Industry Collaboration for Energy Efficiency and Clean Energy Solutions

SDG 7.4.3 – Industry Services for Energy Efficiency and Clean Energy (2024)

Aligned with SDG 9: Industry, Innovation, and Infrastructure and SDG 13: Climate Action

1. Institutional Commitment

Centurion University provides direct services to local industries, MSMEs, farmers, and entrepreneurs to promote energy efficiency and clean energy adoption. The university's approach integrates research, innovation, field demonstration, and skill development to ensure the transition from laboratory-scale solutions to field-level implementation. Centurion University's activities directly support the United Nations SDG 7.4 indicator through energy audits, renewable technology transfer, clean-tech incubation, and industrial training programs aimed at reducing carbon emissions and improving operational efficiency across sectors.

2. Industrial Services and Collaborations

Centurion University has established multiple industry-linked centers and pilot projects that provide energy efficiency assessments, renewable integration, and technological demonstrations to industry partners and local enterprises.

Initiative / Activity	Sector	Service Provided	Outcome (2024)
Schneider Electric–Supported Electrical & Automation Lab	Manufacturing & Electrical	Industrial automation, energy audit, and smart grid training	300+ students and 40+ local technicians trained annually
Solar-Powered Storage & Hybrid Dryer Systems	Agro-processing	Design, patenting, and deployment of solar-powered storage and hybrid dryers	60+ rural producers trained; 30% reduction in post-harvest energy cost
Solar-Operated Drip Irrigation & Agri-Voltaic Demonstrations	Agriculture	Energy audits, IoT-based renewable integration for irrigation	20% improvement in irrigation efficiency, 1.7 LER achieved
Smart Microgrid Pilot (IoT-based)	Rural electrification	Real-time monitoring, load management, and renewable integration	15% grid load reduction in pilot campus

3. Patented Clean Energy Technologies

Centurion University's innovation ecosystem has generated patented, field-deployable technologies that are shared with industry and rural entrepreneurs to promote sustainable energy solutions.

Key Patents (2023–24):

- *Solar-Powered Advanced Onion Storage Structure* — IoT-integrated storage maintaining 25–30°C, reducing spoilage by 25%.
- *Dynamic Solar PV Mounting Structure* — Portable, tilt-adjustable 0.675 kWp frame for dual agri-voltaic use.
- *Hybrid Solar Dryer for Food Products* — Dual-source solar dryer with 20 W PV support, improving drying efficiency by 40%.
- *Optimizing Land Use in Agri-Voltaic Systems* — Enhancing land productivity (LER 1.73) and saving 1,796 kg CO_2/kW annually.

These patented technologies exemplify Centurion University's transition from R&D to real-world renewable energy applications — a model for **university–industry collaboration** in achieving sustainable development.

4. Energy Efficiency through Research and Capacity Building

Centurion University actively supports industries through its Smart Campus and Research Innovation Framework, focusing on the following domains:

- **Energy Auditing:** Faculty–student teams conduct practical audits for small enterprises and campus facilities.
- **Technology Demonstration:** IoT-based dashboards showcase real-time monitoring and energy optimization.
- **Industry-Led Projects:** Collaborative R&D with Schneider Electric, Siemens, and OSDA.
- **Workshops and Training:** 25+ workshops conducted annually on renewable integration, smart automation, and industrial efficiency.

Training Highlights (2024):

- 60 students trained on Solar Hybrid & DC Systems
- 250 rural participants trained on solar irrigation and energy-efficient farming
- 40+ faculty and industry professionals engaged in renewable research collaborations

5. Impact Metrics (2024)

Parameter	2024 Value	Target 2030	Linked SDG Indicator
Installed Solar Capacity	1.25 MWp	2.0 MWp	7.2.1

Annual Energy Saved	1.2 GWh	2.0 GWh	7.3.1
CO_2 Emissions Avoided	1,450 tCO_2e/year	Net Zero by 2035	13.2.1
Renewable Energy Share	55%	80%	7.2.1
Industry Partners Engaged	15+	30+	9.5.1

