Utopia @

NITT

To make NIT Trichy fully self-sufficient w.r.t electricity and analysing the viability, financial statistics, timeframe and possible drawbacks and difficulties

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1. ACKNOWLEGEMENT

We would like to express our deepest appreciation to all those who provided us the possibility to complete this report. A special gratitude we give to our ENIR-11 staff,

Mr Surya sir and Mr Ramesh sir

whose contribution in stimulating suggestions and encouragement, helped us to coordinate our project especially in writing this report.

Furthermore we would also like to acknowledge with much appreciation the crucial role of Mrs.PremaLatha ma'am,
who gave the permission to get all required information and the necessary materials to complete this task.
A special thanks goes to the team,

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who mutually helped the rest to assemble the parts and gave suggestions about the task. We also appreciate the guidance given by other personnel such as the Estate Engineer, Asst. Engineer and the Electricity board for being kind enough to provide all the required data.

2. EXECUTIVE- SUMMARY

Conversion to Self-sufficient campus being the first preference, we have conducted a thorough study at National Institute of Technology, Tiruchirappalli, (Latitude: 10.761088 Longitude: 78.813454) to further substantiate their endeavours in energy conservation. This report encapsulates the field measurements, data collection & analysis and energy conservation/conversion options carried out during the period of March 2019 in connection ENIR project for first year students.

2.1 Methodology:

The preliminary phase, involves information gathering through interviews with various staffs, Estate Management personnel and Previous Records. Current operating data of key parameters influencing energy efficiency were obtained from Estate Management and Electricity department of NITT and through measurements across the Campus. Options for conversion to renewable energy from standard source have been worked out, with Technical and Economic feasibility analysis.

2.2 Energy Scenario:

The entire NITT campus of 777.77 acres has been divided into 3 Zones:

1. Academic Zone: There are 12 Under Graduate Courses and 3 Post Graduate Courses resulting in 15 DEPARTMENTS one Administrative Building. In addition there are two common Computer Labs.

2. Hostel Zone: There are 24 Hostels with 3 computer labs (Octagon + 2 Annexures).

3. Quarters Zone: There are around 380 Staff Quarters.

*HD reconstruction of NITT topology
(Architecture department 2018)

NITT campus has a demand of 1200kVA with the distribution utility, TNEB (Tamil Nadu Electricity Board) and BHEL (Bharat Heavy Engineering Limited), which supplies power to NIT campus at Trichy, through an 11kV line and is metered at the input to the campus. The average annual power consumption at NITT was around 93.97 Lakh kWh/yr. during the year 2018 as against around 104.916 Lakh kWh/yr. during 2016, i.e. there is a decrease of around 10.47% in the electricity consumption during the last two years 2016-2018. The average cost per kWh of electricity is worked out to be around Rs.6.6 per kWh during 2017. Based on the last three years data it is observed that the energy consumption is more during the months of August –September and March -April. This may be due to more number of technical and cultural fests, department symposiums and other club events during this part of the year. The

major energy intensive equipment at the NITT campus is the Split A/C, Pumps, Lighting, UPS, laboratory equipment etc.

3. INTRODUCTION

3.1 Background:

The National Institute of Technology (formerly known as Regional Engineering College) Tiruchirappalli, situated in the heart of Tamil Nadu on the banks of river Cauvery, was started as a joint and co-operative venture of the Government of India and the Government of Tamil Nadu in 1964 with a view to catering to the needs of man-power in technology for the country. The college has been conferred with autonomy in financial and administrative matters to achieve rapid development. Because of this rich experience, this institution was granted Deemed University Status with the approval of the UGC/AICTE and Govt. of India in the year 2003 and renamed as National Institute of Technology. NIT-T was registered under Societies Registration Act XXVII of 1975. The progressive management of NITT recognizing the vital importance of energy as precious resource has been visibly active in implementing energy conservation measures. Our team prepared this report that encapsulates the field measurements, data collection, analysis, and energy conservation options for the field studies carried out during the period of March 2019.

3.2 Climate:

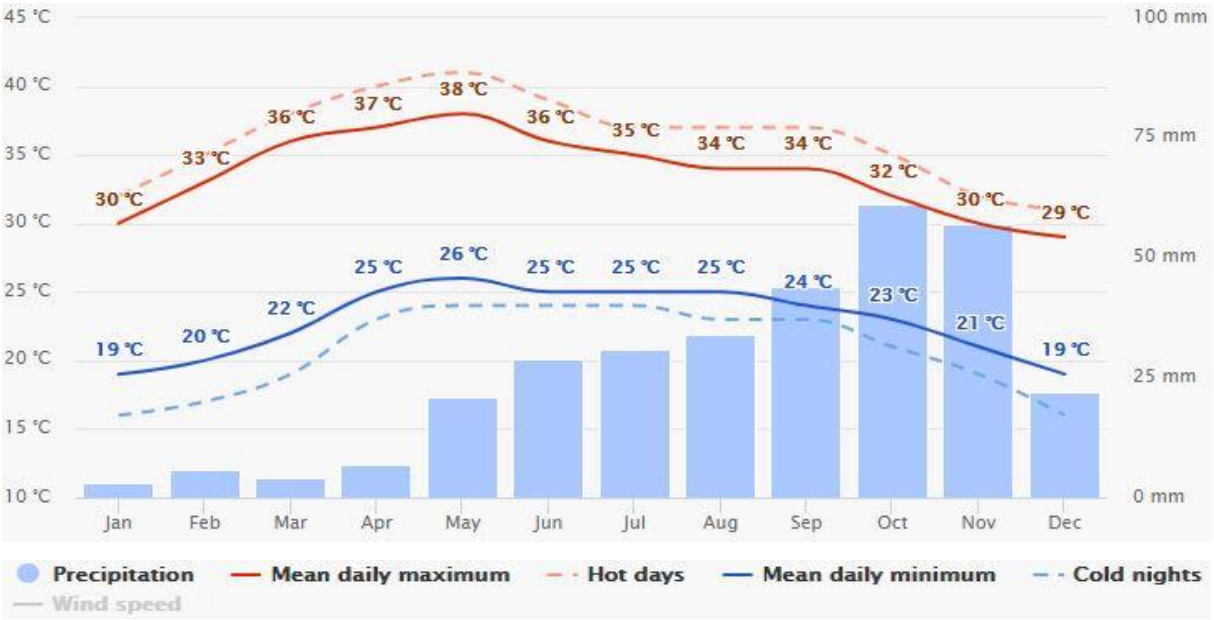
NIT Tiruchirappalli experiences an overall very hot and dry climate throughout the year, making Solar Energy the most efficient source for viable renewable energy for the required demand. However an overall view of all factors such as temperature, clouds, precipitation, wind, etc. needs to be considered before jumping to such conclusion.

