SIDDHARTHA College Code -TP
INSTITUTE OF ENGINEERING & TECHNOLOGY
(Accridited by NBA,Approved by AICTE & Affiliated to JNTU)
Vinobha Nagar, Ibrahimpatnam, Ranga Reddy Dist – 501 506, Telangana, INDIA.
Ph: 08414-222299, 222599, Fax: 08414-222399
E-mail:info@siddhartha.ac.in; www.siddhartha.ac.in

7.1.6: Quality audits on environment and energy are regularly undertaken by the Institution and any awards received for such green campus initiatives

Reports on environment and energy audits submitted by the auditing agency

INDEX

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Sustainable Living Inc

SIDDHARTHA
INSTITUTE OF ENGINEERING & TECHNOLOGY
(Approved by AICTE & Affiliated toJNTUH)
Vinobha Nagar, Ibrahimpatnam, RR Dist - 501506

HUMANITY | DISCIPLINE | EDUCATION

Environmental Audit (Water and Waste Management)

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Acknowledgment

Sustainable Living Inc

Hiran Prashanth
Environmental Sustainability Auditor

20 Feb 2022

Environmental Audit (Water and Waste Management)

The Sustainable Living Inc acknowledges with thanks the cooperation extended to our team for completing the study at Siddhartha Institute of Engineering & Technology (SIET).

The interactions and deliberations with SIET team were exemplary and the whole exercise was thoroughly a rewarding experience for us. We deeply appreciate the interest, enthusiasm, and commitment of SIET team towards environmental sustainability.

We are sure that the recommendations presented in this report will be implemented and the SIET team will further improve their environmental performance.

Kind regards,

Yours sincerely,
Hiran Prashanth

Hiran Prashanth
Environmental Sustainability Auditor
Sustainable Living In

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Executive Summary

The growth of countries across the world is leading to increased consumption of natural resources. There is an urgent need to establish environmental sustainability in every activity we do. In a modern economy, environmental sustainability will play a critical role in the very existence of an organization.

An educational institution is no different. Built environment, especially an educational institution, has a considerable footprint on the environment. Impact on the environment due to energy consumption, water usage and waste generation in an educational institute is prominent. Therefore, there is an imminent need to reduce the overall environmental footprint of the institution.

As an Institution of higher learning, Siddhartha Institute of Engineering & Technology (SIET) firmly believes that there is an urgent need to address the environmental challenges and improve their environmental footprint.

True to its belief, SIET has implemented rainwater harvesting in the campus. Continuing with rainwater harvesting, the college can also investigate the following recommendations:

- **Attain water positive status:** SIET should focus on capturing the harvested rainwater to substitute freshwater consumption, work on sustainable groundwater beyond the fence and create a framework towards attaining water positive status over a period. Presently, SIET is consuming nearly 100 KL of fresh water per day. Since metering is not available, the water consumption is calculated rather than measure value.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

The first step is to increase the water conservation activities in the campus to reduce water consumption at source. The next step is to increase the rainwater harvesting capacity to completely offset the freshwater requirements of the plant. SIET can also explore adopting lakes, desilting of ponds and restoration of water bodies in localities surrounding the campus. Water getting harvested in those structures can offset the freshwater consumption of the college.

- **Install water efficient fixtures**: The best way to conserve water is at the source. Therefore, SIET will have to install water efficient fixtures to reduce water consumption. Some of the water efficient fixtures are:
    - Waterless urinals
    - Electronic taps (e-taps)
    - Electronic flush urinals (e-flush)
    - Foam taps
    - Spring loaded push taps
    - Low flush cistern
- **Install sewage treatment plant / rootzone treatment:** SIET uses more than 100 KL of fresh water per day. Considering that 5 KL (least value) of water is being let to drain without treatment, good opportunity exists to reduce freshwater consumption by treating the sewage water and using the recycled water for gardening and flushing application. Install biogas plant and phytoremediation in series to recycle water and reduce freshwater consumption.
- **Install water flow meters**: Water flow meters are vital in understating the water consumption patterns of the campus. Presently, the water consumption is calculated rather than being measured. Water flow meters gives an accurate status if water consumption in the campus and from the water consumption values, the roadmap for water conservation activities can be prepared.

- **Segregate waste at source**: SIET has provided bins for waste collection. SIET must embark on awareness creation methods to increase the effectiveness of collection and provide more bins for proper waste segregation.
- **Maintenance of waste management yard**: The waste management yard is to be maintained just like raw materials storage room. Waste is nothing but a resource in wrong place. Therefore, by maintaining the waste management yard, quality of wastes can be maintained.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Environmental Audit

SIET and Sustainable Living Inc are working together to identify opportunities for improvement in water management, and waste management. This report highlights all the potential proposals for improvement through the audit and analysis of the data provided by SIET for water consumption and waste management. The report details the process conducted for the analysis such as on ground surveys performed for listing the type of water consumers with consumption per year, types of waste generated and disposal mechanisms.

Submission of Documents

Environmental audit at SIET was carried out with the help data submitted by SIET team. SIET team was responsible for collecting all the necessary data and submitting the relevant documents to Sustainable Living Inc for the study.

Preliminary Study

After the receipt of documents, a desktop review of the data for quality check, followed by preliminary study was carried out by Sustainable Living Inc. In case of discrepancy/inadequacy/non-clarity of data, Sustainable Living Inc team got in touch with the SIET team for clarification/additional information.

Environmental Audit

Data submitted and collected during the visit was used to assess the water and waste management practices of the campus and finally provide necessary recommendation for environmental improvement.

Note

Environmental audit is based on the data provided by SIET team. The scope of the study does not include the exclusive verification of various regulatory requirements related to environmental sustainability.

Sustainable Living Inc has the right to recall the study, if it finds (a) major violation in meeting the environmental regulatory requirements by the location and (b) occurrence of major accidents, leading to significant damage to ecology and environment.

Water Conservation

To achieve a water positive status by continuous reduction of freshwater consumption should be the ultimate focus of SIET. Increased and focused attention should be given to attain water sustainability in future by inculcating the discipline of water conservation.

Fresh water consumption of SIET : 100 KL per day (KLD)

Rainwater harvesting : carried out for roof area

According to the report, 'Water in India: Situation & Prospects', India is the largest consumer of groundwater in the world with an estimated usage of 230 km3 per year. Approximately 60 per cent of the demand from agriculture and irrigation, and about 80 per cent of the domestic water demand, is met through groundwater. As per the Department of Drinking Water and Sanitation nearly 90 per cent of the rural water supply is from groundwater sources. This has led to an increased pressure on aquifers and the resulting hydrological imbalance.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

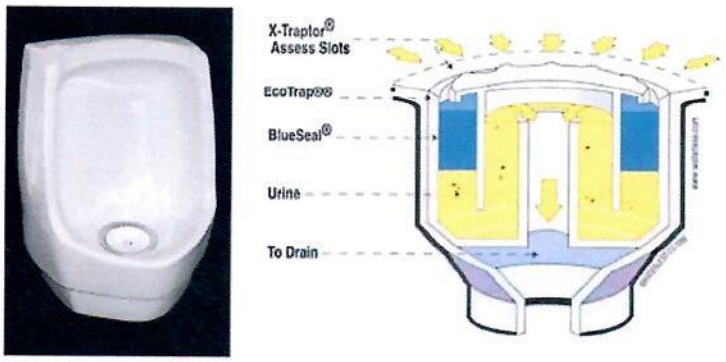
Recommendations for water conservation:

1) Waterless urinals: Waterless urinals look like regular urinals without a pipe for water intake. Men use them normally, but the urinals don't flush. Instead, they drain by gravity. Their outflow pipes conSIETt to a building's conventional plumbing system. In other words, unlike a composting toilet, which leaves you to deal with your waste, these urinals send the urine to a water treatment plant.

a. Urine flows into the drain insert of the EcoTrap.
b. Inside of the EcoTrap the urine moves through a floating layer of proprietary immiscible BlueSeal liquid, which creates a barrier, preventing sewer gases and urine odors from entering the restroom area.
c. The urine below the BlueSeal barrier overspills into the central tube and travels down into the drain line.

