377,996	Table-01
2	Power consumption for Street lights =(B)	kWh / Year	63,153	252,612	Table-01
3	Total (C= A+B)	kWh / Year	157,652	630,608	
4	Deduct energy consumed by bulk services in Housing Pro rata Basis (D)	kWh / Year	21,748	86,992	(59878 /214085) x Energy consumed for bulk service
5	Total (E= C-D)	kWh / Year	135,904	543,616	
6	Built-up Area (F)	Sq. Meter	154,207	154,207	Excluding Housing areas
7	EPI (G= E/F)	(kWh/Sq. Meter/Year)	0.88	3.53	4

EPI of Whole Campus (kWh/Sq. Meter/Year)

July-21 to Sep-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Total Power consumption Buildings =(A)	kWh / Year	2,411,546	9,646,184	Table-01
	Deductions				
2	Deduct energy consumed by bulk services in Housing (B)	kWh / Year	21,748	86,992	(59878/214085) x Energy consumed for bulk service
3	Power consumed by Shops (C)	kWh / Year	29,051	116,204	Table-01
4	Power consumed by Temporary connections (D)	kWh / Year	2,546	10,184	Table-01
5	Total Deductions (E=	kWh / Year	53,345	213,380	
6	Total (F= A-E)	kWh / Year	2,358,201	9,432,80	
7	Built-up Area (G)	Sq. Meter	154,207	154,207	Includes New Hostels(1,2,3,4,5 &6), Guest House, Amphitheater & Research park
8	EPI (H= F/G)	(kWh/Sq. Meter/Year)	15.29	61.17	61

TABLE-01
Summary Sheet of Power Supply and Consumption.

	Supply			Consumption									
Month	Torrent Power	Solar Power	Total	Hostels & Guest house	Academic Area	Chiller Plant	Street light	WTP STP WSC SPS CWPS	Shops	Temporary Connections to Construction agencies	Sports Complex	Research park	Total
	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
Jul.21	755,641	45,676	01,317	159,405	229,896	310,180	19,454	31,508	10720	1,235	3,694	432	776,524
Aug.21	756,658	46,142	802,800	194,043	244,936	279,343	22,327	34,606	9256	746	14,579	17,331	817,167
Sep.21	768,321	39,108	807,429	192,352	232,633	264,773	21,372	28,385	9075	565	14,394	13,367	776,916
Total	2,280,620	130,926	2,411,546	545,800	707,465	854,296	63,153	94,499	29,051	2,546	42,667	31,130	2,370,607
	Transmission loss												1.70%

Annexure-01			
Energy consumption of Chiller plant bifurcation of Hostel and Academic			
Month	Consumption of Power of Chiller Plant during Jan-Mar 2021 in kWh	Consumption of Chiller Plant for Hostels 40% Approx.	Remarks
	A	B=40% of A	
July	310,180	124072	Ratio of 40% considered with total HVAC consumption.
Aug	279,343	111737.2	
Sept	264,773	105909.2	
TOTAL	854,296	341718	

4th Quarter 2021

Quarterly Energy Audit comparison Report

Energy performance Index (EPI) comparison with benchmark (kWh/Sq. meter/year)							
Climate Zone	Building type	Bench mark value	Jan 21 to Mar 21	April 21 to June 21	July 21 to Sep 21	Oct-21 to Dec-21	Remarks for benchmark
Hot and Dry	Academic buildings & Central Arcade	244	81	106	99	89	Customized Bench mark Value based on GRIHA Standard. Sports complex, Research park, is not occupied so far.
Hot and Dry	Hostels	100	32	33	27	30	GRIHA (All Hostels are not in use also New hostels are not fully occupied)
Hot and Dry	Hostels HVAC	-	2	23	19	6	(All Hostels are not in use also New hostels are not fully occupied.)
Hot and Dry	Utilities	-	5	6	3	4	New Areas added which is not fully occupied
Hot and Dry	Institute	191	57	79	61	56	Customized Bench mark Value based on GRIHA Standard

EPI of Academic Buildings & Central Arcade (kWh/Sq. Meter/Year)

Oct-21 to Dec-21					
SI No	Combinations	Unit	Quarterly	Yearly	Remarks
1	Power consumption of Academic Building 01 to 09 & Central Arcade =(A)	kWh / Year	758,662	3,034,648	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year	490,021	1,960,084	Table-01
3	Less Hostel Consumption for AC (C)	kWh / Year	108814	435256	Annexure-01
4	Total (D) = (A+B-C)	kWh / Year	1,052,675	4,210,700	
5	Built-up Area (E)	Sq. Meter	51,043	51,043	
6	EPI (F= D/E)	(kWh/Sq. Meter/Year)	22.33	89.33	89