- Average Max/Min temperature: 33.5°C/23.9°C
- Annual Global Isolation: 1946 kWh/m^2/year
- Tilt Angle for Solar PV: 9°
- Capacity Utilization Factor: 16.5%

(By ISRO 1990-2017)

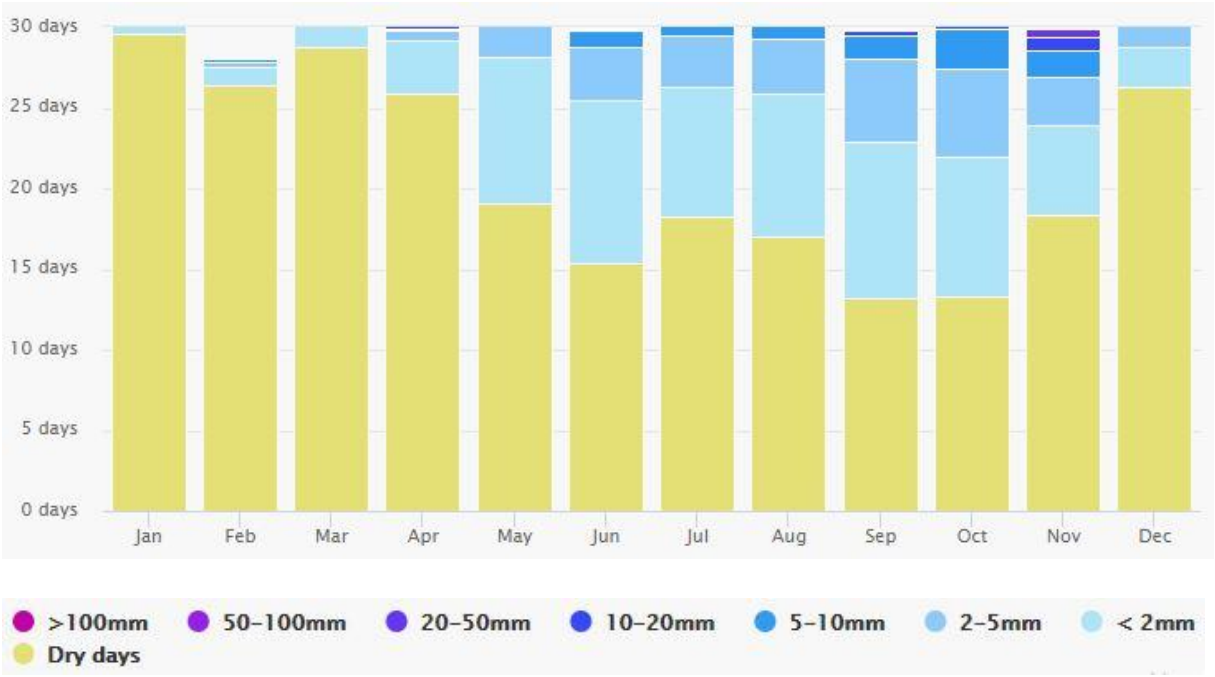
Analysing the following factors helps in providing an overall sketch as to what the climate of NITT has to offer.

Average Temperature and Precipitation:



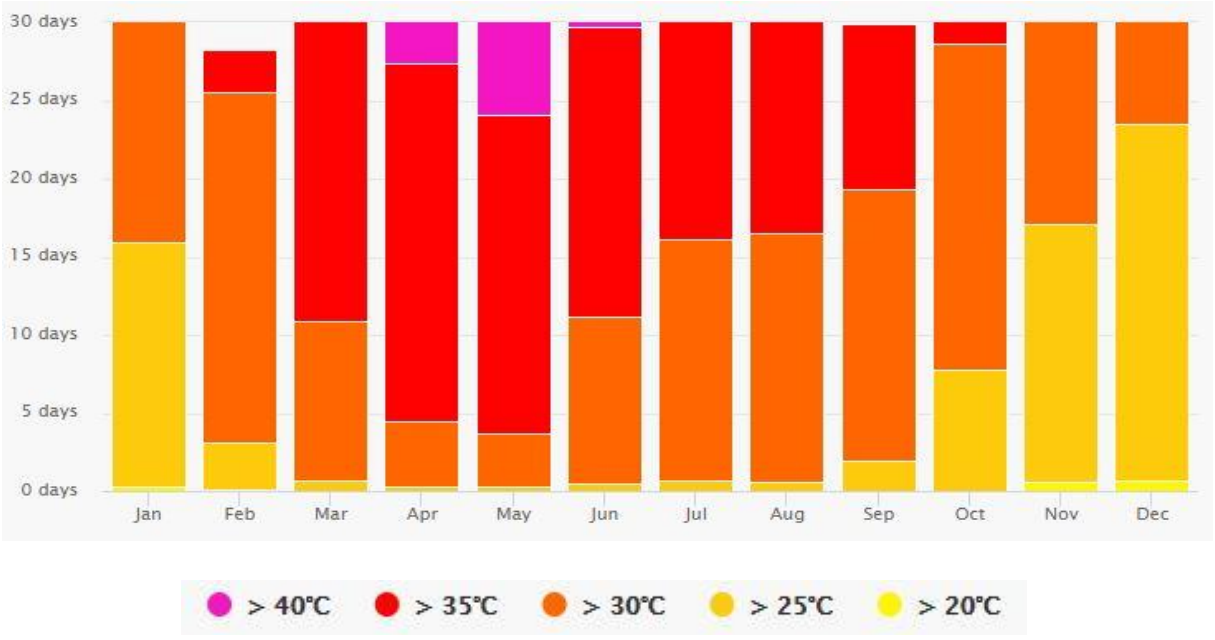
The generalised plot (data from 1990-2018) provides with the overview on what sort of climate the region experiences. Temperature fluctuates but remains constantly above 30°C for the days and 20°C for nights. Precipitation is concentrated towards the end of the calendar year, especially October and November.

Precipitation:



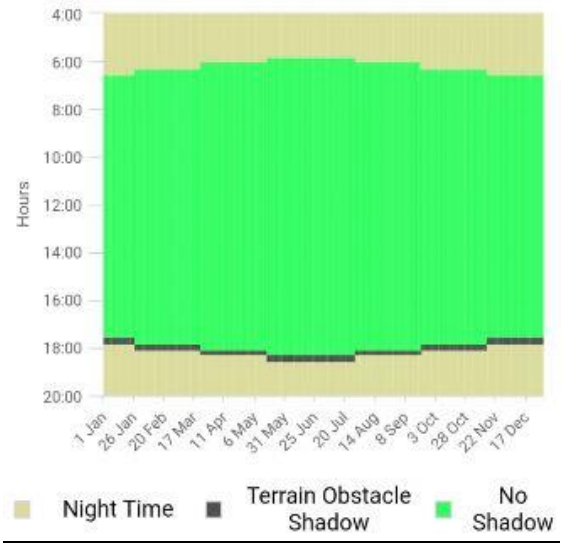
It is to be noted that October and November has similar number of dry days as to September and June, thereby concluding that the quantity of downpour is concentrated to a specific cluster of days.

Temperature:



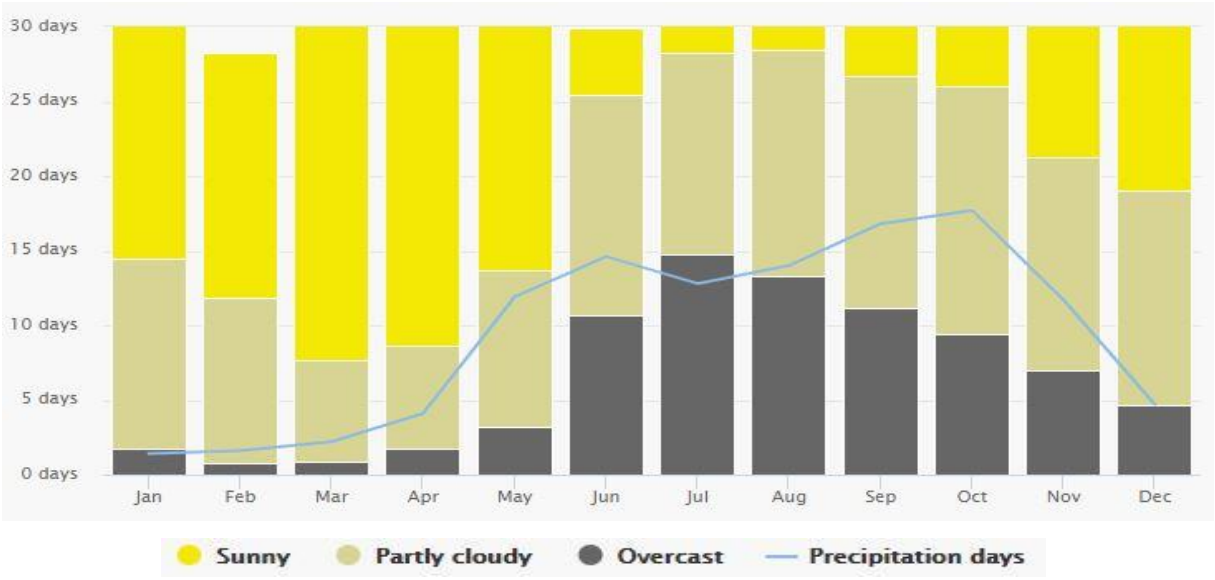
The overall temperature cluster remains similar to the Tamil Nadu region and does not bare any new conclusions.