Waterless Urinal

Waterless Urinal



PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

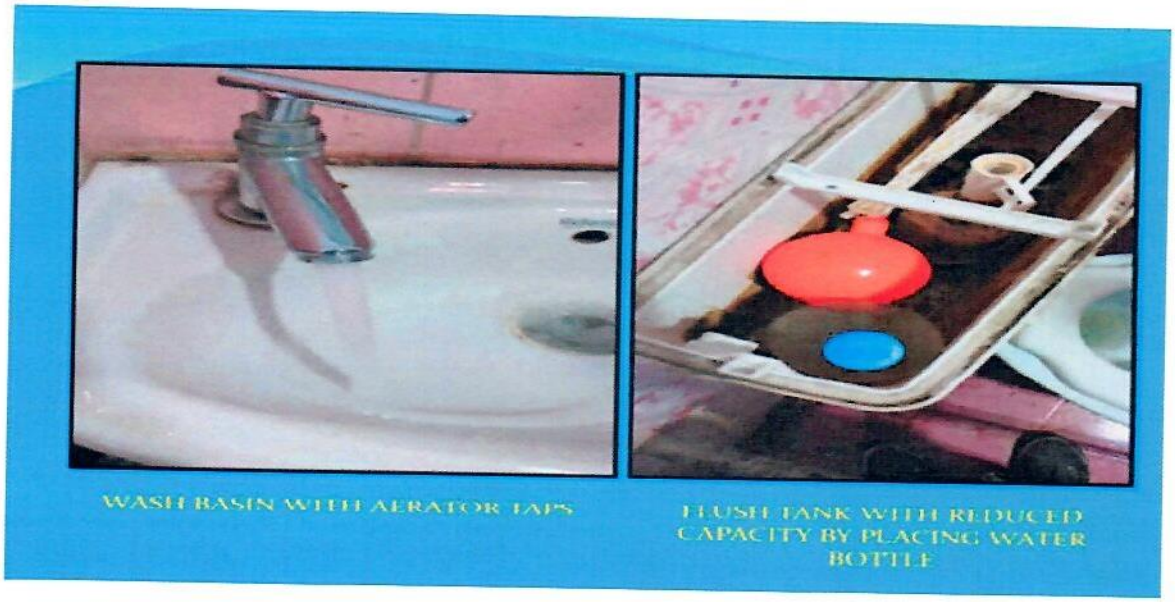
d. Approximately 1500 sanitary uses are possible with just 3 ounces of BlueSeal. When the BlueSeal liquid is gone, it is simply replenished. This only takes about 20 seconds to perform and the EcoTrap is not touched.

e. Urine sediments are retained within the EcoTrap. Replacement is easy and need only be done 2 to 4 times per year depending on traffic to the urinal. As tool called the X-Traptor must be used to remove the EcoTrap. The use of the special tool helps to minimize vandalism. The entire process of replacement only takes 3 to 4 minutes.

Waterless urinals are available for women. Indian manufacturers are supplying waterless urinals technology. Ekameco is one such company providing solution for women waterless urinals. You may visit www.ekameco.com and mail info@ekameco.com for more details on waterless urinals for women.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

2) Volume reduction in flush tanks: One simple method is to add a one-liter equivalent water bottle in the flush tank thereby reducing its consumption majorly. One-liter savings in the tank will help to save approximately by 20% and doesn't require any investment.



3) Rainwater harvesting: Water harvesting or more precisely rainwater harvesting is the technique of collection and storage of rainwater at surface or in subsurface aquifer, before it is lost as surface run off. In artificial recharge, the ground water reservoirs are recharged at a rate higher than natural conditions of replenishment.

According to a report by the Central Groundwater Board published in 2007, the selection of a suitable technique for artificial recharge of ground water depends on various factors. They include:

a) Quantum of non-committed surface runoff available

b) Rainfall pattern

c) Land use and vegetation

c) Topography and terrain profile

d) Soil type and soil depth

e) Thickness of weathered / granular zones

f) Hydrological and hydrogeological characteristics

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

g) Socio-economic conditions and infrastructural facilities available

h) Environmental and ecological impacts of artificial recharge scheme proposed

Rainwater Harvesting Techniques in Urban Area

In urban areas rainwater is available from roof tops of buildings, paved and unpaved areas. This water could be stored and used to replace freshwater as well as used for recharging the aquifer.

4) Display water balance/conservation status at entrance of all blocks for overall involvement of all students & staff

It is suggested to display specific water consumption numbers in terms of domestic use at the entrance of each blocks to create awareness among all students and stakeholders visiting the facility. This daily/continuous awareness creation will ultimately help in reduction of water consumption by students.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Water Saving Gadgets

It is suggested to display specific water consumption numbers in terms of domestic use at the entrance of each blocks to create awareness among all students and stakeholders visiting the facility. This

Electronic Taps (e-taps)

The latest trend in industries is to install electronic taps (e-taps). The advantages of using e-taps are as mentioned below:

- Unlike conventional taps, there is no twisting or turning in e-taps. They have a sensor, which cuts off water supply completely when not in use. This helps in saving up to 70% water during hand wash.
- E-taps enable hands free operation. No fear of cross contamination or contact with germs. E taps score very high on hygiene. It is the most ideal choice for multipurpose and multi-user washrooms.
- E-taps can work efficiently up to raw water TDS of 1,800 ppm.
- The touch free electronic taps, available in AC and DC models consume minimal power only. The AC model has an efficient battery back-up, while the DC model runs on just 4 alkaline batteries.

Operation of Electronic Taps

This has been successfully implemented in several hotels & restaurants. Of late, several industries have also started implementing this proposal. Thus, there is a good potential to optimize the freshwater consumption by replacing the existing taps with e-taps.

Electronic flush (e-flush) urinals

The latest trend in industries is to install e-flush urinals. The advantages of using e-flush

urinals are as mentioned below:

- E-flush urinals are fitted with a sensor, which senses the usage and flush with water for few seconds after use. This helps in saving 70% water during urinal flush.
- E-flush urinals enable hands-free operation and score very high on hygiene. It is the most ideal choice for multipurpose and multi-user washrooms.
- E-flush urinals can work efficiently up to raw water TDS of 1,800 ppm.
- The touch free e-flush urinals available in AC and DC models consume minimal power only. The AC model has an efficient battery back-up, while the DC model runs on just 4 alkaline batteries.

Photographs: Electronic flush urinals

Hand wash

Foam taps

Conventional taps are used in the hand wash areas which results in wastage of large quantities of fresh water. Foam taps are a better fit in these high consumption areas. They consume 25-30% less water than conventional taps.

Photographs: Foam taps

Spring loaded Push taps

Spring loaded push type tap is an alternate device for minimizing hand wash water. The spring-loaded push taps operate with the simple mechanism of pressing the knob for water. The knob is automatically released back to close position in 5-7 seconds. This saves about 30-40% of water compared to the conventional taps.

Photographs: Spring loaded push taps

Low flush cistern

The latest model closets are water efficient and operate in dual mode, with a single flush releasing 2 litres of water and the dual flush releasing 4 litres per flush. This results in excellent water savings.

Photographs: Low flush cisterns

Install sewage treatment plant – Rootzone treatment:

SIET uses more than 13 KL of fresh water per day. Considering 5 KL of water is being let to drain without treatment, good opportunity exists to reduce freshwater consumption by treating the sewage water and using the recycled water for gardening and flushing application. Install biogas plant and phytoremediation in series to recycle water and reduce freshwater consumption.

SIET has already installed a biogas plant for generating biogas from canteen waste. Presently, sewage water is being let out to the drain without treatment. An opportunity exists to generate biogas from the untreated sewage water and use the generated biogas to substitute LPG used in the college.

In 2020-21, SIET had used 4.20 MT of LPG. By generating biogas from sewage water, about 0.9 MT of LPG can be replaced which will result in carbon savings of 2.49 MT CO2e.

