

GREEN AND ENVIRONMENTAL AUDIT REPORT 2022

Prepared for
Amdar Shashikant Shinde College, Medha

Prepared by
Adya Environmental services, Baramati

24th May 2022

Adya Environmental Services


Proprietor

INDEX

Audit

1. Solid Waste Audit
2. Water Audit
3. Noise Audit
4. Biodiversity Audit

Carbon accounting

- A. Carbon Sequestration
- B. Carbon Emissions by campus

Energy Audit

Annexures

1. Soil Quality Report
2. Water
3. Butterfly Photographs



Adya Environmental Services

FLAT NO 1 WING A MUKTI PARK, VANJARVADI, BARAMATI, PUNE- 413102

Reg No : 1931000312846203

Contact no: 9096132521 aeservingfuture@gmail.com

We dare to walk thin green line

Date: 24th May 2022

To,
The Principal
Amdar Shashikant Shinde College,
Medha.

Subject: Detailed Environmental, Green and Energy Audit at your College.

Respected Sir,

Based on field visit, Environmental baseline data collection, field study and our discussion, we are pleased to submit herewith Combined Green Environmental and Energy Audit Report. We are thankful for your timely help and contribution towards making this Report.

Thanking you

Rupali A More

Adya Environmental Services


Proprietor

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/Environmental audit represents the first stage in 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 & 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 ASSM faculty and students & gathered all the necessary information about baseline environment of the college. That covered soil quality, water quality assessment, biodiversity assessment of the campus. AES has also conducted Energy audit of the campus. Noise 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. Carbon sequestration and carbon emissions study is also performed. 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 Plastic free campus, composting, reduction of waste to move towards becoming environmentally sensitive & a more sustainable campus.

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

Garden waste is the main contributor of campus solid waste by volume. Every week near about 6000 to 7000 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 the solid waste volume.

As an educational institute, college's paper and hard paper waste like cardboard, paper covering, printing paper is also high. It accounts for near about 25% by volume. ASSM 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. College staff and students bring back their food waste (Tiffin waste) to their home. Waste from Microbiology lab practicals are first sterilized and then disposed off according to their degradable and biodegradable nature.

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	Biomass + other	E-waste
Library	60	80	3	35	10	NEG	NEG	10
Office area	130	50	3	25	30	NEG	25	20
Classrooms	60	20	2	120	10	250	30	NEG
Total	250	150	8	180	50	250	55	30

TABLE 2 WEEKLY DPT WISE SOLID WASTE GENERATION OF COLLEGE IN GM APX

Departments	Paper	Hard paper	Polythene	Hard Plastic	Glass	Chalks	Steel	Garden	E - waste
Chemistry	140	200	3	150	150	40	3	10	20
Zoology	20	30	2	50	30	30	2	10	10
Botany	30	30	2	40	20	40	2	1000	10
Computer lab	60	40	2	70	10	30	2	10	60
Microbiology	20	30	2	20	30	30	2	10	10
Others	50	30	1	20	30	40	5	10	10
Total	320	360	12	350	270	210	16	1050	120

TABLE 2 WEEKLY SOLID WASTE OF NON-BUILT-UP OF COLLEGE CAMPUS APX (GM)

Place	Paper	Hard paper	Polythene	Hard Plastic	Glass	Chalks	Garden waste	E-waste
-------	-------	------------	-----------	--------------	-------	--------	--------------	---------

Solid Waste of non built-up area	-	100	-	100	10	10	2000 (depends on the	-
-----------------------------------------	---	-----	---	-----	----	----	-------------------------	---

(Please note that Waste Computers and Instruments are not included here. Culture media and other organic waste from practicals is not included here.

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 and Sanitary pads are the third and fourth main contributors. If we differentiate between degradable and biodegradable waste biodegradable waste shows a very large figure compare to Non – degradable waste (glass, electronic, waste, and plastic).

Weekly Biodegradable waste of college is 5-6 kg while non biodegradable waste of campus comparatively small and is 1-1.5 kg. But these are non-biodegradable substances and disturb natural processes. So College should take steps towards waste reduction, reuse and recycling to make its campus more Eco-friendly.

	Waste Type	Percentage
1	Paper	25 %
2	Hard paper	2 %
3	Garden waste	65 %
4	Hard plastic	3%
5	Polythene	2 %
6	Glass	1 %
7	Electronic waste	2%
8	Miscellaneous	1%

	Waste Type	Weight (gm)
1	Paper	570
2	Hard paper	610
3	Polythene	20
4	Hard Plastic	630
5	E – waste	400
6	Glass	330
7	Chalks	470
8	Garden waste, Organic waste	3055
9	Miscellaneous	200
10	Sanitary pads	700

Table Visual analysis of Waste (apprpx)

KEY STEPS BY COLLEGE TO REDUCE WASTE AT SOURCE WASTE

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.

GLASS, PAPER AND HARD PLASTIC

Currently Medha Nagarpanchayat collects this waste from College. On an average 650g of hard plastic and plastic is weekly disposed off by campus. College reduces its Non-biodegradable waste by notable Ecofriendly ways. Approx 1180 gm of paper and hard paper waste goes to dustbin every week. On an average 330 gm of glass goes to waste. College staff reuses some of paper in for their daily office work. College gives remaining paper waste for reuse to other vendors like Raddiwala. For other waste separate storage are provided.

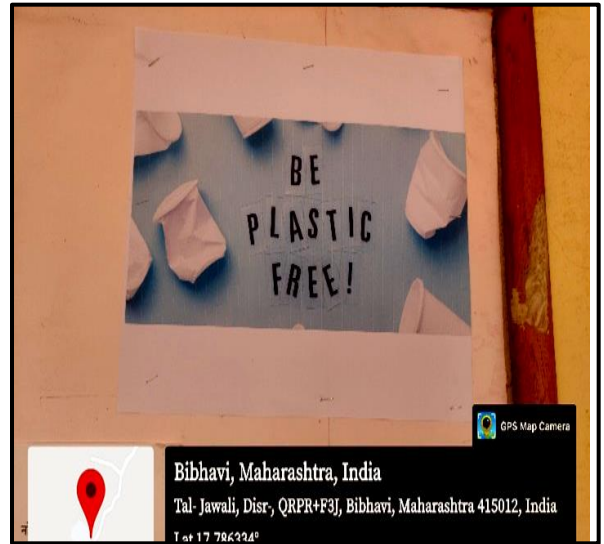


Glass and plastic waste



Non-reusable Paper waste

College
reduces
its
Non-
biodegradable
waste
by



notable Ecofriendly ways. Glass and plastic waste

later segregated and handed over to recycler. And Non-reusable Paper waste is collected by Medha nagarpanchayat. College has proved that one can avoid using plastic utensils with a little effort.