Shadow:



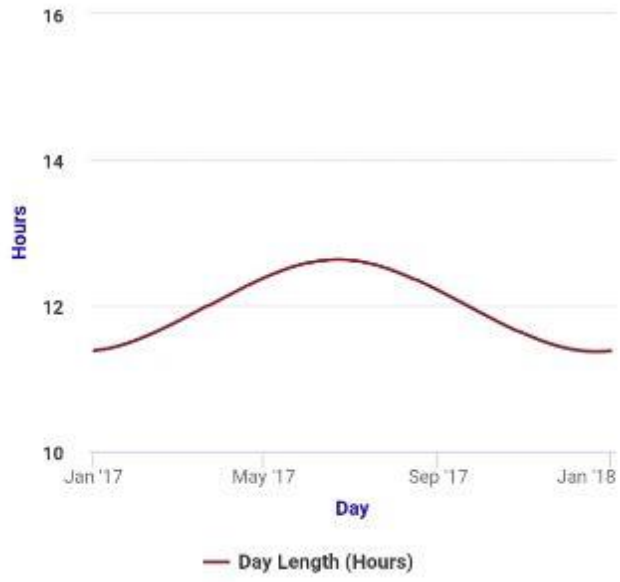
The graph shows that NITT does not receive much shadow from clouds or buildings, making it ideal for solar farm setup.

Clouds:



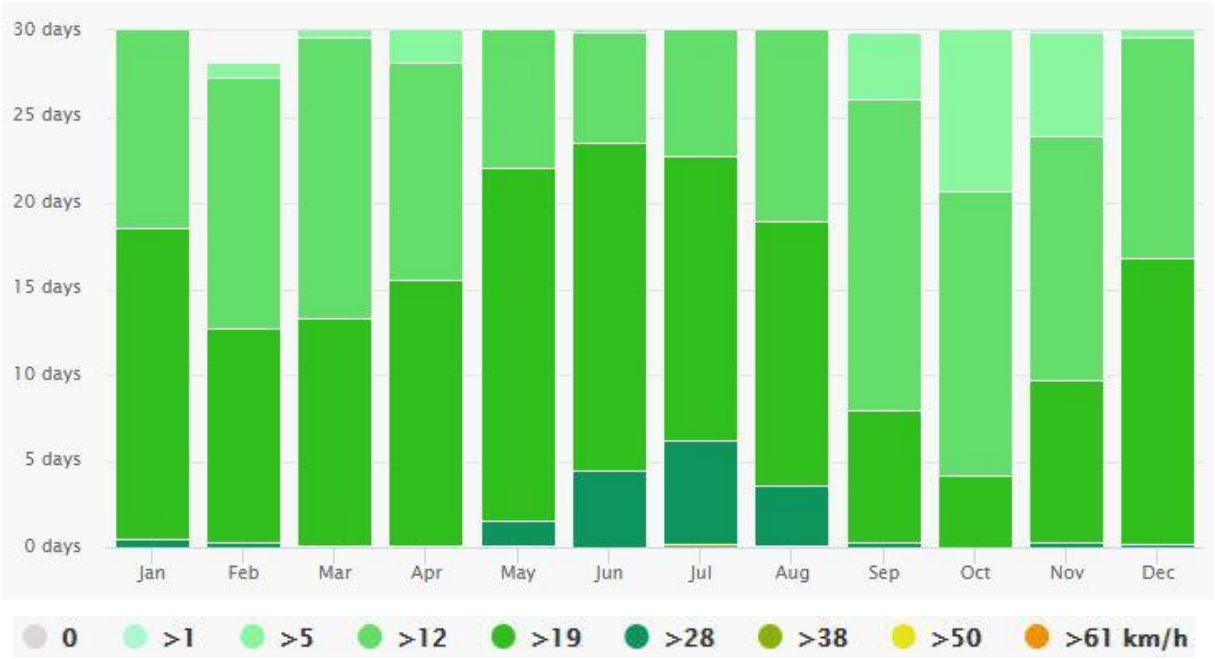
Clouds provide greatest challenge to establishments of solar farms and/or solar roofs. The region of NITT, though it provides higher temperatures, does possess a lot of partly-cloudy days, hampering the efficiency of solar panels.

Day length:



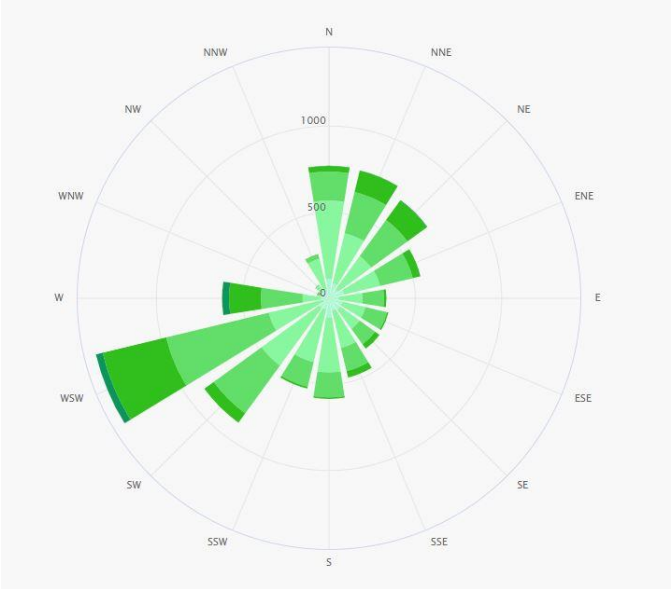
Day length can hugely affect the amount of power generation. NITT possesses an ideal amount of daylight making it feasible to have a solar farm.

Wind:



Clearly NITT does not provide ideal situation for establishment of Wind Farms for generation of electricity.

Wind Rose Diagram:



West-South-West provides the highest frequency for wind farm establishment, however as state earlier wind speeds would not yield profitable results.

3.3 Monthly Energy Consumption:

Month	Year	Consumption (in kWh)	Residential Consumption	Industrial Consumption	Commercial Consumption	Power Factor
May	2017	933808	224117	690065	18673	0.96
June	2017	717896	172277	525693	13564	0.95
July	2017	817224	196133	599987	15376	0.96
August	2017	1037641	249033	762712	20968	0.97
Sepember	2017	1043632	250471	780518	21457	0.96
October	2017	900083	216019	666513	17865	0.96
November	2017	845592	202939	626552	16542	0.96
December	2017	576621	138403	428699	9880	0.98
January	2018	541009	130004	400786	9678	0.95
February	2018	720607	173603	533986	13547	0.97
March	2018	800581	192384	593603	15443	0.97
April	2018	1006074	240384	741186	20988	0.97

Based on the last year data it is observed that the energy consumption is more during the months of August –September and April-May. This may be due to more number of technical and cultural fests, department symposiums and other club events during this part of the year. Furthermore, the consumption increases with the dawn of summer and high temperature, thus utilization of this heat can be beneficial..

