7.1.6 **Q_nM**	***Quality audits on environment and energy are regularly undertaken by the institution*** 7.1.6.1. The institutional environment and energy initiatives are confirmed through the following 1. Green audit 2. Energy audit 3. Environmental audit 4. Clean and green campus recognitions/awards 5. Beyond the campus environmental promotional activities **Options:** A. **Any 4 or all of the above** B. Any 3 of the above C. Any 2 of the above D. Any 1 of the above E. None of the above **(Opt any one)** Upload: • Reports on environment and energy audits submitted by the auditing agency • Certification by the auditing agency • Certificates of any awards received • Any other relevant information	**5**

Documents Needed: Policy document on environment and energy usage: Certificate from the auditing agency Certificates of the awards received from recognized agency (if any) | Report on environmental promotional activities conducted beyond the campus with geo-tagged photographs with caption and date | Any other supporting document for the claims made | Green audit report of all the years from recognized bodies

TEXT

TERI SAS imbibes the notion and practice of environmental protection and building up of a sustainable world in its vision, mission and core values. The institution abides by its core values by religiously following the means and standards of achieving them.

Electricity is the primary source of energy in TERI SAS to operate various equipments such as air conditioning, lighting, water supply, laboratory, and other institutional setups. This is partially taken care of by the solar rooftop system set up in 2015 (reported under entry 7.1.2). The Energy and Resources Institute (TERI), New Delhi certifies the energy audit conducted at the campus of TERI SAS during the FY 2019-20. The Energy Audit Report is enclosed in the Annexure 7.1.6.A.

One of the recent Green Audit surveys found that TERI SAS green campus practices are well perceived and has spilling effect. The practices learned in campus are also adopted by the students at their home. The most recent Green Audit Report which was conducted by the then Head of the Department of Energy and Environment, TERI SAS is enclosed in the Annexure 7.1.6.B.

Similarly, TERI SAS regularly conducts environmental audit using its specialist faculty members of the Department of Regional Water Studies. During the Pandemic, this exercise could not be carried out, however, a few previous Environmental Audit reports are enclosed in the Annexure 7.1.6.C.

With a truly green campus, the TERI SAS puts into practice the very principles it teaches in its classrooms. An architectural delight, the campus has been planned to provide a setting that enhances learning, while simultaneously showcasing the concept of modern green buildings. The award of the "Greenest University and Research Institution", which is one amongst ten inaugural Climate Change Awards organized by Responding to Climate Change (RTCC), a news and analysis website, has been conferred upon TERI SAS (as erstwhile TERI University) in 2013. RTCC is the accredited observer to the UN Framework Climate Change Convention (UNFCCC) and is the TV host for the UN at its climate, biodiversity and desertification talks. This incident attracted adequate media coverage. Several news articles carries this (Link1, Link2, Link3, Link4).

Annexure 7.1.6.D includes a few geotagged photos to provide a glimpse of the clean and green campus of TERI SAS. TERI SAS was awarded with UN GCNI (Global Compact Network India) Award at the 3rd Innovative Practices Awards 2019 held in Mumbai on 31.05.2019. TERI SAS showcased its initiatives on forest landscape restoration and studying the impacts of Nitrogen Pollution on Forest Ecosystems which addresses Sustainable Development Goal 15 through its project on "Sustainable livelihood activities on reclaimed open cast mines: a technology enabled integrated approach in Indian coal sector" (link to recognition; link to HEI website).

Energy Audit
Of
TERI SAS Campus, New Delhi

Submitted to:

Registrar,
TERI School of Advanced Studies,
New Delhi

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Acknowledgment

We are thankful to the management for providing us the kind cooperation and support during the energy audit study of TERI SAS. We had received full co-operation and support from the concerned personnel of all departments during the course of the project. We would like to thank:

- Capt. Pradeep Kumar Padhy (Retd.), Registrar, TERI School of Advanced Studies
- Prof Atul Kumar, Dean Academics, TERI School of Advanced Studies

And all other supporting staff who has given full co-operation and support. All of them had shown keen interest in the project and given us valuable inputs during the course of study.

The Energy and Resources Institute (TERI)

New Delhi

Certificate

This is to certify that an energy audit was conducted at the campus of TERI SAS located in New Delhi (India) by The Energy and Resources Institute (TERI), New Delhi (India) during the FY 2019-20

The Energy and Resources Institute (TERI)

New Delhi

Table of contents

List of tables

List of figures

Executive summary

The report presents the key summary of the analysis and findings from the energy audit study of TERI School of Advanced Studies, New Delhi, for the identification of energy efficiency opportunities at the institute campus.

The primary source of energy is electricity to operate the various equipment such as air conditioning, lighting, water supply, laboratory, and other institutional setups. The total annual electricity consumption of the campus has been estimated to be 1.10 million units during the FY 2018-19.

The identified energy conservation measures (ECM) include the power factor improvement at the incomer and optimization of contract demand. The identified ECM measures for energy and demand reduction are given below.

DSM measures	Electricity saving, kVAh/Year	Estimated Investment, Rs. in lakh	Monetary savings, Rs. in lakh /Year	Simple payback period, Month
Power Factor Improvement	46060	1.37	3.68	4.5
Optimize the contract demand	-	0.35	6.90	0.6
Total	46,060	1.72	10.58	2.0

Course offered	Student Intake capacity
M.A Sustainable development Practices	30
M.A Public Policy and Sustainable Management	30
M.B.A Business Sustainability	30
M.B.A Infrastructure	30
LLM Environment and Natural Resource Law /Infrastructure and Business Law	50

2.0 Energy consuming equipment details

The details of major energy consuming equipment installed in the unit are provided in the following sections.

2.1 Transformer

The details of the transformer installed in the unit are given in table 2.1.

Table 2.1: Details of transformer

Parameters	Unit	Value
Rated Capacity, kVA	kVA	1600
Rated primary voltage, volt	kilo Volt	11
Rated Primary current, amp	Amp	83.98
rated Secondary voltage	Volt	433
Rated secondary current	Amp	2133.46
Design no-load losses	kW	2
Design load losses	kW	14
Maximum efficiency load point	%	37.8

2.2 Electric motors

The details of the electric motors of capacity more than 5 hp installed in the unit are given in table 2.2.

Table 2.2: Details of electric motor

S. No.	Motor ID	Purpose	Rated parameters			
			Capacity, kW	Capacity, hp	Speed	Efficiency, %
1	Bore well Pump	Water pumping	7.5	10	1470	86%
2	Fire line motor 2	Fire safety	7.5	10	1470	86%
3	Fire line motor 1	Fire safety	75	100	1488	92.7%

2.3 Air conditioning

The details of the air conditioning system installed in the unit are given in table 2.3.

Table 2.3: Details of Air conditioning units

S. No.	Type/Make	Serving area	Rated capacity (kW)
1	VRV	Biotech Lab – 001	3.4
2	VRV	Biotech Lab - 002B	2.2
3	VRV	L – 001	5.2
4	VRV	Computer Lab 103	3.4
5	VRV	Computer Lab 104	3.4
6	VRV	L-102	5.2
7	VRV	L-103	5.2

S. No.	Type/Make	Serving area	Rated capacity (kW)
8	VRV	Classroom 204	3.4
9	VRV	Library	5.2
10	VRV	Geo Lab	3.4
11	VRV	Classroom 307	3.4
12	VRV	L-304	7
13	VRV	Media Lab	3.4
14	VRV	Faculty Area	3.4
15	VRV	Environ Lab 1	3.4
16	VRV	Office all Inclusive	5.6
17	VRV	Admin Office	8
18	VRV	Faculty Cabins	14.7
19	VRV	Conference Room	4.5
20	VRV	Cafeteria	5.2
21	VRV	Cafeteria	5.2
22	VRV	Classroom CV 001	10.4
23	VRV	Classroom CV003	5.2
24	VRV	Phd Scholars	5.2
25	VRV	Heat Transfer Lab	5.2
26	Non – VRV	Solar Porta Lab	8
27	Non – VRV	Seminar Hall	6
28	Non – VRV	Classroom C001	6
29	Non – VRV	Hub Room G F	3
30	Non – VRV	Classroom 102	6
31	Non – VRV	Classroom 103	6
32	Non – VRV	Classroom 205	6
33	Non – VRV	Classroom 203	6
34	Non – VRV	Classroom 308	6
35	Non – VRV	Classroom 309	6
36	Non – VRV	Porta Library	10
37	Non – VRV	Hub Room 3rdF	3
38	Non – VRV	Environ Lab 2	6
39	Non – VRV	Classroom 410	6
40	Non – VRV	S M B Lab	10
41	Non – VRV	Hub Room G F	5
42	Non – VRV	Hub Room 1st F	3
43	Non – VRV	Faculty Cabins	7.5
44	Non – VRV	Tech Support Cell	2.5
45	Non – VRV	M I Room	2.5
46	Non – VRV	Warden Room	2.5

S. No.	Type/Make	Serving area	Rated capacity (kW)
47	Non – VRV	Common Room	2.5
48	Non – VRV	Power Lab	2.5
49	Non – VRV	Solar Lab	12

2.4 Backup power generator

The details of the backup power generator (s) installed in the unit are given in Table 2.4.

