

IMPLEMENTATION OF SDG-7: AFFORDABLE AND CLEAN ENERGY IN SHOOLINI UNIVERSITY, HIMACHAL PRADESH, INDIA

STATUS REPORT 2021

7 AFFORDABLE AND CLEAN ENERGY



Centre of Excellence in Energy Science and Technology
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Report on Implementation of SDG-7: Affordable and Clean Energy in the Shoolini University, Himachal Pradesh, India

Executive Summary

As per THE Impact Ranking Shoolini University has bagged top no.2 global ranking for SDG 7 and No.6 in SDG 6. The Centre of Excellence in Energy Science and Technology (CEEST) is coordinating the implementation of United Nations Sustainable Development Goals (UNSDGs) in Shoolini University. In order to ensure the access to affordable, reliable, clean, and sustainable energy for all, the University has taken several measures and formulated and implemented the Energy and Environment Policies in order to achieve the UNSDG targets. Shoolini University is preparing the National Document on the Implementation of United Nations Sustainable Development Goals (UNSDGs) in Higher Education Institutions in collaboration with Association of Indian Universities (AIU). Under this initiative a number of steps in awareness, education, research and transfer of technology have been taken to utilize renewable energy sources to conserve energy, reduce carbon emissions and combat climate change impact by 2025. The use of solar energy for power generation, reduction in the use of fossil fuels in transportation, community cooking, building design and construction have been taken. This report presents the status of implementation of UNSDG SDG-7 and governing policy at Shoolini University, Solan, Himachal Pradesh, India during 2021.

1. Introduction

The Centre of Excellence in Energy Science and Technology (CEEST) is coordinating the implementation of United Nations Sustainable Development Goals (UNSDGs) in the Shoolini University. In order to ensure the access to affordable, reliable, clean, and sustainable energy for all. Shoolini University has taken several measures in renewable energy education research, technology implementation and formulated and implemented the Energy & Environment Policies in order to achieve the UNSDG -7 targets. The university intends to develop itself as a sustainable energy education and research hub and a sustainable development township to act as a model for other Higher Education Institutions in India.

The University has implemented several environmentally friendly solar projects in the University campus for generating solar electricity, hot water and solar steam cooking and energy efficient net zero energy buildings. Under the projects from Ministry of New & Renewable Energy, Govt of India, the Campus of Shoolini University has been converted into a Green Energy Campus with solar energy utilization & environmentally friendly technologies.

1.1 Energy Education highlights and achievements

The global thrust on utilization of Renewable Energy utilization to reduce greenhouse gas emissions for climate change mitigation calls for all organizations and higher education institutions to take immediate measures to lower their carbon footprint.

Shoolini University has established a Centre of Excellence in Energy Science & Technology (CEEST) in 2019 which is led by Prof. Shyam Singh Chandel, Director who has been ranked among top 2% scientists worldwide in the field of Energy as per Stanford University, USA ranking based on Career long research in 2020,2021,2022 continuously for the last three years .:

Website links :

2020: <https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000918>

2021:<https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3>

2022:<https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw>

Centre of Excellence in Energy and Environment : 12 Rank in Energy in India 2021

CEEST has been ranked no.12 in India in the field of Energy as per SCIMAGO Ranking based on Research Publications in Energy

Website link: <https://shooliniuniversity.com/center-of-excellence-in-energy-science-and-technology>.

:



SCIMAGO Ranking Link:

<https://www.scimagoir.com/rankings.php?country=IND&year=2015&area=2100&ranking=Overall§or=Higher%20educ>.

Education in Energy & Climate Action

CEEST has introduced education at B.Tech (Renewable Energy Technology), Master in Energy Technology, Master in Climate Science and Sustainable Development and Ph.D in Energy, Renewable Energy and Climate Change concerns and, Sustainable development. **CEEST was ranked 12th in India for Energy Research by SCIMAGO Institutes Rankings 2021.** The Centre's Scientists have a large number of publications in quality research journals. A large number of patents have already been filed through the same.