3.4 Carbon footprint:

The carbon footprint of NITT is close to **7638.95 tonnes** in electricity consumption alone making it one of the biggest institution in this regard. Therefore conversion of all our consumed electricity to a non-CO_2 emitting source would be a hallmark to the green-campus initiative NITT strives towards. Solar has minimalistic CO_2 production (almost zero) making it further viable for establishment.

4. ELECTRICITY CONSUMPTION AND LOAD TRENDS FOR ACADEMIC ZONE

The following table shows the electrical equipment NITT has in different departments as well as around the campus. These equipment include ceiling fans, tube-lights, plug points, street lights etc. There are 9 Tables presented in this report (data from Audit report Dec 2015):

4.1 CSE Department:

S no.	Name of the equipment	Make	Capacity	Count	Rating	Total consumption
1.	Air Conditioners	Carrier	1.5 tons	10	20A	200A
2.	Air Conditioners	Carrier	2.0 tons	10	30A	300A
3.	Air Conditioners	Voltas	2.0 tons	12	30A	360A
4.	Tube Light	Phillips	Double Tube	241	40W	19,280W
5.	Tube Light	Phillips	Single Tube	46	40W	1840W
6.	Fan	Orient	-	129	65W	8385W
7.	Exhaust Fan	-	-	2	45W	90W
8.	Water Cooler	Voltas	-	1	160w	160 W
9.	Water Filter	Aqua Guard	-	2	40W	80W
10.	EPBX	Amada	-	1	20W	20W
11.	Computer Systems B/W	Deldot	-	45	60W	2700W
12.	Computer Systems Color	Siemens/IBM etc.	-	60	80W	4800W
13.	Printer	Hpetc	-	4	120W	480W
14.	Microprocessor kit	VI Micro	-	18	10W	180W

Total Consumption: 860A and 38015Watts

4.2 Chemical Engineering Department:

Head of the Department 2 Ton A/C – 1 no. Xerox Machine – 1 no. Lighting – 20 nos. Plug Points – 1 no.	**CEESAT Office** Fans – 2 nos. Tube lights – 2 nos. 0.5 Ton A/C – 1 no. Plug Point 5A – 2 nos.
Staff Rooms Tube Lights – 6 nos. Fans – 4 nos. Plug points – 4 nos.	**Class Room 1** Tube Lights – 26 nos. Fans – 6 nos. Plug points 5A – 3 nos.
Class Room 2 Tube Lights – 16 nos. Fans – 6 nos. Plug points 5A – 7 nos.	**Class Room 3** Tube Lights – 12 nos. Fans – 4 nos. Plug points 5A – 6 nos.
Toilets Tube lights – 2 nos. Corridor Lighting – 16 nos. Pathway Tube lights – 16 nos.	**Conference Hall** Lighting – 64 nos. Tube Lights – 1 no. Plug Points 5A – 4 nos. 2 Ton A/C – 5 nos.

4.3 Chemistry Department:

SL. No.	EQUIPMENT	TOTAL NUMBER	CAPACITY	VOLTAGE(V)
1	Vacuum Pumps	4		230
2	Air Oven	4	1.75W	240
3	Heating Metal	6	600W	230
4	Hot Plates	4	1KW	240
5	Gas Plant	1		230
6	Water Distillation Plant	1	2KW	240
7	UV visible spectrophotometer	1		
8	Tube Lights	62		
9	Ceiling fans	17		
10	Exhaust fans	6		

4.4 Other Departments:

Department	Lightings	Fans	Computers	A/C units	Oven Heaters	Motors	Others
P.M.D	60	17	2	0.5 Ton-1 2.0 Ton-2	3500W-3 2500W-1	1 phase	Scanning
MBA	130	55	40	18 nos.	500W- 1 3phase	3 phase- 7.5HP,3HP,1HP	Xerox-1
ICE	128	32	37	7 nos.	1phase-1 3phase-4	-	Xerox-1
LIBRARY	178	155	13	16 nos.	-	-	Xerox-2

There is an overall lack of information on the quantity of specific electronic goods in various department buildings such as OJAS (physics), EEE department, ECE department, etc. Given the usage of similar items as CSE department and the presence of consumption labs, it is safe to assume that consumption is equal to CSE department.

4.5 Motors:

4.5.1 Machinery motors:

SL NO	NAME OF EQUIPMENT	MAKE	CAPACITY
1	DC Compound motor/Alternator	Budapest, Hungary	7.5 KW
2	DC Motor/Induction Motor	Crompton Parkinson/ Kirloskar Electric	5 KW 3.7 KW
3	Induction Motor	PSG Industrial Institute	0.75 KW
4	DC Motor	Budapest, Hungary	3.7 KW
5	DC Compound Motor/Generator	Budapest, Hungary	11 KW
6	DC Motor/Induction Motor	English Electric Motor/ PSG Industrial Institute	5HP 3.7 KW
7	Compound Motor/Induction Motor	GEC/ PSG Industrial Institute	5HP 3.7 KW
8	DC Motor/ AC Motor	British Thompson Industry/ Scott	5 HP 6 KVA
9	DC Motor/ Alternator	Crompton Parkinson Brush Electrical Engg	5 HP 6 KVA
10	Induction Motor	PSG	3.7 KW
11	Induction Motor	GEC	3.7 KW
12	Induction Motor	PSG	1.49 KW
13	Slip ring Induction Motor/ Squirrel-cage Motor	Budapest, Hungary	
14	DC Motor/ Permanent Magnet Alternator	Budapest, Hungary	
15	DC Motor/ DC Machine	Govardhana/Benn Electricals	5 KW
16	DC Motor	Electro Tech devices	7 HP
17	Alternator/ Compound Motor	Kirloskar	5 KVA 3.5 KW
18	Induction Motor	Kirloskar	5 HP
19	DC Compound Motor/ Generator	Kirloskar	3.5 KW
20	DC Compound Motor/ Alternator	Kirloskar	a. KW 5 KVA

4.5.2 Water Pump Motors:

For OHT pumps: It can be observed that the run efficiency of the OHT pumps is evaluated to be 53 and 56% respectively. The efficiency is low when compared with the latest energy efficient and five star rated pumps which are now available in the market and can deliver an efficiency of around 80% .As regards the margin on flow rates, the pumps are operating at almost full flow rates and, no margin is available for higher flows. As regards the margin on drive rated power the pumps are consuming almost the rated power.

For Submersible Pump: It can be observed that the as run efficiency of the submersible pump is evaluated to be 42% respectively. The design value of the pump is not available; in order to compare the operating parameter with rated parameters as the pump is very old. It can be also noted that only one pump of the two submersible pump is currently in operation.