College has banned the use of plastic cutleries. Instead stainless steel plates, spoons and ceramic cups are used in college and college canteen.

Reusable Cutleries

ORGANIC WASTE

Ban on use of Plastic

Organic waste of this college mainly includes garden waste. Other is paper, hard paper, cotton waste etc. Weekly on an average approx 3000gm of garden waste (depending on season) is removed from college premises plus other organic waste (other than gardening area) which further goes to compost treatment. Garden maintenance is done once in a month. And this waste also goes to compost unit. College takes every possible step like reduce, reuse before giving organic waste for recycle and disposal. Medha nagarpanchayat collects college's degradable and non biodegradable waste.

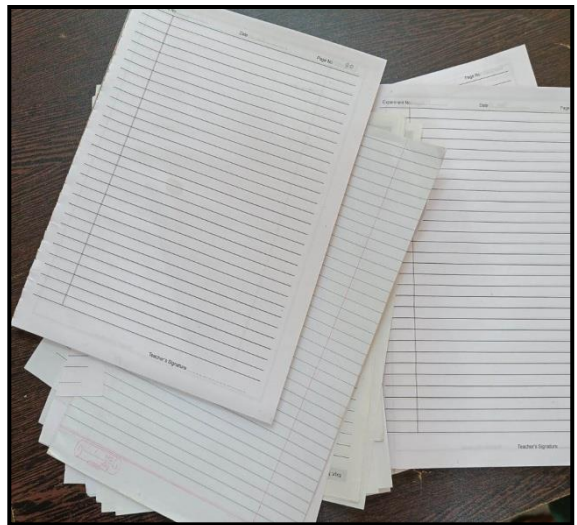
Cotton plugs, threads reused autoclaving

Unused journal papers reused

Biological technique is most appropriate technique for organic and high-moisture wastes. It includes two main processing mechanisms composting and anaerobic digestion/ bio-methanation. So ASSM recycle its waste through composting.

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 ASSM use 'use and throw' type pens. This adds near notable quantity of hard plastic to solid waste per year.




ELECTRONIC WASTE

A 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	<i>Common practices</i>
	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)
	Bury 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.

So if we see the chart of UNSAFE to SAFE practices i.e burning and use of small incinerators is comparatively safe option. Currently college is using burning option. It is done at a distant place and under complete observation (till complete burning of the sanitary waste).

RECOMMENDATIONS

ASSM College should improve its Waste Management Plan 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 Urali Kanchan region:

According to government reports wells in Haveli tehsil are ranging in depth from 24.50 to 201.30 m bgl and the zones have been encountered in the depth range of 4.50 to 158.0 m bgl. The discharge of these wells varies from traces to 12.88 liters per second and static water level varies from 2.54 to 22.52 m bgl. Haveli tehsil falls in moderate rainfall intensity zone. The decadal rainfall average of the Urali Kanchan area is 897.67mm which is slightly higher than pune city. . It is observed that the concentration of high EC more than 3000 has been observed in isolated wells in Haveli tehsil.



Figure: Main Water Tank of ASSM College

WATER SUPPLY OF ASSM CAMPUS

The Primary source of ASSM potable and Non-potable water is Kanher dam water. Kanher dam is an earthfill and gravity dam on Wenna river near Satara. The Dam water filtration unit is located in the vicinity of College. The filtered dam water is collected on top of the hill. This filtered potable dam water is supplied by gravity flow to Medha town and six villages around it. College has cement tank of 20000L capacity. From this tank water is distributed to water tanks of different capacities. One 1000L capacity water tank is placed on Ladies washroom. While two tanks of 500L capacity are placed on gents washroom. There is direct water supply for other water demanding areas from main tank of 20000L capacity. College gets and distributes its water supply through gravity based storage system and there is no electricity required for the same. There is no measurement system available for ASSM's daily water use. We couldn't calculated the daily water requirement as there is no electric pumping system available.

WATER USAGE

ASSM 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 telephonic survey of third year students was conducted.

Water users (2021-2022)	Number
Students - Senior college	1059
Teaching staff	33
Non teaching staff	13
Average number of daily visitors	2
Total	1107

Table 8 Total water users of the ASSM 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

There are three drinking lines in college. In total there are 4 Washroom blocks in the building, which includes 2 for staff (one for Gents and one for ladies) and 2 for students (1 for boys and 1 for girls). Out of these students washroom toilet block is located on the ground.

	Use	Flow rate
1	Drinking	-
2	Toilet	25s/liter
3	Basin	38s/liter
4	Chemistry lab	34s/liter
5	Botany/Zoology/ Microbiology lab	22s/lire

WATER CONSUMPTION CALCULATION

I. POTABLE WATER CONSUMPTION (DAILY)

College uses filtered well water for potable water use

CALCULATION ON THE BASIS OF QUESTIONNAIRES AND FLOW RATES

i. Daily potable water consumption by staff and students: $1107 \times 1 = 1107$ liters/day

Total water use of drinking water is = 1107 liters/day

2. NON POTABLE CONSUMPTION FROM CAMPUS WELL (DAILY)

College uses Well water directly for non potable water use

CALCULATION ON THE BASIS OF QUESTIONNAIRES AND FLOW RATES

i. Water used for flushing by students & staff $1107 (2021-2022) \times 2$ liters = 2214 liters/day

ii. Water use for mopping of Main office area = Water per washing of wiper \times Number

of washing = $100 \text{ liter} \times 1 = 100$ liters/day

iii. Water used for hand and face washing = Average time the tap left open \times Number of times the hand and face washed) \times Average flow rate of taps per second
 $= 10 \text{ seconds} \times 2 \text{ times} \times 0.1 = 2$ liters per capita

So, Total non potable water use by students and staff for hand and face washing = $1.5 \text{ liters} \times 1107 = 1660$ liters.

