GREEN AND ENVIRONMENTAL AUDIT REPORT
2020

Prepared for
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SUMMERY

If self-inquiry is a natural and necessary outgrowth of a quality education, it could also be stated that institutional self-inquiry is a natural and necessary outgrowth of a quality educational institution. Concern about global environmental degradation and resource depletion is a logical consequence of the scholarly research, teaching, and learning that takes place on campuses every day. Because universities & colleges are by nature inquisitive institutions, it is only natural for the colleges to examine itself. The current Green audit represents our effort to build environmental sustainability on the campus. Green Auditing is one contribution that attempts to prevent the destruction of the world in which we live. Stresses that it is everyone's responsibility - that of both individuals and the organizations in which they operate.

Green auditing is a systematic, documented, periodic and objective process in assessing an organization's activities and services in relation to:

Assessing compliance with relevant statutory and internal requirements.

Facilitating management control of environmental practices

Promoting good environmental management

Maintaining credibility with the public

Raising staff awareness & enforcing commitment to departmental

environmental policy

Exploring improvement opportunities

The audit was conducted by **Adya Environmental services**, with a team of **PSKC** faculty and students & gathered all the necessary information about baseline environment of the college. That covered soil quality, water quality assessment of the campus. Noise and air pollution levels of the campus falls within the permissible limits given by CPCB. Water quality of the campus follows the parameters of potable water given by IS 10500:2012. As a responsible institution it understands the importance of its Carbon footprint & developed a plan to reduce greenhouse gas

emissions and other waste in all its activities. College has also planned to promote campus and local biodiversity through detailed action plan and awareness programmes. Along with future action plans College has already undertaken several steps like ‘No vehicle day’, ‘Paper reuse’, ‘Rain water harvesting’, renewable energy to move towards becoming environmentally sensitive & a more sustainable campus. Amid coronavirus outbreak college shutdown in 2020 and remain closed for one year. So the Green/Environmental audit report is based on past and current information.

AUDITS 1. SOLID WASTE AUDIT

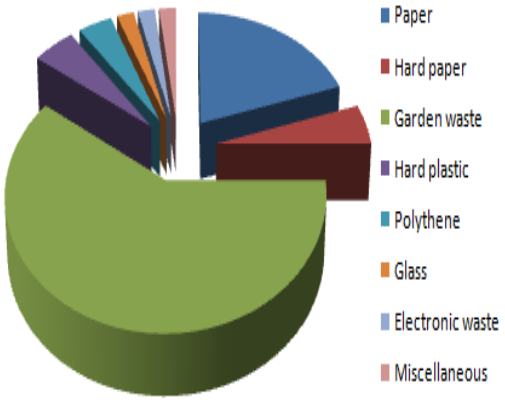
INTRODUCTION

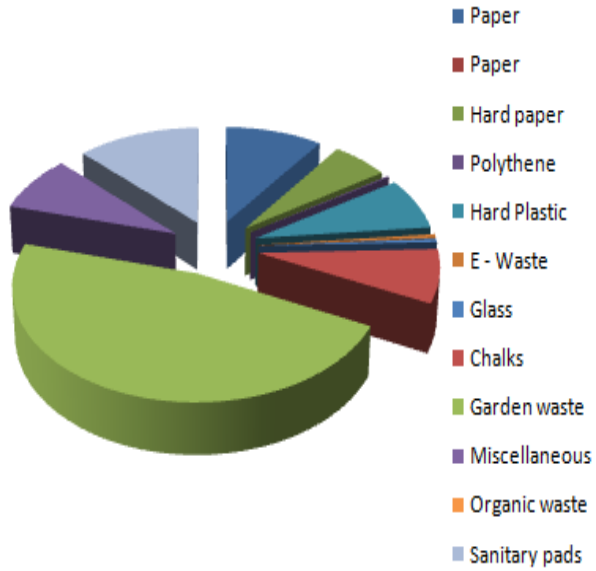
Urbanization and industrialization have resulted in increasing amounts of municipal, industrial and health care waste in the country. Central pollution control board (CPCB) has estimated current quantum of solid waste generation in India to the tune of 48 million tons per annum. Each year everyone in India throws away more than 0.4 tons of waste. Management of such high quantum of waste puts enormous pressure on solid waste management system. Throwing thing away is waste of natural resources and energy which have been used to make the product. Waste has to put somewhere. Most of it is sent to landfill sites or incinerated (burnt), using up land and releasing greenhouse gasses. On an average in India 12% of waste is recycled/composted, 79% is sent to landfill site and 9% is incinerated (burnt)

SOLID WASTE GENERATION

VISUAL ANALYSIS OF MONTHLY SOLID WASTE GENERATION (year 2019)

Garden waste is the main contributor of campus solid waste by volume. Every week near about 1700 gm of Garden waste is removed from college campus. Variation in Garden waste quantity is also found due to the seasonal variation. Paper waste also contributes a lot to solid waste volume.





As an educational institute, college's paper and hard paper waste like cardboard, paper covering, printing paper is recognizable. It accounts for 25% by volume. PSKC converts some quantity of its garden waste to manure by vermicomposting. Food waste is not included in visual analysis of solid waste for college building.

As an educational institute, college's paper and hard paper waste like cardboard, paper covering, printing paper is also high. It accounts for 25% by volume. PSKC converts some quantity of its garden waste to manure by vermicomposting. Food waste is not included in visual analysis of solid waste for college building.

SOLID WASTE ACCOUNTING BY WEIGHT

TABLE 1 WEEKLY WASTE OF OFFICES, CLASSROOMS & LIBRARY IN GM APX

Place	Paper	Hard paper	Polythene	Hard Plastic	Glass	Chalks	E-waste
Library	35	55	2	20	4	NEG	6
Main office	95	60	1	15	2	NEG	6
Classrooms	45	18	2	60	8	280	NEG
Total	175	128	5	95	14	280	12

TABLE 2 WEEKLY NON BUILDING AREA SOLID WASTE GENERATION IN GM APX

Place	Paper	Hard paper	Polythene	Hard Plastic	Glass	Chalks	Garden waste	E-waste
Solid Waste of non built-up areaup area	180	70	2	180	4	NEG	1700 (depends on the season)	8

TOTAL WEEKLY WASTE GENERATION OF CAMPUS

Here we can see that Garden waste is the main contributor of campus solid waste by weight. Paper comes after that. Hard Paper & Sanitary pads are the third and fourth main contributors. If we differentiate between degradable & non biodegradable waste biodegradable waste shows a very large figure compare to Non – degradable waste (glass, electronic, waste, and plastic, sanitary pads). Sanitary pads contain both biodegradable and non-biodegradable part in it, but the waste is included in non-biodegradable waste.

	Waste Type (Volume wise)	Percentage
1	Paper	20 %
2	Hard paper	5 %
3	Garden waste	60 %
4	Hard plastic	5 %
5	Polythene	4 %
6	Glass	2 %
7	Electronic waste	2%
8	Miscellaneous	2%

	Waste (Weight wise)	Weight (gm)
1	Paper	355
2	Hard paper	208
3	Polythene	7
4	Hard Plastic	275
5	E – Waste	20
6	Glass	18
7	Chalks	280
8	Garden waste	1700
9	Miscellaneous	300
10	Sanitary pads	450

PSKC campus produces near about 3.6 kg of waste per week. Garden waste is the main contributor of college waste i.e 1700gm. Weekly Biodegradable waste of college is 2.5

kg while non biodegradable waste of campus comparatively small and is approx 1 kg.