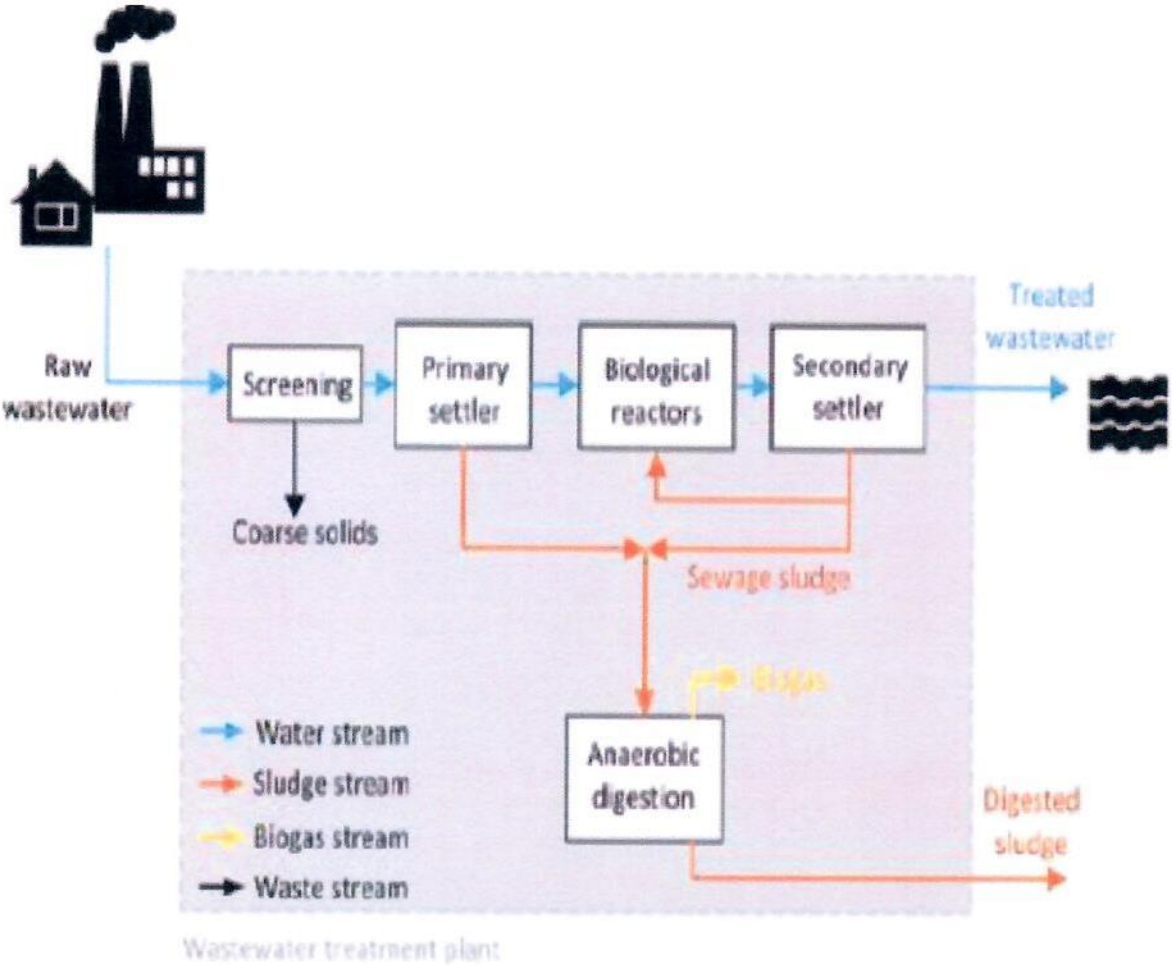
Biogas Production Potential of Wastewater

The sewage water is a useful waster as 1% of it in any quantity is a sludge which when subjected to anaerobic digestion will produce biogas. Wastewater is the effluent from household, commercial establishments and institutions, hospitals, industries and so on. Sewage water source contains large amount of organic material which can be efficiently recovered in as sludge which and when subjected to anaerobic digestion, the sludge produces methane gas (biogas).

Biogas is a mixture of gases containing 50-75% Methane, and 25-50%Carbon dioxide while 0-10% Nitrogen, 0-3% Hydrogen disulphide and 0-2% Hydrogen may be present as impurities which is produced by anaerobic digestion of organic material i.e. a sequential enzymatic breakdown of biodegradable organic material (Biomass) in the absence of oxygen. The process is usually carried out in a digester tank known as biodigester. Biogas is an important energy source used as cooking gas, to generate electricity, etc. thus producing biogas from wastewater is an efficient and

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

sustainable waste management and renewable energy technique. One of the major environmental problems of the world today is waste management and wastewater constitutes a huge environmental problem to the society thus the need for wastewater treatment to recover and also recycle the recovered water for usage.



Wastewater treatment plant

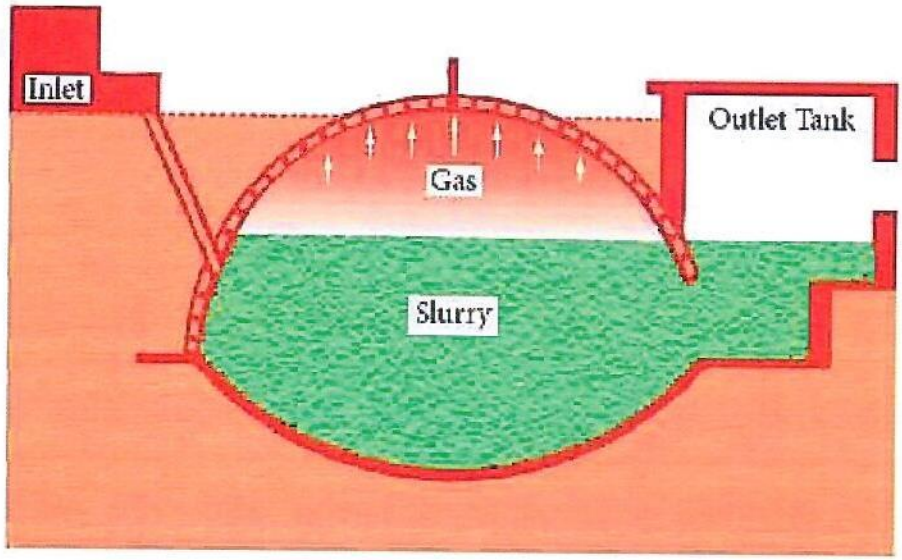
The physical process: this is the mechanical treatment of the water that involves removal of debris from the raw wastewater right from the point it enters the plant. The screening and primary settling of debris. Wastewater enters the treatment plant through the inlet chamber from where it is channeled to the coarse screen that removes solid waste.

The biological process: this involve the biotreatment of the sewage in the bioreactors. It is the heart of the treatment plant where a biological process takes place. The bioreactors of a treatment plant are usually large tanks consisting of several mammoth rotors and submersible mixers. While the rotor introduces atmospheric oxygen into the sewage, the submersible mixers keep the biomass in suspension thus several reactions takes place in the bioreactors.

From the bioreactor, the sewage enters the sedimentation tank. Here the biological process ends and sludge is separated from water such that the clean water is passed to the disinfection tank for disinfection and onward discharge for use while the sludge is removed by the returned activation sludge (RAS) pump that removes and sends part to the anaerobic digestion chamber while some are return to the anaerobic bioreactor for reactivation.

Production of biogas is an anaerobic digestion whereby microorganisms break down biodegradable material in the absence of oxygen to produce methane/carbon dioxide used to generate electricity and heat. Sludge from the treatment plant (primary and activated sludge) is the main feedstock (biodegradable organic matter) in the biogas production plant of a wastewater treatment plant and the biogas production process involves series of steps. The combine sludge resulting from primary and secondary water treatment is gathered, sieved and thickened to a dry solids content of up to 7% before entering the digesters. Optionally, the sludge can be pretreated by disintegration technologies with the aim to improve the gas yield. In the anaerobic digestion process, the sludge is pumped into the anaerobic continuously stirred tank reactors where digestion takes place.

In the process, microorganisms break down part of the organic matter that is contained in the sludge and produce biogas, which is composed of methane, carbon dioxide and trace gases. The raw biogas produced is dried and hydrogen sulphide and other trace substances removed and burned in burners after treatment. The digested sludge is dewatered, and the water reintroduce into the treatment plant while the remaining undigested matter used for organic fertilizer.

