

Report on

Sustainable Development

GOAL 12



RESPONSIBLE
CONSUMPTION AND
PRODUCTION

Ensure sustainable consumption and
production patterns



“The Earth has enough resources to meet the needs of all but not enough to satisfy the greed of even one person”.

- Mahatma Gandhi

At the heart of Sustainable Development Goal 12, is to ensure patterns of activities that hold the key to sustain not only the current but also the future generations. Shiv Nadar Institution of Eminence is built on a sprawling green campus spread over 300 acres and is located in a rural-urban landscape. A mini-city in itself, the campus is surrounded by agricultural land and on one side by the wetlands of Bil Akbarur, while NH 91 is situated on the front side. While the surrounding landscape is rapidly transforming due to urbanization, on campus we proactively plan, act and propose ways in which we can contribute to responsible patterns of consumption and production through teaching, research, institutional practices, and partnerships.

1 Teaching and Learning

We are committed to offering meaningful education around sustainability and related areas to all students across the University besides our core subjects. For undergraduate students, many compulsory courses are regularly offered, such as Environmental Studies (CCC 704), Biodiversity: Assessment & Conservation (CCC 706), Environmental Impact Assessment (CCC 406), Use of Energy in our Daily Life (CCC 624),

and Green Energy Technologies (CCC613) to name a few.

The School of Management and Entrepreneurship offers many core courses with sustainability elements integrated across the undergraduate and graduate programs curriculum. As part of its three-credit course, Sustainable business strategy (STM205), has launched an initiative called *Campus as a Living Lab*. Here, students are challenged with a final project in which they work on sustainability initiatives for the Shiv Nadar campus using *Campus as a Living Lab*. These projects address several key topics in sustainability, such as air quality, solar power, sustainable transport, no plastic, waste management for a circular economy, and many more. The entire exercise is not just a course in the curriculum but a way student thinks of *sustainability* as a living reality.

A course in Pro-Social Consumption (MKT801) acquaint students with skills to do academic research in the area of sustainability and pro-social consumption. Sustainable Operations Management (DOM403) trains students on how to use continuous improvement techniques and value stream mapping to reduce waste and environmental impacts while reducing costs. Other courses include Sustainable Consumption (DOM 901), Marketing Research (MKT 406) and many more.



Campus as a Living Lab Projects: by student in Sustainable Business Strategy (STM205)

Student Projects

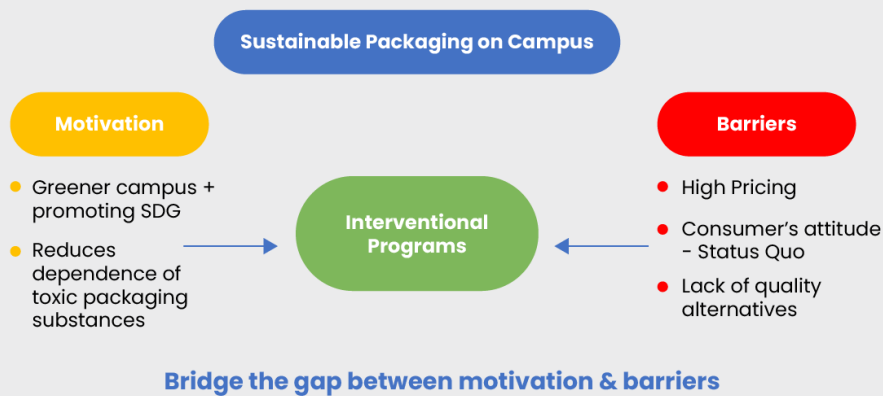
Students undertake many interesting projects as a part of the course curriculum.

Eliminating the usage of unsustainable packaging practices at Swad kathi roll & Nescafe, within Shiv Nadar IoE

Shivam Chaudhary, a student of Bachelor of Management Studies (BMS), did an interesting study

to measure the consumer acceptability towards sustainable packaging practices, at the same time encouraged positive associations towards the adoption of sustainable packaging. After analyzing and interpreting the raw data the study emphasized and later proposed on how to move from a state of reluctance to a desired state.

Bridge the gap between current & desired state



Adopting behavioural change: Grabbo's bring your own bag (BYOB) Initiative

Akshita Maheshwari, Vartika Garg, and Vishesh Bandlish, students from BMS took up a project to eliminate the use of plastic bags

at Grabbo, the campus grocery store. The research and campaign carried out as a part of the project, brought about a shift in the student behaviour who now carry their own bags. The store too has adopted a no-plastic bag policy.