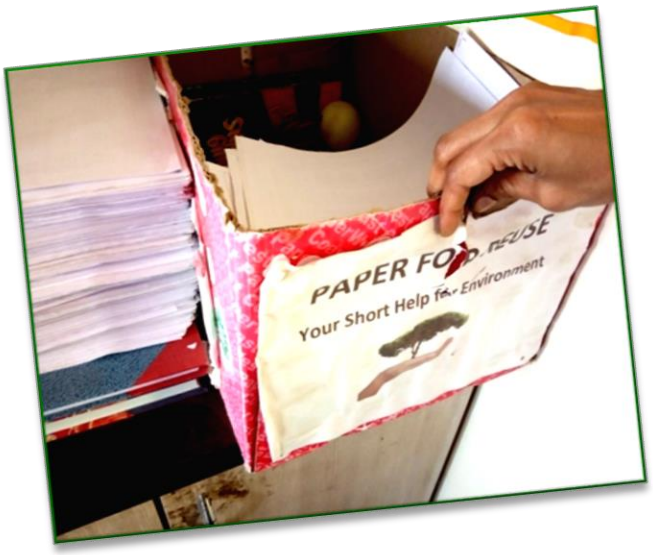
But these are non-biodegradable substances and disturb natural processes.

College has already started taking steps towards waste reduction, reuse and recycling to make its campus more eco-friendly. This detailed solid waste audit will provide necessary inputs for waste and management reduction.

CONTRIBUTORS OF CAMPUS SOLID WASTE

PAPER AND HARD PAPER:

College produces Approx 563gm of paper and hard paper waste goes to dustbin every week. Out of that paper share is near about 355gm while hard paper is about 208gm.



Green practice: Paper reuse

Around the world we use more than 1 million tons of paper every day and 93% of paper comes from trees alone which we can call as virgin paper. Paper also accounts for half of municipal solid waste. The pulp and paper industry is the third largest consumer of energy and uses more water to produce a ton of product than any other industry and is one of the world's major greenhouse gas emitters.

Producing one ton of paper requires 2-3 times its weight in trees. Making paper from recycled content rather than virgin fiber creates 74 percent less air pollution and 35 percent less water pollution.

Anything we can do to save paper will help reduce the amount of trash going into landfills, and it will also reduce energy use and pollution associated with manufacturing, transporting, and recycling new paper products. Perhaps most importantly, when we save paper, we reduce the need to cut down trees to make new paper.

College has started following action plan to minimize paper waste:

- Follow the golden rule. "Think before you print".
- Use both sides of the paper for printing.
- Check your draft 2-3 times on screen before you actually hit the print button.
- Use what technology has provided you, send emails, scan documents and send electronically rather than scanning copies and sending.
- Use the print range feature, print current page etc to print only what you need.
- Don’t throw away misprints instead use them as drafts or print on the other side.
- Change / Minimize on every document you print. It can save a lot of paper by simply changing the margin settings.

CHALK WASTE

Chalk waste is an important contributor of College’s Solid waste. Chalk dust is also an allergic irritant for many students and teachers. Chalk is mostly made up of limestone or gypsum. It can be reused or recycled.

Chalk waste

GLASS, PLASTIC AND HARD PLASTIC

On an average 282 g of hard plastic and plastic is weekly disposed of by campus. On an average 18 gm of glass goes to waste. There should be a separate storage bin for these waste types. Separate storage bins should be provided for three categories of waste (at one place). And it should be given to waste recycler after possible reuse of waste. Currently Deur Grampanchayat collects this non-biodegradable waste from College.

Suggestion – Recycling of chalk

We can use chalk dust, small chalk stubs to create new, bigger, pieces of chalk. We can do so by crushing the small pieces of chalk into powder & then mixing the resulting powder with a bit of water, so that it gets the consistency of a modeling paste. Then, we can use to modeling it into chalk bars. After you finish shaping it, put it somewhere to dry and harden, so that you can use it just like you use regular chalk when it's dry.

ORGANIC WASTE

Organic waste of this college mainly includes garden waste. Graden maintenance is done once in two months. And this waste also goes to vermicompost unit.

USE AND THROW TYPE PENS

Nowadays many people use ‘use and throw’ type pens. Nobody goes to refill the pen with ink. This adds more plastic to our dustbin. Same picture can be found at this College campus. 98% of students of PSKC use ‘use and throw’ type pens. This adds near about 4kg hard plastic to solid waste per year.

College is thinking of creating awareness among students to stop the use of such pens. College will make guidelines about good alternatives i.e the use of Ink-pens. This awareness is needed to be done at every faculty level of college. This can be done by arranging workshops on ‘waste minimization’ and personal observation of students by staff of the college

ELECTRONIC WASTE

College gives its E-waste to a vendor company – …….

SANITARY PADS:

Menstrual Hygiene Management (MHM) is an integral part of the Swachh Bharat Mission Guidelines (SBM-G). The MHM Guideline (Dec 2015) is issued by the Ministry of Drinking Water and Sanitation to support all adolescent girls and women. It outlines what needs to be done by state governments, district administrations, engineers and technical experts in line departments; and school head teachers and teachers.

Unsafe ↓ Safe	*Common practices*
	Throw them unwrapped into fields, rooftops, etc.
	Wrap them in paper/ plastic bag and throwing them outside
	Drying, wrap in paper/plastic bag and throw in dustbins (mostly non-rural)
	Burry them for de-composting
	Throw them in latrine / toilets
	Burn it (rural areas and peri-urban areas)
	Use small scale incinerators (community or school level)
	Municipal waste management / burning in health clinics (more urban)

As the usage of sanitary napkins is increasing, the amount of sanitary waste generated every day is also increasing. It is equally important to address the issue of efficient disposal of this infectious waste. Currently as we see, a major part of this waste is dumped into landfills leading to tremendous land pollution. Sanitary napkins are flushed down the toilet under the name of convenience. All the drains ultimately meet the rivers in the city and thus water pollution increases.

Weekly sanitary pad waste generation of college is near about 450gm. So if we see the chart of UNSAFE to SAFE practices i.e burning and use of small incinerators is comparatively safe option. College has a option to use one of two option to minimize environmental pollution. If college selects the burning option then it should be done at a distant place and under complete observation (till complete burning of the sanitary waste)

Future steps by PSKC towards waste minimization:

RECOMMENDATIONS

PSKC should improve its Waste Management Plan on the basis of ‘4R’ solution (Refuse, Reuse, Recycle, Recover) to achieve its goal of Carbon neutral campus.