Table 2.4: Details of backup power generator

Rated parameter	DG# 1	DG# 2
Make	Volvo	Volvo
Fuel use	Diesel	Diesel
Capacity (kVA)	500	380
Voltage (Volt)	415	415
Average operating hours per month	4.2hrs	4.7 hrs
Average fuel consumption per hour	23.87liters	20.9liters
Other details, If any	-	-

3.0 Energy consumption analysis

This section provides an overview of the various types of energy used, consumption patterns, pricing, and calorific value of each fuel. The application of different fuels and their share in overall energy consumption patterns are explained in this section.

3.1 Electricity

The tariff structure of the electricity, connection type, electricity consumption pattern, contract demand, maximum recorded demand, and power factor for previous months were analysed. The electricity bills were studied to understand the various types of charges applied and the rebate/ penalty imposed on the unit.

The power supply to the unit is from BSES Rajdhani Power Limited utility grid under the tariff category Non-domestic [HT], with 680 kVA sanctioned contract demand. The billing is based on a two-part tariff with maximum demand recorded and energy consumption (kVAh). The analysis of the electricity consumption profile is provided in Table 3.1.

Table 3.1: Electricity consumption profile of the campus

Month & Year	Contract Demand (kVA)	Recorded Demand (kVA)	Consumption (kWh)	Power Factor	Total Amount, Rs
April'2018	680	240	54,080	0.95	811,270
May'2018	680	340	101,820	0.96	1,117,504
June'2018	680	400	142,392	0.96	1,509,710
July'2018	680	420	140,688	0.96	1,503,940
August'2018	680	380	131,736	0.96	1,420,610
September'2018	680	380	126,204	0.96	1,368,110
October'2018	680	320	123,076	0.96	1,369,940
November'2018	680	320	79,940	0.96	960,770
December'2018	680	140	52,640	0.96	707,280
January'2019	680	400	46,920	0.96	605,780
February'2019	680	200	60,380	0.96	762,130
March'2019	680	180	49,080	0.96	675,060

The average billing power factor of the facility has been observed to be 0,96 which is very poor for applicable electricity tariffs. The kVAh billing system is based on the apparent power (kVA) drawn by the facility which does not include the power factor in the calculation. Due to poor power factor (pf less than the unity), apparent power shall increase and the facility has to pay additional charges as the energy consumption charges. As baseline rule: kVAh charges are inversely proportional to the power factor.

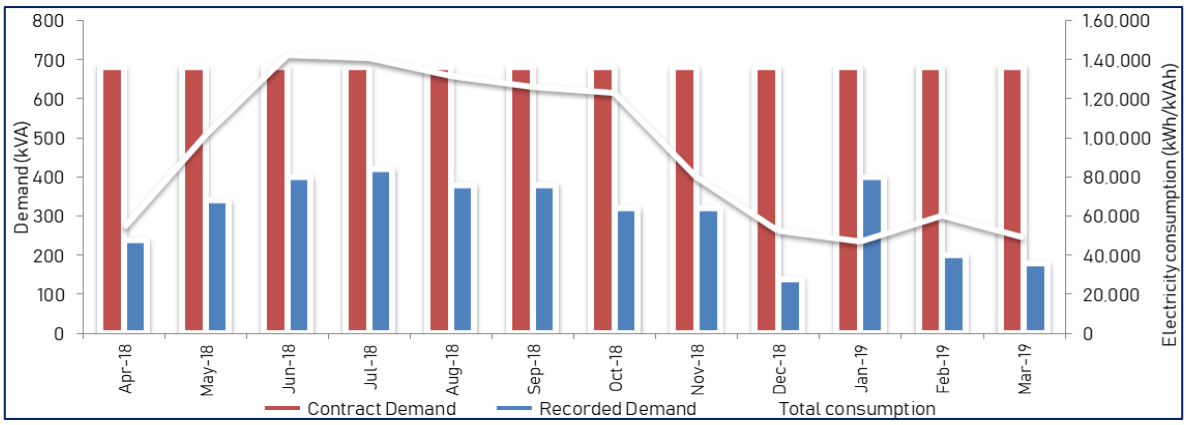

Figure 3.1a: Contract demand, recorded demand, and energy consumption profile

As observed from the above figure, the campus has registered a maximum recorded demand of 420 kVA in the month of July 2018 and a minimum recorded demand of 140 kVA in the month of Dec 2018. The weighted average recorded demand for the year 2018 is 310 kVA against the minimum billing demand 140 kVA. The average electricity consumption of the campus from BRPL is 92,413 kVAh per month. Apart from grid power, the facility is having solar rooftop and back-up power generators to cater to the power requirement during the power cut from the grid. The total installed capacity of solar rooftop and back-up power generation system is 48kWp and 880 kVA respectively. The electricity generation pattern of the back-up power system and solar PV and the percentage sharing in total electricity consumption of the electricity is given in figure 3.1b

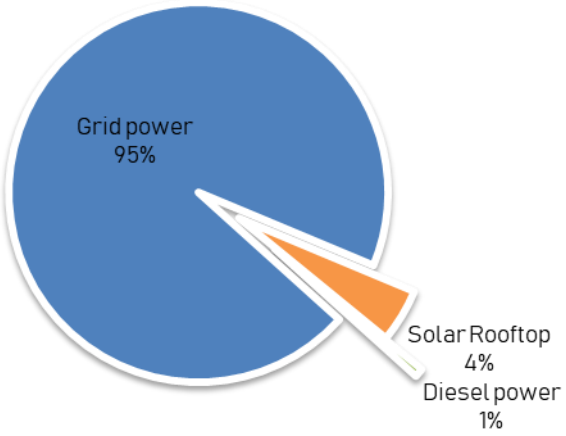

Figure 3.1b: Share of grid power, backup power and solar rooftop PV system

3.2 Monthly generation of solar rooftop and Diesel generator

The average monthly electricity consumption of the facility is estimated to 97666 kWh per month in which 95% is grid power 4% is solar rooftop power and 1% is contributed by DG sets. The month-wise energy consumption pattern (solar rooftop and DG) is shown in figure 3.2

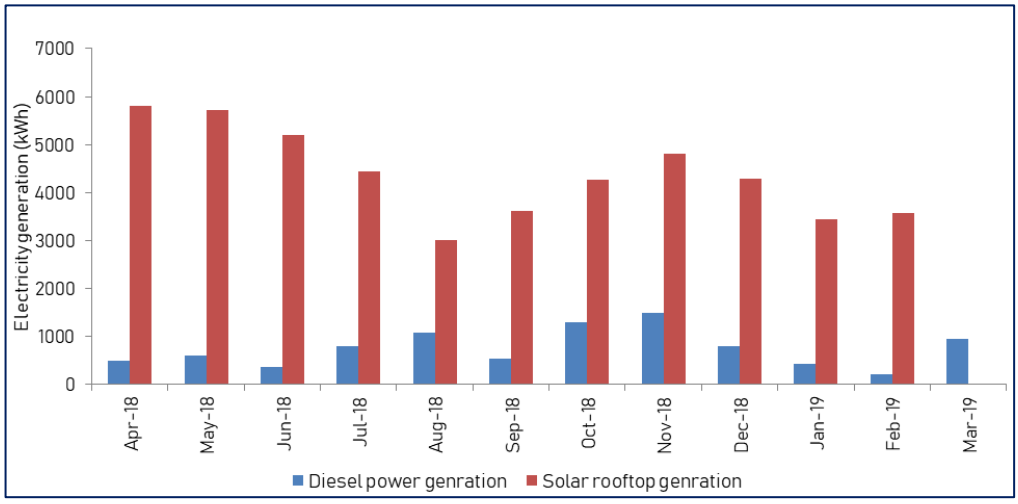

Figure 3.2: Average energy generation of solar rooftop and DG

3.3 Electrical energy share of the campus

Figure 3.4 shows that the Electrical energy share of the university is around 76% and the Non-university Consumption is around 24%.

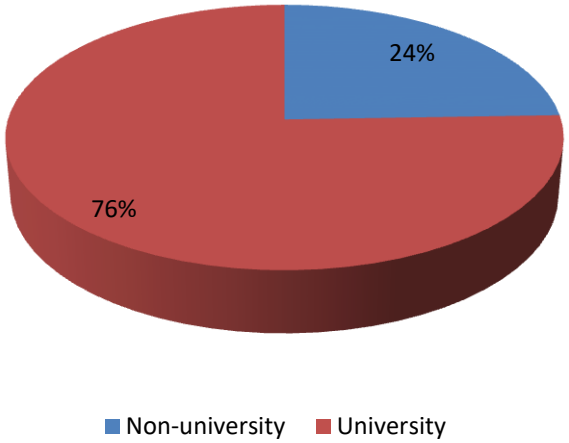

Figure 3.3: Presents electrical energy share of the campus

Key Observations – electricity profile

- The contract demand of the facility is 680 kVA whereas the recorded demand of the campus is 420 kVA. The average of the billing demand is 310 kVA during the last 12 months. However, the campus is paying fixed charges based on the contract demand (i.e. 680 kVA).
- It was observed that the power factor at the main comer is varying in the range of 0.863 – 0.933 whereas the energy charges are applied in KVAh basis on actual consumption.

3.4 Thermal energy

The campus is not using any form of thermal energy.

3.5 Renewable energy

The campus is having 48 kWp Solar rooftop system generating 54,030 kWh per year total 6% of the electrical energy share of the campus is utilizing from the solar rooftop system annually.

