# SDG 12: Responsible Consumption and Production

Ensure sustainable consumption and production patterns

INTRODUCTION

## Doing more and better with less

Sustainable Development Goal 12 calls for sustainable consumption and production patterns. It asks societies to do more and better with less: to use natural resources efficiently, to prevent waste at its source, and to reduce, reuse and recycle what cannot be avoided. The goal extends from production to the final disposal of materials and encourages organisations to manage chemicals and wastes responsibly, to adopt cleaner and more circular ways of making and using things, and to help people everywhere become aware of how their choices affect the environment.

SRM University-AP follows these principles in teaching, research, campus operations and engagement with the wider community. The campus is treated as a living laboratory in which organic residues are handled where they arise and returned to use, wastewater is treated on site, and students and staff are invited to take part in cleanliness, e-waste and resource-awareness activities. Academic staff and student founders carry the same thinking into research on waste valorisation and the circular economy, and into new ventures that turn waste streams into products. The sections that follow set out these contributions.

> **On this campus, waste is treated as a resource: food and garden residues return to the soil, wastewater returns to the landscape, and students and researchers help close the loop.**

SDG 12 KEY HIGHLIGHTS

## SDG 12 at a glance

**9**
events and outreach activities mapped to SDG 12
Aug 2024 – Apr 2025

**3**
incubated startups with SDG 12 as primary SDG
2024–2026

**115**
publications mapped to SDG 12
2024–2025

**100 kg/day**
food-waste input for the 6 $m^3$ biogas plant

**9,704**
LEDs on campus

**6**
electric vehicles available

**86.97 t**
$CO_2e$ reduction compared with the previous year

**4**
carbon offset programmes

RESOURCE EFFICIENCY AND RESPONSIBLE CONSUMPTION

# Efficient equipment, clean mobility and lower emissions

## Efficient equipment on campus

The campus uses 9,704 LEDs, which supports efficient lighting across buildings. Air movement and comfort are served by 1,432 ceiling fans, 43 pedestrian fans and 47 exhaust fans, and 39 lifts are available for vertical movement within the campus.

| 9,704 | 1,432 | 43 | 47 | 39 |
|---|---|---|---|---|
| LEDs | ceiling fans | pedestrian fans | exhaust fans | lifts |

## Electric vehicles

The campus has 6 electric vehicles; a choice made with local pollution in mind. A battery-operated electric vehicle is used mainly to carry visitors on campus tours and runs for nearly 4–5 hours a day. It is charged every day at a charging point inside the campus and covers nearly 30–40 km on a single charge. Some faculty members also use electric two-wheelers for their regular official visits, and the university sees it as a welcome step that calls for more awareness among faculty and students.



A white open electric cart with bench seats parked on a paved area in front of shrubs and a building.



Three white vehicles, two open-sided mini-buses and a cart, parked inside a large hall.

## Emissions and carbon offset

Total annual greenhouse gas emissions from the institution are 11,968 metric tons of CO2 equivalent. The annual emission reduction target is 3.83%, or 1,197 metric tons, and a reduction of 86.97 metric tons of CO2 equivalent has been achieved compared with the previous year. Four carbon offset programmes are implemented, namely an EV cart, a biogas plant, tree plantation and solar PV units, and emission levels are monitored quarterly.

| 11,968 t | 3.83% | 86.97 t | 4 |
|---|---|---|---|
| total annual greenhouse gas emissions ($CO_2e$) | annual reduction target (1,197 t) | reduction achieved compared with the previous year | carbon offset programmes: EV cart, biogas plant, tree plantation, solar PV |

RESPONSIBLE USE OF RESOURCES

# Good practice from the campus energy and resource review

Findings from the campus energy, environment and green review (April 2024 to March 2025) that bear on responsible resource use, waste handling and good practice.