2. WATER AUDIT

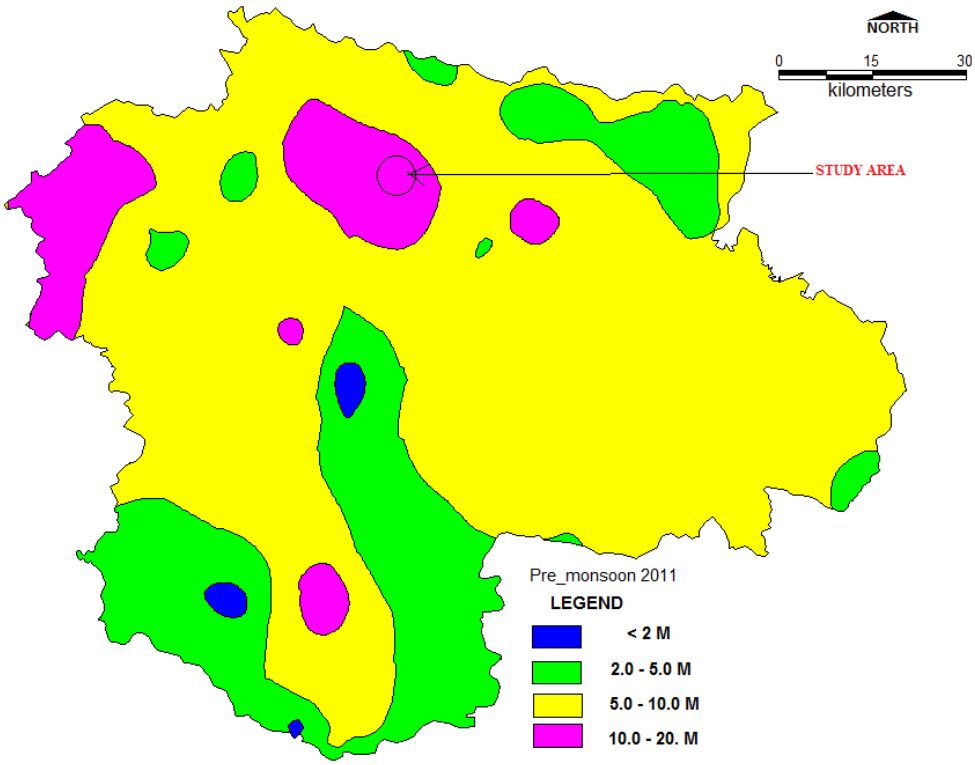
INTRODUCTION

A water audit is a systematic review of a site that identifies the quantities and characteristics of all the water uses. The site may vary from a public water utility, facility (institutional or commercial properties like malls, office, schools etc.) or a household. The overall objective of conducting a water audit is to identify opportunities to make system or building water use more efficient.

Current Water Status of the region:

Almost entire district is underlying by Deccan trap basalt. Also the isolated and small parts adjoining the hilly areas have low ground water development potential. Such areas occur in almost entire Mahabaleshwar taluka and part of Madha, Patan , Wai and Man taluka. The major part of the district is occupied by areas with medium ground water development potential.

Depth to water level in Satara district during may 2011 ranges from 0.09 m bgl (Shendri) to 16.2 (Mahabaleshwar) Depth to water level during premonsoon (May 2011) has been 9 depicted in the following figure. The perusal figure 3 indicate that most prominent range of water level is 5-10 m bgl which is seen almost entire district.



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Depth to water level in Satara district in 2011

The overall stage of ground water development in the district is 69.5% hence it is necessary to adopt water conservation and artificial recharge techniques to increase sustenance of this precious resource.

Drought areas has been observed in major parts of the district in the entire eastern, north eastern and south eastern parts comprising almost entire Khandala, Phanltan, Khatav, Mhaswad talukas and parts of Koregaon and Karad talukas. Deeper water levels of more than 10 m bgl are also seen in northern part around Mahabaleshwar, Khandala and Wai and in south eastern part of the district in the parts of Man and Khatav talukas. These are the areas where the ground water scarcity is quite common when the rainfall is deficient. The stage of ground water development in 5 talukas (Karad, Khatav, Koregaon, Phaltan and Wai) has already crossed 70%. Most of these talukas fall in rain shadow zone of Western Ghats, where rainfall is low. Hence special attention is required in above mentioned areas and immediate steps like ground water augmentation by artificial recharge practice and water conservation should be adopted before further ground water development is planned in these areas.

WATER SUPPLY OF PSKC CAMPUS

The primary source of water for ACCS is a private borewell. The College building receives all of its water supply from groundwater. The current borewell which supplies to PSKCs daily water requirement of drinking and non potable uses is more than ten years old. It is located near the proposed new building of the college and was installed in 2000.

Main water storage tank

The total depth of the borewell is around or about 00 feet. In summer ground water level goes upto 250 feet. The submersible pump of 2.5 Horse Power (HP) was installed. Due to water shortage college tried another borewell installation. But it got failed due to lack of ground water. At present, the working borewell is used for recharging groundwater within the PSKC's rainwater harvesting system.

The pipeline from the borewell is connected to a underground storage tank of capacity 5,000 litres. The Underground water storage tank for storing borewell water is located within campus itself. This is main storage tank of incoming borewell water.

From this storage tank, water is pumped to the overhead tanks by a 2.5 HP pump. There are three water storage tanks located on the terrace of college building. The water from small tank D of 500 litre capacity is used for drinking purpose, while tank C of 1500 litre is used for Girls and boys washroom (one for each). Girl's washroom is located on ground floor and Boys washroom is on First floor. The capacity of tank B is 1000 litre.

Water storage tanks on terrace

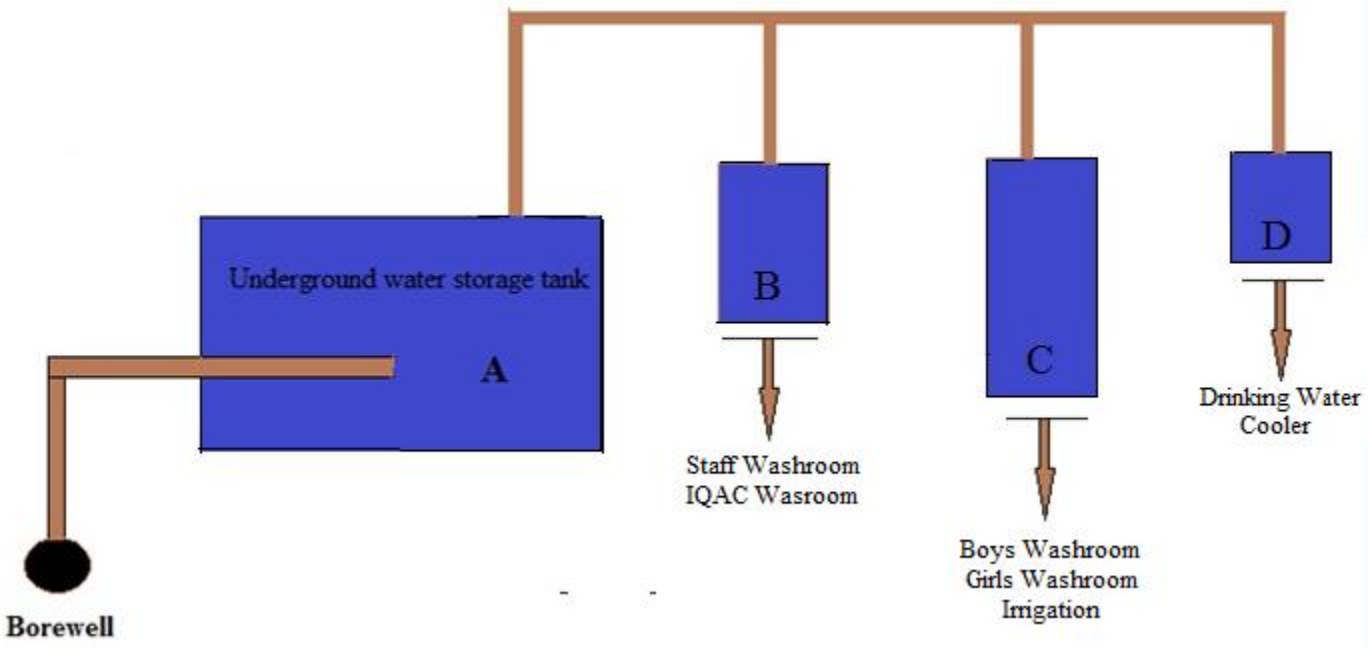


Figure : Schematic diagram of PSKC's water supply system

As per the daily pumping observations to overhead three water tanks PSKC. College daily uses about 3000 liters of potable and non potable water. All day water requirement is fulfilled by borewell water except summer season. Previous years data record suggest that from March to May, near about 30-40 tanker trips are needed in summer to quench the colleges daily demand of water, both personal use and irrigation.