Science lab requirement is approximately 300 liters per day

So, the total water use for flushing and washing = 2214 + 100 + 1660 + 300 = 4274 liters/day

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

* College fulfills its irrigation and canteen water demand directly from bore well water, so this use is not included.

OVERALL WATER CONSUMPTION

Therefore based on the above recordings, monitoring and calculation, the total potable water consumption for ASSM College is 1107 lit/day and non potable water consumption is 6973 liters/day. Overall water consumption is 1702 + 4274 = 5976 liters per day. If gardening is excluded, then the per capita use for non potable water is around 6 liters day.

	Heads	Water use (in liters)
2	Total calculated water consumption from the water audit	5976

Table Total water supply and use at ASSM College

DATA COMPARISON AND ANALYSIS

There may be some variation/difference in the average amount of water that is pumped to the overhead tanks every day for various purposes and the average water consumption calculation.

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 some staff and students living in nearby areas, they also don't use the college washrooms. Some of them bring drinking water from home.

WASTE WATER GENERATION BY ASSM

Every building generates waste water amounting to almost 80% of total water consumed. The major source of ASSM waste water includes grey water from wash basins, lab basins, and black water from toilets. Out of that Black water of ASSM toilets goes sewer lines

ESTIMATION OF WASTE WATER GENERATED BY ASSM

Waste water generated = 80% of water used

So, waste water generated by ASSM based on water audit

= 80% of 4780 liters per day = **4780 liters/day**

THE KEY WATER CONSUMING AREAS

SCIENCE LABS

Science Lab is the highest water demanding area of the campus. There are 4 labs which use high amount of water. Water provided for these labs comes from the well of combined well water source. Out of these labs the water demand of chemistry lab is high due to number of students admitted to this subject and the type of practical's they perform. To arrive at total water use/loss of water from the basin taps by staff & students and to get the idea of water losses due to high pressure, flow rate was computed using the 500ml Beaker test by recording the time taken to fill the bottle, which was then used to compute flow at l/s.

TOILETS: Water consumption is more for flushing application in any building. College has single flushing system in Toilets

IRRIGATION/WATERING OF CAMPUS PLANTS

Plants in the garden are watered in between in the evening to reduce evaporation losses.

CONCLUSION AND RECOMMENDATIONS

1. The water meter should be installed for ASSM's senior college at the inlet of well water and This installation will give correct amount of well water used by ASSM's
2. The installation of water meter 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.
3. **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.

4. **WATER TAPS** College taps works 5-40 seconds per liter. Use of low flow faucets along with other water saving devices such as auto control valves, pressure reducing devices, aerators wherever possible will minimize wastage of water.

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.

LOCATION OF ASSM

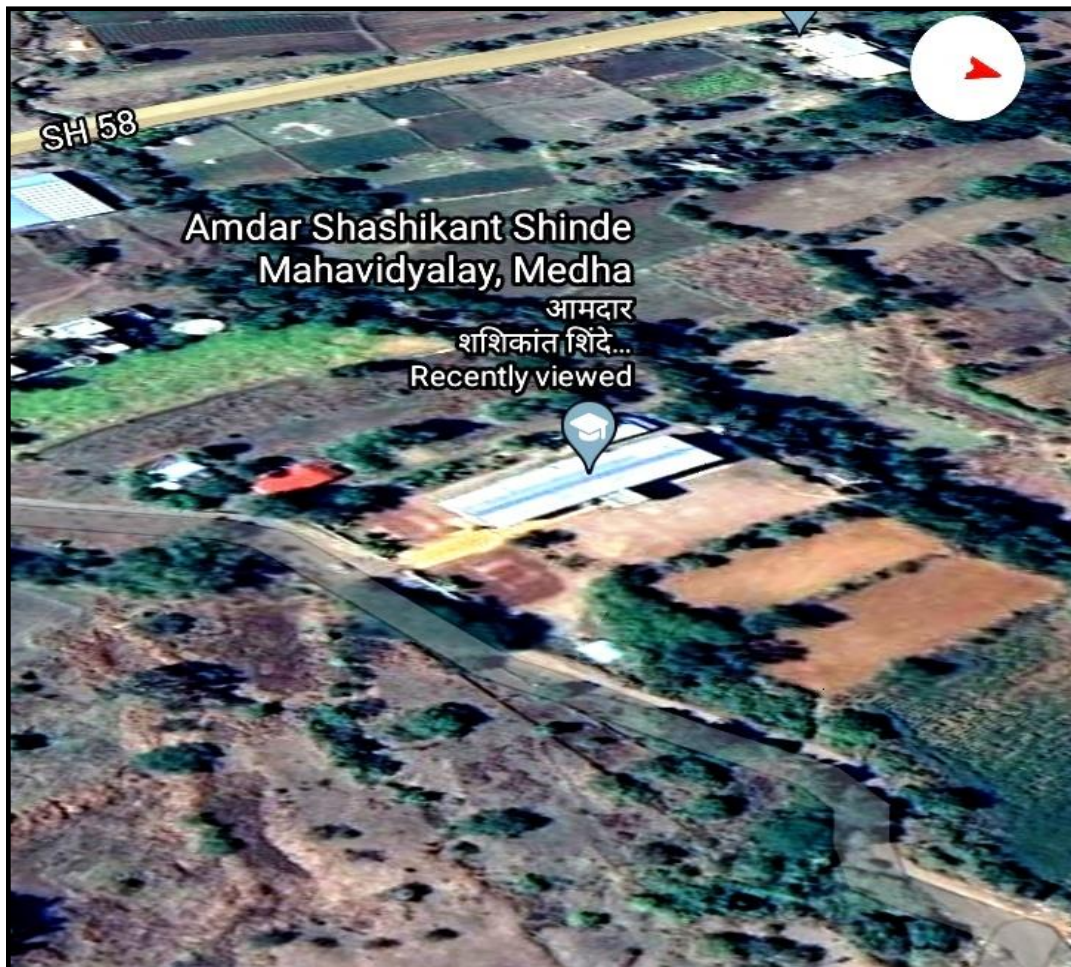


Figure: Noise free location of ASSM, Medha

DISCUSSIONS

The location of ASSM is ideal location for educational institutes. This college is surrounded by green farms, vegetations and hilly wider area. They act as buffer zone to outside noise.