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6. Key Outcomes and Socio-Economic Impact

- **Increased energy efficiency** across 10+ demonstration units and community clusters
- **55% renewable share** achieved in institutional operations (2024 baseline)
- **Skill transfer to 500+ youth, SHG women, and technicians** for renewable adoption
- **Energy-efficient retrofits** in academic and hostel buildings (30% intensity reduction)
- **Sustainable livelihoods** created through clean-energy enterprises

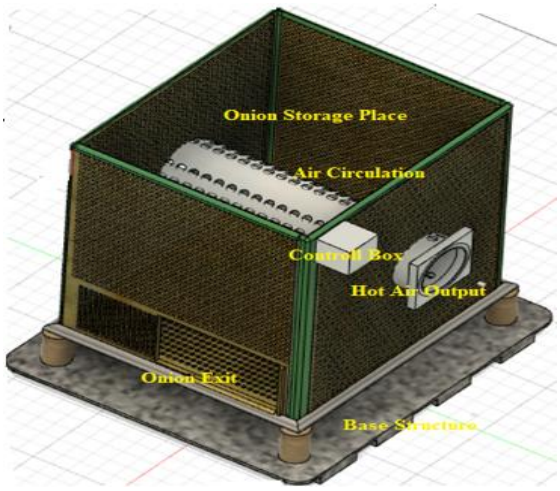
7. Integration with Other SDGs

Centurion University's SDG 7.4.3 initiatives demonstrate strong cross-linkages with:

- **SDG 9:** Industry, Innovation, and Infrastructure — via patents and clean-tech incubation
- **SDG 13:** Climate Action — via 1,450 tCO_2e annual emission reduction
- **SDG 12:** Responsible Consumption and Production — through waste-to-energy and solar dryers

Solar-Powered Advanced Onion Storage Structure

Centurion University, Odisha, has developed an innovative solar-powered advanced onion storage structure to address the critical post-harvest losses and price fluctuations associated with onion storage in India. Registered under Application No. 374953-001, this system integrates a hollow spore-based ventilation pipe, DC fan, abiotic factor controller, and solar panel to maintain optimal storage conditions (temperature: 25–30°C and relative humidity: 60–65%). Designed for both rural and urban markets, each unit can store approximately 500–600 kg of onions, configured in single or double-row layouts. The system not only ensures steady onion supply throughout the year but also minimizes spoilage, stabilizes market prices, and improves farmer incomes. Significantly, the inclusion of IoT-based sensors allows real-time monitoring of temperature, humidity, and gas levels, enabling proactive management of the storage environment. This smart, energy-efficient innovation serves as a scalable solution aligned with sustainable development goals—particularly in clean energy, responsible consumption, and rural infrastructure development.



Level of an Onion Storage Structure

Dynamic Solar PV Mounting Structure

Centurion University's newly registered Dynamic Solar PV Mounting Structure (Application No. 374952-001, published 26 April 2024) provides a portable, adjustable racking system (2.1 m × 1.66 m × 1.2 m) capable of supporting a 0.675 kWp photovoltaic array over an 11 m² footprint—ideal for co-located Agri-voltaic installations. The frame's manual tilt mechanism allows ±5° adjustment around a 40° base angle, enabling year-round optimisation of solar incidence while leaving ground space usable for crops. By integrating energy generation and agriculture on the same land parcel, the design simultaneously boosts renewable-energy yield and food production, making it valuable for farm diversification schemes, rural micro-grids, and environmental demonstration projects. Its simplicity and portability also suit pilot deployments, educational setups, and rapid roll-outs in off-grid or marginal areas where flexible orientation and easy maintenance are critical.