### Responsible use of cooking fuel: cylinder tag monitoring

A cylinder tag system supports tracking of the liquefied petroleum gas used in the kitchens. Each cylinder carries a history tag showing its weight at purchase, the date and time of service and of relief, and its empty weight. Each

month the cylinders completed and those in line, with the kilograms of gas remaining, are quantified, converted into a financial value to obtain Rs./kg, and displayed so that users are motivated to save fuel.

### Records for wastewater and sludge

Good practice includes keeping manual or digital records of the STP water input, treatment and wastewater, and of the sludge quantity and usage. These records allow the quantity of wastewater treated and of sludge produced and reused to be followed over time.

### Green-building practices for waste reduction

Integrated green-building practice supports the reduction of waste materials during construction and in occupancy, best practices for handling organic and non-organic wastes, and lesser use of virgin materials during construction. It forms the plan for the university's future buildings.

WASTE MANAGEMENT AND SUSTAINABLE PRACTICES

# Waste handled where it is produced

Waste at SRM University-AP is handled close to where it is produced. Food and garden waste is converted into manure and gas, and wastewater is treated biologically on site.

## Organic waste converter and vermicompost yard

The university has set up a vermicompost yard so that food waste and fallen leaves are disposed of properly and returned to the soil as manure. Food waste collected from all messes and quarters is mixed in a suitable ratio with dead leaves collected inside the campus. The mixture is fed into a dedicated machine, where sand and sawdust are blended in, and is then held in cement bags to decompose for a specified period. Once it has returned to a thick black colour, the material is packed in small bags in appropriate quantities and handed to the gardening staff for use as organic manure. Because the waste decomposes naturally, the product is treated as organic manure that does not harm the soil.



Shelving with stacked green and red crates inside a covered shed.



A blue machine and a grey control cabinet inside a covered shed, with a green crate at the lower left.

## Biogas plant for food and vegetable waste

Food and vegetable waste generated in the mess and canteen, such as cooked rice, vegetable cuttings and unused vegetables, is processed in a biogas plant rather than discarded. The waste is crushed in a mixer grinder and made into a slurry with water, and microorganisms then break down the organic matter by anaerobic digestion. The plant size is 6 $m^3$ with a waste quantity of 100 kg/day, mixed with 100 litres of water in a 1:1 ratio.



A round green dome-shaped tank with an orange cylinder, a blue bucket and a metal frame, under a roof.

## Biopipe sewage treatment plant

The campus operates a Biopipe sewage treatment plant, a biological system that treats domestic and industrial wastewater without added chemicals and without mechanical aeration. It is odour-free and free of excess sludge, compact and modular so that it can be expanded as needed, low in power consumption compared with conventional aeration-based plants, and low in maintenance. The treated water is suitable for non-potable uses such as irrigation and flushing, which lets the university reuse water instead of drawing fresh supply for every purpose.



Open double doors of a mesh-fronted shed with racks of pipes visible inside.



Pipework and a control panel beside storage tanks under a roof.



Rows of white pipes arranged in racks beside a white column.

## Treated-water reuse in campus landscaping

Reuse of treated water for irrigation keeps the campus green without added fresh-water demand. The photographs show lawns fitted with sprinklers and a campus drainage channel.



Grass lawn with a sprinkler head visible among the blades.