Based on flow rate measurement the average amount of potable water that is pumped from underground borewell water storage tank i.e. Tank A to the overhead tanks (B, C, and D) is about 3000 liters per day. Although on certain days there is a sudden jump & increase in the amount of.water which is generally attribute to increase in certain water uses like gardening, different events etc

WATER USAGE

PSKC building has three floors. To conduct a building water audit water consumption data for all the users were required to be monitored and recorded. Toilet water use including flushing and face/hand washing along with drinking was clubbed under personal water use. In order to collect primary data and to ensure accuracy, a brief questionnaire format was prepared and survey conducted for students.

Water users	Number
Students	586
Teaching Staff	23
Non teaching staff	8
Avg of daily visitors	12
Total	**629**

Total water users of the PSKC campus

The total personal water use was calculated from flow rates, questionnaire and total water users (occupancy of the building). We measured the flow rates of taps and pumping lines.

In total there are 4 Toilet blocks in the building, which includes 1 for Meeting hall, 2 for students (1 for boys and 1 for girls)and one for staff. .Out of these 3

toilet block is located on ground floor. All of these are provided with basins

	Use	Flow rate
1	Drinki	14s/liter
2	Toilet	13s/liter
3	Basin	16s/liter

WATER CONSUMPTION CALCULATION

Total daily water Intake of water,

Tank B + Tank C + Tank D = 2000 lit/day

*Calculated from flow rate and daily water pumping operation to overhead tanks

I. POTABLE WATER CONSUMPTION (DAILY)

College uses filtered borewell water use for potable water use

CALCULATION ON THE BASIS OF QUESTIONNAIRES AND FLOW RATES

i.Daily potable water consumption by staff and students: 1 × 629 = 629 litters/day

Total water use of drinking water is =629 liters/day

2. NON POTABLE WATER CONSUMPTION FROM NAKSHATRA WELL (DAILY)

College uses borewell water for non potable water use

CALCULATION ON THE BASIS OF QUESTIONNAIRES AND FLOW RATES

i. Water used for flushing by students 629 × 2 liters = 1258 liters/day

ii. Water use for mopping of Main office area = Water per washing of wiper ×

Number of washing = 100 liter × 1 = 100 liters/day,

iii. Water use for mopping = 200 litre

iv. Water used for hand and face washing = Average time the tap left open × Number of times the hand and face washed) × Average flow rate of taps per second
= 10 seconds × 1 times × 0.12 = 1.2 liters per capita

So, Total non potable water use by students and staff for hand and face washing
= 1.2 liters ×629 = 754 liters.

So, the total water use for flushing and washing = 1258 + 300 + 754 =2312 litters/day

* The daily water requirement for Science lab is not included here.

OVERALL WATER CONSUMPTION

Therefore based on the above recordings, monitoring and calculation, the total potable water consumption for PSKC College is 629 lit/day and non potable water consumption is 2018 liters/day. Overall water consumption is 629 + 2312 = 2941 liters per day. If gardening is excluded, then the per capita use for non potable water is around 4.75 liters day.

	Heads	Water use (in liters)
1	Average daily water supply, to the overhead tanks from the underground tank	2000
2	Total calculated water consumption from the water audit	2941
3	Difference between water consumption from overhead tanks and actual water use for various purposes	941

DATA COMPARISON AND ANALYSIS

There is a wide variation in the average amount of water that is pumped to the overhead tanks every day for various purposes and the average water consumption calculation. The average water supply (quantity) was based on time taken to overhead the tanks, flow rates and monitoring. The amount of water based on questionnaire, flow rate and water users is 2941 liters per day while the daily water need to overhead all the tanks is 2000 . The calculated water amount is 1.4 times greater than the amount of water which is used pumped in the tanks.

THIS DIFFERENCE COULD BE ATTRIBUTED TO THE FOLLOWING FACTS

- The staff and students present per day in the college were assumed to be 100 % present. In real this percentage varies.
- The observations from questionnaire for personal water use were a representative observations and not a complete study.
- Along with this staff and students living in nearby areas, they don't use the college washrooms. Some of them bring drinking water from home.

WASTE WATER GENERATION BY PSKC

Every building generates waste water amounting to almost 80% of total water consumed. The major source of PSKC waste water includes grey water from wash basins, lab basins, and black water from toilets. Out of that Black water of PSKC toilets goes to soak pits. So PSKC don't discharge any Black water in Grampanchyayat sewer lines

ESTIMATION OF WASTE WATER GENERATED BY PSKC

Waste water generated = 80% of water used

So, waste water generated by PSKC based on water audit

= 80% of 2941 liters per day = 2352 **liters/day**

Waste water generated by PSKC based on pumped quantity

= 80% of 2000 liter per day = **1600 liters/day**

Out of that Black water of PSKC toilets goes to soak pits. So PSKC don't discharge any Black water in Grampanchyayat sewer lines

CONCLUSION AND RECOMMENDATIONS

1. The water meter should be installed for PSKC college at the inlet of borewell water. This installation will give correct amount of borewell water used by PSKC. This will also help to monitor

   This will give correct information about amount of wastewater produced by the college. Along with this characteristics of waste water will help to decide selection of treatment process. The use of best available waste water technique will improve the quality of treated water and it can be used for irrigation.

2. LOW FLOW FLUSHING SYSTEMS Water consumption is more for Flushing applications in any building. Use of more efficient water saving toilets having dual flush system can result in a saving of at least 50% of water. Dual flush systems can be installed in order to allow different volume of water for flushing liquids and solids. To facilitate efficient cleaning at low volume, it is possible to install suitable water closets.

3. NOISE AUDIT

Actual noise monitoring is carried out with the help of sound level meter on various locations shown in figure . We have taken the samples within the free field. The comprehensive study was done inside the campus to calculate the noise level at various important locations such as class room areas, playground, parking area, library location and the data is interpreted for solutions.

Noise level readings (dB) was taken using noise meter.

The readings were taken in certain period of interval and specific timings such as mornings, evenings, afternoon.

Noise monitoring stations of the campus

DISCUSSIONS

Please note that Amid corona virus outbreak college was shutdown in March 2020 and remains closed for one year. So water audit chapter is added from 2019 report to set the future sustainability goals for the college.

Out of 30 average noise recordings at SITE I near college entrance, 7 noise level recordings exPSKCds noise standard. The laid down noise monitoring standard for Silence zone is 50 dB (A) for a day time. The highest noise levels near entrance were seen in the morning. This site is close to primary English medium school. So it shows the impact of School activities in Morning. The visual observations was high rush during evening time on nearby road.

Site II is in the centre of the C shaped campus building. Only 5 observation exceed the noise standard. Almost all noise levels observations falls within standards.

SITE III location is far from of the college building and at ground periphery near to proposed new building of the college. All noise level observations falls within standards.

At some places we can find that the noise levels exceed the standard of CPCB for silence zone i.e. 50 db. But we have taken the samples in free field where there are no reflected sound waves. So this satisfies that the high Noise level (above 50 db) decreases towards classroom areas.

COMMENTS

- Silence is an important factor in education. PSKC campus is an ideal place for education as it nearly follows the standards of PSKC.
- As per CPCB guidelines silence zone is referred as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The campus is at a distance of from crowdie and noisy a r e a o f e v i l l a g e .
- The survey shows that, the plantation of trees and hedge of dense tree cover near nallah in campus do acoustic buffering of outside noise and acts as noise barriers for road
- rush.