4.0 Measurements and performance assessment

The key operating parameters of some of the process equipment, associated auxiliaries and utilities were measured and historical data collated for making DSM/EE assessment. The assessment of the process equipment, associated auxiliaries, and utility equipment is given in this section.

4.1 Transformers

To evaluate the operating performance of distribution transformers, the average load pattern of the facility was collected. The operational efficiency of the transformer is given in Table 4.1.

Table 4.1: Operational efficiency of transformer

Description	Rated capacity, kVA	Test Certificate Details		Calculated Parameters	
		No Load Losses kW	Full Load Losses kW	% Loading	% Efficiency
TR (1600kVA)	1600	2	14	19.38	99.16

The best efficiency point (for given "No Load loss" and "Full Load loss" profile) is 37.80 percent for 1600 kVA transformer. The average loading of the transformer is estimated to be 19.38 percent in 24 hours average cycle of operation

4.2 Electrical motors

The energy audit of electrical motors associated with utility and pumping equipment was carried out to assess the performance and identify the potential for energy savings. The study included motors installed in the utility and other associated systems. The study focussed broadly on the following aspects to assess the performance of motors:

- Loading of motors
- Nature of load (fixed or variable)

The details of measurements, loading patterns, and observations in the electrical motors undertaken in the study are given below in table 4.2.

Table 4.2: Operational loading assessment of electric motors

S. No.	Motor ID	Design Specifications			Loading
		Voltage, volt	Current, amp	Motor rating, kW	%age
1	Borewell Pump	415	18	7.5	78
2	Fireline motor 2	415	18	7.5	89
3	Fireline motor 1	415	165	75	-

In the operational system, motors associated with pumping system was found optimum loaded (i.e. 75-100%)..

4.3 Lighting details of the Institution

The total lighting point and the annual electricity consumption of the institute were collected and the details of lighting points and annual electricity consumption undertaken in the study are given below in table 4.3.

Table 4.3: Lighting details and annual electricity consumption

Sl. No	Type of lamps & ballast	No. of lamps	Rated wattage, watt	Connected load, kW	Average operating hours per day	Annual electricity consumption, kWh/annum
1	5W LED fixture	8	5	0.04	11	136
2	7W LED fixture	447	7	3.13	11	10670
3	12W LED fixture	155	12	1.86	11	6343
4	18W LED fixture	317	18	5.71	11	19457
5	36W LED fixture	331	36	11.92	11	40634
6	30W LED fixture	38	30	1.14	11	3887
7	150W LED fixture	8	150	1.20	11	4092
8	15W LED fixture	51	15	0.77	11	2609
9	50WLED fixture	3	50	0.15	11	512
10	20W LED fixture	12	20	0.24	11	818
	Total	1370				87157.86

5.0 Energy conservation measures

5.1 Power Factor Improvement at main incomer level

5.1.1 Background

The power parameters of the electricity board supply were analysed to identify the deviation from the rated and operational pattern as per installed equipment and machinery in the facility and the applied tariff for power supply. In this context, the power factor also studied at the main incomer feeder of the facility. It was observed that the power factor at the main comer is varying in the range of 0.95 – 0.96 whereas the energy charges are applied in KVAh basis on actual consumption. kVAh billing system is based on the apparent power (kVA) drawn by the facility which does not include the power factor in the calculation. Due to poor power factor (pf less than the unity), apparent power shall increase and the facility has to pay additional charges as the energy consumption charges. The baseline rule is kVAh charges are inversely proportional to the power factor.

5.1.2 Recommendation (Higher Priority)

It is recommended to improve the power factor to unity (0.999) at the main incomer level (HT side) by applying the fixed capacitor banks and automatic power factor controller at the LT side. Figure 5.1 showing the power factor recorded at incomer of BSES Rajdhani supply during the FY 2018-19. Presently facility has provided power factor correction at the main incomer which can be modified to achieve the power factor till unity.

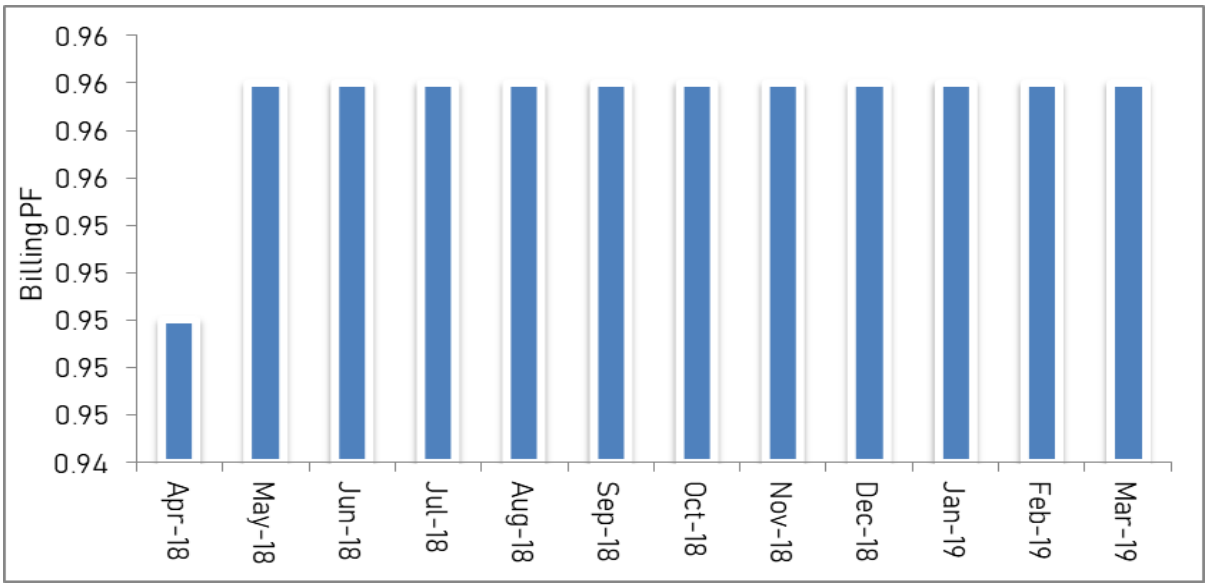

Figure 2.1 Power factor profile of the facility (FY 2018-19)

Since the energy billing in kVAh, the energy charges is inversely propositional to the power factor. The maximum billable demand also depends on the power factor.

5.1.3 Energy saving potential

A detailed energy saving calculation has been given in Table 5.1. It is required for the facility to redistribute the capacitor banks as per the proposed distribution network for TERI SAS if the facility is implementing the recommendation of the distribution system.

Table 5.1 : Detailed energy saving calculation

Particulars	Unit	Value
Monthly energy consumption from Grid	kVAh	1155163
Present Power factor	-	0.959
Proposed power factor	-	0.999
Annual reduction in energy consumption	kVAh/Year	46060
Average Energy charges	Rs./kVAh	8
Annual saving potential	Rs.	368480
Investment required for Fixed Bank	Rs.	137500
Payback period	Month	0.4

NOTE: Preventive maintenance is one of the keys to achieving the targeted energy saving in the system therefore, the engagement of experienced electricians to maintain the system is recommended.

5.2 Optimization of contract demand with demand controller

5.2.1 Background

The power supply to the unit is from BSES Rajdhani Power Limited utility grid under the tariff category Non-domestic [HT], with 680 kVA sanctioned contract demand. The minimum billing demand is 680 kVA (100% of the contract demand). The billing is based on a two-part tariff with maximum demand recorded and the energy consumed in kVAh.

It has been observed (figure 3.1) that the maximum and average recorded demand of the facility during the FY 2018-19 is 420 kVA and 310 KVA respectively. The facility is paying the additional demand charges for 370 kVA (average) every month.

5.2.2 Recommendation

It is recommended to renew the BRPL contract demand to 450 kVA after improvement of the power factor and validate the operation of the power factor

5.2.3 Energy saving potential

This potential will lead to reducing the demand charges by Rs. 57,500 per month. A detailed energy-saving calculation has been given in Table 5.2.3

Table 5.2.3: Detailed energy saving calculation

Particulars	Unit	Existing	Proposed
Contract demand	kVA	680	450
Minimum billing demand	kVA	680	450

Average recorded demand	kVA	310	310
Saving in demand	kVA.	104	230
Monthly demand charges	Rs./kVA/month	250	250
Reduction in demand charges	Rs./year		690000
Investment required for controller	Rs.		35,000
Payback period	Months		0.61

7.1.6.B

7.1.6.B

Green Audit Survey report

teri school of advanced studies

June 27, 2020

TERI SCHOOL OF ADVANCED STUDIES
Globally recognized University in the sphere of sustainability studies
Authored by: Dr. Kamna Sachdeva, Associate Prof.
Department of Energy and Environment, TERI SAS

Kamna Sachdeva

Green audit survey report of TERI SAS

The report is based on insights drawn from a survey conducted using online platform, covering current enrolled students, alumni of the TERI SAS, faculty and staff. The survey was opened on 24th of April and closed on 4th of May 2020. The survey was designed to get satisfaction on sustainability practices and perceived quality of life in the campus. The results showed that stakeholders are satisfied with the practices we adopt in our campus pertaining to greening and sustainability. In fact, it was found that TERI SAS green campus practices are well perceived and has spilling effect, the practices learned in campus has been adopted at their home also.