In north ASSM is at a distance of about 180 meter from Satara-Medha-Mahabaleshwar road (SH-58) . educational complex. College is at a distance of 1.8km from Medha. So there is no effect of road and town traffic.

Parking area of any educational institute is notable noise producer. But here in ASSM, vehicular parking is located outside the college premises. Moreover this gap between parking area and college building is covered by canopy of Trees.

Out of 10 average noise recordings at SITE I near college entrance. Almost all noise levels observations falls within standards, though it is near parking area of campus. The laid down noise monitoring standard for commercial zone is 50 dB (A) for a day time.

Site II is at the building area of the college campus. 0 observation exceed the noise standard. 0 noise level recordings exceeds noise standard.

SITE III location is on the ground of the college. Only 2 observation exceeds the silence zone standard of CPCB.

We have taken the samples in free field where there are no reflected sound waves. So this clears that the Noise level decreases towards classroom areas.

COMMENTS

- Silence is an important factor in education. ASSM campus is an ideal place for education as it follows the standards of CPCB.
- 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 wide distance from road noise of Satara-Medha-Mahabaleshwar road (SH-58).
- College is at a distance of 1.8km from Medha. So there is no effect of town traffic.

ABUNDANCE A total of 42 genera were recorded in the study site. *Polyalthia longifolia* (Moraceae) having 11 individuals was the most abundant Tree species. This was followed by the species *Acacia nilotica* (Fabaceae), *Mangifera indica* (Anacardiaceae), *Ficus variegata* (Moraceae) having 4 individuals each.

RELATIVE ABUNDANCE OF TREES AND SMALL TREE SPECIES

Tree inventory shows the different species found in the study sites and their relative abundance. In this site, 58 individuals were sampled. The species with the highest number of individual was *Polyalthia longifolia* with a relative abundance of 18%. It was followed by *Acacia nilotica* (Fabaceae), *Mangifera indica* (Anacardiaceae), *Ficus variegata* (Moraceae) with relative abundance of 6.8% each.



Figure Backside view of the College building showing vegetation

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 *Polyalthia longifolia*, *Acacia nilotica*, *Mangifera indica*, *Ficus variegata* with relative abundance of 6.8% each.

The Fabaceae were observed to be the most prevalent family. This may be due their plantation, good survival rate and adaptability. Along with this highest number Annonaceae family individuals were recorded. This also attributes to massive plantation of those Annonaceae family species.

Out of first four abundant species of the campus three were native species while one is exotic to India. The four native species alone makes up 32.75 % of total tree number. So roughly we can say that more than large tree cover of the campus is under cultivation of native species and which is good sign for biodiversity of the study area and nearby area.

The campus does not contain tallest layer of vegetation. No emergent and canopy trees found.

CONCLUSION

1. Fabaceae is the dominant family and *Polyalthia* is the dominant species of this area.
2. It does not includes Trees of a **rare, vulnerable or endangered species**
3. This site does not contain tallest layer of vegetation
4. Considerably more population of few species is one of the reasons for low value of evenness

Total Plant List of ASSM campus (name with Family)

B. N.	<i>Ficus sp.</i>
Family	Moraceae
B. N.	<i>Thuja compacta</i>
B. N.	<i>Manilkarazapota (L.) Van.</i>
Family	Sapotaceae
B. N.	<i>Mangiferaindica L.</i>
Family	Anacardiaceae
B. N.	<i>Micheliachampaca L.</i>
Family	Magnoliaceae
B. N.	<i>DurantaplumeriJaca.</i>
Family	Verbenaceae
B. N.	All Spices
B. N.	Plam

B. N.	<i>Bauhinia recemosa</i> Lamk.
Family	Caesalpinaceae
B. N.	<i>Mimusops selengi</i> L.
Family	Sapotaceae
B. N.	<i>Lagerstroemia reginae</i> Rosb.
Family	Lytharaceae
B. N.	<i>Spathodiacampanulata</i> P. Beaun.
Family	Bignoniaceae
B. N.	<i>Hibiscus rosa-sinensis</i> L.
Family	Malvaceae
B. N.	<i>Jasminum sambac</i> (L.) Ait.
Family	Olaceae
B. N.	<i>Ixoracoccinea</i> L.
Family	Rubiaceae
B. N.	<i>Lawsonia inermis</i> L.
Family	Lytheraceae
B. N.	<i>Costus speciosus</i> (Kone.) J. E. Smith
Family	Zingiberaceae
B. N.	<i>Cassia fistula</i> L.
Family	Caesalpinaceae
B. N.	<i>Catherathus roseus</i> (L.) G. Don.
Family	Apocynaceae
B. N.	<i>Vetiveria zizanioides</i> (L.) Nash.
Family	Poaceae
B. N.	<i>Asparagus racemosus</i> var. <i>Javanica</i>
Family	Liliaceae
B. N.	<i>Agave Americana</i> Var. <i>marginata</i>
Family	Agavaceae
B. N.	<i>Acalypha hispida</i> Burm. F.
Family	Euphorbiaceae
B. N.	Rhoeospathaceae (Sw.)
Family	Commelinaceae