4. BIODIVERSITY AUDIT

A TREE CENSUS AND INVENTORY

The present Tree census and inventory study was done to quantify, to create an inventory and to understand phyto-ecological structure of PSKC's Senior college.

Location

Latitude 17°51'32'N

Longitude: 74°07'13''E

…….. Senior college PSKC

OBJECTIVES

1. To make an inventory of tree individuals and tree species in the campus.
2. To undertake phyto-ecological analysis with the help of

a. Species composition

b. Abundance, Relative abundance, density

c. Diameter class and height of the trees

SAMPLING

Since the purpose of the study was to create a detailed inventory of Tree individuals and species, the "Census" was used as a sampling technique. In total, 2 acre of the campus was surveyed and each tree was counted.

Within each plot all individual trees were identified, measured, and recorded. The diameters at breast height of the species were measured using a measuring tape. Trees were grouped into the following diameter classes: medium-sized trees (16–29.9cm), and large trees (>29.9cm).

These species were further grouped into classes according to their height - treelets (small trees)

(<10m), under storey (10–20m), canopy (20–30m), and emergent (>30m

RESULTS

SPECIES COMPOSITION OF TREES

Table of species composition (see Tree inventory table) shows the different tree species found in the study area. A total of 18 species were recorded belonging to 15 families and 18 genera. Annexure of tree inventory shows the different plant species, their families found in the PSKC college campus. A total of 87 tree individuals (height above 3 meters) species were recorded in the study site. Out of 87 tree individuals only 3 were deciduous trees while rests all were deciduous.

Dominant families recorded in the study area according to descending order (based on number of species type in each family) are Bignoniaceae (3) Aracaceae (3) and in remaining other families only one species is recorded (see Tree inventory Table).

ABUNDANCE

From the 18 families recorded in the study sites, the Bignoniaceae and Arecaceae had the highest number of species (3) which belongs to 3 genera followed by the Apocynaceae with 2 species and 2 genera. A total of 18 genera were recorded in the study site. *Dypsis lutescens* (Aracaceae) having 21 individuals were the most abundant Tree species. This was followed by the species *Ficus benjamina* (Moraceae), *Duranta erecta* (Verbanaceae) and *Cocos nucifera* (Arecaceae) having 19, 10 and 8 species respectively.

There were 5 species recorded in this site having only one individual. Out of which 3 species were native. The native species of this site having only one individual included *Caryota urens*, *Cassia fistula*, *Tamarindus indica*, , *Kigellia pinnata*, *Bougainvillea spectabilis*.

RELATIVE ABUNDANCE

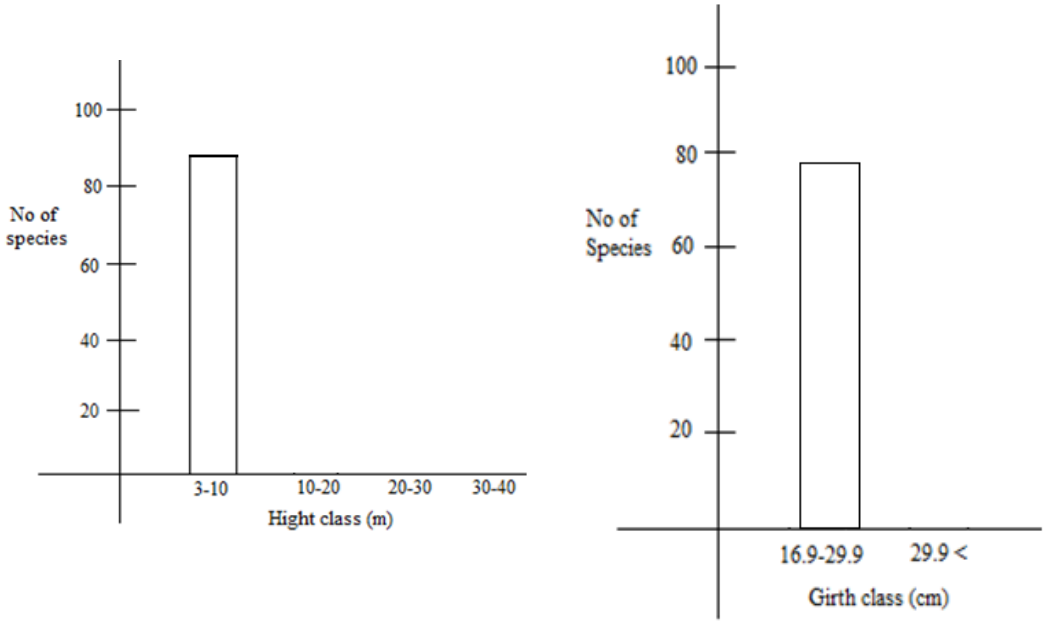
Species composition table shows the different trees species found in the study sites and their relative abundance. In this site, 87 individuals were sampled. The species with the highest number of individual *Dypsis lutescens* with a relative abundance of 14.4%. It was followed by

Ficus benjamina individuals and relative abundance of 13.6%, *Duranta erecta* and *Cocos nucifera* with relative abundance of 12 % and 10.4% respectively.

DIAMETER CLASSES AND HEIGHT OF THE TREES

Trees with different diameter classes were found in the campus. The diameter range was grouped as medium-sized trees (16.9–29.9cm), and large trees (<29.9cm). The site was dominated by trees species having diameters (<29.9cm (large trees). 78 trees of the campus are large sized trees. 9 trees of the campus are small trees having medium diameters (16.9–26.9cm).

Out of the 87 species identified in the study site all 87 species were treelets, <10m tall. No medium sized trees(10m-20m), canopy species (20-30m) found in the campus. Emergent species (>30m)were not found in the PSKC campus.



Height and Girth class Distribution of trees

DISCUSSION

The canopy of the campus is characterized by mixed species i.e. evergreen as well as deciduous. The most dominant trees in this campus are *Dypsis lutescens (*stem number is counted), *Ficus benjamina*, *Duranta erecta* and Cocos nucifera

CONCLUSION

The Bignoniaceae and Arecaceae were observed to be the most prevalent families. This may be due their plantation.. Arecaceae has the highest number of individuals (stem count). Along with this Moraceae family has second highest number of individuals i.e *Ficus benjamina.*

Out of first four abundant species of the campus three are native species while one is Exotic.i.e., The all native species makes up 72 % of total tree number. This ¾ % of native trees is good as per ecological parameters. But when we go towards deeper ecology, term 'native species' is refined as region or area specific native species. So to achieve sustainability and biodiversity conservation goals, we have to consider area specific native species and not country specific native species.

The campus does not contain medium sized and tallest layer of vegetation. No emergent and canopy trees found. The all tree individuals are treelets. The higher number of individuals have diameter less than 30cm. This indicates that plantation is taken place in recent years.

1. Arecaceae and Moraceae is are the dominant families of the campus.
2. It does not includes Trees of a rare, vulnerable or endangered species
3. This site does not contain tallest layer of vegetation.
4. Campus does not contain Large sized trees.
5. It's good to see that 72% tree species are native to India.
6. Large population of single species i.e. plantation of Palm, Benjamin, Duranta is one of the reasons for low value of evenness (low species variety).

BIRD DIVERSITY

In nature bird occur in a variety of habitats – from deserts to the tropical rain forests; the short dry to the tall wet grasslands and on the alpine meadows in the high altitudes; from sea level to above 4000 meters above sea level; on rocks, cliffs in caves and mud banks; along fresh water estuaries, seas and shores. They also occur on man modified lands such as agricultural fields, airfields, along roadsides and hedgerows and gardens, among human habitations and dwellings.

