



AN INTERDISCIPLINARY APPROACH TO ESTABLISH AN ECOFRIENDLY ENVIRONMENT AT HIGHER EDUCATIONAL INSTITUTIONS

Science

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ABSTRACT

Devastation of natural resource, spontaneous increase in population growth rate and undesirable human activities are collectively manifested on today's environmental crisis. Among the issues, global warming and climate change are two issues gained attention for the past few decades. In this context, to conserve the environment, at least in the present state worldwide campaign is required to restore the greener and healthier environment. Although, National Governments put their efforts together to face the existing issues, as a survival point of view in a healthier environment every individual must contribute towards saving the earth from its degradation. At this juncture, creating awareness among the common public is necessitated; but this task require a lot of manpower. Creating alertness right from school going students is quite obvious and in this connection, educational institutions play a prime role with available infra-structure facilities. It may be noted that three main features are necessary to establish environmental awareness among the students, who are all the budding future generation going to govern the nation. As mentioned, basic physical facilities, learning tools and leadership initiatives are three important criteria that requires to impose in a balanced manner to drive the task and achieve the desired results. This article, deals with the requirements of a educational institute to establish ecofriendly, healthier environment for the benefit of the stakeholders.

KEYWORDS

Ecofriendly Environment, Higher Educational Institutions, Environment Audit, Green Campus Audit and Energy Audit

Introduction

Global warming is one of the burning issues of the humanity. The twin-issues, climate change and global warming are not misconceptions but tangible existing environmental problems which are to be resolved instantly (Sivaram et al., 2015). Ever increasing populations, over exploitation of natural resources and exorbitant amount of emission of greenhouse gases are related to the sensitive issues besides unconditional anthropogenic activities. These problems are existed world-wide irrespective of developed countries and developing countries as a result of increased human activities. It is high time now to conserve the degrading environment otherwise the changes will be irrevocable. Environmental problems and their mitigation efforts are complex which require collaborative efforts from all the public elements to reduce the environmental degradation rate. Considering the prevailing situation the ruling Governments plan judiciously and execute the environmental friendly commitments through various programs (Raveesh Agarwal et al., 2015; Sadhan Kumar Ghosh, 2016). However, these long term plans worked out by the governments cannot yield any fruitful results unless the cooperation and support extended by individuals which may reflect in several dimensions.

Currently, environment friendly commitments through various programs were attracted a lot of attention from academics and practitioners at international level besides certain multinational companies concerned about sustainable environmental policies. First of all, educational institutions should take immediate initiatives to implement the sustainable environmental policies. Number of studies on the adoption of sustainable green campus have been carried out by educational institutions located at different countries (Goyal and Gupta, 2014; Kian-Ghee Tiew et al., 2019; Abu Qdias et al., 2019; Anthony Jnr, 2020).

On long run, implementing the environmental policies in educational institution provides healthier environment to the stakeholders which improves the learning skills and liberates the environmental awareness through stakeholders to the society. In this context sustainable campus concept gained significance where the stakeholders have satisfied because they perceived healthier environment. As a first stepping stone, educational institutions must follow the environmental friendly commitments in their day to day routine. On the basis of experience gained through environmental auditing, this study demonstrate comprehensively the integrated requirements for establishing

ecofriendly campus besides strategic planning and implementation of environmental policies by concerned agencies/educational institutions.

Methodology

Study area

Systematic (green campus-, energy- and environment- and hygiene audits) audits were conducted by Nature Science Foundation, Coimbatore at educational institutions during 2021. Audited educational institutions are spread mostly in the southern part of the country, particularly, Karnataka, Maharastra, Telangana and Tamil Nadu (Table 1). Audit/survey covers both qualitative and quantitative measurements including physical facility verification, walk through observation and personnel interaction among designated members of implementing agency in accordance with checklist prepared (Gnanamangai et al., 2021). Invariably the audits conducted by Nature Science Foundation categorically viewed into three dimensions viz., availability of physical facilities, dissemination of environmental awareness through learning tools/conducting public awareness programs, etc., and finally the degree of involvement of implementing agencies.