B. N.	<i>Pterospermumreticulatum</i>W. & A
Family	Sterculiaceae
B. N.	<i>Drypetesroxburghii</i>(Wall). Huru.
Family	Euphorbiaceae
B. N.	<i>Garcinicaindica</i>Choiss.
Family	Clusiaceae
B. N.	<i>Calophylluminophyllum</i> L.
Family	Clusiaceae
B. N.	<i>Vaticachinensis</i>L.
Family	Dipterocarpaceae
B. N.	<i>Dysoxylumbinectariferum</i> (Roxb.) Hook
Family	Meliaceae
B. N.	<i>Sterculiafoetida</i> L.
B. N.	Sterculiaceae
B. N.	<i>Pterospermumreticulatum</i>W. & A
Family	Sterculiaceae
B. N.	<i>Drypetesroxburghii</i>(Wall). Huru.
Family	Euphorbiaceae
B. N.	<i>Garcinicaindica</i>Choiss.
Family	Clusiaceae
B. N.	<i>Calophylluminophyllum</i> L.
Family	Clusiaceae
B. N.	<i>Vaticachinensis</i> L.
Family	Dipterocarpaceae
B. N.	<i>Dysoxylumbinectariferum</i> (Roxb.) Hook
Family	Meliaceae
B. N.	<i>Sterculiafoetida</i> L.
Family	Sterculiaceae
B. N.	<i>Pterospermumreticulatum</i>W. & A
Family	Sterculiaceae
B. N.	<i>Drypetesroxburghii</i>(Wall). Huru.
Family	Euphorbiaceae

B. N.	<i>Hibiscus rosa-sinensis</i> L.
Family	Malvaceae
B. N.	<i>Hibiscus rosa-sinensis</i> L.
Family	Malvaceae
B. N.	<i>Hibiscus rosa-sinensis</i> L.
Family	Malvaceae
B. N.	<i>Punicagranatum</i> L.
Family	Punicaceae
B. N.	<i>Jasminumsambac</i> (L.) Ait.
Family	Olaceae
B. N.	<i>Pimentaofficinalis</i> L.
Family	Myrtaceae
B .N	<i>Manikarazapota</i> (L.)
Family	Sapotaceae
B .N	<i>Manikarazapota</i> (L.)
Family	Sapotaceae
B. N	<i>Gloriosasuperba</i> L.
Family	Liliaceae
B .N	<i>Ricinuscommunis</i>
Family	Euphorbiceae
B. N	<i>Terminalia catappa</i>
Family	Combretaceae
B .N	<i>Mangiferaindica</i>
Family	Anacardiaceae
	Fan pam
B. N	<i>Pongamiapinnata</i>
Family	Fabaceae
B. N	<i>Azadirachtaindica</i> Juss.
Family	Meliaceae
B. N	<i>Agave angustifolia</i> Haw.,syn.
Family	Agavaceae
B. N	<i>Calliandraemarginata</i> Bth.
Family	Mimosaceae
B .N	<i>Mangiferaindica</i>

Family	Anacardiaceae
B. N.	<i>Vitisquadrangularis</i> Gaertn.
Family	Vitaceae
B. N.	<i>Durantaplumeri</i> Jaca.
Family	Verbenaceae
B. N.	<i>Sygygiumcumini</i> (L.)
Family	Myraceae
B. N.	<i>Rhoeospathacea</i> (Sw.)
Family	Commelinaceae
B. N.	<i>Rhoeospathacea</i> (Sw.)
Family	Commelinaceae
B. N.	<i>Rhoeospathacea</i> (Sw.)
Family	Commelinaceae
B. N.	<i>Thujaoccidentalis</i>
Family	Cupressaceae
B. N.	<i>Grevillea robousta</i>
Family	Protaceae
B. N.	<i>Araucaria heterophylla</i>
Family	Araucariaceae
B. N.	<i>Cycasrevoluta</i>
Family	Cycadaceae
B. N.	<i>Cycasrevoluta</i>
Family	Cycadaceae
B. N.	<i>Grevillea robousta</i>
Family	Protaceae
B. N.	<i>Thujaoccidentalis</i>
Family	Cupressaceae
B. N.	<i>Ficuselastica</i>
Family	Moraceae
B. N.	<i>Ficuselastica</i>
Family	Moraceae
B. N.	<i>Ficuselastica</i>

Family	Moraceae
B. N.	<i>Ficuselastica</i>
Family	Moraceae
B. N.	<i>Ficuselastica</i>
Family	Moraceae
B .N	<i>Livistoniachinesis</i>
Family	Araceae
B .N	<i>Livistoniachinesis</i>
Family	Araceae
B. N.	<i>Livistoniachinesis</i>
Family	Araceae
B. N.	Nerium oleander
Family	Apocynaceae
B. N.	Nerium oleander
Family	Apocynaceae
B .N	<i>Mangiferaindica</i>
Family	Anacardiaceae
B .N	<i>Mangiferaindica</i>
Family	Anacardiaceae

BIRD DIVERSITY

In nature birds 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.

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

C DAY AND TIME OF BIRD CENSUS

Date 23rd March 2022, Time of the observations – 7.00 am to 10.30am

Common Name	Scientific Name	College campus
Brahmni Kite	<i>Haliastur Indus</i>	1
House swift	<i>Apus nipalensis</i>	4
Brahmni myna	<i>Sturnia pagodarum</i>	3
Blue kingfisher	<i>Alcedo meninting</i>	1
Grey hornbill	<i>Ocyrceros birostris</i>	2
Red vented bulbul	<i>Picnonotus cafer</i>	5
House Crow	<i>Corvus splendens</i>	3
Common Myna	<i>Acridotheres tristis</i>	4
Black drongo	<i>Dicrurus macrocercus</i>	1
Grey heron	<i>Ardea cinerea</i>	1
Owlet	<i>Athene brama</i>	2

Table List of birds reported at ASSM campus

METHODOLOGY

Direct count method was used to count the birds of campus.. The area was divided to record the number of birds in each part. The divisions were clearly demarcated by landmarks so they can be used subsequently for the same purpose. The observations included the species/common name of the bird, number of individuals observed.



Figure Side view of the College building showing vegetation

BUTTERFLY DIVERSITY

India hosts 1501 species of butterflies (Gaonkar 1996), of which peninsular India hosts 350 and the Western Ghats, 331. Remaining species are mostly forest dwellers and may not be found in the urban area. There is no literature available on butterflies of Medha.