PSKC College comes under habitat of man modified lands. 14 bird species were recorded from the campus

Sparrow roosting on the compound wall

C DAY AND TIME OF BIRD CENSUS

Date 23rd August 2019, Time of the observations – 7.30 am to 10.30am

D. Behavioral observations

a) Roosting of Rose ringed parakeet (*Psittacula krameri)* was seen on tall trees of *Spathodia campanulata,*

Bambusa.

b) Roosting and nesting of large bulbul birds was seen on *Ficus benjamina* and Duranta trees.

c) Roosting Blue rock pigeons were seen on college buildings and on the well of Nakshatra Garden.

d) White eye (*Zosterops palpebrosa)* was seen on Duranta plantation.

e) Purple sunbird (*Cinnyris asiaticus)* enjoys the nectar of campus flowers.

List of birds reported at PSKC campus

Family	Common Name	*Scientific Name*	PSKC campus
Pycnonotidae	Red vented Bulbul	*Pycnonotus cafer*	4
Zosteropidae	White Eye	*Zosterops palpebrosus*	1
Columbidae	Blue Rock Pigeon	*Columba livia*	3
	Eurasian collared dove	Streptopelia decaocto	2
Cuculidae	Asian Koel	*Eudynamys scolopaceus*	1
	Crow Pheasant	*Centropus sinensis*	**1**
Psittacidae	Parakeet	*Psittacula krameri*	**4**
Muscicapidae	Indian Robin	*Copsychus fulicatus*	**2**
	Tailor Bird	*Orthotomus sutorius*	**1**
Nectarinidae	Purple Sunbird	*Cinnyris asiaticus*	**1**
Dicruridae	House Crow	*Corvus splendens*	**2**
	Common Myna	*Acridotheres tristis*	**3**
Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	2
Apodidae	House Swift	*Apus nipalensis*	4
Passeridae	House Sparrow	*Passer domesticus*	5

a) House Swifts (*Apus affinis)* do roosts on the top floors of College building.

b) Roosting Blue rock pigeons (10-20 in numbers) were seen on college buildings

c) Sunbirds both purple and purple rumped enjoys the nectar *of campus flowers*

PLATE – I BIRDS OF THE CAMPUS

Myna (Acridotheres tristis)

Bulbul (Pycnonotus cafer)

Sunbird (Turdoides malcolmi)

White eye

Small Minivet

BUTTERFLY DIVERSITY

India hosts 1501 species of butterflies (Gaonkar 1996), of which peninsular India hosts 350 and the Western Ghats, 331. The literature on biogeographic distribution and habitat preference indicates that the Satara district may harbor about 153 species. Remaining species are mostly forest dwellers and may not be found in the urban area. Koregaon falls in the relatively species poor drier region of the Maharashtra. There is no specific literature available on Butterflies of Koregaon taluka.

OBSERVATIONS

Common Mormon	*Papilio polytes*	Papilionidae
Common Crow	*Euploea core*	Nymphalidae
Common Tiger	*Danaus genutia*	Nymphalidae
Common Jezebel	Delias eucharis	Pieridae
Common grass yellow	*Eurema hecabe*	Pieridae

Butterflies reported at PSKC college campus

BUTERFLIES OF THE CAMPUS

(Eurema hecabe)

Common grass yellow

Common Mormon (Papilio polytes)

Common Crow (*Euploea core*)

Common Tiger (*Danaus genutia)*

MAMMAL DIVERSITY

In Satara Districts animals like the Gray Langur *Semnopithecus hypoleucos,* Indian Hare *Lepus nigricollis*, Indian Grey Mongoose *Herpestes edwardsii* were sighted abundantly all over the district (covering both the northern Western Ghats and Deccan Plateau) followed by Wild Boar *Sus scrofa,* Asian Palm Civet *Paradoxurus hermaphroditus* and Indian Jackal *Canis aureus*. Mammals like Sahayadri Forest Rat *Rattus satarae,* Sloth Bear *Melurus ursinus* and Four-horned Antelope *Tetracerus quadricornis* were more or less restricted to Western Ghats mountain province of the district. Leopard *Panthera pardus* and Jungle Cat *Felis chaus* were noticed frequently to certain extent in the Western and middle part of the district. The Tiger *Panthera tigris tigris* was seen occasionally at Vasota Fort and Koyna area.

The mammals commonly seen on campus - Bandicoot Rat (*Bandicota indica*), House Rat (*Rattus rattus*),

INDIAN FLYING FOX

Role of bats in maintaining the balance of ecosystem is well known. The Indian flying fox often visit the campus. *Pteropus giganteus* occurs in tropical regions of South Central Asia, from Pakistan to China, & as far south as the Maldive Islands. They usually found flying in evening.

COMMENTS

1. PSKC has attractive good and landscape.
2. The dense tree cover of campus acts as filter to air pollution. Campus trees do acoustic buffering of outside noise and acts as noise barriers. Pure environment and silence zone are prime necessities of any educational institute.
3. Along with maintenance of greenery more focus should be given for mixed plantation. Plantings should include a diverse array of species, genera, and families, of different herbs shrubs and trees. This will provide protected habitat for different faunal species of nearby area.
4. The 72% tree cover of the campus belongs to native tree species. This ¾ % of native trees is good as per ecological parameters. But when we go towards deeper ecology, term 'native species' is refined as region or area specific native species. So to achieve sustainability and biodiversity conservation goals, we have to consider area specific native species and not country specific native species.
5. We can replace some ornamental shrubs or herbs with native (native to Koregaon) and useful one (i.e edible, medicinal species). Some areas should be reserved for plantations which attracts local butterfly species. Vines and bushes with long leave attract birds.
6. An integrated landscape approach can help to reconcile the sometimes-competing objectives of development and environmental sustainability.

Environmental Quality : 5. Soil Quality

Introduction

Knowledge of chemical and physical properties of soils has been assessed to understand the capacity of campus soil to support existing green cover. The concept of soil quality includes assessment of soil properties of campus as they relate to ability of soil to function effectively as a component of a Plant health at PSKC campus. In present study soil quality was assessed to know the capacity of a soil to produce biomass. As front campus is physically locked due to fencing of cement wall, so movement from **outside – campus – outside** is significantly restricted.

Status of soil in Maharashtra

The state of Maharashtra represents a mixed landscape with hill ranges, thick forest cover and coastline. The soils of Maharashtra are residual, derived from the underlying basalts. The land in the river basins of Godavari, Bhima, Krishna and Tapi has a deep layer of fertile black basalt soil rich in humus. The rest of the semi-dry plateau has a medium layer black regur soil which is clayey with high moisture retention capacity, rich in iron but poor in nitrogen and organic matter. The peaks of Sahayadri Mountains, the districts of Ratnagiri and the western regions of Kolhapur and Satara are composed of laterite soil. The Konkan coast has sandy loam soil. A variety of red soil and sandy soil is found in the Vidarbha region. Maharashtra's soils are highly deficient in nutrients when compared with the soils of other Indian states. They are lacking in Nitrogen (N), Phosphorous (P) and Potassium (K) and mainly because farmers in rain-fed areas use very little fertilizers. Further, excessive use of water for irrigation also leads to increasing salinity of soils.

Soil characteristics

In order to assess the soil quality PSKC educational campus, a collective soil samples were taken from different sites. Soil samples between 0-20 cm depths were collected. Collected soil samples are analyzed by using water soluble extract of soil samples.

Physical characteristics

Physical characteristics of soil are delineated through specific parameters, viz, particle size distribution in terms of percentage of sand, slit, clay is presented in table. It is observed that texture of original landscape of PSKC educational complex Sandy Clay Loam.

