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Environmental management systems for educational institutions

A case study of TERI University, New Delhi

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Abstract

Purpose – The purpose of this paper is to put forth a model for implementation of an environmental management system (EMS) in institutes of higher education in India.

Design/methodology/approach – The authors carried out initial environmental review (IER) and strengths, weaknesses, opportunities and threats (SWOT) analysis to identify the major environmental concerns in the university. This was followed by preparation of environmental policy and plan based on ISO 14001 guidelines.

Findings – The key concerns in the university have been identified as energy consumption, waste generation, transportation, etc. The SWOT analysis shows that the university is doing satisfactorily in energy efficiency and water conservation while there is scope for improvement in case of waste management, transportation and landscaping. The environmental management plan has been prepared keeping in mind the gaps observed through the IER and SWOT analysis.

Research limitations/implications – Carbon footprint and water footprint analysis have not yet been carried out and hence, quantifiable targets have not been included in the environmental management plan.

Practical implications – Implementing an EMS at the university will help reduce the impact on environment due to various day-to-day activities. It will also lead to developing environmental consciousness in the minds of young professionals who graduate from the university as well university staff.

Originality/value – There have been very few examples of environmental consciousness in educational institutions in India. There is a need for model systems for incorporating environmental management in the university set-up. This research documents the process of identification of environmental concerns followed by preparation of the management plan for an educational institution. The research also documents the need for different aspects of the environmental management plan.

Keywords Environmental management, Universities, Sustainable development, India

Paper type Research paper

Introduction

Reactive approach is fast becoming redundant as environmental problems are becoming complex and multidimensional. What is needed in the present scenario is a professional and systematic approach towards achieving environmental sustainability. Universities, being the hub of activity for innovation and ideas, are the perfect place for instilling the idea of sustainability in young minds and at the same time, creating societal awareness on how sustainability can be integrated in day-to-day life. Globally, universities make

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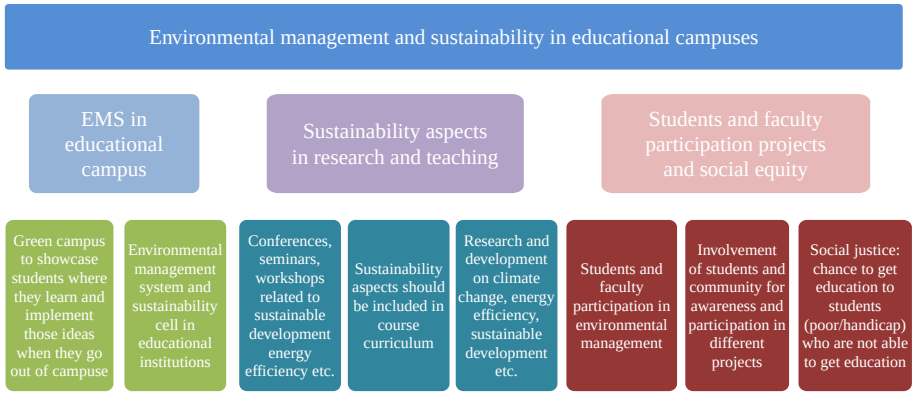
a significant contribution to the society and therefore, have a societal accountability for sustainable use of resources and environmental protection (Sharp, 2002; Viebahn, 2002). With increasing environmental degradation and depletion of natural resource base, the idea of using environmental management system (EMS) as an instrument for improvement of environmental performance has emerged as a strong trend (Rashed *et al.*, 2008). Importance of the impact of universities in terms of environmental pollution and degradation is being realized the world over and universities are adopting environmental management plans and strategies. A number of research publications have been reported in this field (Sharp, 2002; Viebahn, 2002; Mason *et al.*, 2003; Ferreira *et al.*, 2006; Koester *et al.*, 2006; Savely *et al.*, 2007a, b; Alshuwaikhat and Abubakar, 2008; Rashed *et al.*, 2008; Sammalisto and Brorson, 2008).