Survey components

Availability of physical facilities and their maintenance

Components of physical facilities of the agencies that are intended to activate sustainable green campus includes landscape, building area with sanitation facilities, vegetation within the campus and open area for future construction /conservation programs. Broadly, water conservation measures comprises of availability of water resources (domestic and drinking water purposes), rainwater harvesting facilities and waste water recycling system (Pramod Kumar Mahesh, 2017). Considering the clean development mechanism, recycling of generated wastes, energy conservation measures and transportation within the campus gained equal importance where these factors generate ambient atmospheric temperature and considerable amount of greenhouse gases.

Learning tools for dissemination

Though, the educational institutions are supposed to educate a variety of courses, it is immensely important to include the courses related with environmental sciences. So also, it is high time to develop strategically sound learning methods in relation to sustainable

environment. The participatory role of National Cadet Corps (NCC) and National Service Scheme (NSS) in creation of environmental awareness among the public is an important component in dissemination of intended objective.

Initiatives of implementing agencies

Paramount role is to be played by management of educational institutions/agencies in connection with framing sustainable environmental policies and their implementation, monitoring the stakeholders approach and observing the urban communities in the context of environmental cleanliness upkeep. As an integral part of the initiatives of the management, creating the ECO Club Chapters among the stakeholders for dissemination of environmental awareness is also gained proper credentials. All the above parameters are given due importance in sustainable environment audit (Gnanamangai et al., 2021).

Results and Discussion

Components of physical facilities

Without basic infra-structure facility, no educational institution obtained permission to establish itself. Invariably, size of the campus area varied with one institution to another and it ranges from few acres to as high as >700 acres (Bharathiar University and Karunya Deemed University). The spread of the campus is mostly governed by its location; whether it is located at urban or rural area. Most of the audited educational institutions established after 1980's, except Providence College for Women, located at Coonoor, The Nilgiris (Green Audit Report-2021); however, they established with basic physical facility which includes sufficient number of class rooms, laboratories, auditorium, seminar halls, faculty rooms, hostels, staff quarters, open playgrounds, indoor playgrounds, food courts, etc., according to the courses offered by them and number of intake every academic year.

Customarily, all audited educational institutions were established greeneries within the campus and the area under green cover (natural vegetation, man-made plantations, aquatic and terrestrial gardens) was greater than 25%. Since Bharathiar University and Karunya Deemed University located at the foot hills of Western Ghats, both the places natural vegetation accounts more than 50% of total area (Technical Report of Green Campus Audit, Bharathiar University, 2021; Report of Green Campus Audit, Karunya Institute of Technology and Sciences, 2021). As an integral part of green campus activities, Bharathiar University and Kumaraguru College of Technology both at Coimbatore established "Bharathiar Vanam" and "Ahimsa Vanam" in their premises, respectively. In addition, Kumaraguru College of Technology maintaining an in-house native nursery to cope with the demand of its own and others (Report of Green Campus Audit, Kumaraguru College of Technology, 2021). It is noteworthy that Selvamm Arts and Science College, Namakkal, Tamil Nadu established "Selvamm Bio-tech Park" within their premises while VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad and Providence College for Women, Coonoor, Tamil Nadu have established and maintained medicinal gardens within their campus.

Since most of the educational institutions established between 1980's and 2010, constructed buildings preserve their ecology through spatial and strategic planning in accordance with green building concept (IGNC, 2021) which in turn facilitate healthier environment to the stakeholders. In this regard, educational institutions can make several activities in formulating environmentally oriented standard building designs, enhancing open green space for vegetation, reforestation efforts and evaluating sustainable environmental programs. Apart from the building facilities, adequate water supply is essential for day-to-day functioning of any institutions. Almost all the educational institutions satisfies and met their water requirements through water supply by local authorities and/or open/bore wells. Recycling of waste water facilities are available in certain educational institutions; however, recycled water is mainly used for gardening and sanitation purposes and the treated water should not harmful to ecosystem. Production of RO water facility is also available in certain educational institutions, particularly, VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad, Bharathiar University, Coimbatore and St. Joseph's College of Arts and Science for Women, Hosur, Tamil Nadu, India.