ACTIONS TAKEN BY US

- BYOB poster on cash counter
- Permanently removing plastic bags at Grabbo
- Word of mouth the employees of Grabbo



Design of storage system for local gardeners

The Department of Design has many courses that encourages and trains students to develop products using waste materials and solving the problems of underprivileged sectors, Sirish Taneeru, in the Department of Design as part of his Opportunities for Undergraduate Research (OUR) project, designed a storage cabinet for the local gardeners' needs. The paper is published in Scopus-indexed proceedings.

The project looks for appropriate design intervention for the section of society that belongs to bottom of the pyramid. The [paper](#) addresses on how issues related to storing and managing gardening tools and equipment and presents the design development and evaluation from a sustainability point of view. Two gardeners on campus were involved during different stages of product design, addressing their needs and aspirations. The final design incorporates the economic and environmental sustainability aspects.



Assessment of new solution by the gardener



2 Research

Performance Analysis of PCM-Integrated Greenhouse Dryer

Dr. Sumit Tiwari, Assistant Professor, Department of Mechanical Engineering, in his research, addresses the importance of minimizing post-harvest losses of agricultural commodities and maximizing the use of renewable energy sources. Owing to limited agricultural land and non-renewable sources of energy, solar drying is used to reduce the moisture content of a commodity in order to extend its shelf life. Although effective, the research addresses the limitation of operating solar dryers during non-sunshine hours and the cost of time and environment of using energy from external sources. Phase change materials (PCMs) are found to be a feasible alternative to supply heat in non-sunshine hours. PCMs are the version of latent heat storage, which offer high thermal energy storage density as compared to sensible heat storage.

Sehrawat, Ravin, Ravinder Kumar Sahdev, and Sumit Tiwari. "Performance analysis of PCM-integrated greenhouse dryer." In *Advances in Mechanical Engineering and Technology: Proceedings of 6th International Conference on Advanced Production and Industrial Engineering (ICAPE)-2021*, pp. 37-44. Singapore: Springer Singapore, 2022.

Smart Waste Management System in Smart City

The study deals with waste management as one of the important issues and indicates the key to efficient waste management is to ensure useful segregation and disposal. Addressing the problem of delay in the collection and disposal of waste due to human intervention involved in the process of waste management, the paper proposes an efficient waste management system for the segregation and timely disposal of waste. Smart Waste



Management System deals with everyday problems of waste disposal by reducing this human intervention.

Sankar, T., A. Vivek & P. C. Jain (2022). Smart Waste Management System in Smart City. Lecture Notes in Networks and Systems 340 LNNS, 66–72. doi: 10.1007/978-3-030-94507-7_7.

Recent developments in landfill leachate treatment: Aerobic granular reactor and its future prospects

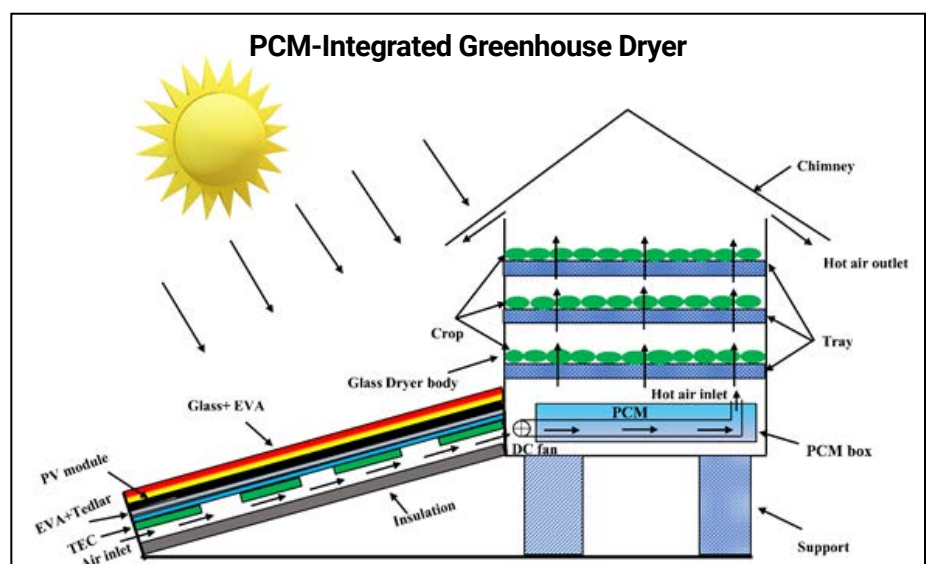
Landfill leachate comprises highly toxic and hazardous compounds posing adverse health effects to the ecosystem and human populations. These leachates must be subjected to suitable treatment before discharging to the environment. However, the high operational cost and presence of recalcitrant matter in the leachate makes the conventional physico-

chemical processes incompetent for treatment. An integrative approach is imperative for treating landfill leachate with a high organic load to meet the effluent standard. The present study highlights an in-depth critical review of various biological processes, recent developments in Aerobic Granular Reactor (AGR), and the factors affecting its performance, mass balance, and the kinetics involved during landfill leachate treatment. It summarizes integrated process for treatment of landfill leachate along with the future prospects of AGR.