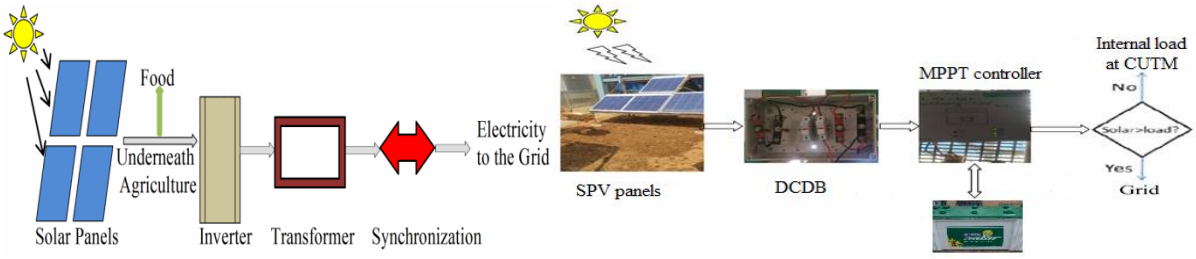
Dynamic Solar PV Mounting Structure

Optimizing Land Use Agri-Voltaic Systems for Enhanced Productivity and Profitability

Centurion University , Odisha, has filed an innovation patent titled "**Optimizing Land Use Agri-voltaic Systems for Enhanced Productivity and Profitability**" (Application No. 202431029561 A), showcasing its commitment to sustainable innovation in the energy-agriculture nexus. This Agri-voltaic system (AVS), developed by inventors Nimay Chandra Giri, R.C. Mohanty, and S. Chakravarty, is designed to optimize land productivity through the

co-generation of food and solar energy on the same plot. The experimental 0.675 kWp system installed over 11 m² of land not only facilitates the cultivation of shade-tolerant crops like turmeric, but also improves microclimatic conditions by reducing ambient temperature under the panels, thereby enhancing energy conversion efficiency. The AVS has demonstrated promising outcomes, including a land equivalent ratio (LER) of 1.73, a favourable benefit-cost ratio of 1.71, and annual CO_2 savings of 1796 kg/kW.

Its portable and modular design, integrated with dual DC microgrids and solar batteries, makes it suitable for low-productivity lands with high solar irradiance. Potential applications span the energy, agriculture, and environmental sectors—enabling dual land use, improved photosynthesis and plant growth, increased farm revenue, and significant reduction in greenhouse gas emissions. The innovation not only contributes to food-energy security but also enhances the socio-economic value of farmers' land, offering a scalable and climate-resilient solution aligned with the Sustainable Development Goals (SDGs).



Experimental Configuration of 0.675 kWp Solar Photovoltaic (SPV) System for Energy Generation

A Hybrid Solar Dryer for Drying Vegetables and Food Products

Centurion University has been awarded a utility patent for an innovative invention titled "A Hybrid Solar Dryer for Drying Vegetables and Food Products" (Application No. 202431039879 A). Developed by inventors Dr.DebashreeDebadattaBehera, Dr. Ramesh Chandra Mohanty, Dr. Shiv Sankar Das, Dr. Sujata Chakravarty, Dr.ArdhenduMouliMohanty, and Dr.ManasRanjanPadhi, this advanced hybrid solar dryer integrates a fin-type solar flat plate collector with auxiliary electrical support to ensure consistent and hygienic drying of vegetables such as tomatoes, potatoes, bitter gourd, and green bananas—both during the day and at night. The dryer features 60 rectangular fins attached to a corrugated, black-painted aluminium absorber plate, which significantly enhances heat transfer through turbulence, raising temperatures by 5–6°C. A dual-glass cover setup increases solar transmissivity and minimizes heat loss, while an 80 mm insulation layer ensures thermal retention. The drying chamber, made of aluminium, includes three wire mesh trays for uniform drying, aided by a cone-shaped chimney for natural convection and moisture removal. A silica gel desiccant system lowers humidity inside the chamber, boosting drying efficiency. Powered by a 20 W solar photovoltaic panel, MPPT charge controller, 12 V lead-acid battery, and three DC blowers, the dryer maintains airflow during cloudy conditions and nighttime. Mounted at a 20° tilt angle for optimal solar capture and built with portability in mind, this system offers a sustainable, energy-efficient, and scalable solution for the food processing industry—supporting clean energy adoption and contributing to reduced post-harvest losses in line with Sustainable Development Goals (SDGs).

