Strategies for Implementing Green Techniques to SMVITM Campus

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Abstract: **As human lives are advancing constantly; the basic needs of human beings have led to imbalance in nature due to the exhaustion of natural resources and pollution. In order to get rid of these problems, green technology should be introduced. These technologies have to be brought into light as people are still unaware of its advantages. So, in our project we have planned to present a proposal to implement green techniques to our college and bring out its advantages. By this, pollution can be reduced, natural resources will be efficiently used and consumption of energy and water will be reduced. Less waste will be generated. This will lead to an eco-friendly environment which will be a base for a healthy society.With the help of these techniques, zero discharge system will be established. By this, pollution of groundwater, land and air due to the improper management of waste will be reduced. Natural resources such as solar energy and rain water will be efficiently used. Valuable natural resources like water will be conserved by treatment of waste water and by reusing and recycling of treated water. The solid waste will be effectively treated by waste management techniques.**

Index Terms: Green techniques, Vermicomposting, Recycling, Reusing.

I. INTRODUCTION

As humans, the environment – The Earth- is our home. Unfortunately the planet is in danger. Many species of animals and plants are nearing extinction. Humanity has a moral obligation to the world and its creatures humans are responsible for taking care of the world, and protecting the environment is one way to be responsible stewards of the world entrusted to their care. It can be achieved through green technology applications like photovoltaic systems, rain water collection, and recycled materials. Hence we are taking an initiative by applying various green techniques to our college campus. By doing this, it would set an example for others.

II. OBJECTIVES

- To design sewage treatment plant to treat waste water and recycle and reuse the treated water.
- To design a vermicomposting plant to treat solid waste.
- To design a solar power system
- To design rain water harvesting system with ground water recharge.

III. LITERATURE REVIEW

Sangeeta Gangwar, (2012) has done a study on Architectural planning and construction for Green Building.study case CII – Sohrabji Godrej Green Business Centre, TERI campus at Bangalore, WB Renewable Energy Development Agency, Kolkata. The aim of the study is to learn simple new green techniques which have already in used in the study area i.e, CII – Sohrabji Godrej Green Business Centre, TERI campus at Bangalore, WB Renewable Energy Development Agency, Kolkata. The methodology included the documentation stage only. From this study we understood new and simple methods using locally available materials.

C. R. C. Mohanty has done study on Reduce, Reuse and Recycle (the 3Rs)and Resource Efficiency as the basis for Sustainable Waste Management. This study includes a case study of brazil. This paper discuss about the life cycle of waste, eco-efficiency, importance of 3R's, conventional waste management process, etc. the effect caused due to the conventional methods have been highlighted in this paper. They have tried to bring out the importance of green method and eco-friendly.

IV. STUDY AREA

General

Shri MadhwaVadiraja Institute of Technology and Management, Bantakal is an engineering college situated in Bantakal. It consists of a vast campus of area 148473m^2. Bantakal is situated in the coastal district Udupi of Karnataka. SMVITM was founded in year 2010. Before the institution was constructed, the entire area was covered by thick forest. Even after the construction, more than 50% is still covered by forest.

Administrative Division

SMVITM is located in coastal region of Udupi district. Its location is 13.2547^{o}N and 74.7850^{0}E. The population in the campus including student, teaching and non-teaching staff, etc. is 1757. The population in boys and girls hostel is 146 and 96 respectively.

Climate

The climate in Bantakal is hot in summer and pretty good in winter. During summer (from March to May), the temperature reaches up to 40^0c. The average temperature is 26.5^0C and in winter (from December to February), it is usually between 32^oC to 20^0C. The monsoon period is from June to September with one of the rainfall averaging more than 4000mm every year and heavy winds.