The bulk density of soil sample in the campus area found to be 1.2 gm/cm^{3,} which is good for plant growth. It is generally desirable to have soil with a low BD (<1.5 g/cm^3) (Hunt and Gilkes, 1992) for optimum movement of air and water through the soil.

Soil porosity is a measure of air filled pore spaces and gives information about movement of gases, inherent moisture, and development of root system and strength of soil. Variation in soil porosity is presented in table. The porosity of soil sample is 45%, which shows moderate water holding capacity.

Sample	%sand	% silt	%clay	Texture	% OM[1]	CEC[2]	BD	Porosity[3]	pH
4	63	17	20	Sandy clay loam	4	42	1.2	45	7.9

Table Physico-chemical analysis of soil samples collected from Campus

Chemical characteristics

pH is an important parameter indicative of the alkaline or acidic nature of the soil. It greatly affects the microbial population as well as the solubility of metal ions and regulates nutrient availability. The pH of original soil of the campus is 7.9 and so is conducive for the growth of plants.

Cation exchange capacity (CEC) determines the storage capacity of nutrients as supplied to plant in exchangeable forms. CEC of the campus soil is 42 meq/100 in the study area is given in table. Very high level of CEC i.e. more than 40 meq/100 normally found in very heavy soils with a high clay content or soils with a high organic matter level. Nutrients can be bound very tightly to the soil particles and availability can be restricted.

Fertility status of the soil

Organic matter present in the soil influences its physical and chemical properties. It commonly accounts for as much as one third or more of the cation exchange capacity of the surface soils and is responsible for soil aggregates. Organic mattes of the campus soil is 4%, which is good for landscaping and gardening.

Recommendations and conclusions

- Soil at different location of the campus is varying in texture and having mixture of native and exotic soil. So soil sample is selected from original landscape area of the campus. It shows that campus terrain has good fertility status and can be used for landscaping and gardening.
- Though the campus soil has enough quantity of Organic matter for Plant growth, improved quantity will help for better Plant growth

Drinking water supply in PSKC College campus

The Primary source of PSKC potable and Non-potable water is borewell water. The College receives its water from well located in the campus. The college treats this well water before using it as potable water. College has water filter to filter borewell water.

Water sampling and analysis

Two drinking water samples were collected from campus premises to assess water quality. One sample was taken from direct well supply and other one was taken from filter. Water before filtration is also sampled to check the quality of non-potable water. This water is used for Laboratories, wash basins, toilets, mopping and irrigation of campus plants.

Source	Sample No.
After filtration	D1

Table Water samples of PSKC campus

Physical parameters such as pH, E.C., TDS, were determined at first. And others are determined by titrimetric methods.

Sample No.	pH	Total hardness	TDS	DO
D1	7.3	56	60	6.1

Table Physical parameters

This table shows the results of physical parameters viz. pH, TH, TDS and DO are in the limits of drinking water parameters

Conclusion and Recommendations

The drinking water (after filtration) quality i.e physical water quality parameters of the PSKC campus are found to be within the specifications for drinking water standards.

It is recommended to college that it should check inorganic parameters viz. Calcium, Sodium, Chlorides and Sulphates. The regular water quality analysis is needed to check the portability of drinking water.

Introduction

Increasing levels of carbon dioxide in the atmosphere are of growing concern globally and locally, and urban forests have a role to play in the battle against climate change. Urban forests can reduce atmospheric carbon directly and indirectly. As long as trees are growing, they remove CO_2 from the air in a process called carbon sequestration, transforming CO_2 into carbon and making use of it to build living matter - leaves, stems, trunk, roots, etc. The Biomass carbon sequestration potential was measured for PSKC campus.

Tree canopy of the campus

The canopy of the campus is characterized by mixed species i.e. evergreen as well as deciduous.

A total of 18 species were recorded belonging to 15 families and 18 genera. Annexure of tree inventory shows the different plant species, their families found in the PSKC college campus. A total of 87 tree individuals (height above 3 meters) species were recorded in the study site. Out of 87 tree individuals only 3 were deciduous trees while rests all were deciduous.

Dominant families recorded in the study area according to descending order (based on number of species type in each family) are Bignoniaceae (3) Aracaceae (3) and in remaining other families only one species is recorded (see Tree inventory Table).

Height and Girth distribution of trees

Assessment of height apart from being one of the most important parameters for calculation in carbon inventory projects along with DBH was considered as a reliable parameter to find out the maturity of a natural or man-made forest for terrestrial sequestration projects.

Out of the 87 species identified in the study site all 87 species were treelets, <10m tall. No medium sized trees(10m-20m), canopy species (20-30m) found in the campus. Emergent species (>30m)were not found in the PSKC campus.

Total biomass assessment

The assessment of above ground and belowground biomass of PSKC campus was carried out within campus

Biomass carbon = (aboveground biomass carbon + belowground biomass carbon)

Conclusion

Total carbon locked in the year of 2019 was 0.08 ton. After considering carbon flux of two years, it can be concluded that 0.1 ton of carbon is locked in the study area of PSKC campus by trees in 2020

7.VEHICULAR EMISSIONS

The emissions inventory is the foundation upon which the regulatory strategy can be formulated. There are many emission sources that contribute to the urban air pollution such as point sources, non-point or area sources, motor vehicles, non-road mobile and natural. Magnitude of contribution from each of the sources depends upon the individual emission rates and the activity level.

The on-road motor vehicle emission inventory can be summarized as the product of an emission rate (e.g., gram/km) and an associated vehicle activity (e.g., km/day).

Survey was conducted to count the vehicles used by PSKC 'ians . Survey was done for one week at 11am 2019.

On an average number of 60 bicycles were counted per day. Around 35 two wheelers are used daily by PSKC students and staff. While 3 four wheelers daily come to the campus.

Amid corona virus outbreak college was shutdown in March 2020 and remains closed for one year. So there was almost zero Vehiclular emissions for one year from March 2020. Following observations were taken in 2019 and are taken for reference to set sustainability goals for college.

Pollutants	Emissions Factor	Number of Vehicle/ day	Emissions (gm/km)	Average Travel (km)	Total Emissions per day
CO	1.4	35	49	10	490
HC	0.7	35	24.5	10	245
NOx	0.3	35	10.5	10	105
PM	0.05	35	1.75	10	17.5
CO2	33.83	35	1184	10	11840

Total emissions by two wheelers

If we consider CO2 emissions only, we can see that 11840 gm/day of CO2 is emitted by two wheelers of PSKC campus. So the CO2 emitted by two wheelers per year is,

gm/year = 2.97 **tones/year**

Pollutants	Emissions Factor	Number of Vehicle day	Emissions (gm/km)	Average Travel (km)	Total Emissions per day
CO	4.3	3	12.9	10	129
HC	2.05	3	6.15	10	61.5
NOx	0.11	3	0.33	10	3.3
PM	0.08	3	0.24	10	2.4
CO2	72.50	3	217.5	10	2175

Table Total emissions by Four wheelers

Emission factors by four wheelers are higher than two wheelers. So the emissions per vehicles are also high as compared to two wheelers. If we consider CO2 emissions only, we can see that 2175 gm of CO2 is emitted by two wheelers of PSKC campus. So the CO2 emitted by two wheelers per year is,

= **0.5 tones/year**

Total Emissions by PSKC vehicles per year = 2W + 4W = 2.97 + 0.56 = 3.53tones/year

From above figure it can be analyzed that though the number of 4W are less as compared to 2W, they do notable contribution in total CO2 emissions of the campus.