A sustainable university has been defined as:

> A higher educational institution, as a whole or as part, that addresses, involves and promotes, on a regional or global level, the minimization of negative environmental, social, economic, and health effects, generated in the use of their resources, in order to fulfill its functions of teaching, research, outreach, partnership and stewardship in ways to help society make the transition to sustainable lifestyles (Alshuwaikhat and Abubakar, 2008, Figure 1).

Successful, all-inclusive programmes have often started with small, grassroots beginning (Sharp, 2002; Mason *et al.*, 2003) and the initiative of university EMS too has had a small beginning. In fact, in many cases, the students have been instrumental in demanding and bringing about a change (Sharp, 2002; Beringer, 2006). Several models have been proposed specifically for colleges and universities including the Osnabruck Management Model for Universities (Viebahn, 2002) and the EMS Implementation Model for US Colleges and Universities (Savely *et al.*, 2007a). The approach for creation and strategic implementation of environment management system vary amongst universities, depending upon the key environmental aspects and impacts that the universities identify internally. The primary field of focus for most universities can be broadly identified as reduction of energy use/energy efficiency, waste management, pollution prevention, and resource and energy conservation.

Although environment management plans (EMPs) for educational institutions have gathered momentum, Indian universities are yet to incorporate it in their



Source: Alshuwaikhat and Abubakar (2008)

Figure 1.
Framework for campus sustainability

management plan. There are no universities in India with a functional EMS till date. The TERI University established and constituted in 1998, dedicates itself to the study of environment, energy and natural resources for attaining the far-reaching goal of sustainable development. The campus is housed in a green building in New Delhi and is spread over two acres of land, and is one of the first in the country for a university and it further aims to minimize the ecological footprint. The genesis of TERI University is rooted in the comprehensive research, consultancy, and outreach activities of TERI, a not for profit independent research institute recognized globally for its contribution to scientific and policy research in the realms of energy, environment, and sustainable development. The university has two faculties – the Faculty of Applied Sciences and the Faculty of Policy and Planning and approximately 400 students.

The aim of this paper is to prepare an EMP for TERI University, New Delhi with a view to minimize the ecological footprint of the university. The proposed EMP aims to identify potential areas for improving the university's environmental performance and give recommendations on how the goals of on-campus environmental sustainability can be achieved. The paper discusses the initial environmental review of the existing structure and the proposed implementation stages of EMS in the university. The initiative is a pioneering effort and can play the role of acting as a model system for other universities and campuses across India to adopt.

Initial environmental review

The IER has been undertaken in consultation with the architect of the building, the housekeeping in-charge and other people involved in the task. Keeping in mind the various activities that are undertaken at a university, five key environmental domains have been identified viz. energy, resources, waste (solid and hazardous), ambient/indoor air and landscaping. A detailed questionnaire has been prepared based on which information has been collected regarding different aspects within each domain. The initial environmental review has revealed electricity consumption and waste management as the thrust areas that need to be addressed along with other activities within each domain (Table I).

SWOT analysis

Strengths, weaknesses, opportunities and threats (SWOT) analysis is a widely used decision-making and planning tool. It is an efficient method for identification and analysis of strong and weak points and for examining the opportunities and threats in a certain domain (Kurttila *et al.*, 2000; Paliwal, 2006; Lozano and Vallés, 2007). Strengths and weaknesses of a system are determined by internal elements whereas external forces dictate opportunities and threats. Advantages of SWOT analysis include simplicity in understanding, ease in use, and efficiency. It is recognized that if correctly applied, SWOT is an appropriate technique for identification of recommendations for organizations (Lozano and Vallés, 2007). In the given case, SWOT analysis was conducted to analyze the existing gaps and to prepare a comprehensive environmental management plan for the university.