"Solar roof top installations of TERI SAS-Showing commitment towards sustainability-installations were inaugurated in 2015"

The survey is intended to investigate whether a Green Campus initiative if TERI SAS has performed well and its information has reached to all, this was assessed asking few basic questions to the stakeholders which follows as:

1.Which of the following sustainability efforts are you aware of on our campus?
Results: Although all the respondents are aware of the one or other type of sustainability practices of TER SAS but energy conservation measures and its information has reached to maximum with 51% of response rate.

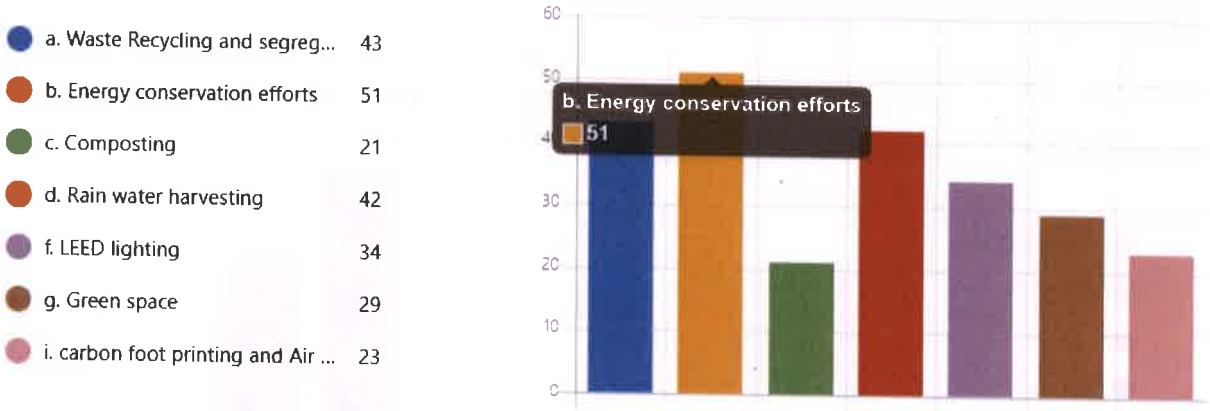

Figure 1. Showing result of awareness respondents have about sustainability practices

2. Which of the three definitions of sustainability below resonate with you? Sustainability means:
Results: For TERI SAS the most acceptable definition for sustainability is: "Taking the long-term view of how our actions affect future generations and making sure we don't deplete resources or cause pollution at rates faster than the earth is able to renew them." Most of the stakeholder has chooses this as the most appropriate definition applicable to TERI SAS efforts.

3. I fully understand the meaning of the term "green campus".
Results: Most of the stakeholders understand the meaning of green campus, only 7% of respondents don't understand the meaning of green campus rest all knows about it.

Figure 2. Showing result of awareness about understanding of definition of green campus

4. My concern towards sustainability issues has grown due to the events, activities and and/or courses offered by my campus.

Results: It is observed that TERI SAS's efforts to build capacity of stakeholders by conducting various programs related to sustainability and green education are useful in increasing the awareness about sustainability and available resources around it.

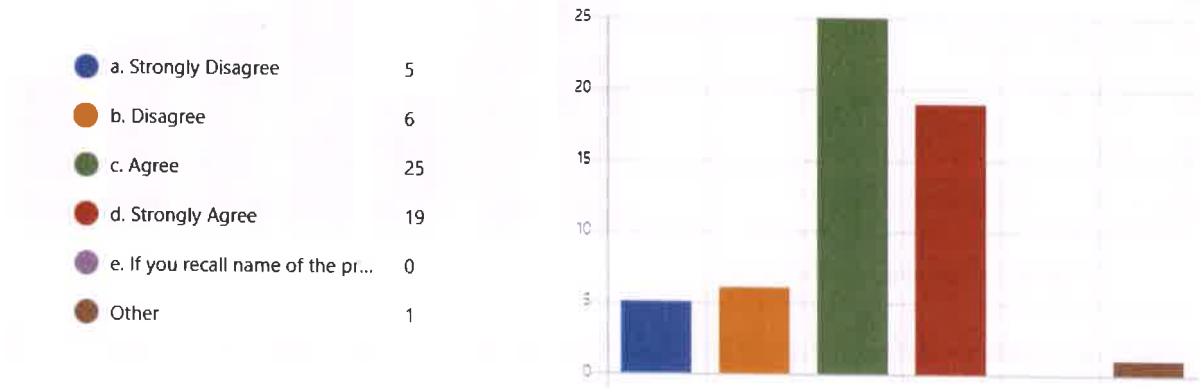

Figure 3. Showing importance of sustainability related programs in building capacity of stakeholders

Some images of the past programs are given to support the statement provide above:

5. How concerned are you about green issues and how it affects your future discourse?

Results: Stakeholders are very concerned about the green issues, somewhere this is the indicator of our success where we are able to inculcate knowledge and importance of green issues.

a. Very Concerned	30
b. Somewhat Concerned	10
c. Concerned	16
d. Not Concerned	0

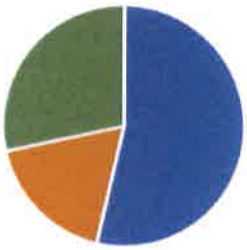

Figure 4. Indicating stakeholder concern about green issues

6. Result of affecting future discourse question shows that, green issues affect their life and future discourse.

a. Yes	50
b. No	0
If yes, then how	1
Other	5

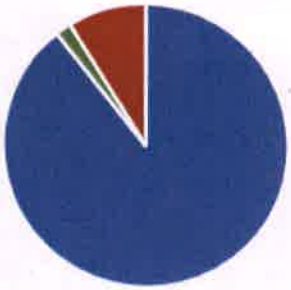

Figure 5. Showing result about how green issues affect future discourse of TERI SAS stakeholders

7. My campus is leader in sustainable practices among other universities.

Result: All believes that TERI SAS is leader in building capacity and imparting knowledge about sustainability

a. Strongly Disagree	5
b. Disagree	2
c. Agree	27
d. Strongly Agree	21

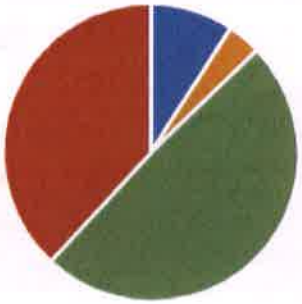

Figure 6. Showing results about perception of stakeholders about TERI SAS leadership in sustainability

8. My campus community is well informed about what is being done to make the campus more sustainable.

Result: campus community is well informed about the sustainability efforts TERI SAS is taking

a. Strongly Disagree	2
b. Disagree	5
c. Agree	39
d. Strongly Agree	10

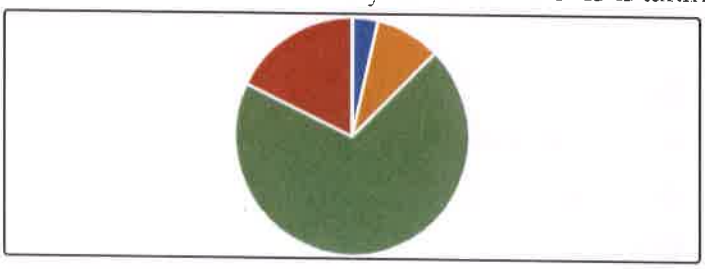

Figure 1. Showing result of awareness of stakeholders about efforts of top management to make campus more sustainable

It can be concluded that TERI SAS is doing its best in implementing sustainable practices in its small but beautiful campus. Off course this is a continuing effort which should be taken every time to new level, for which TERI SAS is committed to. Being a green campus would increase more positive perception of stakeholders about intentions of management towards imparting green knowledge and spreading awareness towards sustainability. The university could also use the Green Campus initiatives for outreach activities for student recruitment. Green Campus initiatives seem to be one of the prominent ways to promote and support global sustainability efforts.

Acknowledgement:
I would like to thanks all the respondents for their time to complete this survey. Moreover, I would like to thank all the persons who has provided vital inputs that further strengthened the survey and analysis.

7.1.6.C

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Environment Audit report

November 16, 2015

TERI University

Gobally recognized University in the sphere of sustainability studies

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Report of the Environment Audit – 2015-2016

November 16, 2015

During 2015-16 Environment Audit was carried out into following areas of the university.

- Raw water quality
- Drinking water quality
- Laboratory safety and cleanliness
- Hygiene and sanitation in canteen and cafeteria
- Hygiene related feedback from faculty members

Our recommendations and suggestions on the above are as given below:

1. Raw water quality

Background: TERI University uses groundwater to meet its water requirements. The ground water is softened using a natural Zeolite based Ion-exchange method before putting into the distribution network of the university. We have analyzed the raw water and the softened water sample in the Environmental monitoring laboratory and found the following results:

S. No.	Date of Sampling	Before Softener			After Softener		
		pH	**Hardness (mg/l as $CaCO_3$)**	TDS (mg/l)	pH	**Hardness in (mg/l as $CaCO_3$)**	TDS (mg/L)
1	31/07/15	7.03	**700**	1684	7.70	**220**	1950
2	1/8/2015	7.10	**680**	1811	7.60	**200**	2063
3	2/8/2015	7.33	**680**	1850	7.58	**640**	2195

We have also calculated Langelier Saturation Index (LSI)[1] and found that its value is 0.51 and 0.55 before and after softening respectively, indicating no improvement in scale forming and corrosiveness properties of water by the softening process. High TDS value of water effects the performance of autoclave and distillation assembly in the PBT and EM laboratories respectively.

