

Environmental alignment towards Net Zero School Campuses: Case study-based approach

Sub theme: Goal 11- Sustainable Cities and Communities

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Abstract

Schools play a crucial role in building the foundation of the learning environment. They not only provide structured settings but also a visual environment that enriches learning by taking appropriate initiatives at a very grass root level. Since schools are the fundamental blocks of the learning environment, they should also serve as the keystone of sustainability. In the contemporary era, it is highly recommended that kids learning in schools establish a close connection with an environment friendly atmosphere. At present Net zero campuses are drawing the most attention in the construction industry fostering the requisites of United Nations 17-Sustainable Development Goals. In light of the above context, this paper shall take up school campuses as the research domain and try to understand the factors which can upgrade a normal campus in alignment with Net zero strategies. This research covers case studies of school campuses to understand a positive impact of environmental strategies. The paper shall focus on understanding the positive impact of Net zero approach in green field projects and opportunities in brown field school projects.

The research methodology shall begin with a literature review followed by case studies, and the targeted Research question shall be 'what factors should be introduced to align the existing school campuses towards Net Zero atmosphere'. The major area of discussion shall focus on awareness about green atmosphere and preparedness towards solid waste management and waste water treatment at campus level. The paper will conclude with few recommendations of strategies to align school campuses towards Net zero strategies. Primary and secondary data collection done to understand and identify the inclination of the schools towards environmental alignment. The objective of the research is to create an awareness in the users towards Net zero approach and sculpting the young minds for natural environment rather than artificial comfort.

Keywords

School campus; Environmental consciousness; Net zero approach; Resource management

1. Introduction

India has got a profound history of education. Ancient records reflect the depth of education system India has produced to inculcate micro level knowledge within the students. That's the reason why Indian scholars have shown supremacy in various fields like medical science, engineering, architecture and so on well in advance before the world explored the theories. The pattern of education used to be qualitative enough to sculpt a student in all departments. Not only theory but practical implementation of concepts learnt was always the strength of the universities that India has witnessed. As an example, 'Gurukul' system that ancient Indian society possessed, had a concept of residential schools where the students used to get enrolled at the age of eight and study there till they turn twenty-five. The knowledge imparted to the students in the 'Ashramas' used to be holistic making them a self-sustainable human being living as a responsible citizen of the society. The scope of knowledge-gain in these ashramas had a humongous range including responsible routine life, discipline, daily chores, scientific theories, deep knowledge of 'vedas' and 'upanishadas', physical fitness activities and so on. The base of this education was practical implementation of the knowledge in routine life.

The whole system was evolved around stages of 'ROOT' understanding as shown in Fig. 1 below:

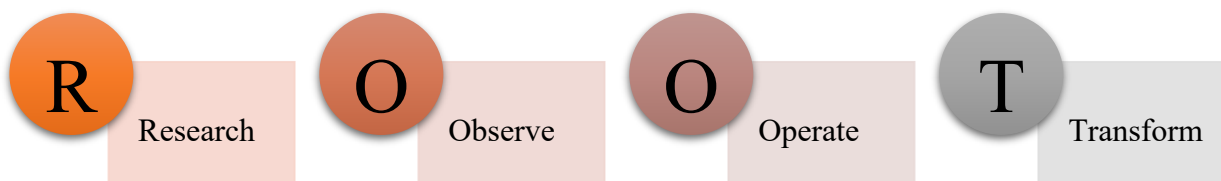


Fig. 1: showing base intent of ancient education structure in India

Source: Author

- a) Research: It is the most important part of the understanding process that gives a student an awareness about the practices.
- b) Observe: It is the understanding of how practices are being performed keeping the focus on the outcomes.
- c) Operate: It is the practical implementation of the knowledge in the correct domain where a change is required.
- d) Transform: It is the ultimate change that is to be brought in order to have a positive impact in the society.

The need in the ancient Indian era was societal elevation through a self-development. More you develop yourself with ROOT understanding, better cultural, moral and practical values will be reflected in the society.

Over the period of time the societal needs got modified and today we stand in the era where the biggest and the most important concern is the environmental challenges. Educational setup plays an extremely important role in moulding the base thought-process of the future responsible citizens.

2. Background

2.1 Need of environmental strategies:

Development and improvement are the unavoidable parts of the human evolution process. The world has moved way ahead and got progressions in various fields to achieve heights of human comfort. At the same time, knowingly or unknowingly lot of environmental damage has been done to achieve this success. The factors like global warming, climate change, floods are the by-products of the human efforts towards so called qualitative improvements. To secure the future generations, it becomes extremely important to control this damage before it takes a toll on human life. Various organizations are already working on the roadmap to attain an environmental balance.