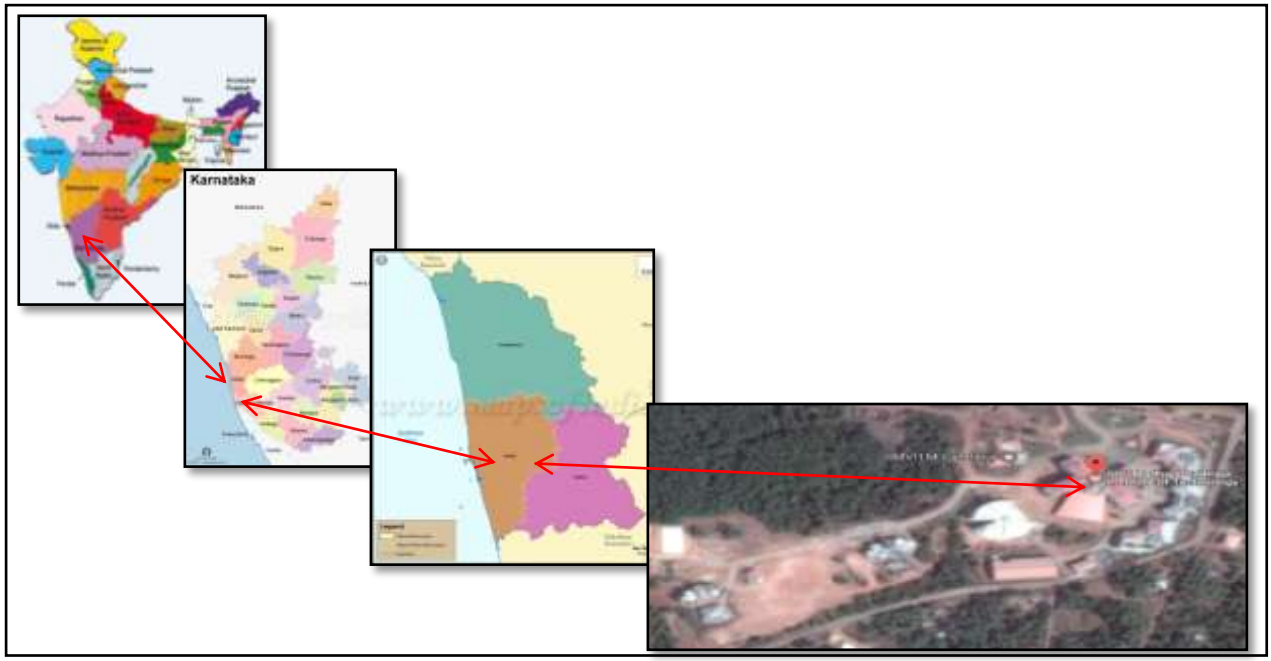

Fig 1: SMVITM campus location

Water Source and Soil Type:

Ground water is the major source of water in the region. There are three bore well and three well in the region.The soil type in the area is red lateritic soil.

V. METHODOLOGY

In this project, four techniques are proposed to establish a zero discharge system in SMVITM campus. The four techniques that are proposed are divided into four stages as shown below in the flowchart.

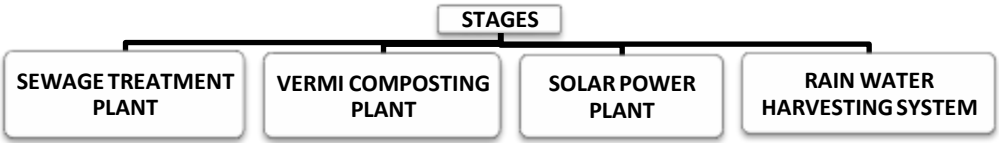

Fig 2: *Flowchart of Methodology*

Green Techniques

The 'Green Building' concept is gaining importance in various countries, including India. These are buildings that ensure that waste is minimized at every stage during the construction and operation of the building, resulting in low costs, according to experts in the technology. Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water and other resources.
- Protecting occupant's health and improving employee productivity.
- Reducing waste, pollution and environment degradation.[1]

Sewage Treatment Plant

Water is necessary for the sustenance of human life. Nowadays, human beings are destroying the environment by wasting this 1% of clean water by throwing garbage into water bodies, careless use of water in the household works, etc. Hence it is important to reduce, recycle and reuse water. One of the methods to reuse and recycle water is treatment of waste water and then the treated water is used for irrigation and flushing. Treating waste water has the aim to produce an effluent that will do as little harm as possible when discharged to the surrounding environment, thereby preventing pollution compared to releasing untreated waste water into the environment. [2]To protective the environment and public health, pollutants need to be removed from the wastewater. If left untreated, these pollutants may negatively affect our water and environment.

Solid Waste Management

Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. Solid Waste Management is one among the basic essential services provided by municipal authorities in the

country to keep clean and it is defined as generation, storage, collection, transfer, transport, processing and disposal of solid waste in a manner that is in accordance with the best principle of public health economics, engineering, conservation, aesthetics and other environmental considerations and also responsive to public attitudes.[3]Vermicomposting technology is one of the best options available for the treatment of organics-rich solid wastes. Vermicomposting refers to composting or natural conversion of biodegradable garbage into high quality manure with the help of earthworms. Earthworms have been used for waste stabilization for many years, especially in Southeast Asian and European countries. [3]

Solar Power System

In India energy problem is very serious. In spite of discoveries of oil and gas of the west coast, the importance of crude oil continues to increase and the price paid for it now dominates all other expenditure. The need of developing energy alternatives is thus evident and considerable research and development work is already in progress in this direction. One of the promising options is to make more extensive use of renewable source of energy derived from sun. Solar power is the conversion of sunlight into electricity, either directly using photovoltaic, or indirectly using concentrated solar power . Sunlight is a renewable energy source which can be converted into usable energy by solar panels.

