

Impact of Sustainable Development on Climate Change and Student Learnings

Santosh Madeva Naik, Surendra Bandi, Mohammed Soheli, Dhanni Pavani

Mechanical Engineering, Hyderabad Institute of Technology and Management, Telangana, India

Abstract— Energy demand is increasing day by day and to overcome these challenges we are depending more on non-renewable energy sources. The non-renewable energy sources such as thermal power plant, nuclear power plant, diesel power plant, etc., release more carbon dioxide and other harmful gasses into the environment. This causes raise in temperature, water getting polluted, etc. To overcome global climate change challenges (temperature raising, water pollution, air pollution, etc.), an affiliated institution in the south of India implements utilizing the renewable energy sources -- wind mill, solar energy & other sources- rainwater harvesting, water recycling, etc. on the campus. This paper describes the details of the implementation of these different projects. The implication of this work is to create awareness of an impactful initiative for other institutions to follow.

Keywords— Green campus; renewable energy source; climate change; PBL

I. INTRODUCTION

This paper explains the clean and green campus implementation and students learning through PBL in an affiliated engineering institution in the south of India. A clean & green campus is one of the main objectives of engineering education. (Mueller, S. 2004) For learning or doing engineering the college environment should be clean & green, it motivates the students to work on society oriented real time projects and concentrate on the learning environment.

In the recent past, (Sampaio et.al, 2010) most engineering institutions are focusing on providing diverse learning experiences through the incorporation of technology (LI et.al, 2008), innovative laboratory initiatives, course and/or individual projects, solving engineering problems, etc. This is certainly required and a good direction in the field of engineering education. However, the institutions must also focus on other aspects that are equally important and are necessary for every institution to focus on the inclusion of a clean and green campus. An attempt is made in this paper to highlight how an institution took up the challenge to make the campus clean and green.

A section of literature in this space exists and more explanation on the same is provided in this section. (Qiushi Deng et.al, 2020) explained greenhouse gas emissions and renewable energy source consumption in South America. The author suggested that to get better quality of life, public policies

regarding climate change and clean renewable energy sources should be promoted.

(Ana Jesús López & Blanca Moreno, 2010) explained the investigation of the economic growth of the European Union and Renewable energy. The twenty-six countries' data collected on the usage of renewable energy, shows that on increasing the utilization of renewable energy the emission decreases significantly. A comparative study has been made on model 1 (country effects & time effects) & model 2 (explanatory variables) GDP growths, where the author recommended model two better than model one. By adopting renewable energy sources in Institutions, students can learn the importance of clean energy and the effect of nonrenewable energy sources.

(Ashok Bindra, 2019) explained the effect of global warming on polar regions. With an increase in carbon dioxide emission, global temperature is rising gradually. Due to this problem ices are melting and living creatures (i.e., polar bears) are starving. According to Intergovernmental Panel on Climate Change (IPCC), we need to reduce carbon dioxide emissions by 45% by 2030. (Xiangyi Wan et. 2018) explained the effect of methane gas emission in southern China, study has been done by mapping methane gas emissions from double paddy rice harvesting and Geographic Information System (GIS) technology for traditional harvesting. The study shows a strong linkage between climate change and methane gas emissions.

(U. B. Akuru et.al, 2013) explained the impact of renewable energy sources on global climate change in Nigeria. The author stated that if we depend on fossil fuels for energy generation the resultant effect will be catastrophic future of the country. Nigeria's contribution towards reducing global climate change is excellent compared with developed countries. (D. Cao et.al, 2018) did a survey on global climate change in regional wise in China from 1980-2018. It is shown that the climate potential productivity (CPP) of vegetation over China's temperature is less compared to other regions.

(M. G. Laub, 2010) explained the initiatives proposed by the government and industry to overcome the global climate change problems. The author stated that combining innovative technology and renewable energy sources can overcome the challenges of global climate change. (Mohibullah et.al, 2006) in this paper explained the effect of harmful gasses after firing coal from eighty-one steam power plants in India. The proper installation of non-renewable energy sources will help to

control environmental impacts. A mitigation plan is explained for reducing carbon dioxide in nature.

II. METHODOLOGY

To reduce the room temperature on the campus and overcome the global climate change problems has the following strengths shown in the figure.1 green building, natural lighting, waste management etc.