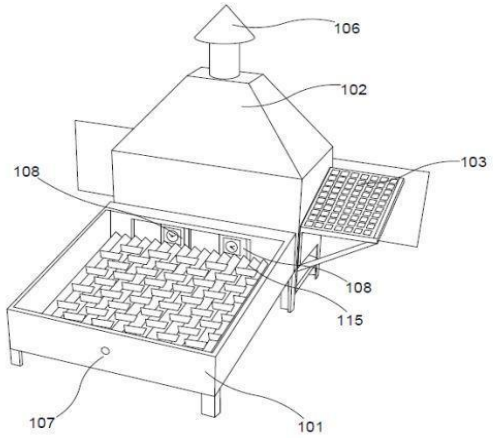


Fig. 1

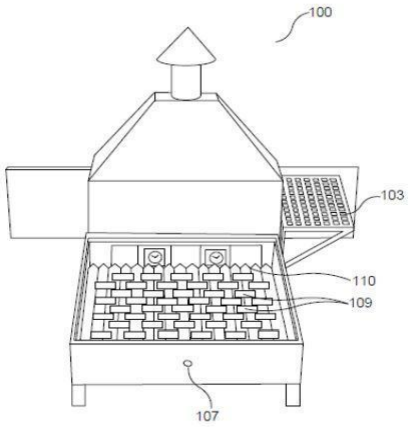


Fig. 2

Auto CAD design for Hybrid Solar Dryer

Student led Solar Dryer and Drip Irrigation

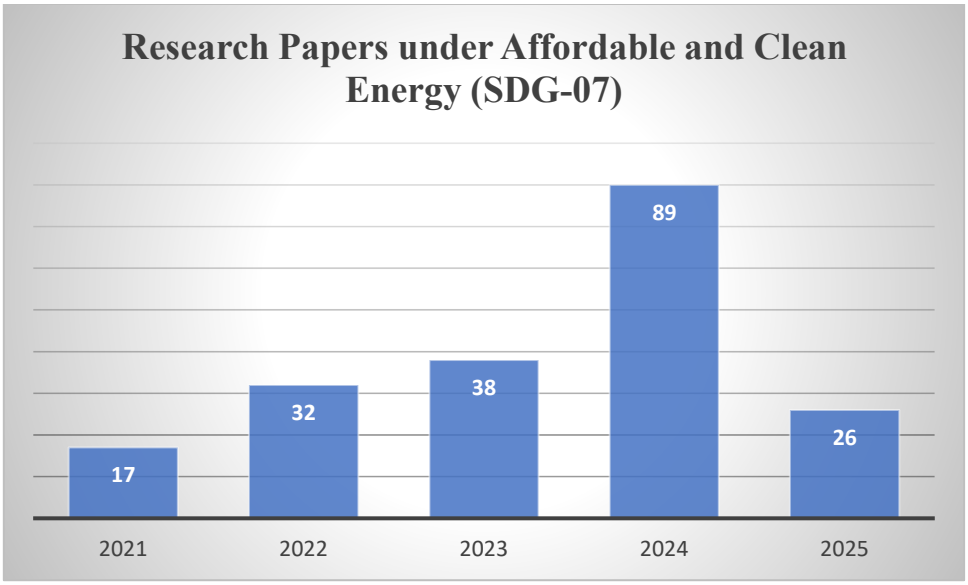
At Centurion University, student-led innovation and sustainable practices are integrated into real-world applications. A solar dryer, designed and developed by B.Tech engineering students, is actively utilized in the university's food processing unit to dehydrate fruits, vegetables, and other food products. This eco-friendly solution leverages solar energy to ensure hygienic, energy-efficient, and cost-effective food preservation, reducing dependency on conventional drying methods and contributing to clean energy initiatives under SDG 7 and SDG 12. This system uses solar power to operate water pumps, ensuring efficient water use through targeted irrigation and minimizing water wastage. The initiative promotes green farming practices, educates students on renewable energy applications in agriculture, and serves as a live demonstration for local farmers on how to adopt solar-powered irrigation for improved productivity and environmental conservation. These efforts underscore Centurion University's commitment to integrated sustainability, innovation, and community outreach.