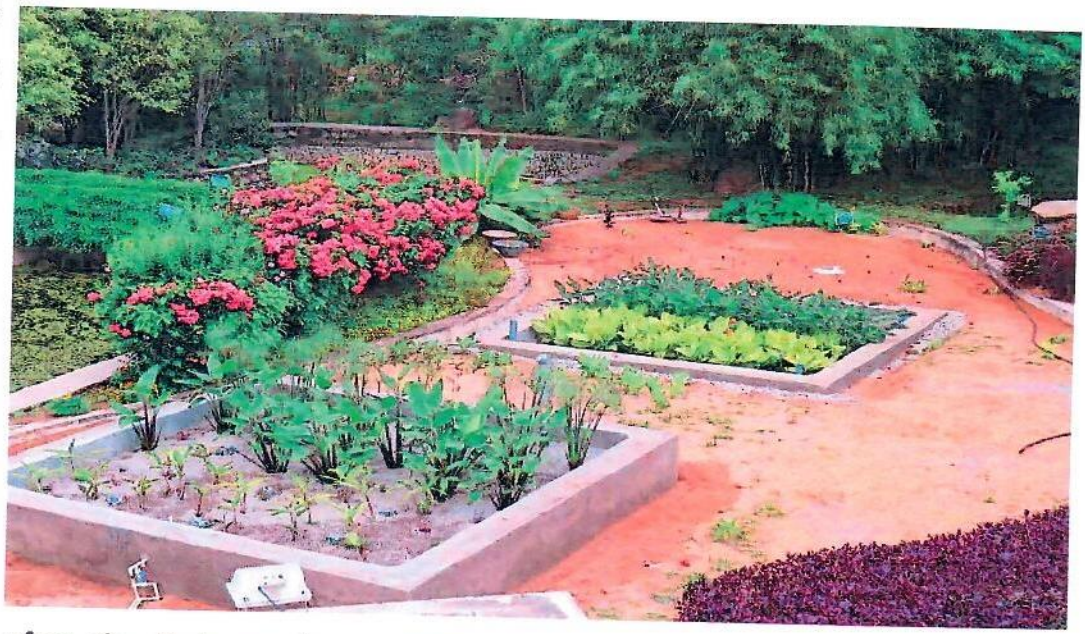


Rootzone treatment:

Root Zone' is a scientific term used to cover all the biological activity among different types of microbes, the roots of plants, water soil and the sun. It consists planted filter-beds containing gravel, sand and soil. The RZWT system utilises nature's way of biologically processing domestic & industrial effluents. This effective technology called Decentralised Wastewater Systems (DEWATS) was developed in 1970s in Germany and has been successfully implemented in different countries mainly in Europe and America.

The root zone wastewater treatment system makes use of biological and physical-treatment processes to remove pollutants from wastewater. Due to its natural process, there is no need to add any input such as chemicals, mechanical pumps or external energy. This reduces both the maintenance and energy costs.

- To accomplish this, the root zone wastewater treatment undertakes the following steps:
- Pre-treatment done in a Settler – a device that separates the liquid from the solid First treatment takes place in a Anaerobic Baffled Reactor – a device with several identical chambers through which the effluent moves from top to bottom.
- Second treatment happens in an Anaerobic Filter – a device filled with a filter material (cinder), through which the effluent moves from top to bottom.
- Third treatment takes place in a Planted Gravel Filter – a structure filled with gravel material and planted with water-resistant reed plants, which provide oxygen to the passing effluent.

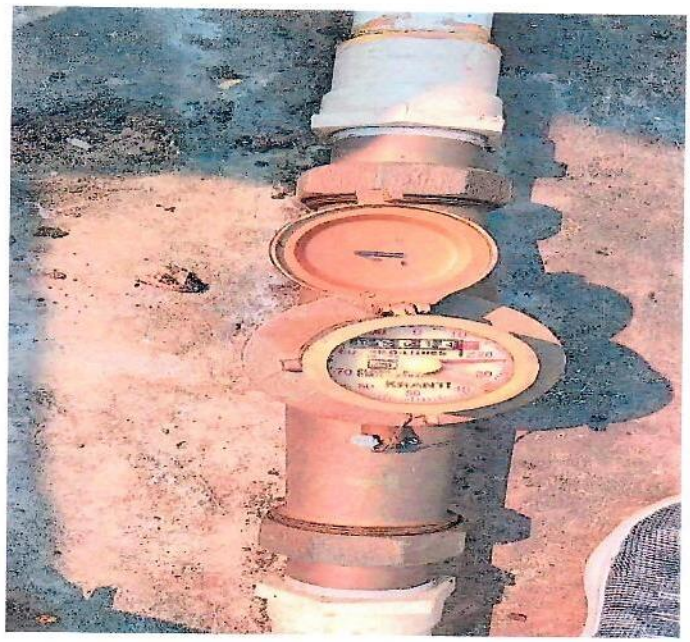


The Root Zone Wastewater Treatment system takes into account the natural slope of the ground, so that water flows from one device to another without any external energy input such as motor pump. Once the reed plants create an established stand, usually after the first growing season, the reed bed requires little or no maintenance. The plant foliage will soon blend naturally into the landscape, ever changing with the seasons and creating a pleasing sight as well!

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Install water flow meter:

Water flow meters are vital in understating the water consumption patterns of the campus. Presently, the water consumption is calculated rather than being measured. Water flow meters gives an accurate status if water consumption in the campus and from the water consumption values, the roadmap for water conservation activities can be prepared.



Water Meters would have many advantages:

- Encourage water conservation – important given strain on water resources
- Encourage allocatively efficient distribution. People would consume to where the marginal cost = marginal utility
- In long term lower overall water consumption would reduce leading to even lower water bills.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Waste Management

India has drawn world's attention with its high paced urbanization and industrialization. Over the last decade, India has emerged as the fastest growing country with rapid economic growth. A renewed focus on sustainable growth and development is imperative as India strives to maintain its high GDP growth rate in its pursuit of achieving developed country status by the year 2022. However, the flip side of higher economic growth has resulted in increased consumption of the natural resources, increased waste generation and hence ecological degradation.

Present status: SIET has initiated waste management activities inside its facility. Separate bins have been provided for different types of wastes. Waste bins are provided throughout the campus and students are being urged to use the bins effectively.

Recommendation: The waste management yard must be maintained in a similar fashion as that of a raw material storage room. Therefore, a total revamp of the waste storage yard is to be carried out. By doing so, the quality of the materials stored in the yard will not deteriorate and can be used a raw material for a subsequent process.

Enhance awareness creation, training and capacity building

SIET should focus on implementing sustainable waste management practices. SIET should regularly interact with Pollution Control Board and TSDF operators to enhance knowledge on waste management. The team should also take efforts to communicate the waste management and other policies and activities to all students in the college.

Achieve zero liquid discharge status

SIET may install a STP to treat and recycle water. The treated water from STP can be used to substitute freshwater by utilizing the treated water in both high end and low-end applications.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Conclusion

Environmental sustainability is a continuous process and there is always a scope for improvement. SIET has displayed itself as an advocate of environmental sustainability by getting environmental audit carried out. The organization has implemented several initiatives and measures to enhance efficiency and to optimize resource intensity. The journey ahead in the path towards environmental excellence has immense scope for improvement as brought out by this report.

SIET needs to focus and work on areas efficiency levels needs to be enhanced. For example: waste management. The observations and suggestions put forth by the report would help the facility in improving its environmental performance and pave way for ecologically sustainable growth.

This report may be taken as a guide and roadmap for achieving higher performance rating in environmental stewardship. As one of the pioneers and leaders SIET shoulder the task of further 'learning – teaching – learning' to improve, excel, and continue the innovative efforts for success of their students and associates.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Sustainable Living Inc

SIDDHARTHA
INSTITUTE OF ENGINEERING & TECHNOLOGY
(Approved by AICTE & Affiliated toJNTUH)
Vinobha Nagar, Ibrahimpatnam, RR Dist - 501506

HUMANITY | DISCIPLINE | EDUCATION

Carbon Footprint and Energy Audit

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

CONTENTS

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Acknowledgment

Sustainable Living Inc

Hiran Prashanth
Environmental Sustainability Auditor

20 Feb 2022

Carbon footprint and Energy audit at Siddhartha Institute of Engineering & Technology

The Sustainable Living Inc acknowledges with thanks the cooperation extended to our team for completing the study at Siddhartha Institute of Engineering & Technology (SIET).

The interactions and deliberations with SIET team were exemplary and the whole exercise was thoroughly a rewarding experience for us. We deeply appreciate the interest, enthusiasm, and commitment of SIET team towards environmental sustainability.

We are sure that the recommendations presented in this report will be implemented and the SIET team will further improve their environmental performance.