(For Butterfly Photographs See Annexure)

OBSERVATIONS

Common name	Scientific name	Family
Tailed jay	<i>Graphium Agamemnon</i>	Papilionidae
Common Mormon	<i>Papilio polytes</i>	Papilionidae
Common tiger	<i>Danaus genutia</i>	Nymphalidae
Common crow	<i>Euploea core</i>	Nymphalidae
Lemon Pansy	<i>Junonia lemonias</i>	Nymphalidae
Common grass yellow	<i>Eurema hecabe</i>	Pieridae
Grass dart butterfly	<i>Taractocera maevius</i>	Hesperiidae
Peacock pansy	<i>Junonia almana</i>	Nymphalidae
Red pierrot	<i>Talicauda nyseus</i>	Nymphalidae

Table Butterflies reported at ASSM college campus

REPTILES OF THE CAMPUS

Pheretima posthuma, and earthworm of *Lumbricus* genus is found in the campus. Other reptiles like Garden Lizard (*Calotes versicolor*), House Gecko (*Hemidactylus flaviviridis*), Satara Gecko *Hemidactylus Satarensis*, Worm snake *Indotyphlops braminus* is also seen in the campus.

Along with this following reptiles are cited in the vicinity of College campus

Checkered Keelback *Fowlea piscator*

Common Indian Krait *Bungarus caeruleus*

Spectacled Cobra *Naja naja*

Russell's Viper *Daboia russelli*

Saw Scaled Viper *Echis carinatus*

Bamboo Pit Viper *Craspedocephalus gramineus*

Banded Kukri Snake *Oligodon arnensis*

Banded Racer *Platycephalus fasciplata*

Green vine Snake *Ahaetula borealis*

Rat Snake *Ptyas mucosa*

Russell's Kukri Snake *Oligodon taeniolatus*

AMPHIBIANS OF THE CAMPUS

Common Indian toad *Duttaphrynus melanostictus*

Indian Bull frog *Hoplobatrachus tigerinus*

Indian Burrowing frog *Sphaerotheca maskeyi*

Narrow mouthed frog *Microhyla nilphamariensis*

Marbled balloon Frog *Uperodon marmorata*

Cricket Frog *Minervarya sp.*

INVERTEBRATES OF THE CAMPUS

Invertebrates

Snails *Eurychlamys platychlamys*

Praying mantis

Grasshoppers

MAMMAL DIVERSITY

The mammals commonly seen on campus – Greater Bandicoot Rat (*Bandicota indica*), House Rat (*Rattus rattus*), Indian hare (*lepus nigricollis*), three striped squirrel. Along with this Indian small fox, Barking deer, Moongoose is also seen in the vicinity area.

HONEY BEES OF THE CAMPUS

Bees and plants have co-existed since time immemorial. Bees depend for their food on plants; nectar provides them with carbohydrate, while pollen supplies protein. Most bees also depend on plants for shelter. In return, bees help with the vital process of plant reproduction. They cross-pollinate flowers, diversify the genetic background of seed, and help plant species reproduce and survive.

Bees need a clean and healthy environment. The existence of natural bee colonies is a good indicator of a healthy environment. Individual bees can also be useful in detecting air pollution. India can boast of being a centre of origin of the world's honeybee species. Out of the five honey-producing bee species, four have occurred in India since ancient times.

Three types of Honey bees were listed in campus

i) *Apis dorsata-the rock bee or giant bee*

This wild bee constructs single, huge, vertical wax comb exposed to light. The nest hangs on tall tree branches or underneath bridges or on rock cliffs. It contributes nearly 75% of total honey production of India

ii) *Apis cerana-indica the Indian hive bee*

This hive bee constructs several vertical parallel combs in dark enclosures like hollows in tree trunks or in the ground. It is relatively stationary and can be kept in wooden hives for commercial production of honey and pollination.

i) *Apis florea-the garden bee or little bee*

This wild bee constructs a single, small, vertical comb in bushes exposed to light. It produces small quantities of honey. It also migrates depending upon the availability of food

MAMMAL DIVERSITY

You can find many different examples of microorganisms in soil, and most benefit the ecosystem in some way. Some of the most beneficial soil bacteria help plants utilize nutrients that they otherwise wouldn't be able to intake with their roots. Perhaps the most well-known and studied type of soil bacteria, nitrogen-fixing bacteria assist many different types of plants with nutrient uptake. There are approximately 10^8 to 10^9 bacteria in a gram of soil, most of them (>99%) have not been or cannot be cultured in the laboratory. Common bacterial genera isolated from soil include

- Bacillus
- Arthrobacter
- Pseudomonas
- Agrobacterium
- Alcaligenes
- Clostridium
- Flavobacterium
- Corynebacterium
- Micrococcus
- Xanthomonas
- Mycobacterium.

Fungi found in soil fall mostly within three groups; decomposers, mutualists (mycorrhizal fungi), and pathogens. Some of the common fungi found in soil include

- Amanita
- Tricholoma
- Torrendia
- Descomyces
- Thelephora
- Verticillium
- Phytophthora
- Rhizoctonia.

Streptomyces is the most abundant species of actinomycetes in soil, followed by other species like Micromonospora, Thermoactinomycetes, and Nocardia. Besides, some actinomycetes are rarely isolated from desert soil, which includes Microbispora, Microtetraspora, Amycolaptosis, Actinomadura, and Saccharothrix.

Almost 90% of actinomycetes genera have been isolated from the soil where they often form much-branched hyphae when growing.

COMMENTS ON BIODIVERSITY OF THE CAMPUS

1. ASSM has attractive green cover and landscape. The noise monitoring studies indicates that this greenery proved beneficial for the betterment of campus environment.
2. The tree cover of campus acts as filter to air pollution. Noise monitoring analysis shows that the 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. Campus inhabits ... species of different trees, herbs and shrubs. This attracts and protects fauna of surrounding area.
4. Along with maintenance of greenery more focus should be given for mixed plantation. Plantings should include a diverse array of local (native) species, genera, and families, of different herbs shrubs and trees. This will provide protected habitat for different faunal species of nearby area including grassland and scrubland.
5. We can replace some ornamental shrubs or herbs with native and useful one. 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.