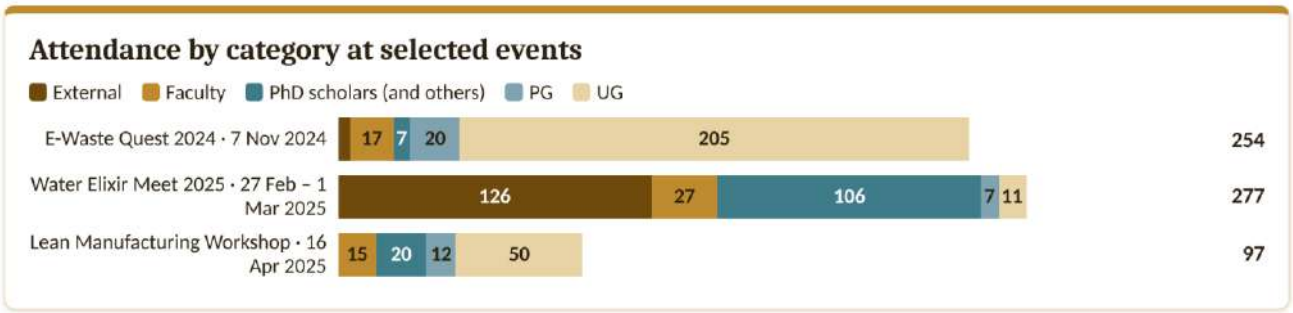


A grassy slope beside a paved path, with a sprinkler head visible.

EVENTS AND INITIATIVES

# Learning and action on waste, water and materials

ATTENDANCE AT SELECTED EVENTS




### E-Waste Quest: Find, Recycle and Revive (EWQ-2024)

**Date:** 7 November 2024, 11 AM to 5:30 PM

**Venue:** APJ Abdul Kalam Auditorium, SRM University-AP

**Organiser:** Department of Environmental Science and Engineering

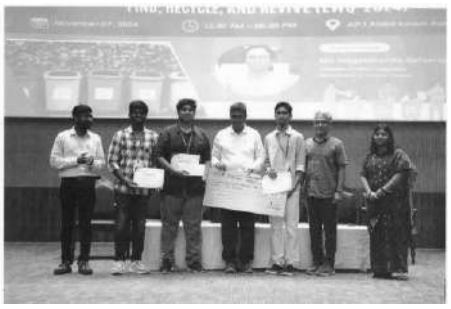
**Attendance:** 5 external, 17 faculty, 7 PhD scholars, 20 PG and 205 UG

A poster presentation held under the Generation Green (Gen G) campaign, which encourages young people to adopt green skills and to manage electronic waste through repair, reuse and recycling. It followed the International E-Waste Day slogan “Retrieve, Recycle and Revive”. The Collector and District Magistrate of Guntur was the chief guest. Posters were presented on themes such as metal recovery and sustainable business models, the future of e-waste technologies, the environmental impact

of e-waste and community engagement, and awards were presented to the best posters. The event helped build a culture of sustainability among students, staff and faculty and educated the community on proper disposal of electronic waste.



Seated audience in a hall during the event.



Seven people standing in a row on a stage in front of a screen, some holding certificates and a large cheque.

## Water Elixir Meet (WE Meet 2025)

**Date:** 27 February to 1 March 2025, 9 AM to 5 PM each day

**Venue:** SRM University-AP

**Type and organiser:** International conference, Department of Environmental Science and Engineering

**Attendance:** 126 external, 27 faculty, 106 PhD scholars and others, 7 PG and 11 UG

An international conference on sustainable water use and management, with keynote sessions by three foreign delegates and six national experts on climate-resilient water systems, membrane separation, digital innovation and community-led water stewardship. The conference led to partnerships between academic institutions, industry and policy bodies on microplastic pollution, PFAS contamination, saltwater intrusion and circular water economies, and produced a compendium of research abstracts and a policy brief. Technical sessions, poster presentations and mentorship opportunities supported early-career researchers and students.




A projection screen and podium on a stage, with a seated audience below.



A decorated stage with a lit lamp and a projected presentation.

## Atmanirbhar Bharat: Innovations in Lean Manufacturing for the Automotive Industry

**Date:** 16 April 2025, 9:30 AM to 5:30 PM

**Venue:** Tiered Classroom, Homi J. Bhabha Block

**Type and organiser:** Workshop, Department of Mechanical Engineering

**Attendance:** 15 faculty, 20 PhD scholars, 12 PG and 50 UG

A one-day workshop with two industry speakers on lean manufacturing principles, electric-vehicle manufacturing, Industry 4.0 and automation. Its objectives include strategies for waste reduction to raise productivity and insights into sustainable manufacturing practices that reduce the carbon footprint. Participants gained an understanding of lean concepts for improving efficiency and reducing costs and of how automation integrates with lean systems, and the event opened opportunities for internships and projects.