Kind regards,

Yours sincerely,
Hiran Prashanth

Hiran Prashanth
Environmental Sustainability Auditor
Sustainable Living In

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Executive Summary

The growth of countries across the world is leading to increased consumption of natural resources. There is an urgent need to establish environmental sustainability in every activity we do. In a modern economy, environmental sustainability will play a critical role in the very existence of an organization.

An educational institution is no different. Built environment, especially an educational institution, has a considerable footprint on the environment. Impact on the environment due to energy consumption, water usage and waste generation in an educational institute is prominent. Therefore, there is an imminent need to reduce the overall environmental footprint of the institution.

As an Institution of higher learning, Siddhartha Institute of Engineering & Technology (SIET) firmly believes that there is an urgent need to address the environmental challenges and improve their environmental footprint.

True to its belief, SIET has installed LED lamps for lighting. The college team has also installed 70 kWp capacity of soalr PV system for generating green power. The team has implemented bio-methanation plant to convert 150-200 kg of biodegradable waste to useful biogas. Sustainable Living Inc Team congratulates SIET team for their efforts.

Keeping SIET's work in energy efficiency, we recommend the following to be taken by the competent team at SIET:

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology.
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Work towards achieving carbon neutrality: INDC emphasizes creating an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030. SIET's net carbon emission for the year 2020-2021 is **204.30 MT CO2e**. SIET should focus on energy efficiency, renewable energy, and carbon sequestration as tools that will enable them to offset the present carbon emissions and achieve carbon neutrality.

Installation of biogas plant: SIET team has installed a bio-methanation system to treat 150-200 kg of biodegradable waste to useful biogas. In 2020-21, SIET had used 4.20 MT of LPG. There is an opportunity to install a biogas plant to generate biogas from sewage water. Presently, sewage water is being let out to the drain without treatment. An opportunity exists to generate biogas from the untreated sewage water and use the generated biogas to substitute LPG used in the college. By generating biogas from sewage water, about 0.93 MT of LPG can be replaced which will result in carbon savings of 2.79 MT CO2e.

Improve energy efficiency of the college: It is recommended to adopt latest energy efficient technologies for reducing energy consumption in fans, lighting, and air conditioners. We recommend the following projects to be implemented at the earliest:

- Replace conventional 70W ceiling fans with energy efficient BLDC fans of 30W
- Install air conditioners energy savers to save energy in split air conditioners

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Carbon Footprint and Energy Audit

Siddhartha Institute of Engineering & Technology (SIET) and Sustainable Living Inc are working together to identify opportunities for improvement in energy efficiency and carbon reduction. This report highlights all the potential proposals for improvement through the audit and analysis of the data provided by SIET for lighting, air conditioning, ceiling fans, and biogas potential.

The report also details the carbon emissions from college operations. For carbon emissions, scope 1 and scope 2 emissions are calculated from the data submitted by SIET. The report emphasizes the GHG emission reduction potential possible through a reduction in power consumption.

Effect of pandemic and online classes on energy consumption and carbon footprint:

The year 2020-21 was affected by the pandemic and because of the pandemic, most of the classes were shifted online. There has been a fluctuation in the consumption of energy in the year 2020-21. SIET's carbon footprint for the year 2020-21 will be smaller compared to the previous year.

Submission of Documents

Carbon footprint and energy audit at SIET was carried out with the help of data submitted by SIET team. SIET team was responsible for collecting all the necessary data and submitting the relevant documents to Sustainable Living Inc for the study.

Carbon Footprint and Energy Audit

Data submitted and collected was used to calculate the carbon footprint of the campus and assess energy consumption and finally provide necessary recommendations for environmental improvement.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Note

Carbon footprint and energy audit are based on the data provided by SIET team and discussions the Sustainable Living Inc team had with SIET team. The scope of the study does not include the exclusive verification of various regulatory requirements related to environmental sustainability.

Sustainable Living Inc has the right to recall the study if it finds (a) major violation in meeting the environmental regulatory requirements by the location and (b) occurrence of major accidents, leading to significant damage to ecology and environment.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

OPPORTUNITIES FOR IMPROVEMENT

As a part of the overall environmental improvement study at SIET, carbon footprint calculations were also carried out. The objective of calculating the carbon footprint of the campus is find the present level of emissions from campus operation and what initiatives that the SIET can take to offset the emissions. By offsetting the emissions, the college can become carbon neutral in the future by adopting energy efficient processes, increase in renewable energy share and tree plantation.

Carbon footprint calculations:

To help delineate direct and indirect emission sources, improve transparency, and provide utility for different types of organizations and different types of climate policies and business goals, three "scopes" (scope 1, scope 2, and scope 3) are defined for GHG accounting and reporting purposes.

For calculating carbon footprint of the campus, Scope 1 & Scope 2 emissions are being considered. Since day scholars use college provided transportation and hostelers stay in campus, Scope 1 and Scope 2 are the highest contributor to overall emissions. For this reason, Scope 3 is not being calculated.

Scope 1: Direct GHG Emissions

Direct GHG emissions occur from sources that are owned or controlled by the company, for example, emissions from combustion in owned or controlled DG sets, canteen, vehicles, etc.; emissions from chemical production in owned or controlled process equipment. Direct CO2 emissions from the combustion of biomass shall not be included in scope 1 but reported separately.

SIET Scope 1 emissions for 2020-21:

Sources of Scope 1 emissions in SIET:

1) Diesel used for college-owned transportation
2) LPG used for canteen

S No	Fuel Type	Description	Activity Data	Units	CO2 eq. Emissions (tons)
1	LPG	Canteen	4.20	MT	12.52
2	Diesel	Transport	9.00	KL	23.76
3	Diesel	Generator	0.365	KL	0.96

Total Scope 1 emissions of SIET : 37.20 Tons (for year 2020-21)

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

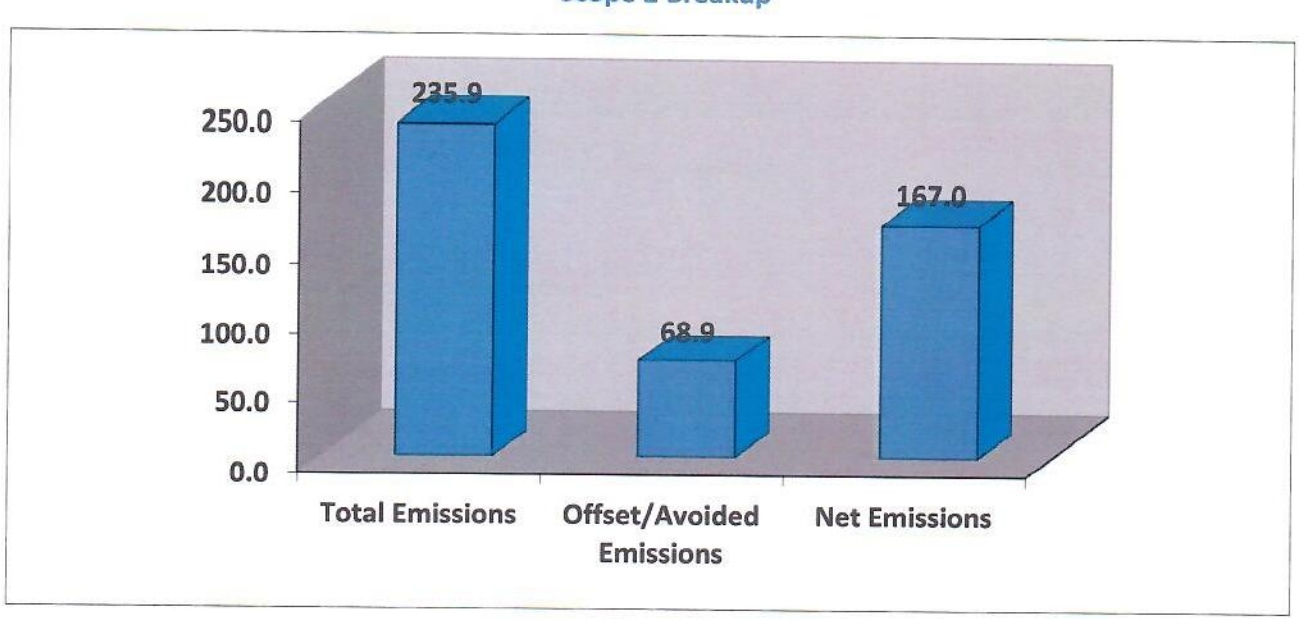
Scope 2: Electricity Indirect GHG Emissions

Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by a company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.