EPI of Hostel & Guest House Buildings (kWh/Sq. Meter/Year)

Oct-21 to Dec-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption inside Buildings =(A)	kWh / Year	595,877	2,383,508	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year			
	Total C= (A+B)		595,877	2,383,508	
3	Built-up Area (D)	Sq. Meter	80,071	80,071	Hostel- 1, 2,3,4,5 &6 + Guest house = 80071 SQM
4	EPI (E= C/D)	(kWh/Sq. Meter/Year)	7.44	29.77	30

EPI of Hostel HVAC (kWh/Sq. Meter/Year)

Oct-21 to Dec-21					
SI No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption inside Buildings =(A)	kWh / Year	-	-	Table-01
2	Power consumption of HVAC Plant (B)	kWh / Year	108,814	435,256	Annexure-01
3	Total C= (A+B)		196,008	784,032	
4	Built-up Area (D)	Sq. Meter	70,266	70,266	New Hostel- 1,2,3,4,5 &6 + Old Hostels Total= 34,323+35943 = 70266 SQM
5	EPI (E= C/D)	(kWh/Sq. Meter/Year)	1.55	6.19	6

EPI of Utilities (kWh/Sq. Meter/Year)

Oct-21 to Dec-21					
SL No	Combinations	Unit	Value	Yearly	Remarks
1	Power consumption of treatment plant =(A)	kWh / Year	107,050	428,200	Table-01
2	Power consumption for Street lights =(B)	kWh / Year	69,298	277,192	Table-01
3	Total (C= A+B)	kWh / Year	176,348	705,392	
4	Deduct energy consumed by bulk services in Housing Pro rata Basis (D)	kWh / Year	24,637	98,548	(59878 /214085) x Energy consumed for bulk service
5	Total (E= C-D)	kWh / Year	151,711	606,844	
6	Built-up Area (F)	Sq. Meter	154,207	154,207	Excluding Housing areas
7	EPI (G= E/F)	(kWh/Sq. Meter/Year)	0.98	3.94	4

EPI of Whole Campus (kWh/Sq. Meter/Year)

Oct-21 to Dec-21					
SL No	Combinations	Unit	Value	Yearly	Remarks
1	Total Power consumption Buildings =(A)	kWh / Year	2,214,831	8,859,324	Table-01
	Deductions				
2	Deduct energy consumed by bulk services in Housing Pro rata Basis (D)	kWh / Year	29,941	119,764	(59878 /214085) x Energy consumed for bulk service
3	Power consumed by Shops (C)	kWh / Year	24,022	96,088	Table-01
4	Power consumed by Temporary connections (D)	kWh / Year	5,583	22,332	Table-01
5	Total Deductions (E= B+C+D)	kWh / Year	54,242	216,968	
6	Total (F= A-E)	kWh / Year	2,155,285	8,621,140	
7	Built-up Area (G)	Sq. Meter	154,207	154,207	Includes New Hostels(1,2,3,4,5 &6), Guest House, Amphitheater r & Research park
8	EPI (H= F/G)	(kWh/Sq. Meter/Year)	13.98	55.91	56

Annexure-01

Energy consumption of Chiller plant bifurcation of Hostel and Academic

Month	Consumption of Power of Chiller Plant during Jan-Mar 2021 in kWh	Consumption of Chiller Plant for Hostels 40% Approx.	Remarks
	A	B=40% of A	
Oct	272,034	108813.6	Ratio of 40% considered with total HVAC consumption.
Nov	119,507		
Dec	98,480		
TOTAL	490,021	108814	

TABLE -01 Summary Sheet of Power Supply and Consumption.													
	Supply			Consumption									
Month	Torrent Power	Solar Power	Total	Hostels & Guest house	Academic Area	Chiller Plant	Street light	WTP STP WSC SPS CWPS	Shops	Temporary Connections to Construction	Sports Complex	Research park	Total
	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
Oct.21	866,211	59,193	925,404	205,555	256,650	272,034	24,502	36,286	9608	1,194	19,287	56,927	882,043
Nov.21	592,639	55,470	648,109	199,254	233,495	119,507	22,054	36,597	7885	770	14,084	18,211	651,857
Dec.21	595,060	46,258	641,318	191,068	218,903	98,480	22,742	34,167	6529	3,619	16,243	15,837	607,588
Total	2,053,910	160,921	2,214,831	595,877	709,048	490,021	69,298	107,050	24,022	5,583	49,614	90,975	2,141,488
	Transmission loss												3.31%