Invariably, all the institutions created proper rain water harvesting systems. Within the campus, rainwater harvesting structures and recharge well have been commissioned at different locations.

Rainwater harvesting pits containing gravels and sand constructed near the buildings and well connected with pipes from roof top to harvesting pits. Besides, rainwater harvesting pits, percolation ponds were also maintained in educational institutions (Kumaraguru College of Technology, Coimbatore and VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad). However, intermittent survey/monitoring of ground water level is required to ensure the improvement in ground water resources and to validate the efficiency of rain water harvesting facility. Revitalizing the clean water resources including improving surface water quality, efficient utility of available water without wastage, recycling the wastewater and conservation of rainwater (simply water circulation model) are relevant factors that should be adopted by the management in order to achieve the sustainable green campus (Peng et al., 20188).

As a highly populated nation in the world, awareness on disposal of waste materials is lacking where littering and open trash disposal behaviors are still commonly adopted by individuals. Open trash burning is considered a common practice to manage large scale waste. In order to restrict the production of wastes, managements should stringently adopt certain policies, centered towards reduction in generous utilization of resources, reusing and recycling the resources. Following the biogas generation utilizing the organic/degradable waste ensures energy saving and waste disposal threats. Production of organic manures using trash is yet another management practices given prior concern with regard to waste disposal. Hazardous wastes, e-waste and construction wastes should be disposed appropriately following standard procedures. Integrated trash management and implementation of policies within the campus environment ensures healthier environment (Kian-Ghee Tiew et al., 2019), however, reducing solid waste is the first step towards creating healthy and green environment (Symyth et al., 2010).

Most of the audited educational institutions are concerned with proper waste disposal system; for example, BNM Institute of Technology, Bengaluru, SVKM'S Usha Pravin Gandhi College of Arts, Science and Commerce, Mumbai, Maharashtra, Providence College for Women, Coonoor and Selvamm Arts and Science College, Namakkal, Tamil Nadu, India were involved in production of vermicompost using degradable organic wastes. On the other hand, biogas facilities are available at Kumaraguru College of Technology, Coimbatore, Velalar College of Engineering and Technology, Erode, Tamil Nadu and VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad where these institutions were efficiently utilized the waste and generated biogas is used in canteen as an alternate energy source.

Efficient energy utilization is one among the criteria that relates with sustainable green campus concept. Ten out of 16 educational institutions audited were thoughtful efficient energy utilization in their premises and they intended to undertake energy audits. Although vast utility of renewable energy sources still faces challenges, educational institutions implement their electricity/energy saving strategy by redesigning networks, monitoring/metering each energy utilizing units, regulation and automation of energy utilization besides regulation of air condition temperature and replacement of old electrical equipment with energy saving units. Organizations can progressively improve their energy efficiency practices by establishing solar panels as an alternate energy source in their environment. By and large all the educational institutions concentrating on efficient energy utilization policies and most of them were installed solar panels as alternate/renewable energy sources besides installation of solar street lights within the campus and solar water heaters at the hostels.

Public transportation is better means of travelling which reduces traffic congestion besides environmental pollution. Even though most of the educational institutions are well connected with roads with scanty to moderate public transport facilities, quite a few organizations provide transportation facilities for their stakeholders for their convenience. Educational institutions need to organize integrated managerial plans in their ecofriendly transportation and proper parking facilities to improve stakeholder's welfare and reduce environmental impacts. Encouraging cycling activities and promoting electric vehicles among the stakeholder's can be a model for the general public which in turn reduce the amount of carbon emission and promotes clean development mechanism within the campus. Considering the environmental protection motto, VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad inducted e-vehicles for

transportation facility of their stakeholders. As one of the integral component of physical facilities of ecofriendly campus, developing ecofriendly mass transportation infrastructure amenities is the need of the hour. Moreover, the campus carbon footprint estimates can offer two tasks, increasing campus community consciousness of greenhouse gas emissions due to their activities and providing a comprehensive basis for sustainable practices and decision making (Ezhilkumar et al., 2020). At this juncture, it is worth mentioning that Selvam Arts and Science College, Namakkal, Tamil Nadu installed an ambient air quality monitoring station in order to monitor the carbon footprints and emission of greenhouse gases.