Two people standing beside a presentation screen; one holds a bouquet.



A seated audience in a classroom with a man standing in front of them.

## Technical Talk: Emerging Pavement Technologies

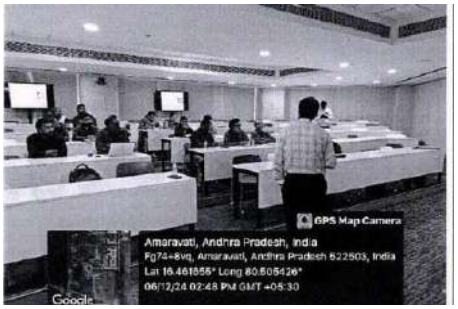
**Date:** 6 December 2024, 2:30 PM to 4:30 PM

**Venue:** C-302, CV Raman Block (hybrid mode)

**Type and organiser:** Technical talk series under an MoU activity between SRM University-AP and R&B, Government of Andhra Pradesh; Department of Civil Engineering

**Attendance:** 18 (PhD scholars, engineers from R&B, Government of Andhra Pradesh, and B.Tech students)

A talk on cost-effective rehabilitation techniques for urban and high-volume roads and on new technologies for pothole patching. It covered white-topping and short-slab concrete pavements, heat-assisted pothole patching and the use of robotics and automation in pothole detection and repair. Participants gained an understanding of these methods and a chance to connect with industry experts for future collaboration.




A classroom with seated participants and a person standing at the front.



A group of people standing in a row in front of a presentation screen.

## Technical Talk: Steel Slag Production and Waste Generation at Vizag Steel Plant

**Date:** 12 November 2024, 2:30 PM to 4:30 PM

**Venue:** Engineer-in-Chief Cabin, R&B, Government of Andhra Pradesh, Vijayawada

**Type and organiser:** Technical talk under an MoU activity between SRM University-AP and R&B, Government of Andhra Pradesh; Department of Civil Engineering

**Attendance:** 6 members (R&B, SH and MDR officials and SRM University-AP faculty)

A presentation by the Deputy General Manager of Vizag Steel Plant on how steel slag is produced and generated at the plant, followed by a discussion on using this waste in road construction. Very large volumes of slag are generated, and the waste must be weathered before it can be used in construction. The Engineer-in-Chief's office suggested a pilot study around the Vizag area and a trial road section near the university to monitor performance.



People seated around a conference table in an office.



Participants seated around a large table in a meeting room.

### ICP-OES Training

**Date:** 12 February 2025, 10 AM to 5 PM

**Venue:** SRM University-AP

**Type and speaker:** Training session by an application manager from Thermo Fisher Scientific

**Attendance:** 4 PhD scholars

A training session that explained and demonstrated the operation and maintenance of an inductively coupled plasma optical emission spectrometer, together with the safety measures needed for accurate, reliable and consistent instrument performance.



A dim photograph of people gathered near laboratory equipment.



A dim photograph of people standing and sitting around an instrument.

COMMUNITY OUTREACH ACTIVITIES

## Cleanliness, awareness and outreach

Cleanliness drives, awareness competitions and outreach days extended sustainability messages beyond the classroom and, in one case, beyond the campus.