A thorough assessment of the existing resources was conducted through the SWOT analysis and the opportunities and weaknesses were then built into the plan such that the plan built upon the opportunities and addressed the weaknesses. SWOT analysis allows rational decision making and rational management (Srivastava *et al.*, 2005). The analysis

Environmental domain	Activity description	Impacts					
		Emissions to air	Waste generation	Wastewater generation	Noise	Impacts on biodiversity	Natural resource depletion
Energy	*Use of electricity*	*			*		*
	Heating and cooling						
	Lighting						
	Photocopying						
	Computers, fax machines						
	Microwave/refrigerator				*		
	Transportation	*					
	Bus/car/train/air						
Resources	Paper plates/cups/napkins		*				*
	Plastic bottles/spoons		*				
	Paper cartons		*				*
	Marker/pen/pencil		*				
	Paper		*				*
	Chalk						
	Printer cartridge		*				
Waste	Canteen		*	*			
	Laboratory	*	*	*			
	Lavatory		*	*			
Ambient/indoor air	Use of diesel generator (DG) sets	*				*	
	Computer/printer	*					
Landscaping	Maintenance of gardens			*		*	
	Use of pesticides/chemical fertilizers			*		*	

Table I.
Initial environmental review and identification of major environmental impacts

helped provide a logical framework for analysis of the given situation and design strategies and tactics that were in tandem with accessible resources as well as technical competency. Through this analysis, the team was able to account for the existing environment-friendly initiatives at the university, and prepare a plan such that benefits of existing activities can be amalgamated into the overarching university-wide plan.

It has been used in this given study with an aim to see how the EMS to be implemented should be shaped in order to take into account the existing concerns related to environment.

SWOT analysis (Table II) has been conducted based on the initial environmental review and results show that the university has a lot of strengths which it can build upon during implementation of the EMP. Weaknesses and threats have also been identified, remedial action for which can be taken through the EMP. The SWOT analysis serves as the foundation for drafting the environment policy of the university and subsequently, defining goals and objectives and drawing up the management plan for various domains.

Environmental management plan

The EMP for the university has been prepared keeping in mind the observations made during the IER and the results drawn from the SWOT analysis (Figure 2). The first draft of the environmental management plan was prepared by a group of masters students and inputs were provided by the concerned faculty member. After that, the plan was presented to the faculty members of the university and their guidance was sought. Once the plan was approved and adopted, a Sustainability Cell was established by TERI University and students were invited to join the cell and contribute to the implementation and monitoring of the EMP. The EMP describes the specific measures that will be undertaken to improve the environmental performance of the university. It aims to define priorities, set objectives, identify parameters of importance, and prepare strategies for achieving objectives and a framework for documentation, reporting, monitoring and inspection. It will help in:

- providing a framework to ensure the existing features are maintained; and
- providing a roadmap for achieving sustainability on-campus.

The benchmarks for the EMP of the university will be sustainability and stewardship.

Environment policy of TERI University

The university aims to involve people at TERI University in reducing the environmental impacts and integrate the environmental concern in all policies, plans and management systems. With this in mind, the following environmental policy is proposed.

TERI University acknowledges and understands its role in striving towards global environmental sustainability. It aims to set standards in terms of on-campus environmental performance through its continuous endeavors.

In this regard, the university shall:

- comply with all requisite environmental legislation and government guideline, wherever applicable;
- ensure that there is optimum utilization of resources and waste generation is minimized;
- integrate environmental concerns in decision-making, e.g. purchasing policy;