Rain Water Harvesting

Rain is the ultimate source of fresh water. With a ground area around houses and buildings being cemented, particularly in cities and towns, rainwater, which runs off from terraces and roofs, was draining into low lying areas and not percolating into the soil. Rainwater harvesting is a system by which, the rainwater that collects on the roofs and the area around the buildings is directed into open wells through a filter tank or into a percolation chamber, built specifically for this purpose. Rainwater is collected directly or recharged into the ground to improve the groundwater storage. Water that is not extracted from ground during rainy days is the water saved.[4]

VI. RESULT AND DISSCUSSION

Sewage Treatment Plant

1] Data Collected

The sample of the waste water was collected from the collection tank. Various tests like BOD_5, COD, turbidity, pH, total suspended solids, and sulphates were conducted to find the characteristics of the waste water. The result of these test are tabulated and is shown in the below table.

Table 1: *Characteristics of Influent and Effluent*

CHARACTERISTICS	EXISITINGVALUES	PERMISSIBLE LIMITS
BOD5	250 to 350	<10
COD	500 to 600	<100
TSS	150 to 250	<20
pH	6 to 8	6.5 to 7.5
Turbidity	63 NTU	5 NTU
Sulphates	30.451	<200

[All the values are in mg/lt except pH and turbidity]

2] Design of STP:

It was decided to design the STP using extended aeration with activated sludge process for Average flow of 260kld and Peak flow of1.5x260=390kld. The components and their size are given in the below table.

Table 2: *Components of STP*

COMPONENT	**No's**	SIZE		
		Length(m)	Breadth (m)	Depth (m)
Collection tank	1	4.0	4.0	4.25
Screening chamber	1	1.0	0.6	0.5
Grit chamber	1	2.3	0.6	0.5
Aeration tank	2	7.0	4.0	3.5
Drying beds	4	3.5	2.5	1.5
Pressuresand filter	2	1.07[Diameter(m)]	-	2.5[Height(m)]
Secondary clarifier	1	5[Diameter(m)]	3.8[Depth(m)]	2.1 in 1[Hopper Slope]

3] Capital investment

- Civil construction is about 15 lakhs
- Cost of equipment is about 10 lakhs
- Total cost of the STP is 25 lakhs.

4] Trade off Analysis

At present, a total of 270 KLD of waste water is produced. Assuming 95% of this waste water, i.e. 257 KLD, will be returned as treated water which is recycled and reused for flushing and gardening. Hence 257 KLD of fresh water is saved by recycling and reusing of waste water. The cost incurred for the construction is around 15 lakhs (approx.) and the overall cost for the instalment of STP is 25 lakhs (approx.).A subsidy of 50% of the total project cost will be provided under the centre sponsored scheme for CETPs. Thus the investment will reduce to 12 lakhs rupees.