SIET Scope 2 emissions for 2020-21:

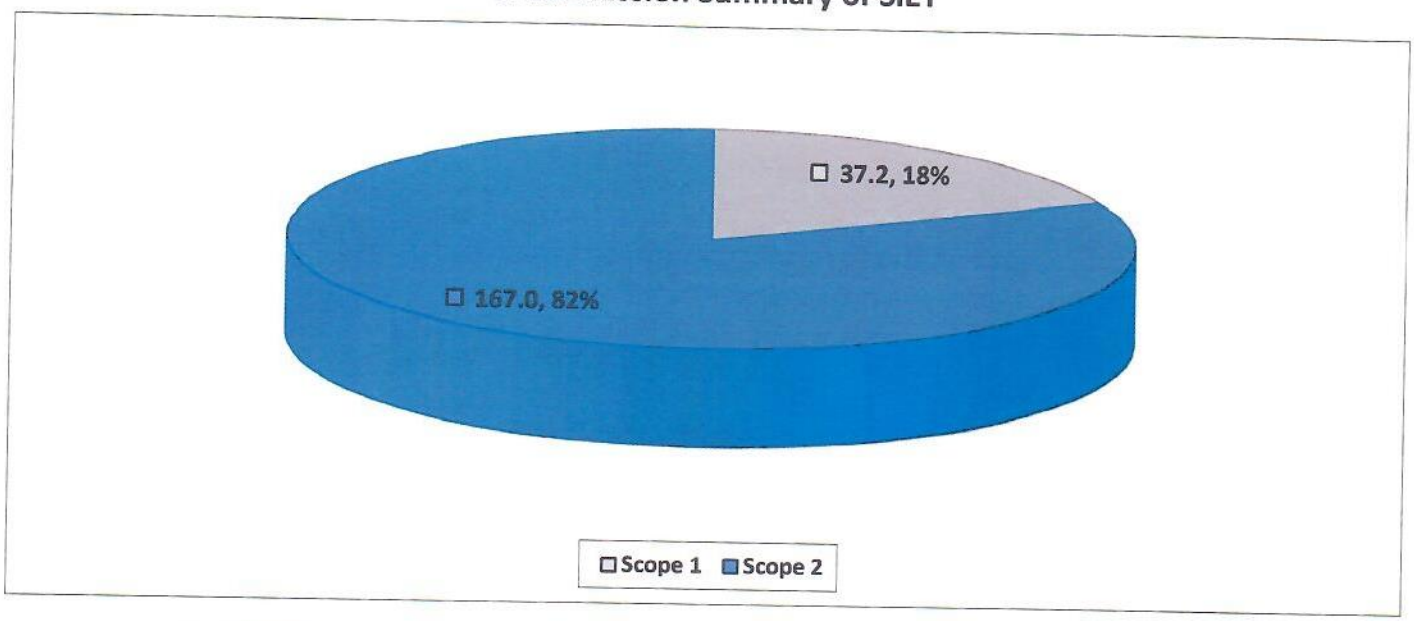
Electricity purchased from grid : 2,03,700

Solar units generated : 84,000



PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

GHG Emission Summary of SIET



Scope 1	37.20	**MT CO2 eq.**
Scope 2	167.00	**MT CO2 eq.**
Total	204.30	**MT CO2 eq.**

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Develop a roadmap to increase contribution of renewable energy in the overall energy consumption

To have a continued focus on increasing renewable energy utilization to 100% which will also lead to reduction in GHG emissions, it is suggested to develop a detailed roadmap on RE utilization. The road map should broadly feature the following aspects -

- Renewable energy potential of SIET and the maximum offset that can be achieved at SIET
- Percentage substitution with renewable energy that SIET wants to achieve in a specified time frame
- Key tasks that needs to be executed to achieve the renewable energy target
- Specific financial break up for each of the projects highlighting the amount required, available and the utilization status as on date
- A regular review mechanism to ensure progress along the lines of the roadmap should be framed
- The roadmap should also highlight important milestones/key tasks, anticipated bottleSIETks & proposed

Renewable energy roadmap should be used as a base to frame GHG emissions reduction target

It is suggested to use the developed renewable energy roadmap to correlate the GHG reduction that each of the renewable energy project will achieve. This approach will provide a base to set targets for reduction in GHG emissions. The action plan for renewable energy will shoulder the action plan for GHG emissions reduction and work towards achieving carbon neutrality.

Explore the option of other onsite and offsite renewable energy projects

The renewable energy field has been witnessing many private investors due its increased market demand and attractive policies in many states. There are Renewable Energy Independent Power Producers (RE IPPs) who have installed RE based power plants like wind, small hydro and solar PV. GOC can consider having a long-term power purchase agreement with these RE IPPs in purchasing fixed quantity of power for a period of 5 to 10 years.

Evolve a system to monitor the implementation of various GHG mitigation opportunities

SIET has an action plan to reduce its GHG emissions. SIET should also evolve a system to monitor the implementation of various GHG mitigation opportunities. It is recommended to use a Gantt chart to mark out the action plan for the activities and track its implementation. Gantt chart will serve as an excellent way to instantly monitor and comprehend all different tasks in one place which would ease tracking of implementation.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Install biogas plant at SIET campus

Presently, sewage water is being let out to the drain without treatment. An opportunity exists to generate biogas from the untreated sewage water and use the generated biogas to substitute LPG used in the college.

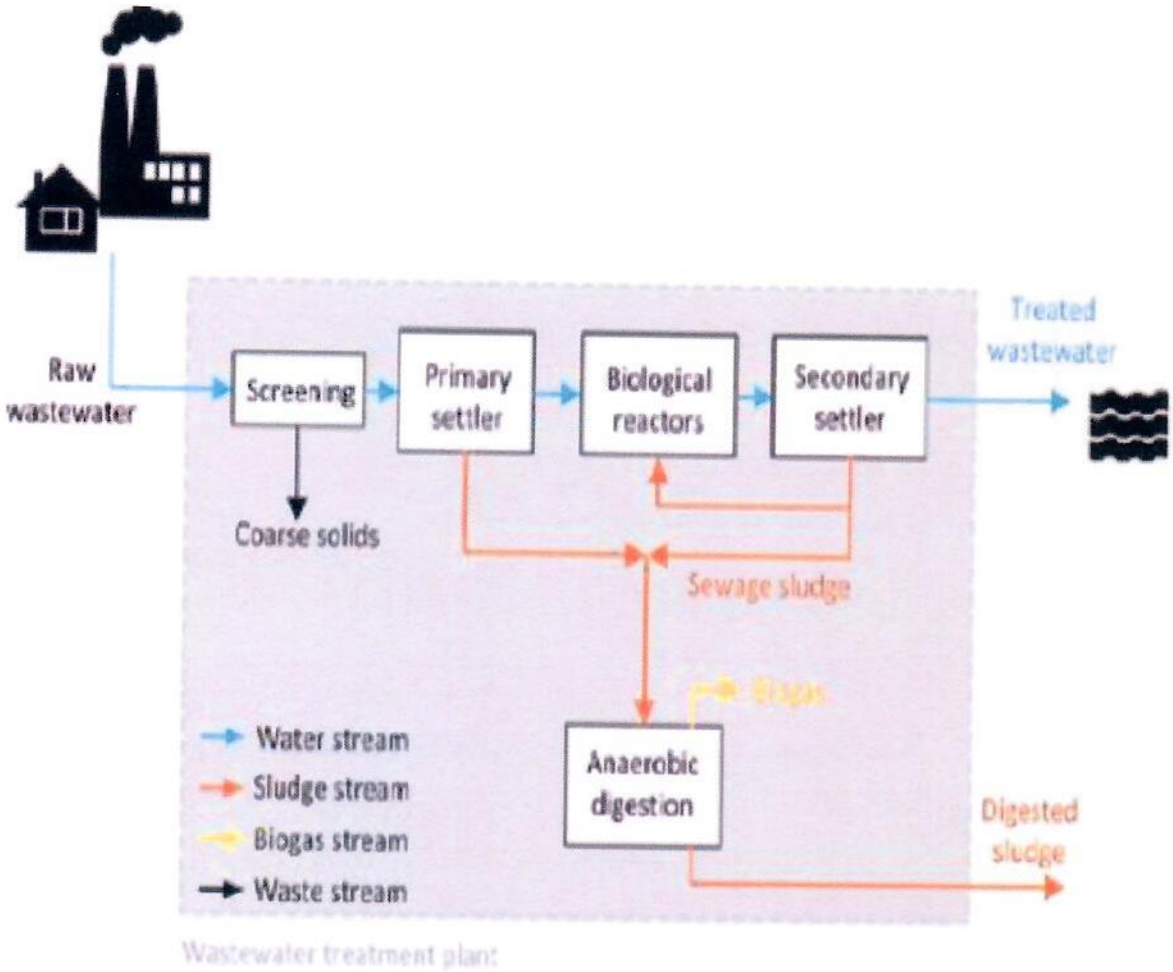
SIET had used 4.20 MT of LPG. By generating biogas from sewage water, about 0.93 MT of LPG can be replaced which will result in carbon savings of 2.79 MT CO2e.