Conclusion:

1. The overall EPI of campus during 2021 is 63 kWh/Sq Mtr/ year against customized EPI based on GRIHA norms is 191 kWh/Sq Mtr/ year. The same during the year 2020 was 77 kWh/Sq Mtr/ year thus there is reduction of 14 kWh/Sq Mtr/ year. The causes of reduced EPI during 2021 is basically due to partial occupation of hostel and newly constructed building.
2. EPI of academic building, however has increased from 87 in 2020 to 94 in 2021(13kWh/Sq Mtr/ year) due to opening of laboratories in 2021 which remained closed for major part of the year in 2020 due to Covid-19 lockdown.
3. Overall transmission losses for the year is 2% as against as against 2.71% in 2020(0.71%-decreased). The permissible limits of transmission in a campus is normally 2.5%.
4. Total power consumption during 2021 is 87,59,335kWh. (81,02,300 kWh from torrent and 6,57,035 kWh from Solar power) as against 71,47,021 kWh in 2020. The increase of 16,12,314 kWh is due to taking over of new assets and air-conditioning load in Guesthouse and New Hostel buildings.

It may thus be seen that the ratio of solar power / Torrent power is 8/100.

<u>Annexure-02</u>		
Calculation of Customized EPI for IIT Gandhinagar		
For Academic Area		
GRIHA Bench mark for Daytime occupancy @8 Hrs./day 5 Days in a week , i.e. 40 Hrs. in a week)	140	kWh/Sq. meter/year
GRIHA Bench mark for 24 Hour occupancy 7 Days in a week , i.e. 168 Hrs. in a week)	450	kWh/Sq. meter/year
Derived Bench Mark for EPI of Academic Area with 100 hrs. in a week (As per <u>annexure-06</u>)		
Per Hour EPI Bench Mark Difference	$(450-140)/(168-40)$	2.42
EPI bench mark Difference for 43 Hrs. (83-40)	(2.42×43)	104.06
Customized EPI derived for Academic Block (kWh/Sq. meter/year)	$=(140+ 104.06)$	Say 244
For IIT Gandhinagar Campus		
Built up Area of Hostel	35943	Sqm
Built up Area of Academic Blocks	45200	Sqm
Total Built-up area	81143	Sqm
Bench Mark for Hostel as per GRIHA	100	kWh/Sq. meter/year
Actual increase due to Air conditioning	26	EPI of Hostel HVAC
Derived Bench Mark for Hostels	126	kWh/Sq. meter/year
Derived EPI for Campus $((244 \times 45200) + (126 \times 35943)) / 81143)$	191.73	For three quarters
For Last quarter $((244 \times 45200) + (126 \times 41209)) / 86409)$	187.72	Built up Area increased
Derived Benchmark $((191.73 \times 3+187.72)/4)$	190.7275	191

<u>Annexure-03</u>					
HT CONNECTION CONSUMPTION AND PAYMENT DETAILS 2021					
Sl. No.	Month	Contract Demand	Billing Demand	Amount	Consumption
1	Jan-21	1,200	1,020	35,03,330	4,65,910
2	Feb-21	1,200	1,143	35,02,490	4,59,160
3	Mar-21	1,200	1,396	47,58,397	6,34,780
4	Apr-21	1,200	1,463	54,78,530	7,30,420
5	May-21	1,200	1,417	51,88,850	7,32,090
6	Jun-21	1,800	1,530	54,54,240	7,22,120
7	Jul-21	1,800	1,635	59,16,820	7,83,360
8	Aug-21	1,800	1,530	56,99,200	7,59,760
9	Sep-21	1,800	1,650	62,07,710	8,25,590
10	Oct-21	1,800	1,698	61,47,050	8,15,660
11	Nov-21	1,800	1,530	46,03,890	5,93,820
12	Dec-21	1,800	1,530	45,54,950	5,79,630
	TOTAL			6,10,15,457	81,02,300

Annexure-04**Ratio of HVAC Consumption of Hostel**

Sl. No.	Location	Chiller Capacity in Tr	Operation Hours / Day	Total
1	Academic Block 6AM to 9 PM	400	15	6000
2	Academic Block 9 PMto 6 AM	100	9	900
	Total Tr of Academic			6900
3	Hostel 9 PM to 6 AM	400	9	4500
	Total			11400
	Ratio of Hostel / Total			0.39
	Say			40%