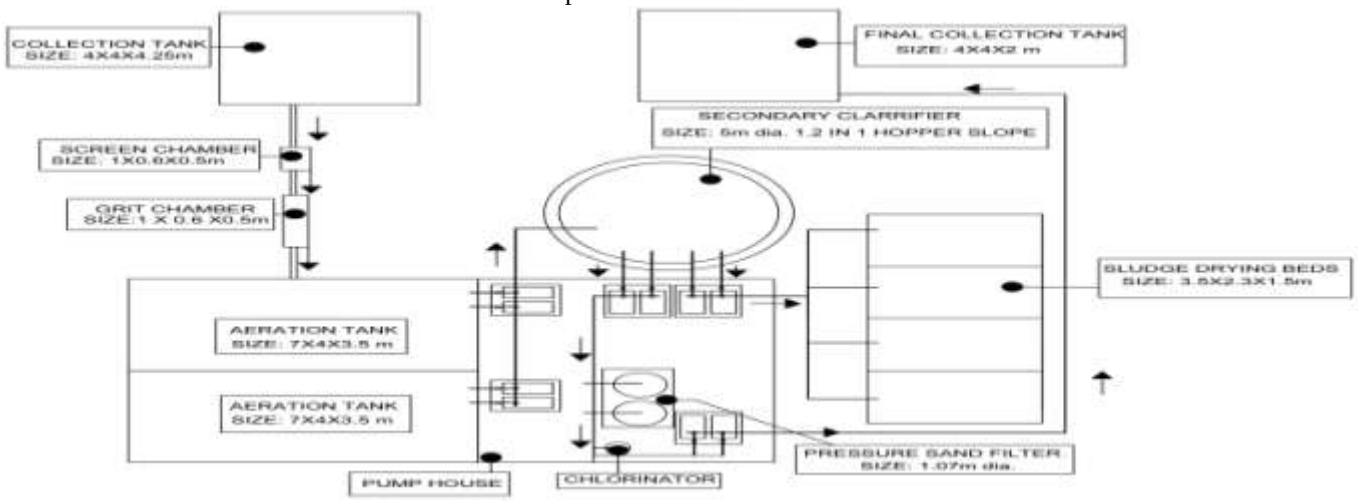

Fig 3: Plan of Sewage Treatment Plant

Solid Waste Management

1] Sources of waste:

Waste management or Waste disposal is all the activities and actions required to manage waste from its inception to its final disposal. The solid wastes generated in SMVITM are of two types: organic and inorganic. This includes vegetable and fruit waste, domestic and institutional kitchen waste, paper, garden waste, cardboard, broken furniture, plastic waste, etc.

2] Quantity of waste produced:

Table 3: Quantity of Waste Produced

SL.NO.	SOURCE	TYPE OF WASTE	QUANTITY
1.	Canteen	Food waste	60kg / day
2.	Canteen	Inorganic wastes	200kg / day
3.	Hostel	Food waste	40 kg / day
4.	Hostel	Inorganic waste	100kg / day

3] Type of Collection:

The waste collection of SMVITM is as follows:

Sweepings: The waste is collected by laborers from each department twice a day, once in the morning and once in the evening. These are collected and put into a bin of 20kg capacity. These are then dumped in a far off location from college and burned.

Canteen waste: The food waste from canteen is collected by laborer and put into bins of 20kg capacity. Everyday three bins each of 20kg capacity are filled. The inorganic waste from canteen is collected in bins of 100 litre capacity. Everyday three bins each of 100 litre capacity are filled.

Hostel waste: The mess waste is collected in bins each of 20kg capacity. Everyday two bins are filled. The inorganic waste is collected in 100 litre capacity bin. Every day one bin is filled.

4] Type of Treatment Chosen:

Depending on quantity of organic waste produced daily, we choose to undertake the **vermicomposting method** of decomposition of organic waste.The vermicomposting tank chosen here is a concrete tank. The suitable standard size of vermicomposting pit is **2.5m x 0.91m x 0.91m** [3].

1 kg of worm will consume 5 kg of solid waste per day. The approximate waste produced in our college is 100 kg per day. Therefore 20 kg of worms are required initially.Since treatment of inorganic waste is not possible within the campus, it is proposed to be outsourced for treatment.

5] Capital Investment

- Civil construction is Rs. 10,000

6]Trade off Analysis

Presently, 50 bags of manure are bought every year. Each bag consists of 15 kg manure which costs Rs 25. So a total of 750 kg per year of manure is bought for Rs 1250. From vermicomposting a total compost of 100 kg is produced. Therefore per year 36,000 kg will be produced. After using for plantation purpose, compost remaining is 35000 kg which can be sold. For 1kg of compost, Rs 9 is charged and if each bag weighs 10 kg then the total income will be Rs. 3,15,000. Under Mission for Integrated

Development of Horticulture, financial assistance is provided for setting up vermicompost units @50% of the cost subject to a maximum of Rs.30,000/- per beneficiary. Thus the investment will reduce to Rs. 5000.

Solar Power System

1] Data Collected

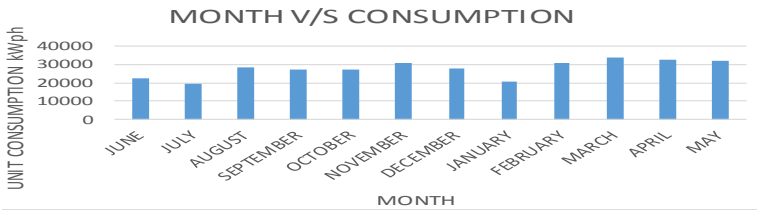

Fig 1: Variation of Electricity Consumption in SMVITM

The above given graph shows the variation electricity consumption in the collage for a year.