[1] **LSI Indication:** -2.0<-0.5 Serious corrosion; -0.5<0 Slightly corrosion but non-scale forming; LSI = 0.0 Balancedbut pitting corrosion possible 0.0<0.5 Sligthly scale forming and corrosive; 0.5<2 Scale forming but non corrosive Read more: http://www.lenntech.com/calculators/langelier/index/langelier.htm#ixzz2cDp0UrPz

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Conclusions & Recommendations

1. The groundwater is 'slightly' scale forming and corrosive, however, the situation is not alarming to give any extensive treatment. Aeration (optional) of water before distributioncan reduce the corrosiveness of water.
2. Existing water softener does not offer any advantage in terms of improving the characteristics of water for its scale forming/corrosiveness properties. Rather, it increasesthe salinity of water and thus overloads the membrane of RO based water treatment processes installed in the university. **Annual expenditure of the order of INR 5.0 lakh (excluding manpower) can thus be saved by stopping the softening process.**
3. Scaling problem in autoclave and distillation assembly can be reduced substantially by using DJB tanker water that has TDS less than 500 mg/l. A water tank of 500-1500 ltr capacity (depending on the space available) can be placed on GF and filled with DJB water tankers, once a week. Water to laboratories can be supplied through this tank. Themaintenance cost of autoclave and distillation assembly is about INR 16000 per annum,which can be reduced by about 50% with the proposed arrangement.

2. Drinking water quality

Drinking water in the university is produced from a RO based treatment process and then storedin the tank of water cooler before it is consumed. We have analyzed the water quality and observed the following:

S.No.	Water Quality Parameter	GF	1st F	2nd F	3rd F	4th F	CGF	CFF	CTF	KRO	P	KT
1.	Chlorides (mg/l)	229	80	59.9	75	50	67	45	112	72	80	597
2.	Fluoride (mg/l)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	0.01
3.	Iron (mg/l)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
4.	Nitrate (mg/l)	4.21	-	3.42	1.71	1.47	1.49	1.99	3.38	1.61	2.88	7.29
5.	pH	6.95	7.03	7.06	7.04	6.94	6.89	6.71	6.94	7.01	6.95	7.38
6.	Sulphate (mg/l)	176	-	61	48	81	132	56	108	168	72	170
7.	Alkalinity (mg/l as $CaCO_3$)	105	60	40	40	40	65	35	70	80	55	500
8.	Total Coliform (CFU)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	4
9.	Total Dissolved Solid (mg/l)	522	213	182	240	163	222	138	284	275	224	1902
10.	Total Hardness (mg/l as $CaCO_3$)	505	125	115	85	260	365	55	510	540	265	600

CGF- Cafeteria GF; KRO- Kitchen RO; P- Pantry; KT- Kitchen tap water

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Conclusions:

1. All values are within the drinking water quality standards and hence safe. Kitchen tap water exceeds the standards for some parameters, but it is used only for cleaning utensils.
2. Water quality of GF RO is significantly high compared to other locations, indicating that RO requires cleaning/servicing. It may be possible that the membrane may need replacement. Same is the case with Cafeteria GF RO.

Recommendations:

1. Immediate servicing of RO at GF and cafeteria GF.
2. Routine servicing of all RO at a frequency of once in 3 months.
3. Routine surveillance of drinking water quality parameters in the laboratory, once in 6months.
4. Cleaning of tanks of water coolers at a frequency of once in 6 months.
5. Prominent display of date of last servicing done and due date of next servicing near toeach water coolers.

3. Laboratory waste management

Waste (solid/liquid) generated in the labs may be chemical or biological in origin. The chemical/ bio-hazardous waste material requires appropriate segregation and disposal.

Recommendations:

1. Appropriately labeled containers /bins be provided to all laboratories in consultation with lab-managers (Mr. Hari Ram Gupta, Mr. Shashank Pandey and Mr Murugan) for segregation and storage of hazardous waste. One often missed category of waste comprises of broken glass-ware, razors and sharp edged material. Each lab should have a separate container for collection of such waste. The possibility of salvaging the value of broken glassware be explored.
2. The contract/agreement with agencies identified for collection of hazardous waste be maintained at all times and should be in knowledge of lab managers.

4. Hygiene and sanitation related matters in the hostel and cafeteria

HOSTEL

Issues:

1. Rodents in hostel rooms continue to be a problem for the hostel residents, despite some measures taken a few months back.
2. Some of the rooms in the hostel, especially the ones on second and third floor have

extreme dampness (largely from bathrooms). Students have also suffered from allergic reactions due to this.

3. Foul odour emanates from air vents in bathrooms and corridor on first floor
4. A few washrooms used by the students were found stinking.
5. The housekeeping staff does not have a separate room for keeping their belongings and changing into work clothes. They use the medical room in the hostel to keep their belongings and change their clothes

Recommendations:

1. Pest control measures may be taken more frequently.
2. It is recommended that repairs related to plumbing should be taken up at the earliest toarrest moisture seepage into walls.
3. Regular cleaning of air ducts should be taken up in order to keep foul smell at bay.
4. Better hygiene practices by the students are expected. Towards this end, a short lecturemay be organized for drawing students' attention to better hygiene practices.
5. It is recommended that housekeeping staff be provided with a separate space to keeptheir belongings.

CAFETERIA / CANTEEN

Issues:

1. Despite the provision for aprons and caps, a majority of the kitchen staff is not habituated to wearing them. The kitchen staff was found using their hands to handle food while cooking instead of spatula.
2. Cutting boards and trolley over which cooking stove have been placed were found very dirty. The latter was heavily greased.
3. One of the deep freezer was found dysfunctional, which had remained so over one week. Cooked food items were found stored without lids in one of the deep freezer and the fridge. Further, non-veg items were stored with the vegetarian items. This practice is not appreciated since many of our students and staff members are vegetarian.
4. Cloth dusters used for wiping the cooking slabs / counters were found extremely dirty.
5. The area for cleaning utensils was found to be extremely filthy. One of the wash basins needed to be refitted within its frame. The kitchen floor remains wet as the utensil washing section is not appropriately managed. Further, the cleaning area is adjacent to the cooking area without adequate space between the two.
6. Students using the canteen and cafeteria do not practice segregation of food and other garbage while throwing in dustbins. They often leave food as well as their plates on the table, thereby, inviting flies.

Recommendations:

1. Proper training and sensitization to kitchen hygiene is recommended for all the kitchen staff.
2. Regular (weekly) cleaning of kitchen equipment, refrigerators and grocery storage section is required.
3. It is recommended that separate deep freezers be used for storage of non-veg and veg items. Any kitchen equipment which is not functional should be repaired at the earliest.
4. Cloth dusters for cleaning cooking slabs / counters should be washed and dried properly before being used again on the cooking counters. Similarly, cloth dusters used forcooking and wiping plates after washing also need to be cleaned every day.
5. The cleaning area may be shifted from its current place by extending the existing kitchen area outwards near the iron staircase. Also, the dustbins in the kitchen need to be covered.
6. The students should be sensitized about different issues related to hygiene and theirresponsibility in maintaining good hygiene practices.

5. Other hygiene related matters

We conducted a survey amongst the faculty members of the university to seek their observationsand views related to hygiene. The result of the survey is given in Annexure I. Administration of the university should take a note on the complaints and suggestions given by the faculty members.

Many of these issues come under the purview of canteen committee, campus committee, general maintenance and safety. Our suggestions and recommendations on some of the pertinent mattersare as follows:

1. **Washrooms: Complaints related to leaking taps and stench is frequent.** A person from administration be entrusted the responsibility to address complaints related to washrooms. The name of the person and telephone number to be displayed prominently on a wall of each washroom so that any student, visitor or the staff member can report thecomplaint to this person without any delay. The person should maintain a register of complaint and action taken report to be checked periodically by Sr. Manager Admin.

2. **Indoor air quality:** Some faculty members have complaints about inadequate ventilation in the room and report problems of headache and tiredness attributable to poor indoor air quality. It is recommended that a wall mounted fan (as installed in Prof VVNK room) be provided in every room. This will reduce the AC requirements (and hence electricity) andimprove ventilation. It is suggested that help of CSE group and Mr Pradeep Kumar, TERI may be taken for indoor air quality monitoring (Specially CO2 levels) and remedial actions.

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3. **Pesticides and anti-**mosquito spray be given in every room during weekends.

4. **Food and canteen:** Canteen committee may look into the issues pertaining to food quality and hygiene in the kitchen. It is suggested that canteen committee may consider the idea of forming a food procurement committee comprising of some hostel students and one member of the canteen committee and Sr Manager (admin) to oversee raw material purchases by the contractor. Another option worth exploring is to "standardize procedures of food procurement" under the supervision of Sr Manager Admin and canteen committee. Further, weekly menu schedule be prepared in consultation with the hostel warden who may ensure that the menu rules out the possibility of re-use of previous day cooked food.

Finally, it is recommended that Sr. Manager (admin) to take up actions on the recommendations given in the report and update the hygiene committee. The committee members will meet againin the first week of December 2013 to review the action taken report and other related matters.