### Swachh Bharat Abhiyan – Swachhata (Cleanliness Video Competition)

**Date:** 21 August 2024, 10 AM to 10:30 AM

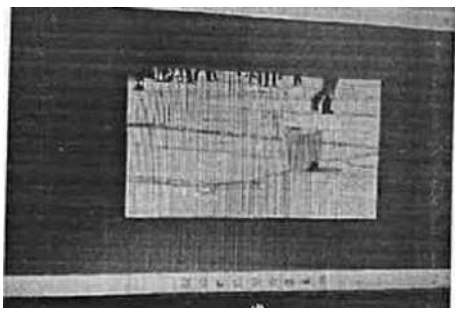
**Mode:** Online awareness programme

**Organiser:** Student Council with the Directorate of Student Affairs

**Attendance:** 19 UG

In line with the objectives of the Swachh Bharat Abhiyan, which include better solid-waste management, cleanliness and hygiene in public spaces and community participation, the Student Council organised an online video competition on cleanliness and hygiene. Students could take part individually or in groups of up to five and submit videos of up to 120 seconds on keeping the classrooms, canteen, hostels, mess and sports ground clean. A panel of judges selected two prize-winning videos for creativity, relevance and impact.


A screenshot on a laptop screen showing a view of a multi-storey building.


A screenshot on a laptop screen showing a video frame.

### Campus Clean Drive

**Date:** 22 January 2025, 2 PM to 4 PM

**Venue:** SRM University-AP campus

**Organiser:** National Service Scheme (NSS), with the Directorate of Student Affairs as contact

**Attendance:** 1 faculty member and 18 UG students

A cleaning drive conducted to keep the campus clean. Its two objectives were to spread awareness about cleanliness and public hygiene and to ensure the cleanliness of campus premises. Students were made aware of public hygiene, and the surroundings were cleaner as a result.



Students holding brooms and a bag while cleaning a landscaped area.



Students sweeping a paved area with brooms.

## ChemZeal 3 – A Day for Chemistry

**Date:** 30 November 2024, 9:30 AM to 5 PM

**Venue:** APJ Abdul Kalam Auditorium

**Organiser:** Department of Chemistry (outreach activity)

**Attendance:** 315 external, 22 faculty, 17 PhD scholars and 6 PG

An annual outreach day organised by the Department of Chemistry together with the Directorate of Admissions for BSc and Intermediate students from nearby colleges. The programme combined a talk by a visiting electrochemist with a science exhibition and hands-on experiments related to everyday life, and gave visitors a view of the university's laboratories. The event drew a strong response from students and teachers, and the department plans to continue it in the coming years.




A speaker at a podium beside a projected slide titled "ChemZeal 3 - 2024".




A large seated audience in a tiered auditorium.

RESEARCH AND PUBLICATIONS

# Research on waste, recovery and circular production

SRM University-AP has 115 publications mapped to SDG 12 for 2024–2025. The works below are those most directly concerned with waste, resource recovery and circular production, grouped by theme.

### E-WASTE, BATTERY RECYCLING AND METAL RECOVERY

| Title, authors and DOI | Year | Type |
|---|---|---|
| **Policy pathways to sustainable E-waste management: A global review**<br>Grandhi, S.P.; Dagwar, P.P.; Dutta, D. · DOI 10.1016/j.hazadv.2024.100473 | 2024 | Article |
| **Applications of deep eutectic solvents in metal recovery from E-wastes in a sustainable way**<br>Suffia, S.; Dutta, D. · DOI 10.1016/j.molliq.2023.123738 | 2024 | Review |
| **Sustainable recovery of rare Earth elements from industrial waste: A path to circular economy and environmental health**<br>Dagwar, P.P.; Iqbal, S.S.; Dutta, D. · DOI 10.1016/j.wmb.2025.02.004 | 2025 | Review |
| **Upcycling of Li-Ion Battery Recycling Residues to Graphene Oxide: Life Cycle Hotspots and Production Scale Impacts** | 2025 | Article |

| Title, authors and DOI | Year | Type |
|---|---|---|
| Nandikes, G.; Goswami, L.; Oh, S. et al. · DOI 10.1021/acssuschemeng.5c05262 | | |
| **Recovery of metals from spent lithium-ion batteries using agricultural waste, applications and circularity framework**<br>Iqbal, S.S.; Ramadan, N.; Dagwar, P.P. et al. · DOI 10.1016/j.seppur.2025.133860 | 2025 | Article |