Table II. Results of SWOT analysis for TERI University

Domain	Strengths	Weaknesses	Opportunities	Threats
Energy	Use of energy efficient heating and cooling systems (e.g. earth air tunnel, thermal mass storage and variable refrigerant volume system, etc.); energy savings of the order of 60 per cent as compared to a conventional building Building design and lighting arrangement support use of daylight Building direction and design also prevents heating during summer	Greenhouse gas emissions due to energy consumption have not been taken into account Efficiency of cooling systems reduces under humid conditions necessitating use of supplementary cooling systems during rainy season The solar water heating system is being used only in the hostel block No strategy in place to safely dispose off used compact fluroscent lamps (CFLs)	Revenue generated through energy savings can be invested to make environment management more efficient in the university Extending the facility to the academic and administrative blocks Environmental consciousness may lead to a switch over to LEDs in the future	Unsafe disposal of CFLs may prove to be an environmental threat
Water	Approximately 25 per cent savings in water usage due to use of low flow fixtures Treatment of wastewater generated in the hostel block of the university; use of treated water for landscape irrigation Rainwater harvesting for aquifer recharge	Only hostel wastewater is treated	Revenue generated through savings can be invested to make environment management more efficient in the university The wastewater treatment facility can be extended to treat the wastewater generated from the other buildings of the campus Treated water can be used for landscaping purpose	Some portion of water is used from underground and this area is already declared as water scare area
Waste	Hazardous waste to be processed through an external agency Organic waste to be treated in-house and manure used for university gardens	Paper waste is not being recycled at the university	Waste segregation can be carried out and paper waste generated at the university can be recycled	Accidental leakage/spill of hazardous waste from laboratories during storage
Air quality	Use of stacks as per government notification for the DG sets six monthly monitoring of ambient/ indoor air to keep track of the quality of air		Air stacks are also used as a platform for students learning system in air quality management course for stack monitoring	Chances of increase in level of air pollutants during peak hours due to increase in the number of vehicles plying in the area

(*continued*)

Table II.

Domain	Strengths	Weaknesses	Opportunities	Threats
Landscaping/ biodiversity	Approximately 30 per cent of total area covered by green open spaces	TERI University area is very rocky, so cannot allow all types of species to grow	Opportunity to develop roof gardens; plant vegetables in the gardens for canteen ERI University took an initiative greening the surrounding area with the help of Indian Oil corporation	New species may grow in the local region
Transport	Car pooling instead of one person one car mode is being practiced by students as well faculty members; university has provided for a bus service for students and staff	Area in which the university is located is not well connected to the main link road. This may result in an increase in the use of private transport	Infrastructural development because of a rise in institutional as well market facilities Government has started bus for students to save emission from private vehicles as an initiative of TERI University sustainability cell a part of EMS system	Emission may rise in future
Legislation/ laws	The university is performing well under existing guidelines	There are no laws or guidelines in the Indian legal system for environmental management in universities	EMS system may help an initial model to develop such models for other universities in India	Absence of any prescribed guidelines for EMS in universities may result in a lack of impetus for continual improvement
Miscellaneous	Use of University Management System (UMS) which reduces resource consumption (like papers, prints, photocopy, etc.) University focused on environment, having a green building improves the image Small university, hence, if EMS established, the idea of environmental protection will become an integral part of university operation and management		University already has a UMS, can be made paper free/zero paper in the future to reduce the carbon foot print Can serve as the model for EMS implementation for universities across India Can serve as an excellent learning module for students at the university financial benefits can be used for further improvement of the system	Conflicts may arise between anthropogenic activities and environment, since the university campus is located in the fringe area of the Delhi ridge

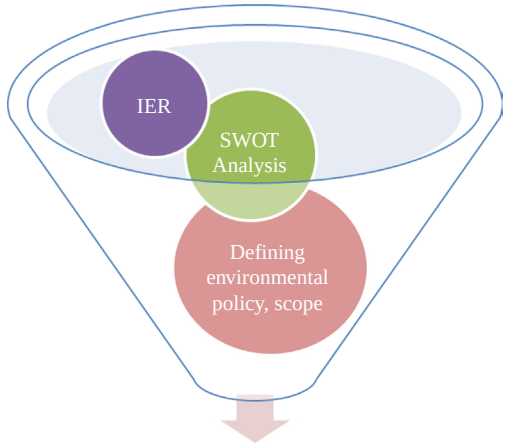


Figure 2.
Steps followed for preparation of the environmental management plan for TERI University

- implement an EMS; and
- strive towards continual reduction in ecological footprint of the university as it grows.