Annexure I Hygiene survey

Respondent	Comments
1.	1. The dining hall should be more clean in the sense that it should be a flies freeregion in true sense of the term. 2. The servers in the hall should wear clean gloves and they should not be the same to handle the used plates and the like which is the case as of now. 3. Kitchen should be regularly inspected. I found the kitchen quite dirty most ofthe times. 4. Regular surveillance appears necessary to ensure the quality of food ingredients. 5. The health of kitchen staff must be checked periodically with some pathological tests to ensure they do not carry any contagious disease.
2.	However, my immediate reflection would be about the ground-floor restrooms!!Those smell filthy all the time, so much so that sometimes those make the corridor in front of L-001 stinking!
3.	I have the feeling the canteen, especially ground floor, and what I have seen from the kitchen, could be much cleaner. On Monday I found a strong smell of the toilet close to L-001. I feel also that the equipment in the bathrooms need to be checked and maintained on regular basis. I find often flushed not working or taps

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	dripping. In the small coffee room on the second faculty floor it would be ofgreat help if the water outlet for rain water gets improved so that strong rainfall events do not flood the room and if the waste wateroutlet is taken off the floor surface.
4.	Following are issues I feel strongly about: 1. Inadequate dustbins, with segregation so that different kinds of waste arebinned separately. 2. Inadequate usage of good floor cleaners by the sweepers. Our third floor is very dirty even after they mop the floor. 3. Canteen food, particularly some items have given many of my colleagues andme an upset stomach. The hygiene conditions of the canteen must be improved. 4. No cleaning takes place on the little roof outside my room on the third floor.Ideally there should be some plants and a clean space to look out to, given thatwe are associated with an university with a focus on sustainability and the environment.
5.	There are flies in our rooms.
6.	1. AC ducts and filters be periodically cleaned to ensure clean air flow. This is especially necessary in the context of lack of windows / other form of ventilation. 2. Blinds may be periodically dusted / cleaned to remove dust accumulation. 3. Water purification systems in water coolers be inspected for their effectiveness. 4. Using disinfectant for mopping floors (if not on daily basis then twice a week)in order to keep flies at bay. 5. Washrooms of students be cleaned and floors mopped with disinfectant on adaily basis since these are being used by a larger number (students, staff and guests).
7.	1. Periodic cleaning of AC ducts. 2. Provision to open windows in all faculty cabins. 3. Ensuring good air circulation and intake in the system so that cabins don't become stuffy. 4. Providing a small fan in each cabin, as in Dr. Kishore's. 5. Renewal of contract for disposal of lab waste as required.
8.	1. Hygiene in washrooms. 2. Some do not deposit the used plates and glasses in the dust bins rather they keep it somewhere outside. Whenever there is wind this will get scattered

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	hereand there. 3. Ground floor toilets are always stinking. This welcomes you in the morning when you wait for the lift. This also cause embarrassment when you have guests. 4. Pantry needs some more hygiene. Recently that region also started stinking. Microwave needs regular cleaning. 5. We need to make sure that the cafeteria especially the kitchen is clean (I am not sure how it is inside, but once in a while we need to check that if possible).
9.	The tap fitted the gents toilet at our floor is quite hard and does not close properly leading to water wastage. Shall be grateful if you kindly look into the matter, although I am not sure whether it is exactly the ToR of your committee. Also the small kitchen from where we take our tea and coffee or heat our food gets filled with water and becomes inaccessible especially during heavy rain and the water logging especially in the kitchen is not very healthy. This, I understand mainly happens due to gush of water coming from the side of the balcony. If a sun-shade/ or an adjustable shade could be fitted above the balcony, then I guess this problem won't recur.

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7.1.6.C

Environment Audit report

May 6, 2016

TERI University

Globally recognized University in the sphere of sustainability studies

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Environment Audit Report II

2016-2017 May 6, 2016 TERI University

This report is the outcome of the investigations done by committee members during 2015-2016.

There has been a remarkable improvement in the hygienic conditions of the University and students and faculty members recognize the prompt action and proactive approach of the General Administration of the university on this matter. Action has been taken on most of the recommendations given in first report of the environment audit which was submitted in November 16, 2015.

Following aspects were investigated by the committee

- Drinking water quality
- Sewage treatment and water recycling
- Solid waste management
- Hostel
- Kitchen
- Laboratory
- Other health and hygiene related matters

1. Drinking water quality

The General Administration of the university has been successful in doing away the use of plastic bottles in the University. Drinking water quality is being monitored every month in the environmental laboratory of the University as well as by the maintenance staff. The water quality parameters are displayed and this practice is appreciated even by visitors of the university. Currently, there are no issues related to drinking water quality in the university. As it is being monitored regularly, therefore, any issue that may arise in future will be addressed immediately.

2. Sewage treatment and water recycling

The working of sewage treatment plant (STP) was first investigated by Prof Kansal in the month of August 2015. He suggested a protocol for operation of the STP. As the STP is based on biological treatment process, use of chemicals in the STP was stopped, except for the use of sodium hypochlorite solution in the final treated water tank.

Some of the uncomfortable observations w.r.t. STP is as follows:

1. The sewage treatment plant receives very less quantity of wastewater in comparison to the quantity of water used in the university. We were informed that only hostel block is connected to STP whereas, wastewater generated from cafeteria kitchen, admin and

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7.1.6.C

academic block is directly disposed into sewers. However, indications are that even hostel block is not fully connected to the STP or there may be some arrangement of by- passing hostel sewage directly into sewers.

2. The above postulate is further strengthened if one observes the characteristics of water quality at the inlet of STP (Table 1). The values are found to be consistent during monitoring done in the month of September, December, and April. The values at the inlet(raw sewage) indicates:
   (a) BOD (organic pollution) is nearly half in comparison to sewage characteristics, indicating that it is diluted.
   (b) High value of phosphorus (almost 5 folds higher than sewage) indicates that thewastewater is mainly of detergent/ soap origin.
   (c) Very low value of suspended solids concentration further indicates that the flushingwater is not entering into sewage treatment plant.

Table 1: Water quality in sewage treatment plant

S.No	Water quality parameter	Inlet	Outlet
1	pH	8.4	8.2
2	BOD (mg/l)	125	90
3	COD (mg/l)	190	90
4	Nitrogen (mg/l)	15	7
5	Phosphorus (mg/l)	45	30
6	Total suspended solids (mg/l)	50	15

Based on 2 (a), (b) and (c) above, it is suspected that only the washing (laundry/bathing) water from the hostel area is reaching the STP and the rest is by-passed into sewers.

3. It is further observed that the maintenance staff of the university is not comfortable in handling the STP and often neglects it. For instance, instead of dosing sodium hypochlorite (disinfectant) in the treated water tank, they were found occasionally dosingsodium hydroxide.
4. Sludge has never developed in the STP, which indicates there is effectively no treatment of wastewater.
5. The outlet wastewater quality is suitable for its application in garden and horticulture purpose (i.e. meets land disposal standards).
6. It is believed that if entire quantity of wastewater generated in the university is treated, it can meet a substantial amount of water required for green belt, developed by the university and hence will significantly reduce the purchase of tanker water.

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7.1.6.43

Recommendations:

1. It is recommended that the entre drainage system of the University be checked thoroughly from the building drawings and also through physical verification of wastewater flows.
2. At least, dishwashing wastewater from kitchen should essentially be connected to STP.

Case 1: If there are no by-pass systems in the University

This is a happy situation, and the inlet tank of STP needs small modification and the treated water can be used for horticulture. Rest of the STP can be dismantled and the space can be used for other purposes.

Case 2: If by-pass points are found and decision is made to divert entire wastewater to STP

Under this situation the wastewater will be characterized again and suggestions for operation of STP will be made. It is likely that the use of treated sewage will substantially reduce the cost of tanker water purchase.

3. Solid Waste Management

Currently, adequate number of bins is provided throughout the campus and the university looks clean. Further, efforts have been made by General Administration to send the paper waste toIHC and from there waste is sent to recycling units. However, there is an ample scope for improvement in existing solid waste management practices. Some of the observations in this regard are as follows:

1. **Waste collection:**

(a) Promoting habit of waste segregation: The existing bin systems do not allow for waste segregation, hence a substantial amount of waste gets soiled and become unsuitable for recycling. Though, it is recognized that University generates very less amount of waste, but there are few places where bulk of waste is generated and waste segregation will beof much help.
(b) Faulty selection of bins: The existing bins that has a swinging lid is not suitable for disposal of wet waste (garbage), it often gets soiled. People tend to throw the garbage over the lid (with the assumption that it will slide into the bin). This creates unhygienic condition (see figure 1).
(c) Staff engaged in waste collection is not using hand gloves and apron.
(d) At some locations there is a need for placement of bins, whereas, at some other locations the size of bin is not adequate in comparison to the waste generation (Figure 2).

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Figure 1.Existing bins for garbage

Figure 2. Overflowing bin

2. Waste disposal:

About 150 kg of solid waste is generated in the university (Table 2), of which about 90% is organic compostable waste, nearly 3 kg paper waste, 5 kg mixed garbage (bulk of which is in form of thermocol plates/plastic spoons/paper cups) and 0.5 kg infectious sanitary waste (from washrooms, more from women). Small quantity of waste is generated from laboratories.