Learning tools for dissemination

An environmental study/science is the learning process/course of the ecosystem which enables the individuals to understand the environment which in turn helps to overcome the negative impacts. Environmental studies emphasises the need of biodiversity conservation and utility of natural resources in a fruitful manner. In order to create environmental awareness among the budding generations, the University grants Commission in India has made it mandatory for the educational institutions to introduce a course on "Environmental studies". It is a multi-disciplinary field integrating botany, zoology, chemistry, physics, environmental science and engineering, geology, etc.

In order to create environmental awareness among the stakeholders, the management implement environmentally friendly curriculums in the educational courses. Positive integration of sustainable principles into technical curriculums requires systemic changes in current educational approaches. In this context, students need to be equipped with perspective skills and high level thinking to facilitate transitions towards sustainable development. Adoption of technology in learning process at educational institutions enhances the opportunities drive towards pleasant workable environment. A promising way of offering innovative learning atmosphere is through e-learning and virtual classes. Further, e-books are another environmental friendly learning medium where they do not need paper as against the conventional books. Genesis and Oluwole (2018) reported concepts, challenges and prospects of paperless higher education system and Shoui et al. (2019) recognized the implementation of paperless office through e-customs systems. During the pandemic situation, paperless education system has been introduced indirectly through e-education; however, post-pandemic period, the system should be followed extensively considering the healthier, ecofriendly higher educational institute campuses.

Initiatives of implementing agencies

Role of management/implementing agencies is a crucial in constructing sustainable ecofriendly campus through the policy making and implementation besides monitoring of the same. The commitments of the managements in achieving ecofriendly campus is vital where educational institutions have implemented clear strategies and well structures initiatives to implement sustainable practices. On implementation, gaining support from the individuals of the institution is also a paramount importance which significantly contributes towards building up of ecofriendly environment. Role of management includes initiate and motivate the implementation of the ecofriendly environment and provide policy instruments oriented towards establishing green campus which needs to become superior in the process.

At the time of formulating policies, the management of any educational institution should consider the available physical elements within their campus. Particularly, the management should give due importance in the following arena while framing the policies. Green campus facility which includes the topography, natural vegetation, flora and fauna, soil health, degradation and conservation, etc., while water resource facility should cover source of water supply, quality and utility, rain water harvesting and wastewater recycling facilities. Under trash management policy/activities, waste collection, segregation, transportation and disposal must be given due importance. Solid-, hazardous-, construction-, e-wastes should be disposed following the standing rules and regulation. Organic and degradable wastes can be utilized for biogas generation and preparation of compost manure for which individual protocols should be framed and monitored regularly for their uninterrupted functioning. Following the energy management policy, it facilitates clean development mechanism within the campus where the policy will take

care of utility of electrical energy, use of fossil fuels, renewable energy sources, solar energy, etc. Further, it is more important to provide priority to include environmental education to nurture the skills of stakeholders besides participation/implementation of government aided schemes in relation to mitigation of environmental degradation.

As mentioned, these activities are fundamentally based on stakeholder's participation and their support to strengthen the environmental policies of the educational institutions. In this regard, ecofriendly environmental activities has been considered as a learning components which includes innovative research, teaching components and social interactions within or outside the academic activities. It may be noted that sound ecofriendly environment is one of the component considered in NAAC ranking events. Concisely, commitments of the management required to adopt certain strategic plans viz., coopting environmental friendly policies by all individuals, organizing ecofriendly extracurricular programs, following an ecofriendly culture in daily routine and participating ecofriendly campus ranking programs.