Sustainable development goals, Carbon footprint reduction, Net zero strategies, green initiatives are some of the fields the world is moving ahead with. Renewable energy, conservation of natural resources, 3R (Reduce, Reuse, Recycle) strategies, Optimum utilization of natural resources, waste management are some of the initiatives identified for a secured future.

2.1 Need of environmental strategies:

The implementation of the environmental strategies needs to be the part of routine in human life if we are aiming towards a safe and controlled future. Educational institutions are considered to be one of the effective ways of doing so considering that the education creates the base of future generations. The future professionals are the present learners. The current Indian education system and the can be subdivided in parts mentioned here (Fig. 2) The depth of knowledge level increases as we move higher.

The existing education system can contribute significantly towards developing environment conscious professionals of tomorrow.

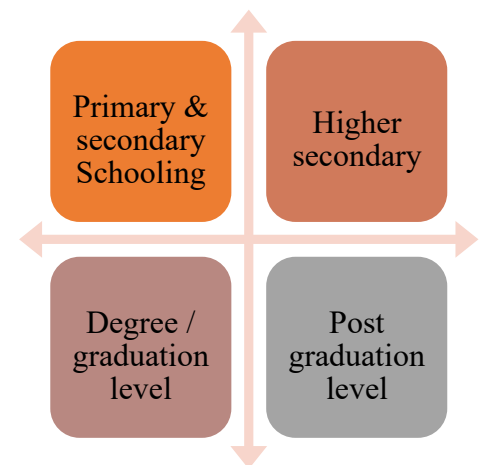


Fig. 2: Showing education division in India

Source: Author

The role of educational institutions can prove extremely valuable in structuring a net zero society of future by imparting correct, necessary, logical and practical knowledge in the students to align the future of the country towards environmentally sustainable balance. A correct knowledge at a sensible age can result into responsible future citizens. Getting into the details of our present initiatives and understand the efforts taken by various school authorities becomes extremely important to know where do we stand in order to be an 'environmentally educated' country. Whatever field the school children pick up as a part of their profession in future, environmental stability is directly associated with him / her.

The research tries to gauge the gravity and possibility of initiatives like awareness campaigns, hands-on projects, experiential learning, methodical involvement have a huge potential at the school level which is extremely useful in developing interest of students towards Net zero concept alignment.

3. Aim

Aim of the research is to identify possible ways of implementing Net Zero initiative levels to impart in school campuses of India.

4. Objective

- To understand current preparedness of the schools towards understanding of Net Zero strategies.
- To study initiatives taken up by various school institutions in India towards understanding and implementation of Net zero strategies.
- To propose initiatives at school level which help institutions to align students towards Net Zero future.

5. Scope

- The research will be able to surface awareness of school children towards simplified concepts of Net Zero initiatives.
- The ongoing initiatives of schools in India shall help understanding the acceptance level of the school-going children.
- The proposed initiatives at school level shall be tested for barriers in implementation.

6. Limitations

- The research is limited to school institutes and does not cover larger picture at higher education.
- The research is limited to certain initiatives and not entire Net Zero concept at large.
- The research is restricted to Indian context and does not cover global canvas.

7. Research Question

'What factors should be introduced to align the existing school campuses towards Net Zero atmosphere?'

8. Methodology

The research is compiled with understanding of efforts taken by various institutes at local level. Case studies are done to understand initiatives taken by some of the educational organization to get aligned with Net Zero concepts. Primary sample surveys are done in some of the Mumbai based schools as to understand the current practices in schools and to know their preparedness to be part of Net Zero alignment. Observations are listed for further discussion about how simplified concepts of Net Zero initiatives can become a parallel part of regular studies in school. Research concludes with the recommendations at school level which shall be brought into the picture to generate interest amongst the young generation about the sustainable future and Net Zero routine practices.

9. Literature review

9.1 Initiatives taken by Indian Government towards Net Zero:

Several government initiatives in India have aimed to develop and implement policies through various building rating systems, such as the Indian Green Building Council (IGBC), which launched voluntary ratings for net-zero energy buildings since 2018. In 2021, with the backing of the Ministry of Power, the Bureau of Energy Efficiency (BEE) launched the “Shunya labelling” program, an exclusive certification designed to promote net-zero and net-positive energy buildings in India.

During the UN Climate Summit in Glasgow in 2021, India declared its commitment to achieving net-zero emissions by 2070. In late 2022, the national government introduced its “Long-Term Low-Carbon Development Strategy,” outlining India's pathway to a net-zero economy. The strategy emphasizes a significant expansion of renewable energy, improvements in energy efficiency, low-carbon transportation through enhanced fuel efficiency and cleaner fuels, including electric mobility. It also highlights efforts to increase forest cover, promote green hydrogen, and explore low-carbon solutions in challenging sectors.