- Presently electric power required per month: 36000 units
- Rate per unit: 7 rupee60 paisa
- Total monthly electric bill: 2, 50,000 per month
- Unit required per day: 1200 unit
- Amount required per day: 9120 rupees
- Working days per year: 265 days (excluding holiday and rainy season)
- Free power generation in 65 days: 78000 units (65*1200)

2] Area Required

- 1Kw = 4units
- Required units per day are 1200 units.
- 1200 units/4 = 300 Kw.
- 1kw requires 100 sqrt ft.
- For 100 Kw we need area of 30,000 sqr ft.=>$\sqrt{}$ (30,000) = 173.20 feet
- Hence say required area is 175*175 feet

Fig 2: *Location of Solar Panels*

3] Capital Investment

- Capital investment for 1Kw of solar panel is about 80,000 rupees
- The requirement is about 100Kw and the estimated cost is 80 lakhs

4] Trade off Analysis

The Total investment on solar panels is about 80lakh.The monthly electric bill is around 2.3lakhs approximately. The Government gives subsidy of 30% for commercial buildings. And the investment thus reduces to 56 lakhs. The power generated during the non-working days i.e. 65days can be sent to the Grid. The MESCOM will give about 6rupees per unit and the power generated during non-working day is 1200units. Thus saving a total of 4.6 lakh rupees per year. We get an annual income of 4.6lakhs by Grid and the monthly electric bill around 2.4 lakh per month can be saved. The amount invested can be recovered within 2 years.The sun provides a very abundant supply of energy that is available to all of us. This energy can be completely used. It is eco-friendly and cost effective. sometimes there will be power cut in the locality due to which the power generator should be operated which is again consumes more fuel and the cost also increases. By using solar energy to produce electricity these problems can be avoided.

Rain Water Harvesting

The rain water harvesting technique proposed for SMVITM is ready use tank and recharge pit with barrel. The rain water falling on the roof of admin block, E&C block, mechanical block and the work shop will be collected and stored in a tank. The excess water from the ready use tank will be sent to recharge pit. Before the water is sent to the storage tank it will be filtered using simple sand filter.

1] Ready Use Tank

The ready use tank will be set up near the mechanical workshop and the filter is placed on top of the tank. The ready use tank is made of concrete. The annual average rainfall in the area is 3.5m. The catchment area available in the region is as follows:

***Table 4**: Available Catchment Area*

BUILDING	CATCHMENT AREA
E&C block	1015.698 m^2
Mechanical block	1015.698 m^2
Admin block	1339.338 m^2
Mechanical work shop	1122.517 m^2

Total area considered=4493.252m^2

Annual average rainfall=3.5m

Potential of the area= 4493,252 x 3.5=15,726.382 m^2

Assuming 120 days of rainfall=15,726.382/120 =131.053m^3 =131.053x10^3 litre

The total amount of water that can be collected is 131.053x10^3 litres, so we will provide a sump to collect a small portion of water and the remaining will be sent to the recharge pit. A sump will be provided of capacity 2000 litres. The slump will be made of concrete of rectangle section of size 2.0m x1.0m x 1.0m.

2] Recharge Pit

Here the recharge pit will be made using barrels method. This method was invented by A.R. Shivkumar[3].The capacity of the barrel is around 200 litres normally. One barrel is required for the roof area of 400 sq. ft.Here we use 3 barrel and their bottom are cut open. The 3 barrel is interconnected to each other. The water fills the first barrel, the excess water will go to the next and this will repeat.

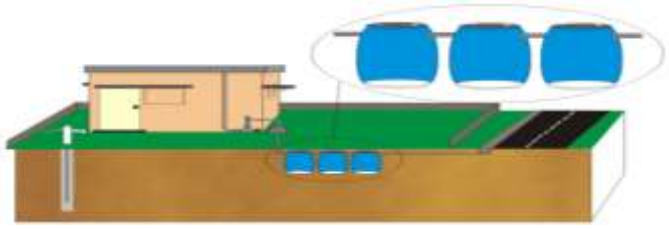

***Fig 3:** Recharge Pit with Barrels*

3] Capital Investment

- Civil construction is around is Rs. 10,000.
- Cost of equipment is Rs. 25,000.
- Total investment is Rs. 35,000.

4] Trade off Analysis

A tank of 2000 liter capacity is provided. The rain water is collected in the tank. The remaining water is sent for ground water recharge which in turn will increase the ground water level in the surrounding areas. The water collected in the tank is used for cleaning vehicles, utensils, floors, etc. By this process, fresh water used for cleaning purpose is saved. By recharging the ground water we can reduce the scarcity of water.Government of Karnataka is providing a subsidy of 80% of total investment for rain water harvesting system. Thus the investment reduces to Rs. 2000.

VII. CONCLUSION

Environment is a home to all living beings. Managing it properly is every person's duty. But we see that these days this is being ignored. Green techniques help in the conservation of natural resources and prevent the pollution of the environment. Not everyone knows the importance of these techniques today but if everyone is made aware of this and if it implemented everywhere then the lifespan of the earth will increase.

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