Management of an educational institution should be exposed their inherent commitments towards creating ecofriendly environment through adopting their illustrated policies and promote all kinds of ecofriendly activities, particularly awareness programs, maintenance of vegetation, proper trash disposal, etc., centered towards clean development mechanism. Fairly clean and healthy environment promotes an effective teaching learning processes. In this context, sign boards indicating energy/water conservation quotes in respective places should be erected. Sign boards representing tobacco free and plastic free zones can be distinctively placed. Besides, organizing social responsible awareness programs to the nearby tribal, rural and urban areas is mandatory to the educational institution through National Cadet Corps and National Service Scheme camps. While implementing such eco plans in the campus, the management should engage Eco clubs, Nature clubs, Youth Red Cross units, Women cell and Fine Arts clubs.

Under Clean India Mission project, Swachh Bharat Abhiyan and Jal Shakti Abhiyan schemes are introduced by the Indian Government which aimed at a step towards sanitation, solid waste management, and supply of clean drinking water and promote cleanliness across the nation where educational institutions mandatorily implement the same to secure the environmental hygiene. Global universities have implemented the environmentally friendly concept with varying success levels, standards, and implementation strategies. Sustainable ecofriendly campus concept required to be implemented because the stakeholders of educational institutions are considerably satisfied and have better perceived life quality than that of other agencies (Tiyarattanachai and Holimann, 2016).

Encouraging residential education can reduce emission of greenhouse gases to a greater extent which nullify the mass rapid transportation. Installation of solar panels for alternate energy sources, erection of solar street lights within the campus and induction of solar water heaters in the hostels may be considered which in turn diminish the rate of carbon emission. Establishment of biogas plant at pilot-scale level can reduce the degradable organic waste management and supports fuel requirements of the educational institutions, partially. Additionally, planting tree saplings within the campus will tend to increase the rate of carbon dioxide sequestration. Implementation of paperless administration, adoption of e-vehicles for internal transportation are considered immediately in order to construct ecofriendly sustainable green environment in educational institutions. On the whole, developing sustainable, healthier environment within the campuses of higher educational institution are not only depends on the management policies, it should be attained through community engagements/human resource management and stakeholders commitments.

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Table 1. List of educational institution audited by Nature Science Foundation during 2021

State	Educational Institution	Elements audited*
Karnataka	BNM Institute of Technology, Bengaluru	Green campus
	Mount Carmel College, Bengaluru	Green campus and Energy audits
Telangana	VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad	Energy, Environment, Green campus and Hygiene audits
Maharashtra	SVKM'S Usha Pravin Gandhi College of Arts, Science and Commerce, Mumbai	Energy, Environment and Green campus audits
Tamil Nadu	Providence College for Women, Coonoor, The Nilgiris	Energy, Environment and Green campus audits
	Bharathiar University, Coimbatore	Energy, Environment, Green campus and Hygiene audits
	Bishop Ambrose College, Coimbatore	Energy, Environment, Green campus and Hygiene audits
	Kumaraguru College of Technology, Coimbatore	Green campus and Environment audits
	Sankara College of Science and Commerce, Coimbatore	Environment audit
	Nehru Arts and Science College, Coimbatore	Energy, Environment and Green Campus audits
	Karunya Institute of Technology and Science (Deemed University), Coimbatore	Green campus audit
	St. Joseph's College of Arts and Science for Women, Hosur	Green campus and energy audits
	Velalar College of Engineering and Technology, Erode	Green campus and Energy audits
	Dr. NGP Arts and Science College, Coimbatore	Green campus and Environment audits
	Kovai Kalaimagal Educational Trust, Coimbatore	Green campus and Environment audits
	Selvamm Arts and Science College, Namakkal	Green campus, Energy and Environment audits
*Details of audit reports given under Reference section		