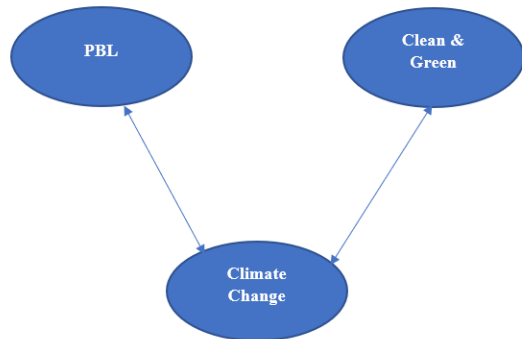


Fig. 1. Block diagram

The institution campus has 50% of greenery including medicinal plants shown in the figure.3, used for medicinal purposes and to absorb more carbon dioxide in nature. The institution believes that nurturing nature helps to promote creativity for learning among the students (Naik et.al, 2021). Hyderabad Institute of Technology and Management (HITAM) is the first educational campus in India to receive a silver rating for a green building. The green building, natural cooking in all classrooms and laboratory, and maximum usage of natural lighting and the ambiance encourages students in learning, creative thinking, innovation, etc.

In the research, it is said that the water level is going down yearly due to unlimited water usage & climate change. Fig.2 explains water recycling and minimizing water usage on campus.

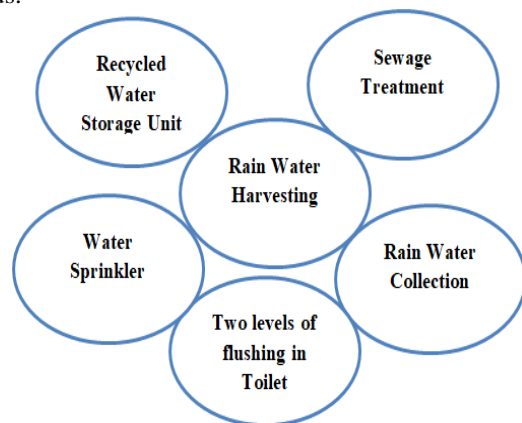


Fig. 2. Water Saving

Various methods are used on the campus for efficient usage of water as shown in figure.3. Saving water is one of the important aspects in the context of climate change and the increase of scarcity. In the Monsoon season rainwater is collected in a pond and used for garden watering purposes and cleaning which is shown in figure 4.



Fig 3. Medicinal Plant



Fig. 4. Rainwater Harvesting

The wastewater or used water is transferred to the sewage treatment plant. The sewage treatment plant has a water capacity of five thousand liters shown in figure.5, where contaminants of water are removed in this process. After purification, water is transferred to the recycled water storage unit and then this water is used for gardening and trees. For birds, water pits have been built drinking purposes shown in figure.6.



Fig. 5. Sewage Treatment Plant

As a part of promoting renewable energy sources windmill is installed on campus. This windmill generates 1KW of electricity which will be used for laboratory electricity purposes. The 1KW capacity of solar panels installed on campus which is used for laboratory electricity purposes shown in the figure. 7.



Fig. 6. Water pits for Birds



Fig. 7. Windmill & Solar Energy

The organic waste produced from the canteen is used for preparing vermicomposting shown in figure.8. After preparing compost it is used for plants.

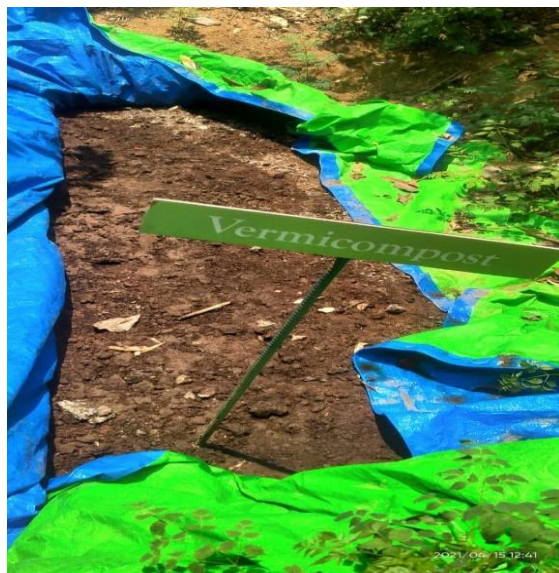


Fig. 8. Vermicomposting

Students have been involved in all these approaches as a PBL case study project. After studying this Clean & Green campus approach students have been involved in societal-oriented PBL projects. As a course PBL projects students have identified problems on the college campus & the near village. The teams are formed by adding multidisciplinary students a maximum of five students in a team (Minimum of 02 students from different disciplines). A sixteen week course is designed for solving real-time problems. We followed a design thinking process for designing the course. This PBL project is considered an academic mini project. In 11 teams of multidisciplinary students (n=55) 80% of teams engaged in climate change problem-solving projects & 20% of teams participated in agriculturally based projects. The student's performance evaluation rubrics is shown in Table.1