Location	Capacityofpump(HP)	Year of installation
Water Management Farm (opal)	7.5	2008
East Bore well	7.5	2012
New Bore Well (opal)	6	2011
QIP (Quarters)	1.5	2011
Open well near ICE	7.5	2010
REC middle School	1.5	2007
Zircon	7.5	2008
Jade	1.5	2010
Beryl	1.5	2011
Garnet A	1.5	2008
Garnet C	1.5	2008

PUMP Location	No	Power rating
Near Chemical Dept.	4	10 HP
New near Chemical Dept.	4	10 HP
Near Director's Bungalow	2	10 HP

4.6 Street Lights:

S .No.	Locations	No.	Qty.	Total	Watts	Total Watts
1	Temple Street	10	1	10	24	240
2	3 to 6 streets	6	6	36	24	864
3	7 to 12 streets	4	5	20	24	480
4	13th street	5	1	5	24	120
5	13A to 13B street	3	2	6	24	144
6	13 to 13B cross	4	1	4	24	96
7	14th street	4	1	4	24	96
8	14th street Bore well road	5	1	5	24	120
9	15th street	3	1	3	24	72
10	15th to 17th street	5	3	15	24	360
11	18th to 19th street	3	2	6	24	144
12	14 to 19 cross	7	1	7	24	168
13	PG street	7	1	7	24	168
14	Hospital street	4	1	4	24	96
15	7 to 14 cross	3	1	3	24	72
16	11 to 17 cross	2	1	2	24	48
17	Temple to guest house	2	1	2	24	48
18	Temple to 13th street cross	20	1	20	24	480
19	Hospital to Trec step road	17	1	17	24	408
20	Cross Road	3	2	6	24	144
21	Emerald to Agate road	17	1	17	24	408
22	Cross Road	3	1	3	24	72
23	Ruby to Lapis Road	13	1	13	24	312
24	Cross Road	2	2	4	24	96
25	Topaz to Sapphire	13	1	13	24	312
26	Hospital to aquamarine Road	13	1	13	24	312
27	Zircon Road	6	1	6	24	144
28	Chemical to Garnet	14	1	14	24	336
29	Garnet to Lapis Road	6	1	6	24	144
30	Punel Tank to well Road	5	1	5	24	120
31	IT Centre to Sump road	21	1	21	24	504
32	EMC opposite Road	11	1	11	24	264
33	Silver Jubilee Building Opposite Road	10	1	10	24	240
34	Hospital to SJB road	9	1	9	24	216
	TOTAL NUMBERS			**327**		**7848**
1	Institute entrance road stadium	5	2	10	70	700
2	Institute Avenue road stadium	35	1	35	70	2450
3	Others stadium	30	1	30	250	7500
4	Quarters Avenue road	42	1	42	70	2940
5	Admin block fountain light	100	1	100	14	1400
6	Institute entrance pathway road	75	1	**75**	20	1500
	Total Numbers			**217**		**16490**
	Total Watts					**24338**

4.7 Ceiling Fan

At present in NITT campus there are more than 20K number of ceiling fans with 80W rating and around 7K number of ceiling fans with 60W rating. The average power consumption of these fans is around 70 watts and 50 watts respectively, with an average air velocity of 1.1 m/s. It may be noted that the average flow of 1.1 m/s delivered by these fan is low when compared with the high speed energy efficient fans available in market.

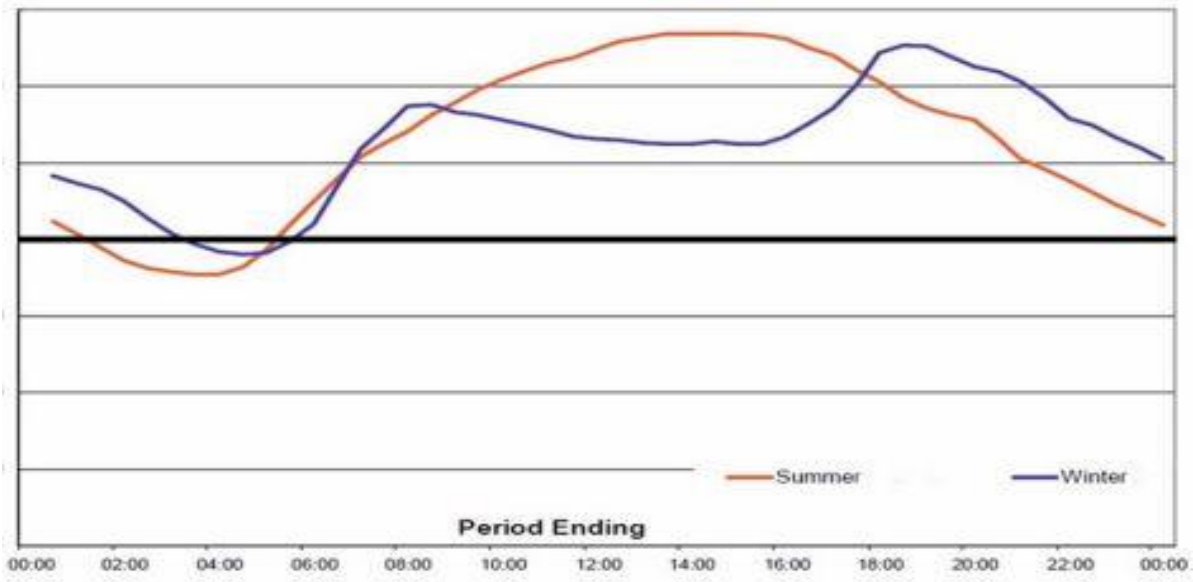
4.8 Diesel Generating set (DG set):

Currently NITT meets its power supply from diesel generating set in the absence of grid power. The designed ratings of the existing DG sets are three 500kVA, one 600kVA, one 380kVA with power factor 0.98.Capacitor Banks are provided for improving the Power Factor. During the field measurements it has been observed that DG output is variable for respective sets and catering to the needs of server room and main building or hostel. From past data it was found that the specific power generation per liter of diesel is very high i.e. 1.52 kWh/litre.

5. OPERATION LOAD

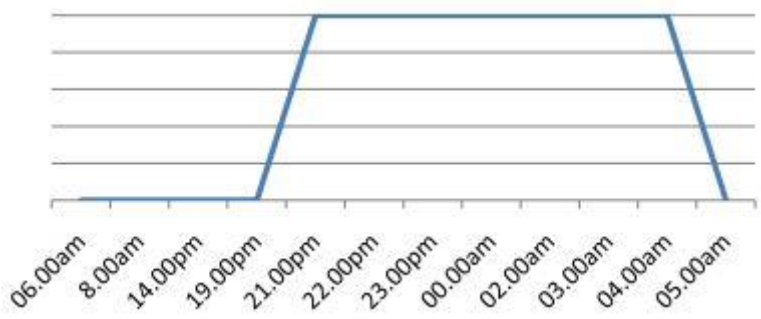
5.1 Air Conditioner:

As mentioned in the load tables there are many air conditioning units present in the campus. Mostly they are of capacity 0.5 Ton and 2.0 Ton. They are in maximum use during daytime in academics sector whereas later in the night in the quarters. So as per the data available we can say that their use is optimized. The load curve given above shows the peak time for quarters.



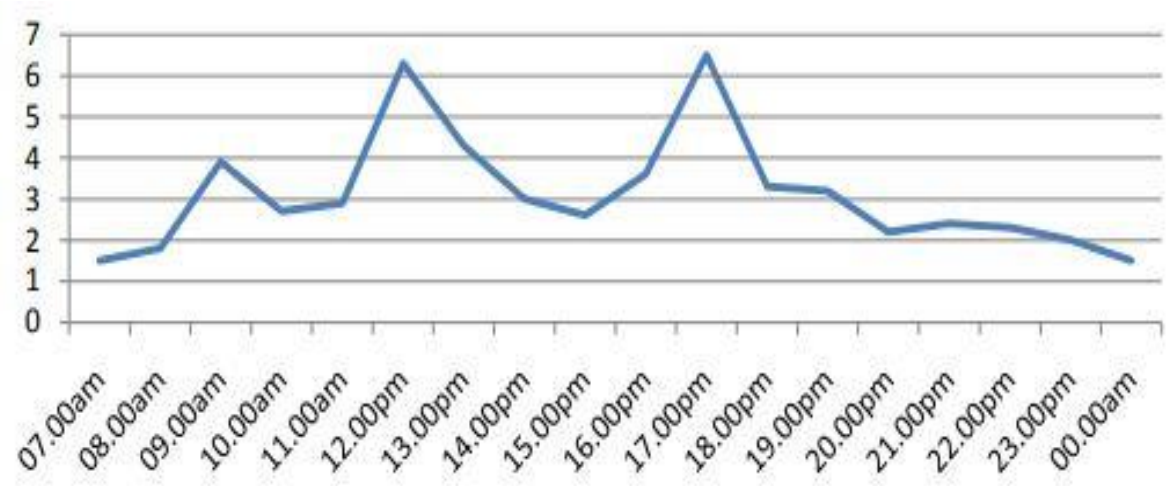
5.2 Street Light:

As we can see from the load curve, the peak hour for street lighting is after 1900 hours and during daytime does not contribute to the load.



a. NITT Campus (All three zones put together):

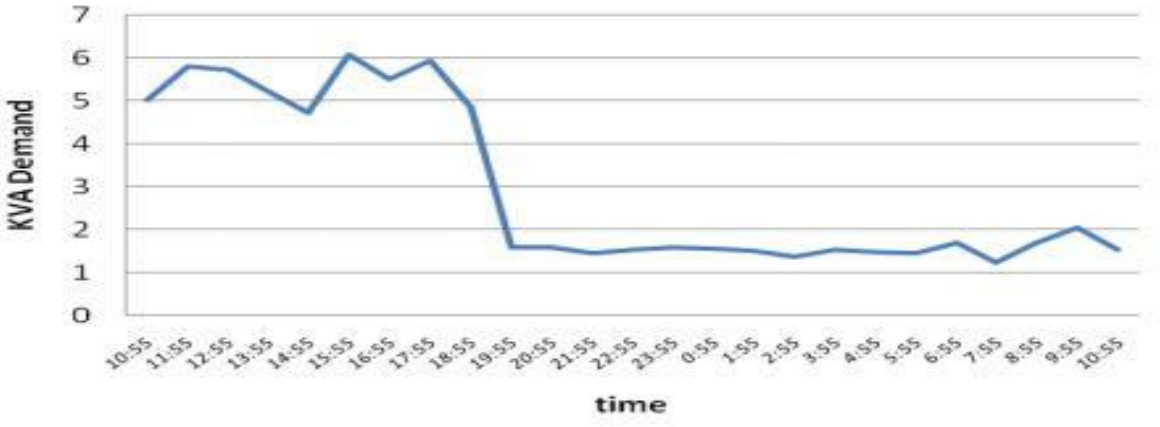
The peak hours for the NITT Campus are shown in the graph. Here two peaks are present in the early hours of the day and then a dip and again a rise. The dip is because of the lunch break we have between 12.00 to 14.00pm. Then again the academic area resumes which justifies the second peak.



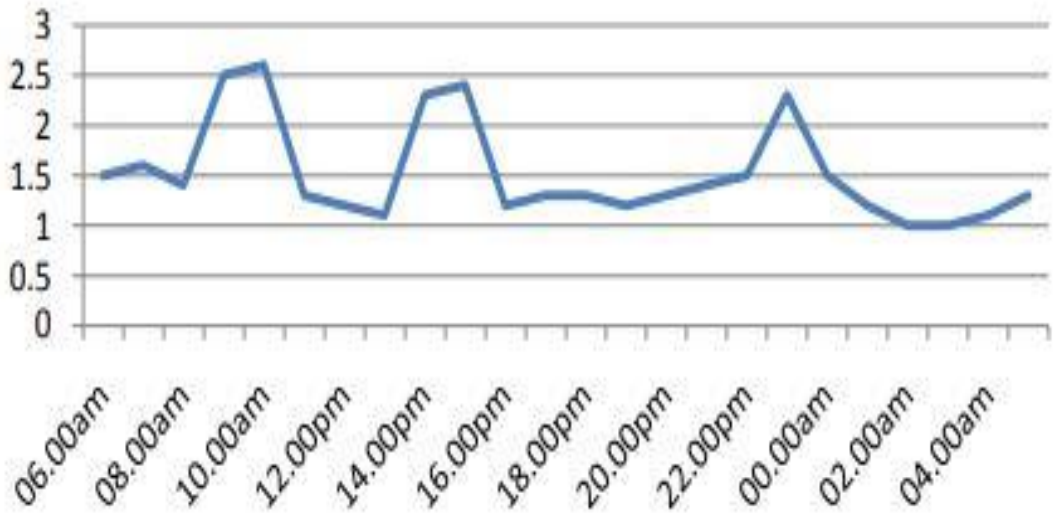
Y-axis: 1unit = 100 kWh

b. PO block:

For the load curve of the P.O block it can be observed that the load is uniform value of around 5.4kVA during the office hours i.e. 1000 hours till evening 1800 hrs., whereas around 1.6kVA after wards, since only security lighting is only load during the night time.



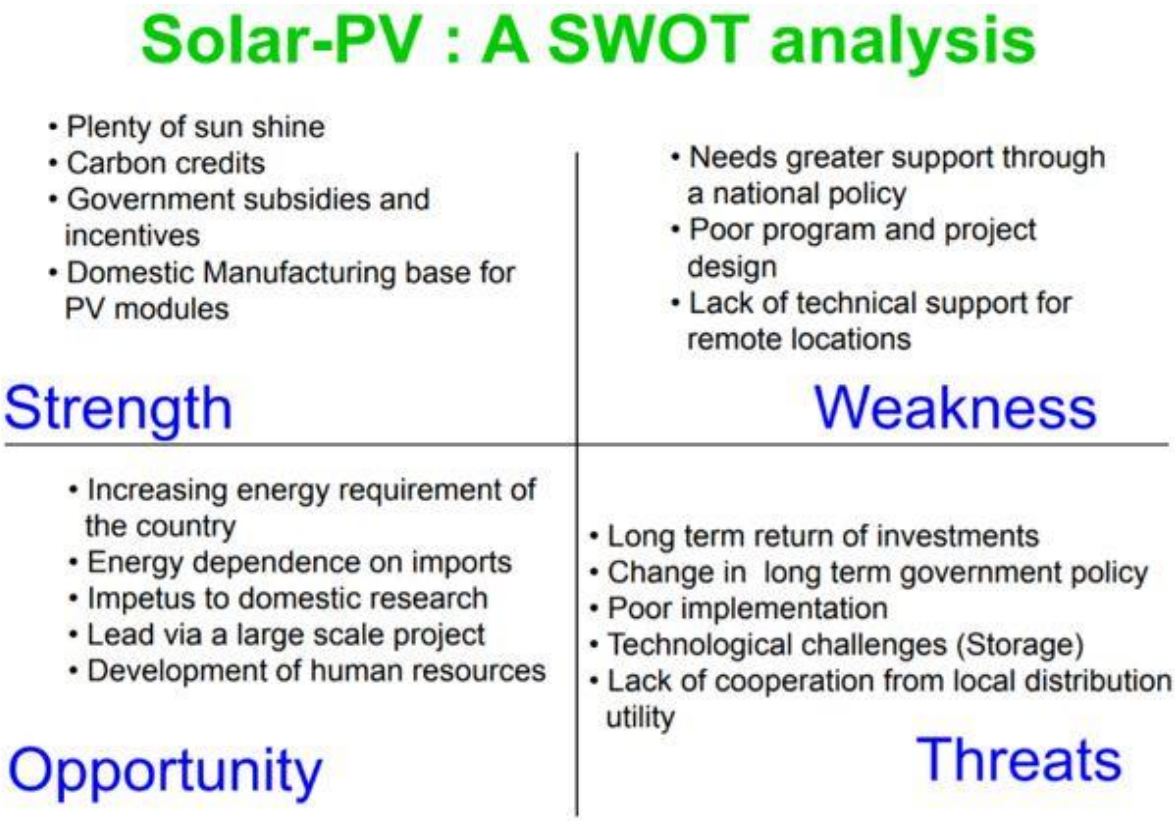
5.4 Hostels:



Y-axis: 1unit = 100 kWh

The peak hour for the day is early morning and at night after 2100 hours. This peaks can be correlated to the classes' schedule.