Saxena, Vikalp, Susant Kumar Padhi, Pritam Kumar Dikshit, and Lopa Pattanaik. "Recent developments in landfill leachate treatment: Aerobic granular reactor and its future prospects." *Environmental Nanotechnology, Monitoring & Management* 18 (2022): 100689.

Disposable Paper-Based Biosensors: Optimizing the Electrochemical Properties of Laser-Induced Graphene

Laser-induced graphene (LIG) on paper substrates is a desirable material for single-use point-of-care sensing with its high-quality electrical properties, low fabrication cost, and ease of disposal. The current study presents a systematic in-depth study on LIG synthesis to elucidate the complex relationship between the surface microstructure

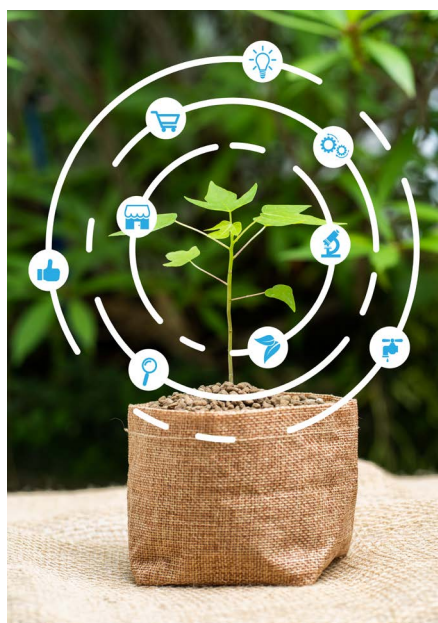


and the resulting electroanalytical properties. The study also shows how high-quality, sensitive LIG electrodes can be integrated into electrochemical paper analytical devices.

Bhattacharya, Gourav, Sam J. Fishlock, Shahzad Hussain, Sudipta Choudhury, Annan Xiang, Baljinder Kandola, Anurag Pritam, Navneet Soin, Susanta Sinha Roy, and James A. McLaughlin. "Disposable Paper-Based Biosensors: Optimizing the Electrochemical Properties of Laser-Induced Graphene." *ACS Applied Materials & Interfaces* 14, no. 27 (2022): 31109-31120.

Editorial: Plastic to Bioplastic (P2BP): A green technology for circular bioeconomy

The study proposes a model of developing "hybrid-plastic" ie, blended Bio-and FD-Plastics and/ or complete valorization of FD-Plastic as Bio-Plastic as an approach to re-incorporate those end-of-life FD-Plastics into the value chain. Microbes produce Bio-Plastic, such as Polhydroxyalkanoate (PHA) or polylactic acid (PLA), from sugars (derived from agricultural biomass such as sugarcane juice or corn or lignocellulosic biomass derived after pre-treatment) and/or from greenhouse gases [such as methane (CH₄), carbon dioxide (CO₂), etc.,] under fermentation conditions.



However, the Bio-Plastic production from a meager 2.42 million tons (0.6% of FD-Plastic) in 2021 and is forecasted to reach 7.59 million tons by 2026 (European Bioplastic, 2021). Considering the future demands for FD-plastics and the problem associated with its disposal, it is very important to develop sustainable biotechnologies to convert the FD-Plastics' waste into value products.

Priyadarshini, Richa, Thava Palanisami, Arulazhagan Pugazhendi, Arumugam Gnanamani, and Obulisamy Parthiba Karthikeyan. "Plastic to Bioplastic (P2bp): A Green Technology for Circular Bioeconomy." *Frontiers in Microbiology* 13 (2022): 851045.

Optimal restoration of common property resources under uncertainty

Mining for minerals, while a good source of income to the local economies, results in significant environmental damages. The Aravalli Mountain Range in India protects Delhi and adjoining areas from desertification risks posed by the Thar desert through acting as a physical barrier. However, it has degraded over time due to persistent illegal mining and encroachment by real estate developers. The restoration efforts undertaken to restore Aravallis have remained

largely unsuccessful due to a lack of sufficient financial incentives. This study asks whether financial incentives for afforestation, such as desertification prevention permits and water-based payments for ecosystem services, can promote restoration of mineral rich commons in the Aravallis. The study designs an incentive structure through which local communities benefit from water and land based payments resulting from restoration.