CARBON DIOXIDE EMISSIONS AND ITS ASSIMILATION BY CAMPUS TREES

In green audit college has also assessed carbon sequestration by campus trees.. And carbon flux shows that campus plants have capacity to absorb/sequester around 0.03 tons of carbon this year. This capacity gets increased by every year.

If we quantify CO2 flux of 2020 to carbon dioxide,

0.1 tones of Carbon = 100 kg of carbon

To determine the amount of CO2 that the trees removed from the atmosphere, we have to multiply the carbon value by 3.67. This value is the mass conversion factor for carbon to carbon dioxide.

100 kg of carbon * 3.67 = 367 kg of CO2 = 0.367 tones CO2 per year So it can be concluded that campus trees has capacity to assimilate 0.367 tonnes of CO2 per year.

While the vehicular emissions study showed that total emissions of PSKC vehicles (2019) is 3.53 tones/year. This value is 9.67 times greater than Carbon dioxide assimilation capacity of campus trees. In 2019 this ratio was 12 times greater than carbon sequestration.

ENERGY AUDIT

ENERGY SCENE

Primary source of energy at PSKC is electricity. Electricity is used for all electrical appliances like lighting, fan, pumps, computer and lab instruments. Also water is used for drinking, domestic & gardening purpose.

ENERGY: SOURCES & UTILIZATION

Primary energy / natural resources utilized at the service center are electricity & water. These sources are consumed for the generation of motive power and water for drinking, washing & domestic usage, gardening respectively. The source of electrical power for the service center is from MSEDCL grid

Objectives

- Collect historical data to analyze background activities
- Collect & analyze monthly billing data & energy consumption data for the period of one year.
- Review on billing demand, load factor, etc. and suggest method to reduce maximum demand

Monthly Electricity Consumption of College building Electricity bill analysis

Meter number 192271713653 March –December 2020

Sr. No.	Parameter	Value	Unit
1	Contract Demand	-	kVA
4	Avg. Unit Consumption (electricity audit)	3	kWh/Months
5	Avg. Unit Consumption (electricity bill)	3	kWh/Months
	Avg. monthly bill	2497	Rs/month

Monthly Electricity Consumption of College building Electricity bill analysis

Meter number 192271715095 March –December 2020

Sr. No.	Parameter	Value	Unit
1	Contract Demand	26	kVA
4	Avg. Unit Consumption (electricity audit)	11.2	kWh/Months
5	Avg. Unit Consumption (electricity bill)	12.7	kWh/Months
	Avg. monthly bill	2900	Rs/month

Average monthly MSEDCL unit's consumption as per electricity audit is 4 units and 11.2 respectively.
Average monthly MSEDCL unit's consumption as per electricity bill is 3 units and 12.7 respectively.

WATER

For water quantification there is no any metering system available at building section.

Water flow meter has to install at all major water line for recording consumption of water.

LEVEL OF AWARENESS

The level of awareness for energy conservation in top management is high since they are using star rated lighting, fan & other electrical appliances. College should organize different training programs for general awareness. Trainings on energy conservation are not found on records. It should be ensured that everyone knows the operating energy conservation parameters

The electricity bill consists of following parts

- Demand charges
- Unit charges•
- Time of Day Charges
- Other charges, which cannot be controlled
- Load factor is an indicator to assess if the billed maximum demand charges can be reduced. The monthly load factor is calculated as follows:

Renewable Energy - Wind-solar hybrid energy system

Along with MSDCL Electricity College has Wind-solar hybrid energy system. This system is provided by Unitron Energy Systems Pvt. Ltd, Pune. But currently this system is not in use due to technical error in it. Otherwise it should have provided around 10KW energy to the College. Technical details of the system are as follows.

1.	**System Details**	
	a) MNRE Sanction No. and date	23/01/2009-SWES, dt 16/04/2012
	b) Capacity of the system (KW)	10KW
	Aero generator Component (KW)	6.4KW
	SPV Component (KW)	3.6KW
	c) Name of Manufacturer / Supplier	"UNITRON"
	d) Commissioning Date	08/05/2012
2.	**Estimated Energy Requirement**	
	a) Type of load	
	b) Usage Time (hours)	6 to 9 hours
	c) Quantity	-
	d) Per Day Energy Requirement (kWh)	30 to 45 kWh / day
3.	**Technical Details of the System Installed**	
	a) Aerogenerator	
	Total Capacity	6.4KW
	Capacity of single machine	3.3KW
	No, of Machines	2 Nos.
	MNRE's reference No. / date of issue of inclusion in MNRE list	C-WET/R&D/EMPL/2010-11/02 Dt. 25/06/2010
	Rated wind speed	10.5m/s
	Rated Peak power	3600 watts
	UIN of each aero generator	UE/MAH/361/080512 UE/MAH/362/080512
	Voltage controller	Automatic
	Over speed protection	Through frequency, voltage and angle furling
	b) SPV Modules	

	Total Capacity	3.6KW
	Capacity of each module	300Wp
	Nos. of SPV Modules	12Nos.
	Peak power per module	300 Wp
	Weight	29kgs
	Dimension	1955 X 990 X 42MM
	Temperature	- 40 to + 90 Deg. C.
	Wind load	Up to 200 kmph
	c) No. and Place of Installation of Energy Meters	2 Nos. In the control room
	d) Battery Bank	
	Total Energy Consumption / day	30 to 45 kWh
	Voltage configuration	96V
	Power factor	0.8
	Battery efficiency	75%
	Depth of discharge	50 to 60% typical
	Battery capacity required	600AH
	e) Inverter	Pure sine wave
	Total Load	4KW
	Power factor	0.8
	Inverter efficiency	Approx. 90%
	Inverter capacity required	5KVA

Total cost of the project is 24.2 lacs. Ministry of New and Renewable Energy, Government of India has given subsidy of 15.00 lacs and remaining funds was given by the mother institution.

- **Usage:** Per day energy requirement of the institution is 15 to 25 kWh. This energy has been utilized for office, library, computers, and other electrical and electronic equipments.
- **Benefits:**
    - System gives un-interrupted power supply to the campus.
    - It helped us to promote ICT enabled short duration certificate courses.

* Compal=ny support our sister concerns with the excess power back-up.
* It has helped the teachers and students to have an unprecedented teaching learning experiences with the use of information and communication technology without any power snag.

. Recommendations

1. College should conduct awareness programmes about energy saving
2. College should reduce its dependence on conventional energy sources and should choose the option of clean fuel i.e. nonconventional energy sources. To achieve this AES strongly suggest the repair of Wind-solar hybrid energy system. College should plan to set up Solar energy unit. Those practices will help to reduce energy footprint of the college
3. There is little gap between energy consumption calculated from Electricity audit and Electricity bill. It indicates the little Energy wastage. But amid corona virus outbreak college was shutdown. And due to this we can see the very little Energy wastage. According to past audit there was a wide gap between Energy audit and Energy bill. So College should conduct awareness programs about energy saving.
4. College should do water pumping in the hours of 4am to 6 am OR 10pm to 12pm to minimize its unit charges.

- Make an energy-savings plan and allow all staff to contribute to it. When they see their ideas are put in an action plan, it will motivate them to closely follow the action plan and laid out procedures to help reduce energy consumption.
- Hold energy-saving contests. Encourage employees to honestly and accurately track their energy-usage in the workplace, and award employees who have provenly reduced their consumption.
- Ensure all staff and students are taught about new energy-saving equipment, sensors, and practices. Only with accurate and proper knowledge can staff really understand the why and apply an energy-saving mindset.