Solar Dryer

Solar Drip Irrigation

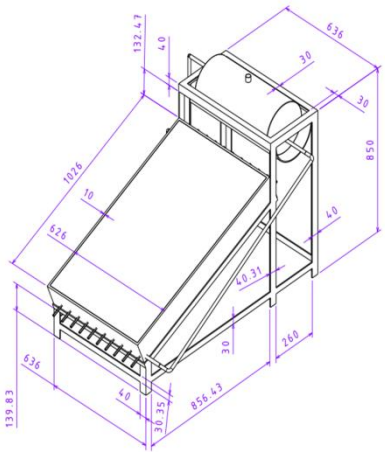
Academic Publications Toward SDG 7

Centurion University has made significant academic contributions toward SDG 7 (Affordable and Clean Energy), with a total of 234 publications between 2021 and 2025. The university's research output in this domain has shown a consistent upward trend, reflecting its growing commitment to promoting sustainable and clean energy solutions. Starting with 17 publications in 2021, the number rose to 32 in 2022 and 38 in 2023, followed by a notable increase to 89 publications in 2024—demonstrating an intensified research focus on renewable energy technologies, energy efficiency, and energy access.



An Evacuated Solar Collector System for Efficient Water Heating

A Utility Patent has been published titled *"An Evacuated Solar Collector System for Efficient Water Heating"* (Application No. 202531079524), invented by DebashreeDebadattaBehera, Swarup Kumar Sahoo, Shiv Sankar Das, Pradeep Kumar Sahoo, Ramesh Chandra Mohanty, and Sujata Chakravarty. The invention introduces a cost-effective solar water heating system employing an optimized evacuated tube solar collector (ETSC) with copper absorber pipes and vacuum-sealed glass tubes to significantly reduce heat loss and improve thermal efficiency. The system integrates a transparent glazing cover, insulation layers, and a thermosyphon-enabled insulated tank, eliminating the need for pumps or controllers. Designed with low-cost, commercially available materials, it is well-suited for domestic and small-scale commercial applications. Experimental validation has demonstrated higher water outlet temperatures and better heat retention than conventional flat-plate collectors, making it a sustainable, scalable, and eco-friendly solution for water heating.



Schneider Electric–Supported Laboratory at Centurion University

Centurion University, in collaboration with Schneider Electric India Foundation, has established a state-of-the-art Electrical and Automation Laboratory on the university campus. Schneider-supported lab is a part of Centurion University's "Skill Integrated Higher Education" model and is designed to bridge the gap between industry requirements and academic learning. This initiative aligns with Centurion University's vision of providing industry-integrated, hands-on education in emerging technologies relevant to smart energy management, automation, and sustainability.

The Schneider Electric Lab is utilized by students of Electrical Engineering, Electronics, and Mechanical departments for both academic and applied learning purposes.

1. Student Involvement and Practical Learning Activities

Students actively engage in:

- Lab-based practical sessions integrated into their semester curriculum.
- Project-based learning (PBL) under the supervision of trained faculty and Schneider-certified trainers.
- Skill Certification Programs offered jointly by Schneider Electric and Centurion University under NSDC frameworks.
- Workshops focused on automation, energy efficiency, and sustainability.
- Community and field projects, such as wiring installations, solar setups, and automation of local facilities.

2. Outcomes and Impact

Aspect	Outcome
Skill Development	Over 300 students trained annually in Schneider Electric-certified modules on electrical installation and automation.
Employability	Graduates gain industry-relevant skills, improving placement rates in power, automation, and manufacturing sectors.
Innovation & Projects	More than 25 student-led design projects on smart automation and energy efficiency implemented on campus.
Sustainability Education	Supports SDG 7 (Affordable & Clean Energy) and SDG 9 (Industry, Innovation & Infrastructure) by promoting sustainable technology practices.
Industry Collaboration	Ongoing partnership with Schneider Electric ensures updates in curriculum and exposure to the latest industrial tools.

Students Taking Training in Schneider Lab