Results shows that only about 2% of the waste (paper waste) is being recycled, whereas as potential exists to compost and use 90% of the organic waste which is about 125 kg/d.

Entire university waste is currently stored in a large bin (see figure 3) from where the waste is disposed into the community bin. This mixed garbage includes sanitary waste, which is infectious in nature and should not have been mixed with other waste.

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Table 2 Waste generation pattern in the university (data through direct observations anddiscussions with the staff).

Location	Current collection practice	Daily waste generation rate	% organic matter
Administrative block	Once daily in morning, not on Sundays and holidays	**1-2 kg**	20-30%
Academic block	Once daily in morning, not on Sundays and holidays	**1-2 kg**	5-10%
Hostel	Once daily in morning	**8-10 kg**	10-15%
GF Canteen	Twice- thrice daily in morning andevening (afternoon if needed)	**100-150 kg**	80-90%
FF Cafeteria	Once daily in morning normally	**8-10 kg**	40-50%
Washrooms	Once daily in morning, not on Sundays and holidays	**3-4 kg**	Nil
Labs	Once daily in Morning	**1 kg per lab**	Nil
Amphitheatre, activity room, library, PhD room, Cafeteria building 3rd floor, and elsewhere	Once daily in morning, not on Sundays and holidays	**3-4 kg**	10-15%

Figure 3. Waste storage in the university.

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7.1.6.46

Recommendations

1. Waste collection, promoting waste segregation, bin designs, capacity and location aregiven in Annexure 1.
2. Location of the bin near Amphitheater is currently hidden and can be located in theprominent visible place.
3. Staff involved should be issued hand gloves and apron.
4. Waste collected from washrooms includes sanitary napkins which is an infectious waste. This category of waste should be disposed along with the biotechnology laboratory waste.
5. Use of disposable thermocol plates/cups/paper plates should be discouraged to the extent possible especially when a student is purchasing food for consumption within the canteenarea.
6. A vermi-composting plant to be set-up for the organic garbage.
   (a) Sufficient space is identified and is available near the exiting STP.
   (b) Approximate cost of the plant will be about INR 10000.

It is expected that with the execution of above recommendations:

(a) University will be able to recycle 95% of its waste.
(b) Compost thus produced will serve the requirements for horticulture and Green belt.

3. Hostel

With reference to the issues raised in the previous report of the hygiene committee, some positive change has been noted:

- The problem of rodents in the hostel rooms has been effectively tackled through pestcontrol.
- Dampness and foul smell: the extent and severity of dampness has come down since ittakes some time for drying up completely.
- Foul odour from air vents in bathrooms and corridor on first floor has reduced.
- The housekeeping staff has been provided with a separate room for keeping their belongings and changing into work clothes.

Current issues:

- The medical room in the hostel needs proper ventilation. The only source of fresh air is small slatted shafts, which is not only inadequate but also allow mosquitoes and hot airto come in during summers. Fan provided for air circulation is not adequate to keep room cool.
- Mosquitoes throughout the campus, especially in night.

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Recommendations:

1. Another round of maintenance check related to plumbing may be taken up for arresting/ assessing dampness. Cleaning of air ducts needs to be taken up for reducing dust and dirt accumulation and thereby, also keeping foul smell at bay.
2. Air condition or adequate ventilation and temperature control be ensured in the medical room.
3. Area wide anti-mosquito gaseous spray especially during the months of February, March,and August to October.

5. Kitchen

Some of the issues raised in the previous hygiene committee report that have been addressed, though partly, are:

- Utensil washing area has been moved some distance away and opposite to the cookingarea.
- Kitchen staff occasionally use apron. However, cleanliness of aprons is still an issue.
- Utensils used for cutting, and cooking is relatively cleaner in comparison to last inspection.
- The deep freezer has been partitioned to separate vegetarian items from non-vegetarian.

Current Issues:

1. In general, students are not satisfied with the quality of food served in breakfast and dinner. Though this aspect is out of the purview of the Hygiene committee, however, students want the committee to flag the issue related to the quality of rice (often not fully cooked) and chapatti (suspected to be occasionally mixed with refined wheat flour). The food is sometimes is too spicy and at other times too bland. Prominent complaint of the student is that the same caterer when cooks for university function, the food tastes far better.
2. The kitchen staff is still not completely habituated to wearing caps and aprons. Primary reason is high temperature and not adequate ventilation.
3. OTG/Grill and trolley over which cooking stove have been placed are heavily greased.
4. The fridge is found to be dirty and with spilled food items / curries etc.
5. Cloth dusters used for wiping the cooking slabs / counters and during cooking are dirty and inadequate.
6. The floor do not have proper gradient, as a result of which water takes longer time to drain. Further, in the absence of adequate space for keeping large utensils after washing, the same are placed on the floor adjoining the washing area.
7. Not enough storage space for utensils etc prompted caterer to store items at STP (see picture below).

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8. No firefighting system is available in the kitchen.

Recommendations:

1. Repeated training and sensitization to kitchen hygiene is recommended for all the kitchenstaff.
2. Regular (weekly) cleaning of kitchen equipment, refrigerators and grocery storage section is required. The idea of "one-time weekly mess off" can be mulled over so that staff gets time to do mass cleaning once a week.
3. Cloth dusters for cleaning cooking slabs / counters should be washed and dried properly before they are used again on the cooking counters. Similarly, cloth dusters used for cooking and wiping plates after washing also need to be cleaned every day. There should be an adequate stock of cloth dusters. Perhaps University Administration should issue cloth duster every week and charge the cost from the caterer.
4. The kitchen needs to be expanded from its current size since all the operations from storing of dry ration, cooked items, vegetables etc. to actual cooking and serving, to washing of utensils is being done from one area. This is not only unhygienic but even impedes efficiency of workers.

Main issue

1. It needs to be checked if the canteen requires a license to operate. See "Food Safety and Standards (Licensing and Registration of Food Business) regulations, 2011 : http://www.fssai.gov.in/Portals/0/Pdf/Food%20safety%20and%20Standards%20%28Licensing%20and%20Registration%20of%20Food%20businesses%29%20regulation,%202011.pdf

2. Kitchen size is not adequate: Smooth and coordinated traffic flow in a Kitchen is very important. As per the guidelines for **"Approval of Restaurants by Tourism Dept, Govt. of ŃCT, Delhi";** kitchen size should be about 300 sq ft. with at least 3 sinks.

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Suggestions for the consideration of the university

Three times meal for over 50 people is being cooked regularly in the kitchen. The existing kitchen was not designed for cooking and also there is a space crunch. This cannot ensure adequate and consistent hygiene and cleanliness by the staff. Secondly, in case of external inspection, the current design of the kitchen will not be found suitable. Moreover, absence of dishwasher and adequate cutlery increases the solid waste due to rampant use of disposable plates etc.

University is now offering a substantial business to a caterer. It may be an attractive business proposition to any food chain/restaurant. Therefore, selection of the caterer should be based on competitive bidding every year and the space provided to the caterer be either charged (as rent)or it should result in the form of subsidized pricing of food served to students.

Option I: Explore the interest from prominent food chains having their own centralized kitchen (for eg. Café Coffe day, Nirulas, kitchens serving airlines etc.) so that the food is cooked at some other location and the existing kitchen is used only for the purpose of heating/final dressing of food.

Option II: Design and construct a proper kitchen with dish washer and invite caterers on a competitive basis through open tenders every year.

3. **Laboratory**

A set of recommendations were made to lab-managers of research laboratories on Aug 21, 2015 and they were being followed. There are no issues currently with the waste management and safety procedures.

There is a need for provision of a fume hood in the Environment laboratory at 3rd floor for proper venting of noxious fumes.

Information: The committee, hereby, informs that from the year 2014, SMS water Grace BMW Ltd , Directorate of Health Services (DHS), is duly authorized by DPCC (Delhi Pollution Control Board) under the rule of 8(4) to collect the bio-hazardous waste for appropriate treatment.

4. **Other Hygiene and health related matters.**

- There is often bad odour around toilets near L001.
- Indoor air quality needs to be monitored, especially for CO, CO_2 and formaldehyde. CEE group of TERI/Dr Suresh Jain can be approached for this. Many people have complaints which are similar to that of sick building syndrome.
- In PhD scholar room (4th floor) there are no fans. Students are present in PhD room till 8 pm and when AC is switched off at 5 pm, it becomes difficult for them to continue.

7.1.6.50

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Summary

1. Inspection of wastewater drainage, operation of STP and wastewater recycling
2. Promoting waste segregation, replacement of bins at some locations and installation of avermi-composting plant. Total cost INR 15000/-.
3. Fume hood in the 3rd floor laboratory. Total cost INR 130000/-.
4. Disposal of sanitary waste from washrooms along with biotechnology laboratory waste.
5. Indoor air quality monitoring.

It is suggested that a meeting between the Administration and the hygiene committee members be held in order to understand the recommendations of this report and the second meeting be held immediately after execution of agreed tasks.

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Annexure I

Provision of bins in the University

1. Bins currently provided at the personal desks (for e.g in the faculty rooms), environmental laboratories, solar laboratory, hostel rooms will remain as it is.
2. 2nd floor of the Administrative block (near coffee machine), 3rd floor of the cafeteria block, one on each floor of the academic block, student activity room and in the Amphitheater the bin design is shown in Figure A1.