ORGANIC WASTE, FOOD WASTE AND THE CIRCULAR BIOECONOMY

| Title, authors and DOI | Year | Type |
|---|---|---|
| **Sustainable mitigation and management of segregated organic wastes: a socio-economic-environmental analysis for metropolitan cities**<br>Carbonel, D.; Nandikes, G.; Pandey, N. et al. · DOI 10.1080/02772248.2025.2486821 | 2025 | Article |
| **Anaerobic digestion-derived digestate valorization: green chemistry innovations for resource recovery and reutilization**<br>Jacob, S.; Kundu, D.; Chintagunta, A.D. et al. · DOI 10.1039/d5gc01053e | 2025 | Review |
| **Advances on characteristics and valorization of food waste towards the sustainable production of bio-methane and purification**<br>Sethupathy, A.; Arun, C.; Vigneswaran, V.S. et al. · DOI 10.1016/j.fuel.2024.131388 | 2024 | Review |
| **Advancements in microbial production of polyhydroxyalkanoates (PHA) from wastes for sustainable active food packaging: An eclectic review**<br>Adak, S.; Kayalvizhi, R.; Bishai, M. et al. · DOI 10.1016/j.bcab.2024.103288 | 2024 | Review |

SMART WASTE CLASSIFICATION AND PLASTIC USE

| Title, authors and DOI | Year | Type |
|---|---|---|
| **Intelligent waste classification approach based on improved multi-layered convolutional neural network**<br>Chhabra, M.; Sharan, B.; Elbarachi, M. et al. · DOI 10.1007/s11042-024-18939-w | 2024 | Article |
| **Advanced YOLO-Based Trash Classification and Recycling Assistant for Enhanced Waste Management and Sustainability**<br>Kumar, M.G.V.; Kumar, M.; Rao, K.N. et al. · DOI 10.1109/ICoICI62503.2024.10696214 | 2024 | Conference Paper |
| **The Plastic Problem in Research Laboratories: A Call for Sustainability**<br>Dasari, V.V.; Suresh, A.K.. · DOI 10.1021/acssusresmgt.5c00114 | 2025 | Note |

STARTUPS AND INNOVATION

# Startups turning waste into products

Three incubated startups have SDG 12 as their primary SDG. Each takes a different route to responsible production: converting waste into materials, making durable products from natural wood, and automating waste segregation.

WASTE TO WEALTH

### Dwell Crafts Innovations Private Limited

The venture collects vegetable and fruit waste to generate vegan leather, turning an organic waste stream into a material for products.

**Incorporated:** 7 Apr 2024
**Incubation:** 10 Apr 2024 – 10 Oct 2025
**Founder:** Staff

TOYS · SOCIAL IMPACT FOCUS: SUSTAINABILITY

### Neemtoys Private Limited

The company manufactures neem wooden toys and sells them through a direct-to-consumer brand.

**Incorporated:** 27 Dec 2023
**Incubation:** 22 Jan 2025 – 22 Jan 2026
**Founder:** External

WASTE MANAGEMENT · SOCIAL IMPACT FOCUS: SUSTAINABILITY

### Ekovamps Pvt Ltd

The company's Smart Trash Colonizer uses AI and ML concepts for waste segregation and redirection to the respective bins, reducing waste volume and offering up to 700% more capacity than conventional bins.

**Incorporated:** 27 May 2023
**Incubation:** 22 Mar 2025 – 22 Mar 2026
**Founder:** External

CONCLUSION

# Progress towards responsible consumption and production

Taken together, the work for SDG 12 shows responsible consumption and production being practised across several parts of the university. Organic waste from kitchens and gardens is processed on site, wastewater is treated biologically, electric vehicles and efficient lighting are in use, and good practice points the institution towards careful records, fuel monitoring and waste-conscious building design. Events on e-waste, cleanliness, sustainable construction materials and water have given students and partners a place to learn and act, while research on waste valorisation and circular resource use and three incubated ventures extend the same thinking into knowledge and enterprise.