Description of the plan

Management structure

For successful implementation of the environmental policy at the university, the roles and responsibilities of the various levels of management have to be well defined (Figure 3). The management is spear-headed by the Review Committee, consisting of the top management authorities of the university viz. the Chancellor, the Dean and the Registrar. The main responsibility of this committee is to monitor the overall functioning of the EMS. It would regulate the resources required for the maintenance and operation of the plan, and review the EMP (at least annually), to ensure its continued utility, suitability and adequacy in promoting continual improvement. Next in hierarchy is the Management Committee, consisting of two faculty members and three students. The role of this committee is to serve as the link between top management, and the staff and students. Other responsibilities include ensuring transparency in the management procedure, supervision of activities of the Steering Committee and a continuous effort towards integration of the EMS into the existing management framework of the university. The third tier is constituted by the Steering Committees for each environmental domain, each having three students and a fixed number of student volunteers. The student volunteers would either be taken up on a yearly basis at the

Note: Proposed management structure for environmental management at TERI University

Figure 3.

beginning of each semester. The Steering Committees work to ensure that the targets of the EMS are met and revise these targets on yearly basis to improve their performance. The committees are also responsible for documenting the progress. The Management Committee will review the records of the work. Delegating the responsibility of the Steering Committee to students would facilitate better communication and awareness amongst the like, and this can be supplemented with occasional workshops, seminars and other interactive activities. It is essential to bear in mind that the initial implementation of the EMP is not the final goal, and continuous and dedicated effort would be crucial for reducing the impact of the university's activities on the environment.

Documentation system

The university needs a documentation system that would keep track of the effectiveness and efficiency of the environmental management plan. The university management system being used presently contributes to reduction in the paper use and leads to easier recordkeeping. Some basic steps that are being undertaken can be summarized as follows:

(1) An environmental information system, which links different departments at an operational level and also, helps to publish information internally to the members of the university and if required to the public in general is being prepared.

(2) Documentation of all events conducted as a part of EMS as well as of reports from internal and external audits will be carried out after the implementation of the EMS.

Training and communication

Training and communication are considered the key factors for successful implementation of an EMS in a university set-up, and majority of the students, faculty and other employees should be included in it. Studies reflecting on EMS at universities point out that environmental awareness and consciousness are important factors in the greening of campuses (Viebahn, 2002; Sammalisto and Brorson, 2008) and proper training and effective communication can act as tools for achieving sustainability. At TERI University, the approach towards training and communication has been designed to be such that it helps to educate/inform people about the university's environmental policy, environmental aspects, everyday procedures, along with sensitization of individuals towards on-campus environmental issues.

Training students and staff. A training package containing information on the EMS, key environmental aspects of the university, roles and responsibilities in achieving conformance with the environmental policy and activities of the environmental management committees, is being prepared and would be made available to all students and staff of the university. Regular discussions, seminars and workshops have also been planned to be used as teaching and training methods. Experts within and outside the university would be invited to conduct talks.

Training new employees and students. New employees will be given a copy of the environmental policy and will be informed about the structure and aspects of the EMS during the orientation programme. The same information package will also be provided to all external students/faculty arriving at the university.

Training environmental auditors. Internal environmental auditors, which include a set of faculty members and students, will be trained in auditing methods. The training

will include information on various aspects of environmental auditing- planning, conducting and reporting.

Communication procedures will be implemented and documented for implementation of the EMS:

- The environmental coordinators of the respective steering committees will serve as communication link between the various departments and the management committees.
- The management committee will in turn be responsible for communicating all vital information to the review committee, for example, through submission of six-monthly reports or internal audit reports.
- All students and staff will be kept informed about any ongoing or upcoming activity within the environmental management framework. This will be done through notices, brochures, e-mails or display on the university web site.
- A communications log will be maintained to keep records of internal communications as well as external communications, for example, of those with regulatory agencies or experts outside the university.