Ranjan, Ram. "Optimal restoration of common property resources under uncertainty." *Resources Policy* 77 (2022): 102688.

3 University Operations

Campus Food Waste Tracking System

The university has a comprehensive and documented food waste tracking system to measure and monitor food waste at each level, i.e., production, handling, storage, processing, and distribution. Taking efficient measures and maintaining daily food waste log, we have reduced food wastage per person from 26.52 kg in 2018-19 to 9.2 kg in 2021-22.

Besides, giving a minimum guarantee to the dining hall vendors to keep a check on production, the food waste

FOOD WASTE TRACKING SYSTEM

The food waste is then processed via organic waste compost plant for horticulture activities. This also provides food waste to piggery farm near the campus

Collection of food waste

Collected food waste is measured and documented

Data gets reported into Lean path software

Daily records are maintained in the log book



is used for composting within the campus. The packed food is offered in recycled containers.

Free Store on Campus

The free store is a student-led initiative on campus that came into

At Shiv Nadar IoE we closely monitor our footprints

- The campus has a restrictive use of plastic. This behaviour is encouraged on campus through communicate and posters for responsible consumption and conservation.
- Since 2019, plastic waste is being monitored, tracked, and disposed of through green disposal methods. To date, we have achieved a 47% decrease in plastic waste disposal. The waste paper collection and disposal happens through the government-certified recycler who in turn provides recycled paper, paper, and other stationery.
- We have special contracts and systems in place for the safe disposal of hazardous and medical waste.
- We undertake extensive documentation of water usage and reuse.
- We have 500KL sewage treatment plant for reuse of water for irrigation and horticulture.
- Solar water heaters and a solar power plant of a capacity of 430kwp is installed to transition from complete captive power generation.
- As a part of our Energy Consumption Analysis and Conservation Plan, we review our energy use on a continual basis to identify opportunities for improvement. To document the energy consumption of each building, electricity meters are installed in every building and a full analysis of energy consumption is reported monthly basis in the "Energy Performance Index Report". This helps to check waste on a continuous basis.

being as a part of their practical project for a course on Executing Marketing Plans (MKT504). The project is to promote the concept of recycling. The university community has enthusiastically responded to the idea of converting pre-loved clothes into re-loved ones for someone else.

Organic Farm: On-going Community-Driven Initiative

The university is in the process of establishing a plan to engage students and community members in the cultivation of organic fruits and vegetables on campus. A five-acre land has been earmarked to enable nature-friendly farming, and provide healthy food to students and the community.



4 Partnerships

Dr. Bikramjit Rishi, Professor, School of Management and Entrepreneurship, in collaboration with Prof. Vinit Dani, Vignana Jyothi Institute of Management, Hyderabad has published an interesting case study on the Center for Sustainable Agriculture (CSA). The [research](#) was published by Ivey Publishing, Canada. The founder of CSA developed a sustainable agriculture model to help farmers lower crop failure risk and reduce production costs. It collaborated with farmers, producer associations, governments,

and markets. The introduction of organic products allowed the company to integrate sustainability into its core business plan.

A commitment to encouraging global citizenship through education

We participated in UNLEASH 2022, a global SDG platform in Mysuru, India. It brought together over 1200 participants worldwide to participate in a global hackathon on the thematic area Source to Sink. As part of this collaboration, the Shiv Nadar IoE hosted the first-ever campus hackathon in India, bringing together participants from several partner organizations.



Start-ups to address sustainability

The University supports start-up ideas through the Atal Incubation Center (AIC) to encourage and create an active entrepreneurship culture. AIC is set up on a 10,000 sq. ft space at the University with the support of the Atal Innovation Mission, NITI Aayog, Government of India. The University and the Government provide 50% of the core funding to a start-up selected through a rigorous process and mentoring through University leadership and professors.

One such example is [Envoprotect](#). This is a solid waste management startup providing the most sustainable solution for processing the plastic waste emerging out of recycled paper mills which is otherwise dumped or burned and converting it to climate-conscious products for heating applications.

Shiv Nadar Institution of Eminence is fully committed to the UN Sustainable Development Goals (SDGs). We have embraced a four-pronged strategy for SDGs through **teaching, research, our core institutional practices, and partnerships.**

SHIV NADAR

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