As the Government of India undertakes various initiatives to achieve net-zero (Carbon Neutral), the University Grants Commission (UGC) is also launching efforts to make educational campuses net-zero since 2023. It says education institutions can significantly contribute to India’s net-zero goals by achieving carbon neutrality on their campuses and also have set some guidelines for the same.

9.2 Case Studies:

9.2.1 Case Study 1

The first case study done is of Eco-Schools India which is an international initiative (programme undertaken by different schools) aimed at enhancing environmental education and raising awareness about sustainable development issues in schools, specifically by involving students in grades 1 to 5. Eco-Schools India is a component of the broader global Eco-Schools program, which is implemented through the Foundation for Environmental Education network across more than 70 countries. It is a program by the Centre for Environment Education, under the Ministry of Environment Forests and Climate Change. The main five themes on which the program focuses are healthy living, energy biodiversity, waste and water to curb climate change, as shown in figure 3.

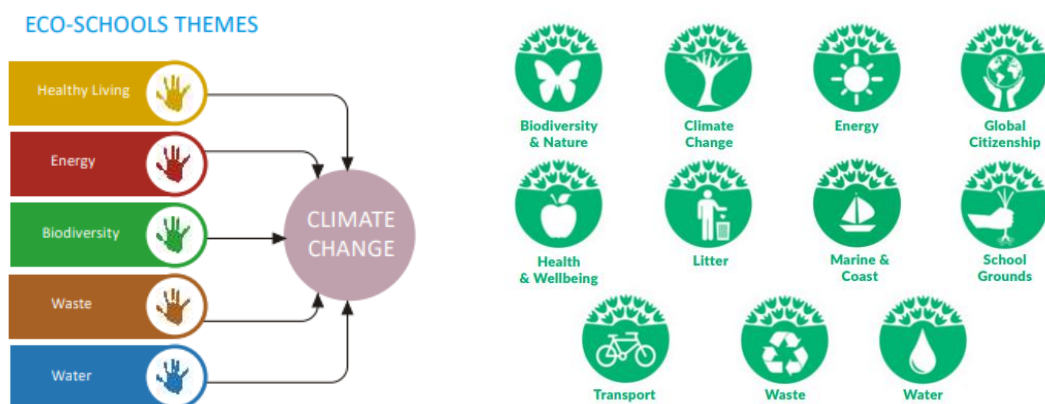


Fig. 3: Eco school themes for climate change mitigation
Source: <https://ecoschools.in/>

Following table shows how Eco-Schools Address different SDGs.

	How Eco-Schools Addresses This SDG	Suggested Theme Link
	Quality Education The Eco-Schools methodology is a powerful tool for providing quality education for sustainable development at all school levels. Its whole institution approach ensures an inclusive implementation throughout the whole kindergarten, school or campus, and the involvement of all children and students.	All Themes
	Clean Water and Sanitation Within the Eco-Schools programme students are being sensitised to the sustainable use of water and sanitation. The Theme Water especially focuses on this issue by providing an introduction to the importance of water both locally and globally and by raising awareness of how simple actions can substantially cut down water use.	Water
	Sustainable Cities and Communities By integrating Themes such as Sustainable Living, Waste Management and Responsible Consumption into the curriculum, students learn how to reduce the environmental impact of their schools as well as of their personal lifestyles. Through the fostering of responsible behaviour within the school environment, students will also learn how to value and protect the cultural and natural heritage in their countries, as well as abroad.	Litter Waste
	Climate Action Many of the countries running the Eco-Schools programme help schools and communities build Climate Change resilience. Examples of school activities include projects for rainwater harvesting, soil stabilisation, food production, sanitation, and waste management, amongst many others.	Climate Change

Fig. 4 Showing Eco-school themes related to SDGs
Source: <https://ecoschools.in/>

9.2.2 Case Study 2

The second case study is done for Net zero waste water (waste water treatment) of Adarsh Vidyaprasarak Sanstha's College of Arts & Commerce campus at Badlapur, Maharashtra. The project caters to about 2,600 students and 800 people attending special programmes. The initiative was taken by Badlapur Municipal Council and the Board of "Adarsh Vidya Mandir School" to go for Decentralized Reuse-oriented Wastewater Management.

A single storied sanitation block is been constructed with separate enclosure for ladies and gents. Each enclosure has 1 western-style pedestal cistern-flush for the physically challenged person and 4 bucket-flush squatting-type toilets. The gents' toilet block is provided with Waterless urinals. Sufficient no of toilets and wash basins are provided in both ladies and gents toilet block.