1.2 Global Ranking top no.2 for SDG 7 and No.6 in SDG 6 for Shoolini University Research in Energy and Climate Action

A large number of research papers in these areas have been published in top ranking Journals which has led to **top no.2 global ranking for SDG 7 & No.6 in SDG 6** for the University as per THE global impact ranking in 2022.



Evidence:

SDG-7 Rank 2: <https://www.timeshighereducation.com/rankings/impact/2022/affordable-and-clean-energy>

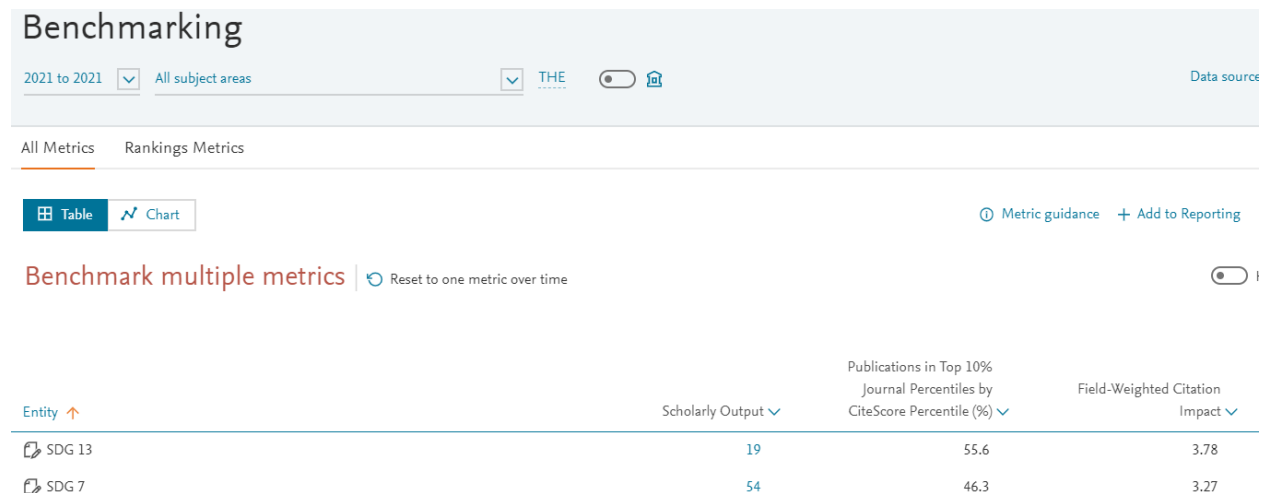
SDG-6 Rank 6: <https://www.timeshighereducation.com/rankings/impact/2022/clean-water-and-sanitation>

Research in Energy: FWCI metrics related to SDG-7 and 13 of Shoolini University:

SDG 7 FWCI: 3.27

SDG 13 FWCI :3.78

Evidence : SCIVAL



(Annexure I- List of Publications Related to Energy)

Highlighted research of Centre of Excellence in Energy Science and Technology in 2021

<https://solarbuildermag.com/news/better-solar-pv-output-prediction-model-shoolini-university-researchers-say-they-have-one/>

CEEST has catalyzed the action on sustainable Development goals in the University by preparing a National Document on the Implementation of UN SDGs in Higher Education Institutions in India in collaboration with Association of Indian Universities (AIU) during 2021.

Already a governing ‘Energy and Environment Policy’ has been formulated in 2019 to set the roadmap and required actions to make the University carbon neutral by 2025. The scientists are working in priority research areas on Climate change in Energy, especially use of renewable energy applications in Agriculture, Sciences, Engineering, Biotechnology, Food technology and Pharmacy. The main objective of these initiatives is to develop the University as a sustainable education and research hub and township to be model for the higher education Institutions in India.

2. Initiative on Solar Photovoltaic power generation -Installation of a 400 kWp Grid Connected Solar Photovoltaic Power Plant - An initiative under United Nations Goal 7 and 13

Solar Energy is harnessed through Solar Photovoltaic panels installed on the rooftops of the University building blocks, hostels and car parking. The University campus is connected to the main grid operated by HP State Electricity Board (HPSEB). The solar electricity so generated is used to meet the partial energy needs of the University. The electrical energy used by the university in 2021 was 10,77,700 kWh (3,880 GJ) and out of which 3,41,476 kWh (1229 GJ) was produced by the solar plant.