REFERENCES

- Abu Qdais, H., Saadeh, O., Al-Widyan, M., Al-tal, R. and Abu-Dalo, M. 2019. Environmental sustainability features in large university campuses: Jordan University of Science and Technology (JUST) as a model of green university. *Int. J. Sustain. High. Educ.* 20: 214-228.
- Anthony Jnr, B. 2020. Green campus paradigms for sustainability attainment in higher education institutions – A comparative study. *Sci. Technol. Policy Management* 12: 117148.
- Energy Audit Report. 2021. Providence College for Women, Coonoor 643 104, The Nilgiris, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.13.
- Environment Audit Report. 2021. Kumaraguru College of Technology, Coimbatore 641 004, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.41.
- Environment Audit Report. 2021. Providence College for Women, Coonoor 643 104, The Nilgiris, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Ezhilkumar, M.R., Saravanaumar, P., Sowmiya, S., Tharshini Priya, G.B., Dineshkumar, S. and Gokul Das, M. 2020. Estimation of carbon footprint for an educational institution located in an urban part of Coimbatore. *Journal of Xi'an University of Architecture & Technology XII (III)*: 5188-5166.
- Genesis, E.D. and Oluwole, O.N. 2018. Towards a paperless higher education system in Nigeria: concepts, challenges and prospects. *J. Educ. Soc. Behav. Sci.* 24: 1-15.
- Gnanamangai, B.M., Murugananth, G. and Rajalakshmi, S. 2021. A Manual on Environment Management Audits to Educational Institutions and Industrial Sectors. Laser Park Publishing House, Coimbatore, Tamil Nadu, India. p. 127.
- Goyal, E. and Gupta, M. 2014. Moving toward socially and environmentally responsible management education-Case study of Mumbai. *Journal Applied Environmental Education & Communication* 13: 146-161.
- Green Audit Report. 2021. Providence College for Women, Coonoor 643 104, The Nilgiris, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- IGBC. 2021. Indian Green Building Council. <https://igbc.in/igbc/>
- Kian-Ghee Tiew, Noor Ezlin Ahmad Basri, Kohai Watanabe, Shahrom M. Zain, Ah-Choy Er and Hong Deng. 2019. Higher educational institutions recycling management in Malaysia. *International Journal of Business and Society* 20 (1): 277-285.
- Peng, S., Cui, H. and Li, M. 2018. Sustainable rainwater utilization and water circulation