Specifications

1. Dual bin, each bin to have a capacity of about 5 litres, made ofHDPE/wood without sharp edges.
2. Each bin to have a label for "organic" and "recyclable" material(with example).
3. Sweepers of the university should sort and dispose the wastecollected from bins at personal desks into the

Figure A1: A suggestive design of bin

3. Washrooms (especially women) are shown in figure A2.

Specifications

1. A standard bin of similar design can be purchased from themarket.
2. Capacity: about 5 liters

Figure A2: A suggestive design of bin in washrooms

4. Biotechnology laboratory (Figure A 3)

About 10 litres capacity

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5. Cafeteria (Ground and first floor): Figure A4

Figure A4: Suggested design of bin with clear marking and each bin to have a capacity of 5.28 gallons.

6. Kitchen: Figure A5

Figure A5: Two bins each with a lid and with wheel base, one near wash sink and the other near stove. The lid design should be such that the lid can remain open on its own for a longer duration. Capacity of each bin should be about 20 litres.

7. Garden area (given below, as this bin will not obstruct watering activity and is easilymovable).

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Annexure 7.1.6.D. Geotagged photos of maintenance of areas outside and inside TERI SAS campus

Figure 1. Outside TERI SAS Campus

Figure 2. Battery Operated Car parked inside the TERI SAS campus

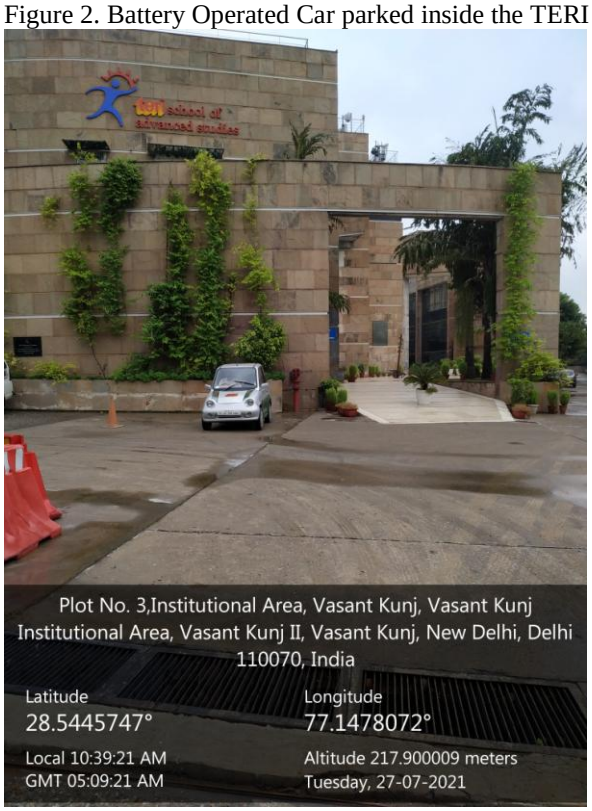

Figure 3. Greenery inside the TERI SAS campus

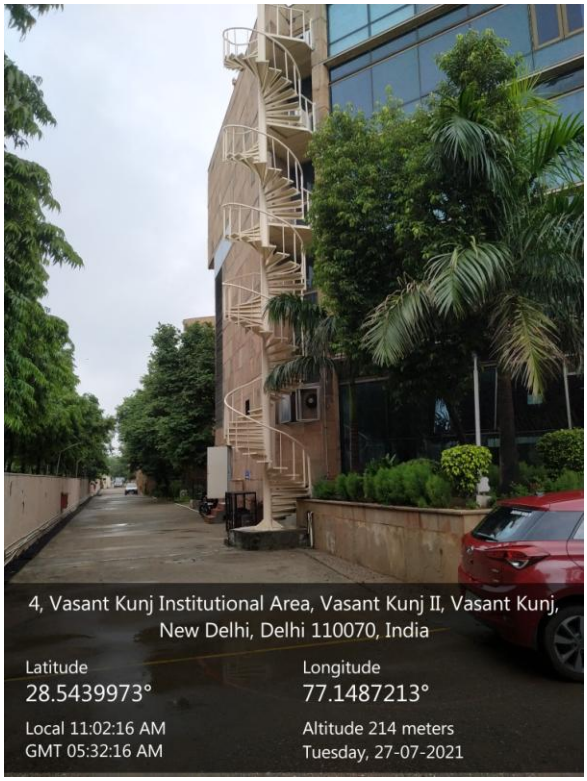

Figure 4. Greenery inside the TERI SAS campus

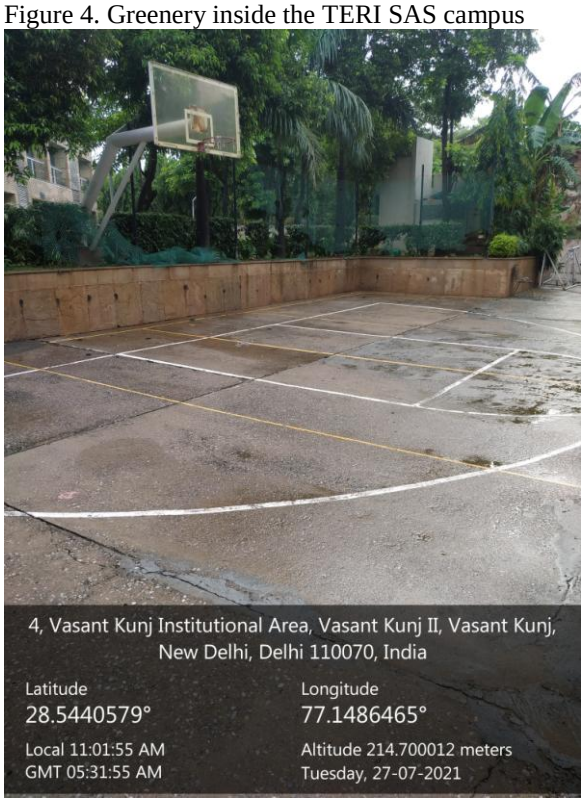

Figure 5. Waste management inside the TERI SAS campus

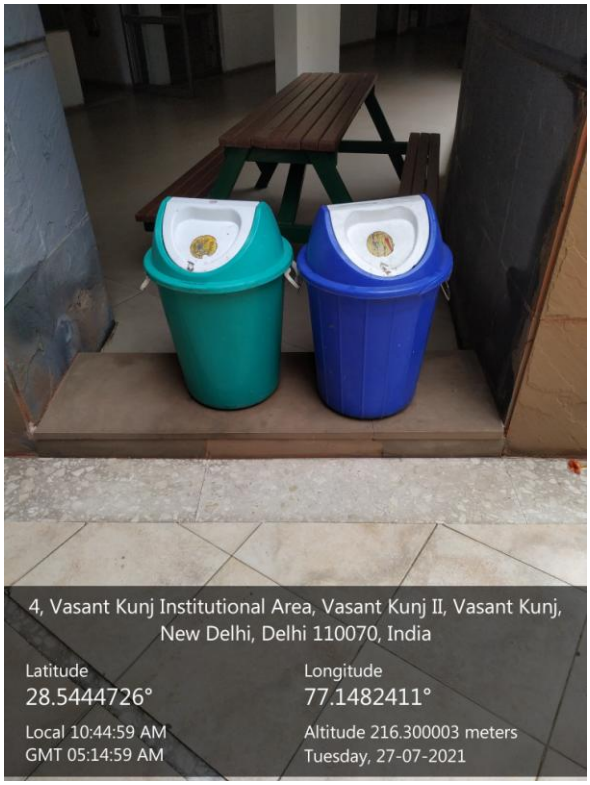

Figure 6. Greenery inside the TERI SAS campus

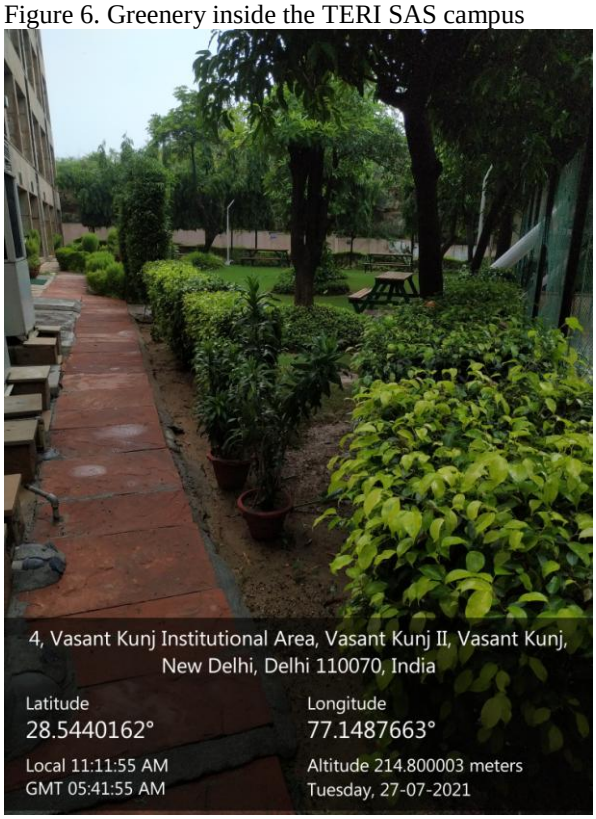

Figure 7: No Smoking sign outside the gate