Carbon accounting A. Carbon Sequestration Potential

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 CO₂ from the air in a process called carbon sequestration, transforming CO₂ into carbon and making use of it to build living matter - leaves, stems, trunk, roots, etc. The Biomass carbon sequestration potential was measured for ASSM campus.

Total biomass assessment

The assessment of above ground and belowground biomass of ASSM campus was carried out within 15 acres.

$$\text{Biomass carbon} = (\text{aboveground biomass carbon} + \text{belowground biomass carbon})$$

The total biomass has been summarised below in table

Carbon pool	Estimated Quantity (Tones)
Aboveground Biomass	0.6
Belowground Biomass	0.2
Total Biomass	0.8
Total carbon	0.4

Table Total biomass carbon sequestration in ASSM campus

Conclusion

Total 0.4 tons of carbon is locked in by the trees of ASSM campus

B. 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 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).

The observations used in calculating vehicular emissions are visual observations of the i.e 2022. Around 30 two wheelers were used daily by ASSM students and staff. While 5-6 four wheelers were daily parked in the campus.

Based on the past vehicle observations and with the help of emission factors given for Indian vehicles total emissions by ASSM campus are calculated here.

Pollutants	Emissions Factor	Avg Number of Vehicle/ day	Emissions (gm/km)	Average Travel (km)	Total Emissions per day
CO	1.4	30	42	15	630
HC	0.7	30	21	15	315
NO _x	0.3	30	9	15	135
PM	0.05	30	.55	15	825
CO ₂	33.83	30	821.7	15	12325.5

Table Total emissions by two wheelers

If we consider CO₂ emissions only, we can see that 1325.5 gm/day of CO₂ is emitted by two wheelers of ASSM campus. So the CO₂ emitted by two wheelers per year is,

$$50745 * 185 = 2280217 \text{ gm/year} = 2.2 \text{ tones/year}$$

Pollutants	Emissions Factor	Avg Number of Vehicle day	Emissions (gm/km)	Average Travel (km)	Total Emissions per day
CO	4.3	5	21	50	1050
HC	2.05	5	10.25	50	512
NOx	0.11	5	0.55	50	27.5
PM	0.08	5	0.4	50	20
CO2	72.50	5	362.5	50	18125

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 18125gm of CO2 is emitted by two wheelers of ASSM campus. So the CO2 emitted by four wheelers per year is,

$$33125 * 240 = 4350000 \text{ gm/year} = \mathbf{4.3 \text{ tones/year}}$$

Total Emissions by ASSM vehicles per year = 2W + 4W = 2.2 + 4.3 = 6.5 tones/year

From above figure it can be analyzed that though the number of 4W are less as compared to 2W, they do major 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. Study shows that 0.4 tones of carbon is sequestered by campus plants. 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 to carbon dioxide,

$$0.4 \text{ tones of Carbon} = 362 \text{ kg of carbon}$$

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.

362 kg of carbon * 3.67 = 1328 kg of CO₂ = 1.328 tonnes CO₂ per year So it can be concluded that campus trees has capacity to assimilate 1.328 tonnes of CO₂ per year.

While the vehicular emissions study showed that total emissions of ASSM vehicles is 6.5 tonnes/year. This value is 5 times greater than Carbon dioxide assimilation capacity of campus trees.