- model for green campus design at Tianjin University. *J. Sustain. Water Built Environ.* 4:4017015.
- Pramod Kumar Mahish. 2017. Water audit: a case study of Govt.Digvijay Autonomous post graduate college, Rajnandgaon, Chhattisgarh. *Indian J. Sci. Research* 13 (2): 78-881.
- Raveesh Agarwal, Mona Chaudhary and Jayveer Singh. 2015. Waste management initiatives in India for human well being. *European Scientific Journal.* June 2015. Special edition: ISSN: 1857-7881 (print). P.105-127.
- Report of Energy Audit. 2021. Bishop Ambrose College, Coimbatore, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Energy Audit. 2021. Mount Carmel College, Bengaluru, Karnataka. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Energy Audit. 2021. Nehru Arts and Science College, Coimbatore 641 105, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Energy Audit. 2021. Sankara College of Science and Commerce, Coimbatore 641 004, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.11.
- Report of Energy Audit. 2021. Selvamm Arts and Science College, Namakkal 637 003, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.23.
- Report of Energy Audit. 2021. St. Joseph's College of Arts and Science for Women, Hosur 634 126, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.11.
- Report of Energy Audit. 2021. SVKM'S Usha Pravin Gandhi College of Arts, Science and Commerce, Mumbai 400 056, Maharashtra. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p. 38.
- Report of Energy Audit. 2021. Velalar College of Engineering and Technology, Erode 638 012, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.13.
- Report of Environment Audit. 2021. Bishop Ambrose College, Coimbatore, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Environment Audit. 2021. Dr. NGP Arts and Science College, Coimbatore, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Environment Audit. 2021. Kovai Kalaimagal Educational Trust, Coimbatore, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Environment Audit. 2021. Nehru Arts and Science College, Coimbatore 641 105, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Environment Audit. 2021. Sankara College of Science and Commerce, Coimbatore 641 004, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Environment Audit. 2021. Selvamm Arts and Science College, Namakkal 637 003, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Environment Audit. 2021. SVKM'S Usha Pravin Gandhi College of Arts, Science and Commerce, Mumbai 400 056, Maharashtra. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p. 89.
- Report of Green Campus Audit. 2021. Bishop Ambrose College, Coimbatore, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Green Campus Audit. 2021. BNM Institute of Technology, Bengaluru 560 070, Karnataka. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.28.
- Report of Green Campus Audit. 2021. Dr. NGP Arts and Science College, Coimbatore, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Green Campus Audit. 2021. Karunya Institute of Technology and Sciences (Deemed University), Coimbatore 641 114, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.17.
- Report of Green Campus Audit. 2021. Kovai Kalaimagal Educational Trust, Coimbatore, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Green Campus Audit. 2021. Kumaraguru College of Technology, Coimbatore 641 004, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.19.
- Report of Green Campus Audit. 2021. Kumaraguru College of Technology, Coimbatore 641 004, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.19.
- Report of Green Campus Audit. 2021. Mount Carmel College, Bengaluru, Karnataka. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Green Campus Audit. 2021. Nehru Arts and Science College, Coimbatore 641 105, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Report of Green Campus Audit. 2021. Sankara College of Science and Commerce, Coimbatore 641 004, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.15.
- Report of Green Campus Audit. 2021. St. Joseph's College of Arts and Science for Women, Hosur 634 126, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.30.
- Report of Green Campus Audit. 2021. SVKM'S Usha Pravin Gandhi College of Arts, Science and Commerce, Mumbai 400 056, Maharashtra. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p. 71.
- Report of Green Campus Audit. 2021. Velalar College of Engineering and Technology, Erode 638 012, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.18.
- Report of Hygiene Audit. 2021. Bishop Ambrose College, Coimbatore, Tamil Nadu. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India.
- Sadhan Kumar Ghosh. 2016. Swachhaa Bharat Mission (SBM) – A paradigm shift in waste management and cleanliness in India. *Procedia Environmental Sciences* 35: 1527.
- Shoui, H., You, K.B. and Lee, K-H. 2019. Development and installation of novel solutions for implementing paperless office: focus on Tunisian e-custom systems. *Asia Life Sci.* 3: 1591-1602.
- Sivaram, P.M., Gowdhaman, N., Ebin Davis, D. and Subramanian, M. 2015. Carbon footprint analysis of an educational institution. *Applied Mechanics and Materials* 787: 187-191.
- Smyth, D.P., Fredeen, A.L. and Booth, A.L. 2010. Reducing solid waste in higher education: The first step towards 'Greening' a university campus. *Resour. Conserv. Recycl.* 54: 1007-1016.
- Technical Report of Energy Audit. 2021. Bharathiar University, Coimbatore 641 046, Tamil Nadu, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.51.

50. Technical Report of Energy Audit. 2021. VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad 500 090, Telangana, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p. 44.
51. Technical Report of Environment Audit. 2021. Bharathiar University, Coimbatore 641 046, Tamil Nadu, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.108.
52. Technical Report of Environment Audit. 2021. VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad 500 090, Telangana, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p. 87.
53. Technical Report of Green Campus Audit. 2021. Bharathiar University, Coimbatore 641 046, Tamil Nadu, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.142.
54. Technical Report of Green Campus Audit. 2021. Bharathiar University, Coimbatore 641 046, Tamil Nadu, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.142.
55. Technical Report of Green Campus Audit. 2021. VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad 500 090, Telangana, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p. 77.
56. Technical Report of Hygiene Audit. 2021. Bharathiar University, Coimbatore 641 046, Tamil Nadu, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p.34.
57. Technical Report of Hygiene Audit. 2021. VNR Vignana Jothi Institute of Engineering and Technology, Hyderabad 500 090, Telangana, India. Submitted by Nature Science Foundation, Coimbatore 641004, Tamil Nadu, India. p. 32.
58. Tiyyarattanachai, R. and Holimann, N.M. 2016. Green campus initiative and its impacts on quality of life of stakeholders in green and non-green campus universities. Springer Plus 5:84.