Blackwater from the toilets along with greywater from the washbasins is diverted to a "biogas settler" where solids are retained in the chamber for anaerobic decomposition. The effluent from the biogas settler is further drained by gravity to an Anaerobic Baffled Reactor (ABR) and Up-flow Filter. After Anaerobic Baffled Reactor the treated water goes to a small-scale horizontal flow constructed wetland (HFCW) through a up-flow filter. From HFCW the water gets discharged to a polishing pond for the final phase of the treatment. Waterless urinals are provided with membrane stench traps which are specially designed for Indian urinals. The urine from the gent's toilet is separately collected in a collection tank as a part of source separation. The tank is provided with an over flow to the anaerobic treatment plant. Treated water and hygienized urine are supposed to be used in kitchen garden, campus landscape or for irrigation purpose. The dried sludge from the biogas settler, baffled reactor and up-flow filter are used as fertilizers within the campus.

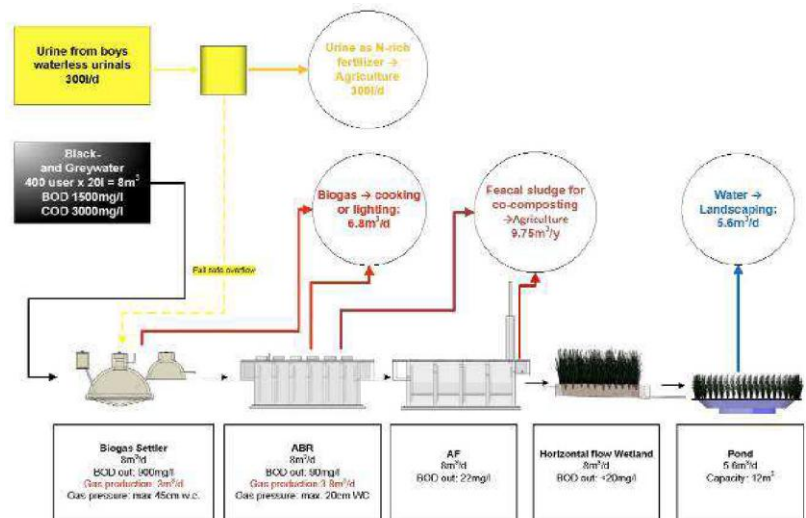


Fig. 5 Flowchart of Wastewater management scheme

Source:

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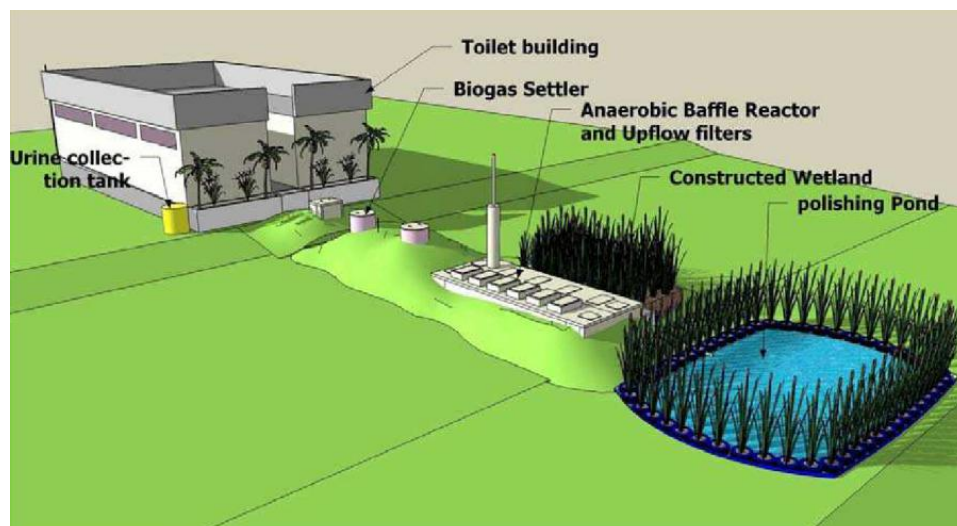


Fig. 6 Scheme of pilot project

Source:

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9.2.3 Case Study 3

The third case study done is for Net zero solid waste (Solid waste management) of Chetana H.S college campus, Bandra. The key to effective waste management lies in properly segregating waste at its source and directing it through various streams for recycling and resource recovery. The potential source of solid waste in the campus comes from the class rooms, Exam section and admin area of the campus through de-binning or sweeping. Majorly the solid waste comprises of documents, forms, yearly outdated files, vegetative waste from canteen, outdated electronic hardware and construction waste from building renovation etc. The waste from the bins are collected daily and after segregation the un-recyclable waste is disposed in the BMC (Brihanmumbai Municipal Corporation) bin at 3pm. The organic waste from the canteen is collected and put in to the compost pit which is placed in one corner of the playground. The garden waste which includes weeds, grass, and plant cuttings are left to dry and later they are used in landscape for mulching. The dried leaves shedded from the trees are also used for mulching in landscape. The construction waste is not produced regularly, whenever they are produced, they are stored in bags and later they are transferred in to green field construction site for plinth filling etc. The scrap waste like tin plastic, iron and mild steel are collected, stored and sold which goes for recycling purpose and the institute also earns out of it. A significant portion of waste consists of paper, which is also sent for recycling. Students also collect Plastic materials from the neighborhood and donated to the NGOs for recycling. In 2019, students collected 150 kilograms of plastic to commemorate the 150th anniversary of Mahatma Gandhi.

10. Primary Survey

A primary survey through a questionnaire was conducted to understand the ground reality of few of the secondary schools in Mumbai on a sample basis. The survey aims to know few facts about the scenario of some of the renowned schools in the city and their status and intent towards Net zero alignment in routine practice. It tries to understand the nuances of campus-level initiatives currently adopted by the school. It also aims to understand the basic information students and parents have about certain direct activities which contribute to the Net zero practices. The outcomes are as below:

10.1 Mode of transport

To understand the gravity of air and noise pollution around the school campus, a survey includes a question about mode of transport that students use to reach the institution premises. The feedback reflects that 42.9% of the school children use School vans or School buses to reach. 21.4% of the students travel by auto. However, students who prefer to come walking to the campus reflects to 7.1%.

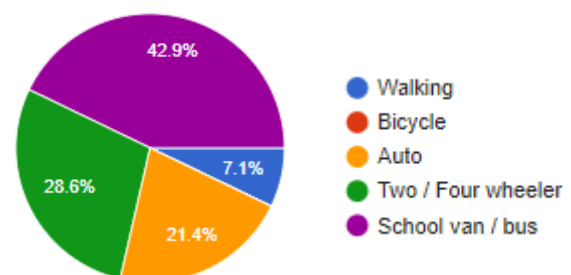


Fig. 7: Showing mode of transport used by stakeholders
Source: Primary survey by Authors

10.2 Net zero concept basics

It is extremely important for the users and stakeholders of the building or campus to understand the basics of sustainable practices and ultimately Net zero initiatives. The survey conducted about awareness of Net zero practices shows that 14.3% of the users are not aware of these practices. 64.3% have heard about it but only partially aware about the practices and only 21.4% know the initiatives.

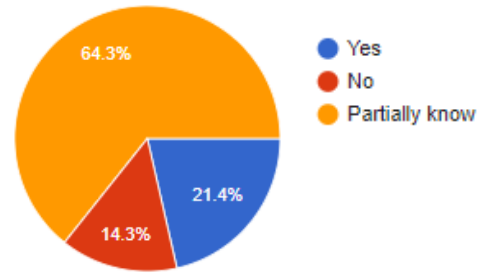


Figure 8: Showing Net zero concept basics

Source: Primary survey by Authors

10.3 Activity based information

A data collection is done to understand the activities that users are aware of which are considered to be Net zero initiatives. Following are the responses.

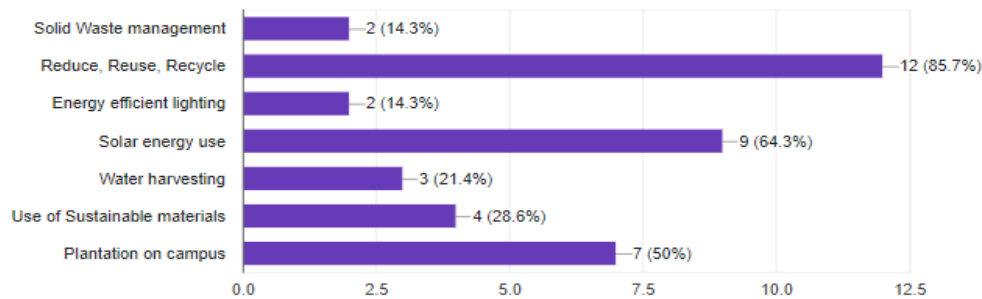


Figure 9 showing known practices of Net zero amongst users

Source: Primary survey by Authors

The feedback reflects that 85.7% of the users are familiar with the concepts of Reduce, Reuse and Recycle. Solar energy consumption is also one of the known topics amongst them followed by plantation which is 64.3%. On campus plantation is another activity which has an awareness of 50% stakeholders. The other initiatives are Less than 50% including Use of sustainable material (28.6%), Water harvesting (21.4%), Solid waste management and Energy efficient lighting (14.3% each).