Table.1 Assessment

Sl. No	Teams	Climate Change solving/ Agricultural Type (40M)	Technical component (30 M)	Prototype working (30M)	Total Marks (100 M)
1	A	-----	-----	-----	-----
2	B	-----	-----	-----	-----
3	C				
4	D				
5	E				

- Climate Change solving/ Agricultural Type (40M) – Should be related to a clean & green campus approach.
- Climate Change solving/ Agricultural Type (20M) – It can be related to app/virtual-based technology
- Climate Change solving/ Agricultural Type (10 M) – No technical approaches involved
- Technical component (30 M) – Should be Hybrid technology (Ex: Solar & Wind)
- Technical component (10 M) – using other resources (Ex: Lithium-ion battery)
- Prototype working (30M) – Feedback should be taken from the stakeholder & prototype components should be evaluated on the field.
- Prototype working (10M) – No Feedback taken from the stakeholder & prototype in working condition

III. RESULTS

The institution campus always has C to 6 °C less than the usual temperature, compared with the outside temperature in the summer season as shown in Table 2.

Table 2. Climate Temperature

Sl. No	Month	Year	Inside Campus Temperature (°C)	Outside Climate Temperature (°C)
1	April	2021	31	35
2	April	2020	33	38.7
3	April	2019	34	39.4
4	April	2018	36	41.8
5	April	2017	31	36
6	April	2016	36	41
7	April	2015	36	41.5



Fig.9 Agriculturally based & Waste management project



Fig.10 Clean & Green Campus related project



Fig.11. One District One Green Champion Award 2021

The student's team developed renewable energy-based real-time projects shown in figure.9&10. This project was developed by multidisciplinary students, and we got feedback from the students it shows that students enjoyed doing the real-time projects and they got motivated to do a real-time project because of stakeholders given this problem. 80 % of students recommended implementing these courses module-wise in 4 years of Bachelor study and 20% of students recommended implementing community engagement or social learning PBL course in the first year B. Tech Programme. The institution

awarded as "One District One Green Champion" Awards 2021 (Swachhta Action Plan 2020-2021) by Mahatma Gandhi National Council of Rural Education (Department of Higher Education, Ministry Education, Government of India) for clean and green campus shown in figure11. The Ministry of Education encouraging institution to adopt swachhta action plan clean & green campus initiative by awarding & recognizing in District level.

A. Discussion and Implications

Following (A. Talamon, 2013) from green sustainable building lot of energy can be saved through this the energy demand will be decreased. Lot of studies have introduced the different techniques for the green environment and their impact on climate change. This study has shown the implementation of various initiatives and its result which clearly shows the changes in the climate that are benefiting the surrounding people. It provides a healthy environment to the student and faculty that improve their concentration toward healthy learning.

Some of the implications of this work include institutions willing to have a clean and green campus can follow the description provided in this paper and proceed accordingly. In addition to the various existing best practices, this paper can serve as a base or reference model for institutions in India.

IV. CONCLUSION

The institution has no air conditioner on the campus and the campus has maximum energy utilization dependent on clean and green energy. By maintaining clean and green practices on campuses we can overcome the global climate change problems. By adopting a sustainable green building concept, we can use less energy in the classrooms and laboratory for lighting purposes. The MNRE (Ministry of New and Renewable Energy) Government of India promotes Renewable Energy Sources usages and advantages, by adopting solar, wind, and biomass energy for daily need of electricity we can overcome the global climate changes.

A. Directions for Future Work

This study describes the different projects implemented as a part of the clean and green campus initiative in an affiliated institution in India. This study has some potential directions for future work that are listed in this section. (1) (Kittur, & Salunke, 2020) examining students' understanding of the overall aspects of a clean and green campus by collecting data quantitatively (2) critically understanding both the student's and faculty's perceptions of the changes they experience on campus because of this initiative a qualitative research design could be implemented (Kavale et.al, 2016). This study can also assess how this initiative impact students' learning (if any). (3) determining the impact of the clean and green campus initiative by computing the energy savings, carbon footprints, sustainability aspects, etc. (4) Assessing the different projects

as a part of the initiative to understand specific revisions and improvisations needed moving forward.

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