Biogas Production Potential of Wastewater

The sewage water is a useful waster as 1% of it in any quantity is a sludge which when subjected to anaerobic digestion will produce biogas. Wastewater is the effluent from household, commercial establishments and institutions, hospitals, industries and so on. Sewage water source contains large amount of organic material which can be efficiently recovered in as sludge which and when subjected to anaerobic digestion, the sludge produces methane gas (biogas).

Biogas is a mixture of gases containing 50-75% Methane, and 25-50%Carbon dioxide while 0-10% Nitrogen, 0-3% Hydrogen disulphide and 0-2% Hydrogen may be present as impurities which is produced by anaerobic digestion of organic material i.e. a sequential enzymatic breakdown of biodegradable organic material (Biomass) in the absence of oxygen. The process is usually carried out in a digester tank known as biodigester. Biogas is an important energy source used as cooking gas, to generate electricity, etc. thus producing biogas from wastewater is an efficient and sustainable waste management and renewable energy technique. One of the major environmental problems of the world today is waste management and wastewater constitutes a huge environmental problem to the society thus the need for wastewater treatment to recover and also recycle the recovered water for usage.

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.



The physical process: this is the mechanical treatment of the water that involves removal of debris from the raw wastewater right from the point it enters the plant. The screening and primary settling of debris. Wastewater enters the treatment plant through the inlet chamber from where it is channeled to the coarse screen that removes solid waste.

The biological process: this involve the biotreatment of the sewage in the bioreactors. It is the heart of the treatment plant where a biological process takes place. The bioreactors of a treatment plant are usually large tanks consisting of several mammoth rotors and submersible mixers. While the rotor introduces atmospheric oxygen into the sewage, the submersible mixers keep the biomass in suspension thus several reactions takes place in the bioreactors.

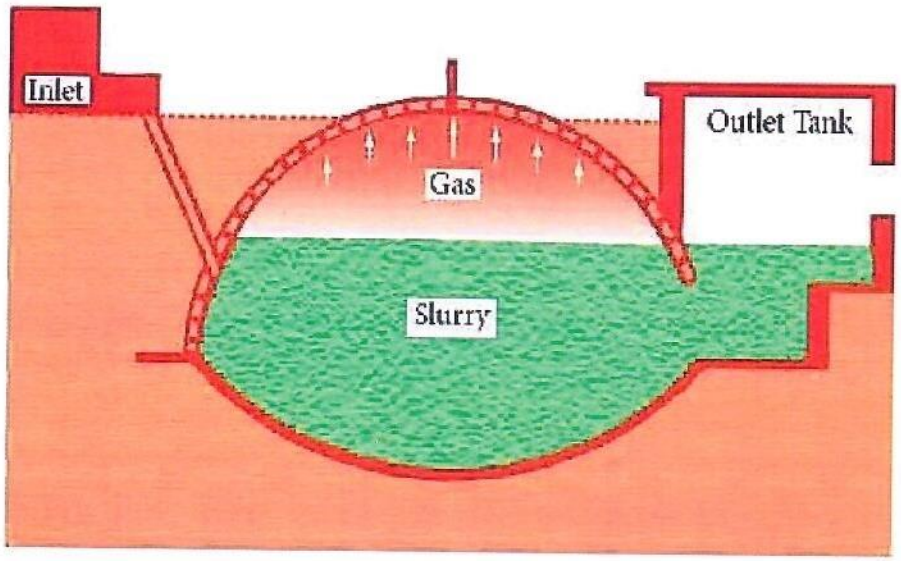
From the bioreactor, the sewage enters the sedimentation tank. Here the biological process ends and sludge is separated from water such that the clean water is passed to the disinfection tank for disinfection and onward discharge for use while the sludge is removed by the returned activation sludge (RAS) pump that removes and sends part to the anaerobic digestion chamber while some are return to the anaerobic bioreactor for reactivation.

Production of biogas is an anaerobic digestion whereby microorganisms break down biodegradable material in the absence of oxygen to produce methane/carbon dioxide used to generate electricity and heat. Sludge from the treatment plant (primary and activated sludge) is the main feedstock (biodegradable organic matter) in the biogas production plant of a wastewater treatment plant and the biogas production process involves series of steps. The combine sludge resulting from primary and secondary water treatment is gathered, sieved and thickened to a dry solids content of up to 7% before entering the digesters. Optionally, the sludge can be pretreated by disintegration technologies with the aim to improve the gas yield. In the anaerobic digestion process, the sludge is pumped into the anaerobic continuously stirred tank reactors where digestion takes place.

In the process, microorganisms break down part of the organic matter that is contained in the sludge and produce biogas, which is composed of methane, carbon dioxide and trace gases. The raw biogas produced is dried and hydrogen sulphide and other trace substances removed and burned in burners after treatment. The digested sludge is dewatered, and the water reintroduce into the treatment plant while the remaining undigested matter used for organic fertilizer.

Calculations:

Sewage water available per day	:	5 KL (Least value considered for calculation)
Sludge in 10KL of sewage water	:	1% (100 kg)
From 6kg of organic waste	:	1 kg of biogas can be produced
Therefore, from 50 kg	:	8.33 kg of biogas can be produced
Kg of biogas	:	0.45kg of LPG
Per day equivalent LPG production	:	3.25 kg per day
Annual LPG production for 250 days	:	937.50 kg
No. of 19 kg LPG cylinders that can be substituted:		49 cylinders
Cost of 19 kg cylinder	:	Rs. 1350 / cylinder
Savings	:	49 cylinders X Rs. 1350 / cylinder
	:	Rs. 66, 150 / annum
Investment	:	Rs. 2, 50, 000
Payback	:	36 months (3 years)
Annual emission reduction potential	:	2.79 T CO2



PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

ENERGY EFFICIENCY

Annual energy consumption of SIET campus is 56,885 units. There are major blocks in the campus which consumes energy for their operation. Major energy consumers are:

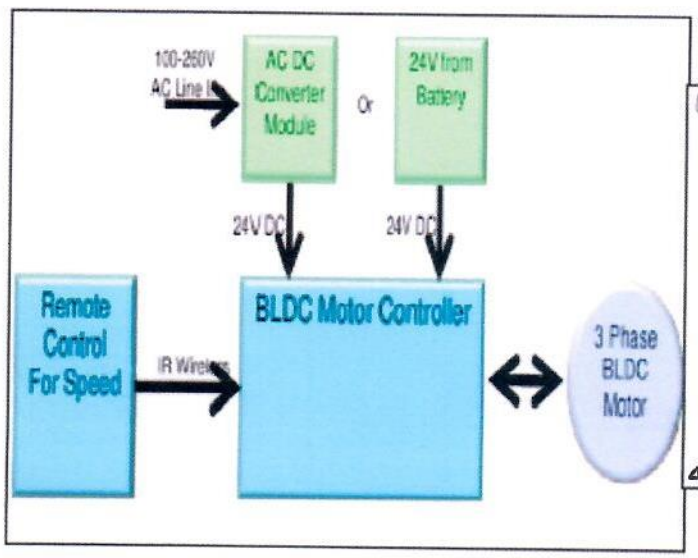
1. Fans
2. Air conditioners

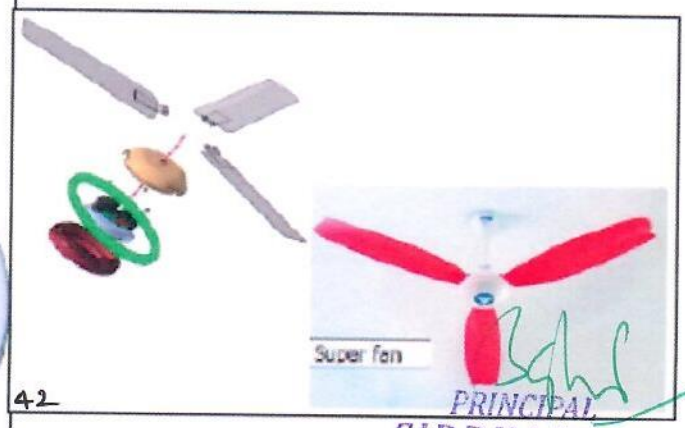
Replace Conventional Ceiling Fans with Energy Efficient BLDC Fans

During the Energy Audit at SIET, a detailed study was carried out to identify the potential for replacing the existing ceiling fans with BLDC super fans. There are 1154 fans operating in SIET campus.