10.4 Importance of Net zero strategy

After knowing some of the initiatives of Net zero strategy, 100% of the respondents showed positive approach towards implementation of the strategies. The response is taken to understand the absorption quotient of the users towards the effective application and implementation of the strategies in the campus. The response helps to figure out the strategical and practical planning of the concepts.

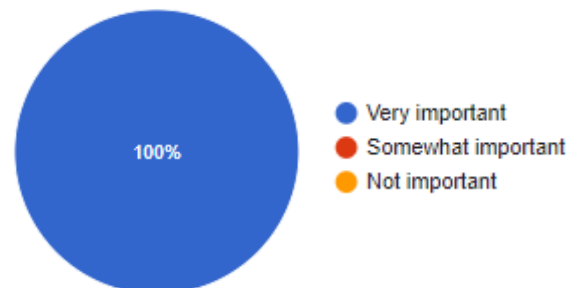


Figure 10 Showing Importance of Net Zero Strategy

Source: Primary survey by Authors

10.5 Introduction to concepts in teaching

The results above show the proportion of the users who have heard about some of the Net zero strategies through school teachings. 35.7% of the respondents have heard about waste disposal, 25% about water harvesting and 78.6% about Solar energy.

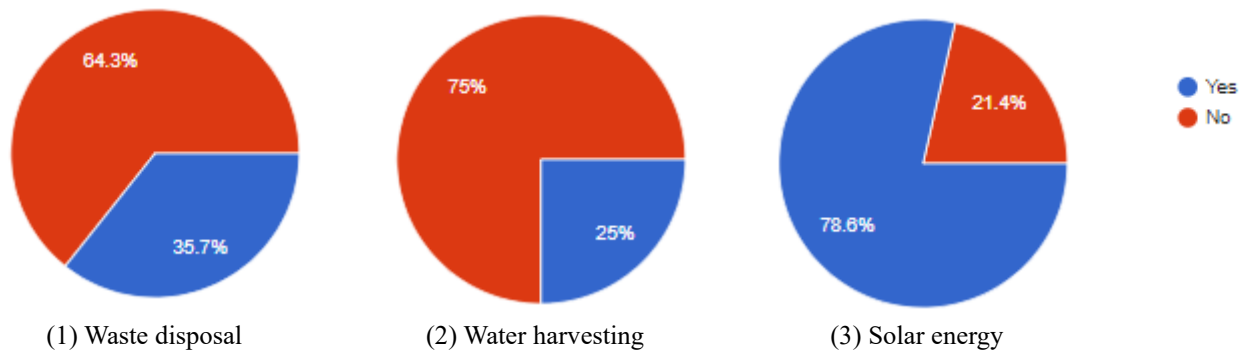


Figure 11 Showing Introduction of Net Zero concepts in teaching
Source: Author survey

10.6 Willingness of participation

A survey is conducted to understand the willingness to participate in the initiatives that are possible under Net Zero strategies. The result surfaces that 50% are positively willing to participate, 42.9% are somewhat willing to participate. However, 7.1% of the respondents have shown their resistance to participate in the alignment initiatives if given an option.

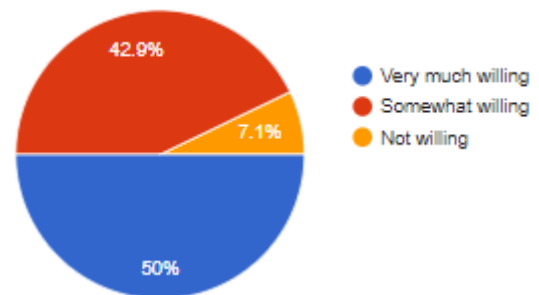


Figure 12: Showing willingness of stakeholders to participate
Source: Author survey

11. Observations from case studies

11.1 Case Study 1

Few observations after adaptation Eco schools programme in different schools are: Eco schools give an outstanding chance for students to learn about and address environmental issues within their schools and local communities. The programme enhances environmental awareness and fosters a better school environment. It teaches leadership skills to the students to make the change in environmental related issues. The curriculum is enriched with hands-on experiences on waste management, vermicomposting etc. There are Financial savings for schools and opportunities to pursue funding for environmental action projects under this programme.