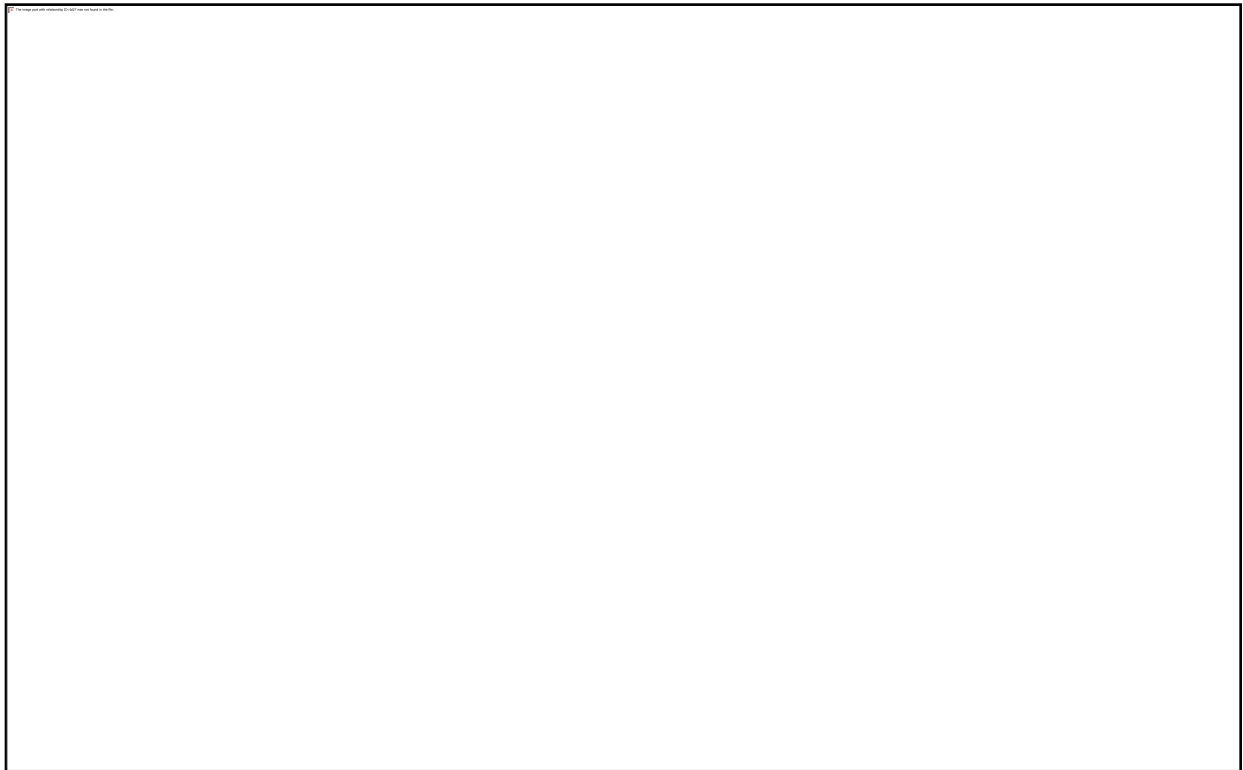


Figure: Image showing vehicular parking area of the campus

CONCLUSION AND RECOMMENDATIONS

Total 0.4 tons of carbon is locked by the campus trees of ASSM. Carbon flux calculations show that carbon sequestration capacity of trees will get increased by their age.

The Value of CO₂ emissions of ASSM campus vehicles is 5 times greater than carbon dioxide assimilation capacity of campus trees. Plantation is needed to assimilate the CO₂ emissions. As well as reduction in the use of four wheelers and two wheelers by college staff and students and can also do major impact on CO₂ reduction. Though the number of four wheelers are less as compared to two wheelers, they have significant contribution in total CO₂ emissions of the campus

ASSM staff and students must use public transport. Generally use of Bicycle is an eco-friendly transport option to lower the CO₂ emissions . But if we consider safety of staff and students bicycle option is not feasible and safe. College is thinking of starting activities like 'No vehicle day' (at least once in a month).

ENERGY SCENE

Primary source of energy at ASSM 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

Sr. No.	Months	Sanctioned demand Demand (kVA)	Units Consumed (kWh)	Total Bill, (Rs.)	Rs./kWh
1	JAN 2022	0.7 KW	647	5399	8.34
2	FEB 2022	0. 7 KW	635	5220	8.22
3	MAR 2022	0.7 KW	526	4470	8.49
4	APRIL 2022	0.7 KW	752	6140	8.16

5	MAY 2022	0.7 KW	799	6480	8.11
6	JUNE 2022	0.7 KW	906	7280	8.03
7	JULY 2022	0.7 KW	669	6200	9.26
8	AUGUST 2022	0.7 KW	697	6340	9.09
9	SEPTEMBER 2022	0.7 W	666	6080	9.12
10	OCTOBER 2022	0.7 KW	638	5920	9.27
11	NOVEMBER 2022	0.7 W	664	6070	9.14
12	DECEMBER 2022	0.7 KW	779	7110	9.12

Electricity bill analysis

Sr. No.	Parameter	Value	Unit
1	Sanctioned load	0.7	KW
3	Avg. Unit Consumption (Electricity bill)	698	Units/Month
4	Avg. Unit Consumption (Electricity bill)	23	Units/day
5	Avg. Unit Consumption (Electricity audit)	32	Units/day

Average monthly MSEDCL unit's consumption is 698 units and average monthly consumption by as per electricity bill is 1.3 times lower than the Electricity audit.

WATER

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

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

LEVEL OF AWARENESS

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:

Maximum demand should be monitored regularly so as to reduce non-critical loads when set maximum demand is reached. And also need to reduce contract demand in such way that to avoid excess demand charge by considering future load.

Maximum Demand Controller

- High-tension (HT) consumers have to pay a maximum demand charge in addition to the usual charge for the number of units consumed. This charge is usually based on the highest amount of power used during some period (say 30 minutes) during the metering month.
- The maximum demand charge often represents a large proportion of the total bill and may be based on only one isolated 30 minute episode of high power use. Considerable savings can be realized by monitoring power use and turning off or reducing non-essential loads during such periods of high power use.

Power Factor Incentive & Penalty

- Whenever the average power factor over a billing cycle or a month, whichever is lower, of a High Tension consumer is below 90%, Penal charges shall be levied to the consumer at the rate of 2 % (two %) of the amount of monthly energy bill (excluding of Demand Charges, FOCA, Electricity Duty and Regulatory Liability Charge etc.) for first 1 % (one percentage point) fall in the power factor below 90%, beyond which the penal charges shall be levied at the rate of 1 % (one %) for each percentage point fall in the power factor below 89%. Such penalty will however not be applicable to Railways for Power Factor up to 72%.
- Whenever the average power factor is more than 0.95, an incentive will be given to High Tension industrial (HTP-I, HTP-II & HT- SEASONAL), and HTP-III & HTP-IV consumers, irrespective of status of TOD meter installation.

point) fall in the power factor below 90%, beyond which the penal charges shall be levied at the rate of 1 % (one %) for each percentage point fall in the power factor below 89%. Such penalty will however not be applicable to Railways for Power Factor up to 72%.

- Whenever the average power factor is more than 0.95, an incentive will be given to High Tension industrial (HTP-I, HTP-II & HT- SEASONAL), and HTP-III & HTP-IV consumers, irrespective of status of TOD meter installation.
- The said incentive will be at the rate of 1% of the amount of the monthly energy bill (excluding Regulatory Liability Charges, Demand Charges, FOCA, Electricity Duty) for every 1% improvement in the average power factor above 0.95.
- For power factor of 0.99, the effective incentive will amount to 5% reduction in the energy bill and for unity power factor; the effective incentive will amount to 7% reduction in the energy bill.
- Power factor will be computed, by the method of kWh / KVAh & rounded off to two decimal points as per the existing practice.

RECOMMENDATIONS

1. Average daily Unit use as per Electricity bill is 1.3 % lower than the use calculated from Energy audit. This difference could be attributed to the following facts.
 - i) Holidays and half days are not considered in the Energy audit calculation.
 - ii) This difference may be due to location of the College building. College has good natural ventilation and light. This makes ASSM campus, a functional, habitable and environmentally sustainable habitat.
2. College should do water pumping in the hours of 4am to 6 am OR 10pm to 12pm to minimize its unit charges.
3. College should go for Non conventional sources of Energy.

Adya Environmental Services


Proprietor