Instead of conventional ceiling fans, latest technology BLDC fans which consume only 30W can be installed in the newly constructed building. A brushless DC (BLDC) motor is a synchronous electric motor powered by direct-current (DC) electricity and having an electronic commutation system, rather than a mechanical commutator and brushes. A BLDC motor has an external armature called the stator, and an internal armature called the rotor.

The rotor can usually be a permanent magnet. Typical BLDC motor-based ceiling fan has much better efficiency and excellent constant RPM control as it operates out of fixed DC voltage. The proposed BLDC motor and the control electronics operate out of 24V DC through an SMPS having input AC which can vary from 90V to 270V. The operational block diagram of a BLDC motor is as follows:





PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology

Calculations:

With the replacement of existing ceiling fans with Super Fans the energy consumption is likely to reduce by 55% per fixture. Considering 100 fans being replaced with super-efficient BLDC fans, 3.50 kW can be saved. Considering the average operating hours to be 2000 and unit cost as Rs. 7.50, the calculations are as follows:

Total no. of fans in college	:	1154
No. of fans considered for calculation	:	100 (First cycle of change)
Energy consumption per fan	:	70 W
Total energy consumption of fans	:	70W X 100 fans
	:	7 kW
Super-efficient BLDC fans energy consumption	:	30 W
Savings from 70W to 30 W	:	55%
Total savings in fans energy consumption	:	55% of 7kW
	:	3.5 kW
Savings per year	:	3.5 kW X 2000 hrs X Rs. 7.50 / unit
	:	Rs. 0.75 Lakhs
Investment	:	Rs. 2, 50, 000
	:	52 months
Annual emission reduction potential	:	6.00 T CO2

Install Air conditioners energy saver for spilt air conditioners:

Present status: As per the data obtained from SIET team, the campus has majorly 1.0 TR units installed. There are 38 spilt air conditioners installed in the campus.

Recommendation:

We recommend installing "Airtron", an energy saver that can be installed at every individual unit of AC. The Airtron is the world's most advanced AC SAVER, with all the controls of a Precision AC. The Airtron's dual sensors reference the Room and Coil & Ambient Temp, and uses complex, multiple algorithms in a "closed -loop circuit" to reduce the Compressor Run-Time, to ensure the high savings while maintaining and displaying the Set temperature accurately. The Airtron is Programmable for geographical location and climate and adapts automatically to changes in

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

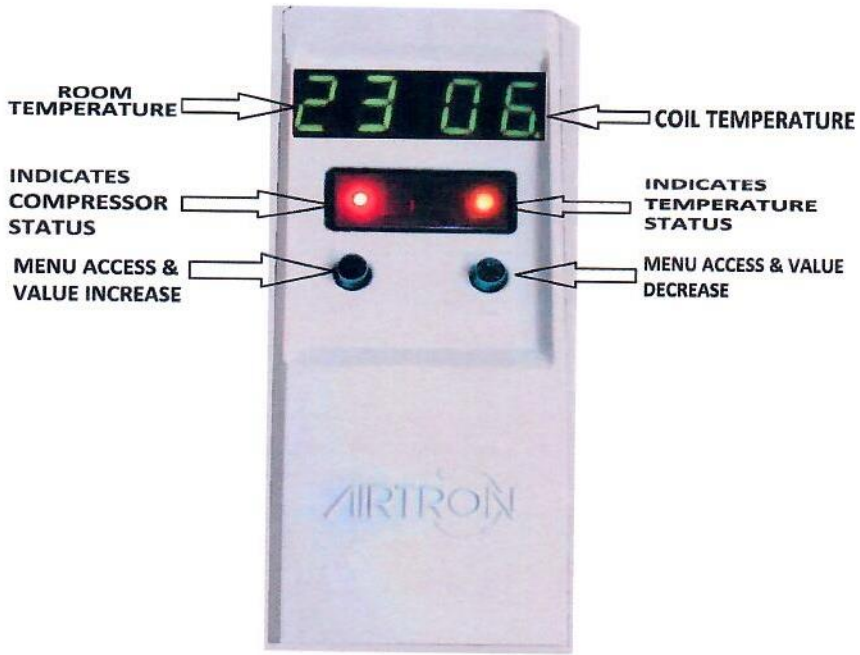
season and ambient conditions.

This unique device has been developed on Patent-Published technology and approved by leading MNC'S, PSU'S and Govt. Departments. The Airtron is validated by EESL (Energy Efficiency Services Ltd.), Ministry of Power, Government of India, for 44% savings. The Airtron has been validated on all AC's- Inverters, 5 Star, Splits, Multi-Splits, Packages, ducts, Windows, Cassettes from 1.0 - 20.0 TR, LG ltd, Videocon Ltd, Tata Communications, L&T, Nestle, Ashok Leyland etc. The AIRTRON comes with a Remote for setting the Room Temperature, and in a Non-Flammable Polycarbonate Enclosure, with SMPS Power Supply, to tolerate w ide Voltage and Current fluctuations, Surges, Spikes and Sags.

In our case, Airtron installation can reduce the energy consumption of each fixture by 15% on a conservative basis. For a total energy consumption, for air conditioners, as 18 units can be saved in a day for 30 air conditioners.

Saving Calculation: Considering 250 days of operation and unit cost as Rs 7.50/-.

- Monetary annual savings : Rs 40,000/-
- Total investment : Rs 80,000/-
- Payback period : 24 months (2 years)
- Annual emission reduction potential : 6 MT CO2



PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.

Conclusion

SIET has initiated few energy efficiency activities in their campus. While Sustainable Living Inc appreciates the plant team for their efforts, we would like to emphasize that opportunity exists further reduce the energy consumption. Installation of renewable energy is to be given major focus. RESCO model can be adopted to install renewable energy without upfront capital investment. We in Sustainable Living Inc are sure that all the recommendations mentioned in the report will be implemented by SIET team and the overall environmental performance of the campus will be improved.

List of Vendors

Equipment	Supplier Name	Contact Person	Mail Address	Contact Number
AC Energy Saver	Gloabtel Convergence Ltd	Mr Chirag Morakhia	chirag@gloabtel.com	9324176440
AC Energy Saver	Magnatron International	Mr Kishore Mansata	indiaenergysaver@gmail.com	9748727966
BLDC Ceiling Fans	Atomberg Technologies Pvt Ltd	Ms Roshni Noronha	roshninoronha@atomberg.com	9987366655
BLDC Ceiling Fans	Versa Drives	Mr Sathish	sathish@versadrives.com	94885 94382
LED	Havells India Ltd	Mr. Sunil Sikka	sunil.sikka@havells.com	0120-4771000
LED	Kwality Photonics Pvt. Ltd.	Mr. K. Vijay Kumar Gupta	kwality@kwalityindia.com	+ 91 40 2712 3555
LED	OSRAM Lighting Pvt. Ltd.	Mr Nitin Saxena	N.saxena@osram.com	+91 124 626 1300
LED	Reckon Green Innovations Pvt Ltd	Mr Krishna Ravi	krishna@reckongreen.com	9985333559

PRINCIPAL
SIDDHARTHA
Institute of Engineering & Technology,
Vinobha Nagar(V), Ibrahimpatnam(M),
Ranga Reddy District-501 506.