A suggestion pool has been established in order to involve as many members of the university as possible. A dropbox has been set up where students/faculty/staff can drop in suggestions, remarks, etc. Some space on the university web site has been earmarked for describing the EMS of the university. This would facilitate information transfer by providing a common platform for posting important news as well as for collecting suggestions and queries.

Environmental domains

The primary domains in consideration include energy, resources, waste (solid and hazardous), ambient/indoor air, and landscaping/biodiversity. Following sections define the management plan for each of the domains.

Energy management

The university building already has features that contribute to close 60 per cent energy savings vis-à-vis a conventional building. However, in the coming years, the university plans to adopt renewable sources of energy on-campus. Besides this, the university believes that there is a need to ensure maintenance of the existing cooling and heating systems. The steering committee for energy will ensure regular maintenance check for each of the systems. Training is also being given on how to take care of the existing infrastructure to the steering committee members and housekeeping staff deployed for the purpose of maintenance of the heating and cooling systems. The university is also carrying out a detailed carbon footprint analysis for the university, which would help in estimating the total GHG emissions due to energy usage. Quantitative targets would then be undertaken for reduction in energy consumption.

Waste management (*solid and hazardous waste*)

Table III lists the various types of waste generated at the university. The university aims to follow the three-tier approach for waste management (Figure 4). This three-tier

concept of waste management is being incorporated in the university purchase policy, daily operations, and also in campus culture.

Following are few options which are being exercised in the field of waste management:

- Priority is being given to eco-friendly brands followed by those that are recyclable or made from recycled material for purchases.
- Use of paper cups is being discouraged and people are being motivated to use their own mugs/cups instead of paper cups. All faculty members are already using their own bone china cups to reduce the usage of paper cups.
- On-campus use of plastic bags is discouraged.
- Paper usage is being minimized and the university management system is a step in that direction. The university also has a student information system (SIS) which basically helps reduce paperwork and records are maintained for the students online. Students are encouraged to submit their assignments and term papers through SIS to reduce the wastage of paper. Double-sided printing option is being used at all terminals with access to printers.
- Waste segregation is being carried out strictly; organic waste will be composted in-house (biological treatment has proposed for biodegradable waste) in future and the manure will be used for the gardens in the campus. The composting pit will either be built in-campus, or just outside the campus, after taking due permission from Municipal Corporation Development Authority, New Delhi. Chemical and hazardous waste from laboratories is sent to a certified agency for processing and no part of the waste is disposed elsewhere.
- Paper waste is sent to an external recycling unit and reused.

Ambient/indoor air management

The university is located in an area with greenery and hence, the quality of air is good. However, a sampling exercise is being carried out to get baseline data on air quality of the area in and around the university as well as within the buildings. In the long run, the

Table III.
Summary of waste types that being generated at the university

Waste type	Details
Chemical and hazardous waste	Waste generated in environmental monitoring and biotechnology laboratories
Waste electrical and electronic equipment	Computers, liquid crystal displays, telephones, etc.
Municipal solid waste	Waste being generated in the canteen, classrooms, administrative block and washrooms
Paper waste	Scoping exercise needs to be carried out in order to estimate how much paper waste is being generated per day

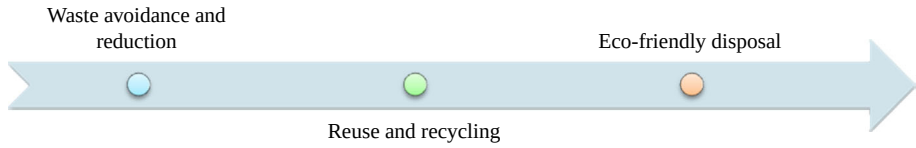


Figure 4.
Three-tier approach of waste management

university is considering adopting the American Society of Heating, Refrigerating and Air-Conditioning Engineers standards for indoor air quality. A key concern vis-à-vis ambient air quality is transportation. Since the university is located approximately a kilometer from the main road and the public transport is not very efficient, many staff members as well as students are using private transport for commuting to and fro from the university. The staff and students are being encouraged to use carpool and alternatives like cycling, walking, etc. Many students at the university are staying within a radius of three to five kilometers of the university and hence, such initiatives are expected to be successful. However, the university understands that mere motivation and encouragement will not lead to increased use of public transportation and some measures which are being taken include:

- Financial incentives for use of ride and share facility/carpools are being planned along with allocating use of cars of even and odd numbers on different days of the week.
- A campus shuttle is being used to bring students to the campus from a designated point to discourage use of personal vehicles. Use of public transport is encouraged.
- A log of business/academic travel for university staff/faculty/students is being maintained.

Landscaping

Given the fact that the university campus has a 30 per cent green cover, there is a need to ensure that the kind of plants that are planted in the campus are suited to the local conditions and do not require too much water. An inventory of species found in and around the campus is being conducted in order to get the baseline data which can be used as reference for future work on biodiversity management. A management plan is also being prepared for minimizing use of potable water for irrigation as well as minimal use of pesticides and fertilizers in the gardens. Roof gardens are being planned and creepers will be grown to further increase the green area in the building. Greening of the area just outside the campus is also being carried out.

Water management

The university aims to make efficient and environmentally responsible use of water, including identifying opportunities for water recycling and reuse. The first step in this direction is calculation of water footprint of the university including the canteen and hostel facilities which is under process currently. This would allow us to know what the share of water consumption for various activities and a strategy can then be devised for reducing the water footprint. Estimates suggest that on an average, the cooling systems require approximately 800 L/hour water. Besides this, water requirements in the building amount to approximately 13,500 L/day. This calculation has been made based on the IS: 1172:1193 specifications. The university already has a wastewater treatment plant for the hostel block where maximum amount of wastewater is expected to be generated. The treatment plant has a capacity of 25 m^3/day with an average flow rate of 1 m^3/hour.

Monitoring mechanism

A monitoring mechanism has been established which will ensure a regular check on implementation of the EMP as well as impact of the plan in improving environmental performance of the university.

Following are some ideas that have been undertaken for monitoring the implementation and functioning of the EMP:

- Internal audits will be conducted on a regular basis of six months at the university. Besides routine internal audits, surprise checks are also in the pipeline in order to ensure that there are no concern areas in implementation.
- Student volunteers will carry out monthly performance evaluation of each domain.
- Once in a year, an external audit will be conducted. Since hiring a professional auditor is expensive, fellow experts from universities and research institutions will be invited for review of the management system.
- Indicators are being set for measuring/gauging the performance in the environmental domain, e.g. daily water consumption for the building, percentage green spaces, etc.

Conclusions

Universities across the globe are taking commendable steps to ensure the impact of their day-to-day activities on the environment is minimal. The present study discusses the steps in implementation of EMS at TERI University. The university strives to attain sustainability in the long run and considers EMS as one of the tools to attain it. Initial environmental review has been carried out to know the different environmental aspects of TERI University. It has been observed that electricity consumption and waste management are the thrust areas that need to be addressed along with other activities within each domain. Even though there are several existing features of green building in the campus such as earth air tunnel and thermal mass storage and variable refrigerant volume system for cooling air which consumes approximately 60 per cent less energy as compare to conventional cooling system.

SWOT analysis has been carried out to know the strength and weakness of the TERI University EMS. It was good exercise for TERI University because the greening in the nearby area and public transport for TERI university students is output of SWOT analysis. Sustainability cell is also functional to take care about other environmental issues in the campus.

As a result of EMS initiative, carbon footprint calculations have been in process to know how much carbon footprints are because of TERI University and how much can be reduced with different mechanisms. The proposed EMP is currently in the process of implementation and with this; the university has taken one step ahead on the path of sustainability. The university hopes that this would serve as a step in the right direction and more educational institutions in the country would follow suit.

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