6. CONVERSION OF NITT TO FULLY SOLAR POWERED CAMPUS.



MNRE (Ministry of New and Renewable Energy - Central Government) has set the target to install 227 Gigawatt (22,70,00,000 kilowatt) by 31 March 2022. To achieve this target Govt. is promoting solar in many ways. Govt. of India also sectioned an amount of Rs. 5000 crore for solar subsidies only

6.1.1 Financial Undertaking:

COMPONENTS	EXPENSE (in Lakhs PER 5 ACRE)
One Time Expenditure:	
Modules	330
Civil and general work	55
Inverters	40
Electricals - Cables, Transformers, etc.	65
Grid extension and Bay extension	40
Buffer	15
TOTAL	545
Yearly Expenditure:	
Operation and Maintanence	6
Annual inflation	5%
Insurance	0.15%

Estimated Expenditure per 5acre (year 1): Rs. 5.5 crore

This data is post Subsidy provided by the Govt. of India to Institutions for setting up of solar planes (30% of total cost)

6.1.2 Solar Fields:

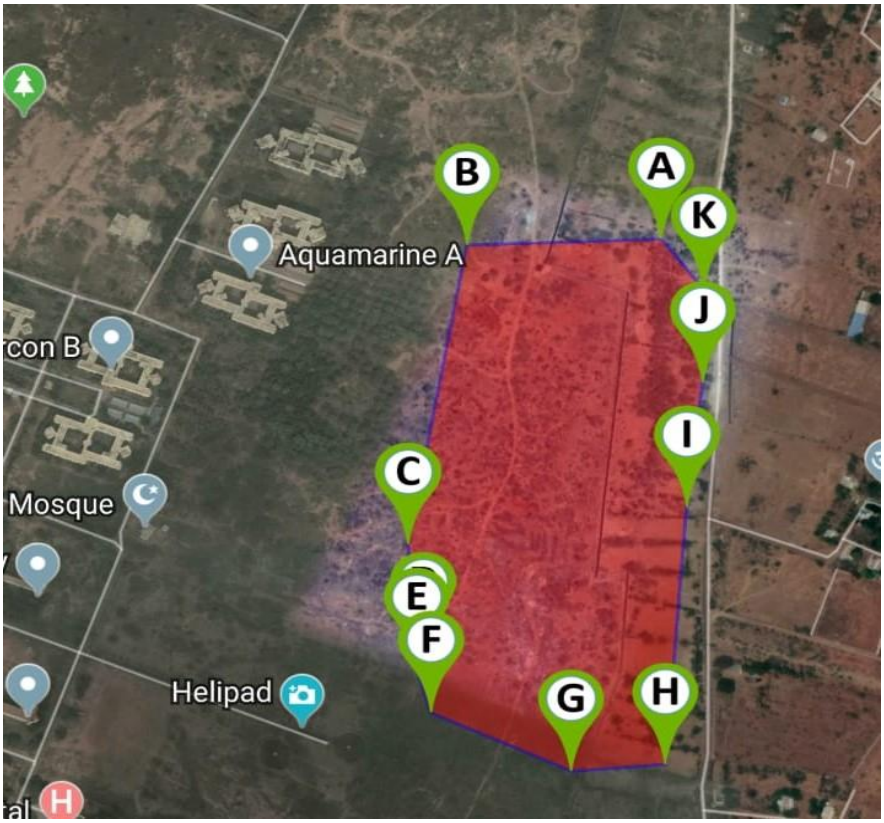
The formation of solar fields within the NITT campus is highly risky due to the very high movement of both people and wildlife. Although NITT is a very well planned college, there is a stark absence of free land sufficiently away from the Residential or Hostel zones. This puts the need for establishment of proper fencing and other barriers as high priority.

Benchmark investment in 2015 for a solar plant in India is about Rs. 6.1 Crores/MW. This includes all the capital expenses. Operations & Maintenance annual contracts are typically about Rs. 5-6 Lakhs/MW without trackers and 7-8 Lakhs/MW with trackers, usually escalating annually at 5%.

Region 1:

Near Helipad – Area: 1, 03,546 m^2

Perimeter: 1413.48 m



Approximately 25.5867738294 acre establishment

Electricity generation- 310.12 Lakh kWh per year (329.9% of 2018 consumption)

Establishment cost (approx.) 38.635 crores, with yearly expenditure of 300 lakhs.

Cost saved per year: 6.2 crores + sale of excess electricity.

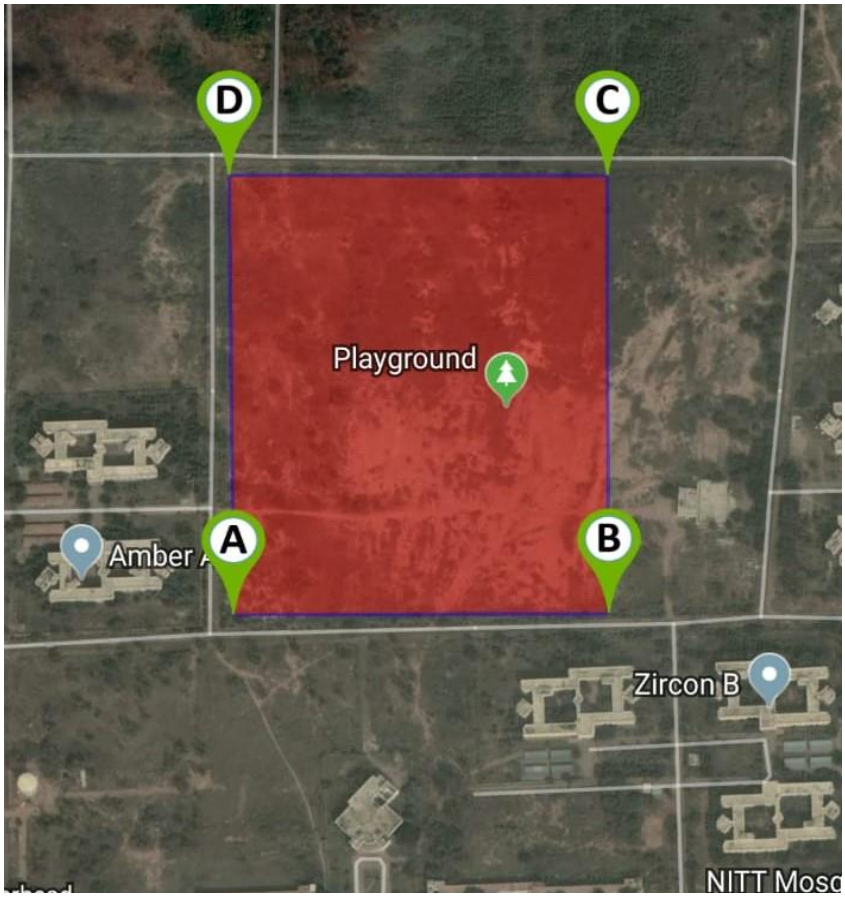
Payback period – 3 years.

- Too close to hostel grouping.
- Probable disturbance to NITT wildlife such as cow and birds.
- Setup would require building roads for transportation.
- Generating 300% of requirement would mean that NITT can sell the excess for upto 12 crores every year.

Region 2:

Zircon Playground – Area: 63,195.6 m^2

Perimeter: 1077.03 m



Approximately 15.615972845acre establishment

Electricity generation- 189 Lakh kWh per year (203% of 2018 consumption)

Establishment cost (approx.) 22.78 crores, with yearly expenditure of 180lakhs.