11.2 Case Study 2

Some good initiatives towards net zero waste water practice in Case Study 2 are: Specially designed squatting pans or pour-flush” pans are used to keep water consumption low. Taps are not provided inside the toilet cubicles. To use less amount of water, toilet users have to fetch water with a bucket (approx. 5 litres) from a central tank which is located within the toilet block. Low flow fixtures are used inside the

toilet blocks and canteen kitchens to reduce water consumption. Water from the polishing pond is used for irrigation purposes. The biogas produced can be used for cooking or lighting purposes. Collected hygienized urine can be used within the campus for agriculture/gardening purposes.

11.3 Case Study 3

Some good initiatives towards net zero solid waste practice in Case Study 3 are: Students are encouraged to display their creativity by making artifacts from waste materials. Each class is encouraged to separate waste at the classroom level, with two bins provided for this purpose. Each class is encouraged to minimize the daily waste generated. Students are encouraged to gather plastic materials from local shops, hotels, and vendors near the college to promote the principles of 'reuse, reduce, and recycle.' This plastic is then donated to an NGO for reuse. To curb the generation of paper waste many of the administrative processes and exam procedures are conducted online to save on paper. Garden waste goes for mulching and acts as natural fertilizer to the soil. Kitchen waste goes to compost pits which get converted to nutrient-rich compost.

12. Observations from primary survey

The primary survey was conducted to understand the overall awareness and preparedness of Net Zero strategies amongst the school stakeholders. The survey includes the responses of Secondary school stakeholders involved in teaching – learning process. The observations are as follows:

12.1 Campus surroundings

The survey results reflect that above 90% students travel to the school campuses using School buses, vans, private vehicles or autos as a mode of transport. The heavy vehicular movement around campus directly affects the air quality around the school and within the campus. The scenario is an alarming situation as the pollution related issues can affect the health of huge number of stakeholders coming to the school. Negligible proportion i.e. less than 10% prefers walking or bicycles to reach the school. Air quality in and around the school campuses is a major concern considering the expected healthy atmosphere in the school campuses. Net Zero strategies are the most relevant outcomes to mitigate the issue and bring down the health concerns amongst the school children and other stakeholders.

12.2 Net Zero awareness

The primary survey reflects that majority of the stakeholders are only partially aware of the efforts which can improve the environmental deterioration. Large number of stakeholders are partially aware about Net Zero strategies. As a positive outcome of the survey, the proportion of stakeholders who have partially or fully aware of these strategies is more than the number who are totally unaware about these strategies. Majority of them are aware about the strategies like Reduce-Reuse- Recycle, Solar energy and Tree plantation drives. This opens up the scope for regularly imbibing an information amongst the students. Other strategies like Solid waste management, Sustainable material handling, Water Harvesting, Energy efficient Lighting are also required to be introduced at the secondary level so that the students are well aware about them.

12.3 Understanding a need of participation

There is a positive result of survey which highlights that 100% of the respondents agree that there is an importance of Net Zero campuses. There is no resistance from them to start the initiatives revolving around

Net Zero Strategies. More than 50% of the respondents are interested in participating in the initiatives if conducted by the school management. Their participation in such activities shall definitely bring a positive change in the overall campus experience. The following response shows their interest in various activities they would like to be a part of.

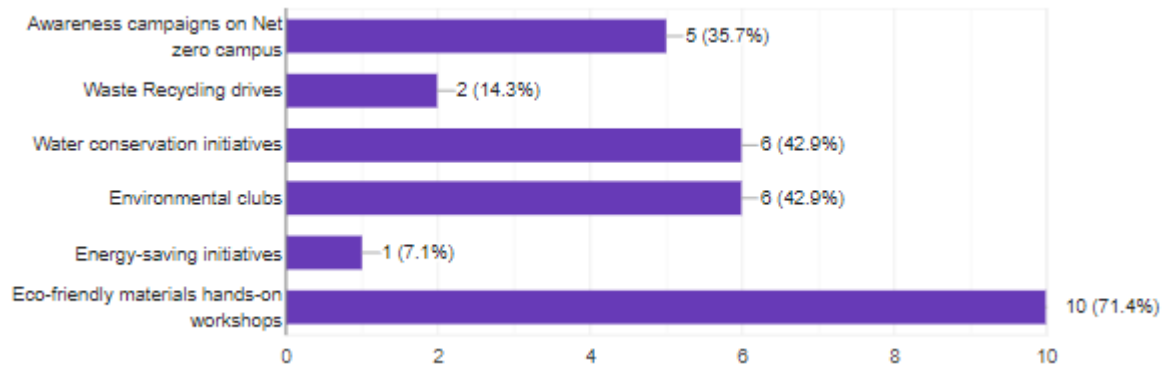


Figure 13 Showing interest of stakeholders in Net Zero activities
Source: Primary survey

13. Discussion and findings

Case study 1 indicates that the concept of Net Zero campuses can be introduced at an early stage, such as in schools, similar to how eco-schools teach various aspects of sustainability to students. It can be implemented as a national initiative or programme and can be taken up by different educational institutes to spread awareness and educate the school children about the concept of Net Zero campus.