Cost saved per year: 6.2 crores sale of excess electricity.

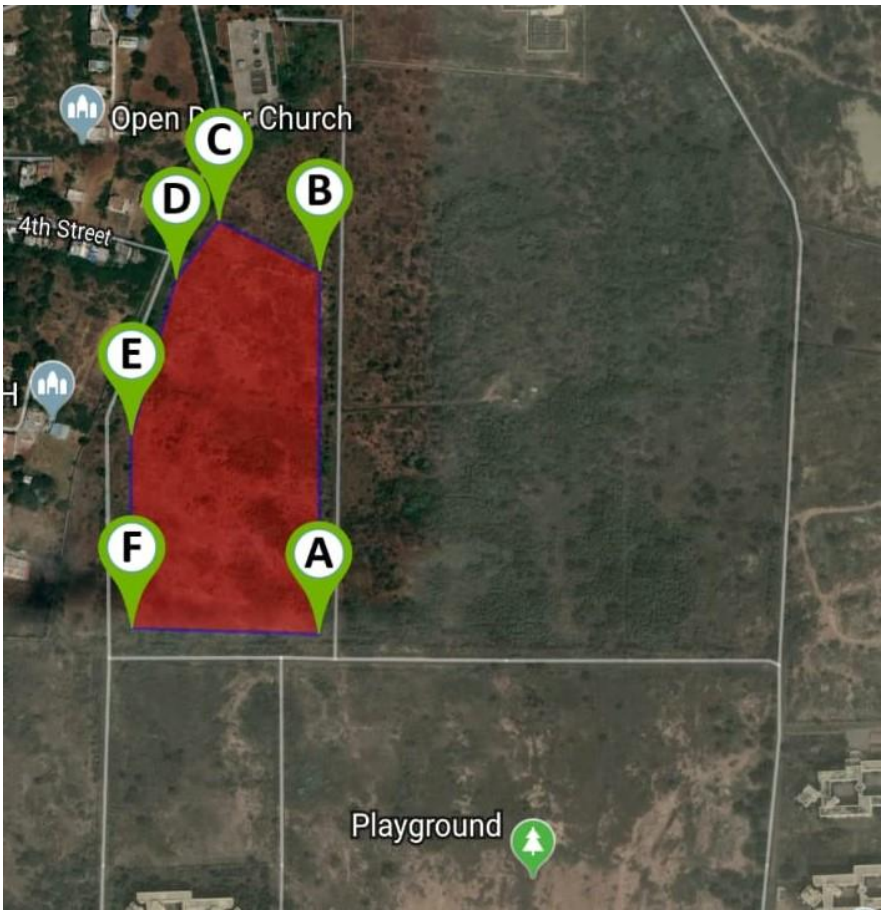
Payback period – 3 years.

- No vegetation for removal and present in sparsely used region.
- Generating 200% of requirement would mean that NITT can sell the excess for up to 6 crores every year.
- Safest and most viable setup location within campus.

Region 3:

Near Teak Forest – Area: 34,147.76 m^2

Perimeter: 892.66 m



Approximately 8.438095261049 acre establishment

Electricity generation- 102 Lakh kWh per year (109% of 2018 consumption)

Establishment cost (approx.) 12.28 crores, with yearly expenditure of 96lakhs.

Cost saved per year: 6.2 crores.

Payback period – 1.5 years.

- Too close to NITT perimeter and the villages outside.
- Too close to sewage plan and Teak forest.
- Cheapest of all proposed regions, would provide required amount of electricity.

6.1.3 Solar Roofs:

BUILDING NAME	ROOF AREA (m2)
LHC	5763.96
ORION	7910.93
OJAS	9362
ADMIN BLOCK	4882.3
AGATE	1830.1
DIAMOND	1834.45
CORAL	1844.21
JADE	1133.98
GARNET A	2445.58
GARNET B	2466.92
GARNET C	2478.13
ZIRCON A	2634.32
ZIRCON B	2634.32
ZIRCON C	2591.8
AMBER A	2181.94
AMBER B	2345.3
AQUAMARINE A	2278.36
AQUAMARINE B	2309
OPAL	2673.21
OPAL B	2744.28

Total Roof area: 64046.87 m^2

Approximately 15.6177 acre establishment

Electricity generation- 193 Lakh kWh per year (197% of 2018 consumption)

Establishment cost (approx.) 28.79 crores, with yearly expenditure of 200lakhs.

Cost saved per year: 6.2 crores.

Payback period – 2 years.

- Installation would be hindered due to presence of students.
- Proposed generation would be similar in terms of output as Solar Farm region 2.
- Could indirectly provide cooling to buildings due to its presence on rooftops and thereby reduce consumption of AC and fans.
- Bird dropping would be a hindrance.
- Not very viable to set it up on all building tops.

6.1.4 Operation and maintenance:

• Cleaning of primary reflection sleeping and standing dishes

• Replacing the mirrors if reflectivity deteriorates

• Seasonal adjustments: Some seasonal adjustment is required for summers and winters to maintain proper focusing on the receiver.

• Greasing of mechanical parts

6.1.5 Street Lights:

A total of 544 street lights of various wattage is present throughout NITT. The total consumption per year is 24,338 kWh. Conversion of all these Street lights to Solar powered, with batteries storage would save up to 41.3 lakhs per year, with a recuperation period of 5 years.

- Already installation have begun in small scale.
- Bird droppings provide hindrance.
- Most viable of all options.

6.1.6 Solar Water Heater

A total of 17 hostels are present in NITT. Conversion of all standard water heaters to solar water heater. On an average each hostel requires 4 such heaters, totally costing Rs. 40,000 for the heater with additional plumbing and maintenance costs being non-inclusive. The overall setup would recuperate within 4 years of installation.

- Obviously very beneficial.
- However usage depends of how cold the temperature is, thus it would be too risky for complete conversion from electric heaters.

6.1.7 Solar Steam Cooker

Could be a viable method for cooking of rice, idli, dal, etc. in messes across the campus. Data is insufficient on the extent of feasibility, this could further result in decreasing our dependencies on external sources for power.

- Mock implementation required to access the extent of success.

6.1.8 MEMS Technology

Micro Electrical Mechanical System (MEMS) has found wide applications throughout the world used for the conversion of any form of energy to electrical energy. MEMS piezo layered cantilever beams can be embedded underneath the roads (5cm below) to harness ambient vibrations produced by the vehicles to generate electrical Energy. If laid at a stretch of 1km it can produce 100s of KW sufficient to cover the needs of hostels and quarters. Also if MEMS gyroscope is made to fit with the trade mills present in Gym areas then a lot of energy can be saved and utilized around the campus.

- However at this moment in time it is only fiscally feasible in the long run.

7. CONCLUSION

- NITT seems to be actively trying to reduce its overall usage of current over the last few years.
- NITT does not process the capability of having energy providing windmills due to the lack of wind speed.
- The best source thus remains to be Sunlight.
- Major energy consuming sectors in Academic zone are Departments of Electrical, Civil and Mechanical because of the motor and other heavy loads.
- Other major consumers are Computer Science Department and the various Internet Labs that are present here because of server and ups load and Air Conditioning facility present there.
- Consumption from residential area is seen mainly in the latter half of the day.
- Creation of Solar farms seems to be feasible provided funding from administration.
- Solar roofing remains to be the best source of solar power for individual buildings, but requires high maintenance.
- Region 2 (Zircon Playground) is the best place to establish the Solar Field that would provide double the 2018 usage. This excess electricity can be either sold or used to provide Thuvakudi with free electricity.
- Solar powered streetlights can be fruitful, but regular complaints of bird-dropping hindering the effectiveness raises concern.
- MEMS could be considered in the future.

Thank You

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