It is evident from case study 2 and case study 3 that practically Net zero waste water is easier to implement in a greenfield project where plumbing layouts are laid at a very initial stage whereas Net zero solid waste can be implemented and practiced in green field as well as brownfield projects very easily.

14. Recommendations

- Policy level initiative should be taken by the central government where every institute should implement Net Zero concept in the campus in terms of solid waste, waste water or energy.
- To implement Net Zero concept school need to identify four broad stages of focused area 1) Outreach and education 2) Programs and Services 3) Facilities and infrastructure 4) Provision of measuring results
- Schools should implement a customized syllabus that includes at least one subject that is entirely paperless, including its examination.
- Students should earn rewarded with academic credits based on foundational principles of reusing, recycling, and renovating aligning with Net Zero concept.
- Separate budget should be allocated at institute level for Net Zero alignment.
- The paper strongly recommends establishing a dedicated department specifically for Net zero alignment in the educational campus.

14. Conclusion and way forward

Conscious pedagogic approach at the right stage can benefit the institute as well as the stakeholders to achieve Sustainable Development Goals. Net zero alignment is one of the very important milestones towards achievement of Sustainable Development Goals. As it is evident from the primary surveys that there is very little awareness about the Net Zero concept at school level so the need of the hour is to introduce Net Zero concept in their curriculum and spread awareness about it. In addition to raising awareness, it's crucial to foster willingness and action towards achieving Net Zero. Therefore, government policies and financial support should be provided to institutions at both the state and central levels to encourage school management authorities to adopt these initiatives.

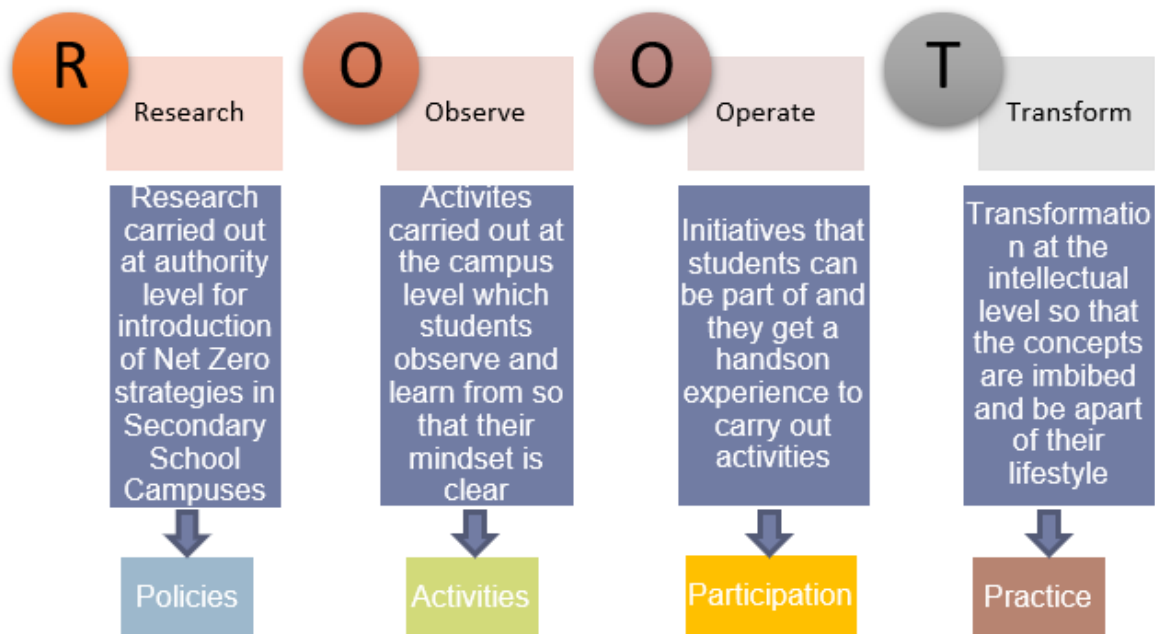


Figure 14 1 Showing modified ROOT analysis parameters
Source: Author

Modern ROOT analysis can be modified as per the modern requirements where the parametric details of Research, Observations, Operation and Transformation can be redefined. Under every parameter various aspects can be touched upon which in turn gives opportunities to reframe Policies, Activities, Participative learning and Practices.

“Net zero is not just a target; it's a responsibility we owe to future generations”

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