Figure 1: 400 kWp Grid connected Solar Photovoltaic Power Plant at Shoolini University



Figure 2: Distribution of 400kWp grid-connected Solar Photovoltaic Power Plant on different rooftops and Car parking shed in the University campus

3. Concentrated Solar Steam Generating Cooking System

A Solar steam generating cooking system (Scheffler Type) is installed on the roof top of Girls hostel of Shoolini University. The system is based on the concentrated solar technology.



Fig 3a Concentrated solar powered community steam cooking system

The solar radiation falling on the dish, is concentrated onto a receiver, which heats the water and convert into steam to cook food for 500 girl students residing in the hostel saving about 2 LPG gas cylinders every day thus saving conventional fuel and money. The system is also used as a research facility by the PhD student to design and monitor the performance of the CSP system.



Figure 3b: Concentrated solar steam cooking system installed on roof top of the Shoolini University

4. Solar water heating systems for hostels

Solar flat plate collector and evacuated tube collectors are installed in all hostels of the University provide hot water daily for hostel residents.



Figure 4: Installation of 38000 litres per day solar water heating systems in the university campus.

5. Reducing fossil fuel consumption and carbon dioxide emissions use of electric carts for local transportation in the campus

The university has introduced three electric carts for local transportation for students, faculty and visitors inside the university campus to restrict the movement of personal vehicles inside the campus during working hours.



Figure 5: Electric Carts for local transportation in the university campus.

6. Bio-energy utilization - Use of biogas for Cooking from agriculture and Animal Wastes

In order to utilize agriculture, cow dung, food waste and kitchen waste, and promote the research and use of biogas as the fuel, the CEEST has installed a 1.5 m³ Plastic biogas system for demonstrating use of non-polluting fuel in the agricultural farm of the University which is being used for cooking by the farm laborers.



Figure 6: Biogas plant for cooking installed in agriculture farm in Shoolini university

7. Installation of Solar Street Lights

Shoolini University has installed a 42 solar street lights of 40W capacity inside the campus for night time lighting purposes thus utilizing free Solar energy and saving conventional electricity.



Figure 7: Solar streetlights installed in the University campus.

8. Monitoring solar, wind, and other climate data for research

CEEST has installed a high quality automatic weather station on the roof top of the library building that monitors Global Solar Irradiance, Wind Speed, Wind Direction, Temperature, Relative Humidity, Rain fall data as well as photosynthetic active radiation which are critical for research and development of new Energy technologies, Climate Change related hence contributing towards research and development SDG-7 and SDG-13. The data are being used in boosting the reliable research and development of renewable energy technologies, by utilization of the renewable resources, and making plans for the sustainable township.



Figure 8: CEEST Automatic weather station installed at Shoolini University.

9. Participation in National and International Conferences Related to Energy

Teachers, researchers, and students have participated in international and national conferences related in the field of renewable resources, storage systems, smart grids, hybrid systems, etc.

10. Establishment of New Solar Energy Research Labs

High tech labs in Photovoltaic, Solar thermal, Wind and Bioenergy are being planned to be established in a phased manner for education, research based on the state-of-the-art technologies that help researchers and students and participate in utilizing and improving the existing technologies and developing new ones.

11. Energy Conservation & Energy Efficiency improvement

Sensors are used for energy conservation in the University. 90% of lights in the university are LED based 20-Watt tube light which saves up to 50% energy. Most streetlights in the campus have photocell controllers, which switch the light on and off at the right natural light levels, normally near dusk and dawn. These sensors have time delays and hysteresis to prevent change-over too quickly. There is a plan to convert to 100% sensor-based street lighting/ outdoor lighting system to prevent wastage of electricity.

Use of LED Lighting: University campus is moving towards total LED lighting system, which are more efficient than incandescent light bulbs or compact fluorescent lighting (CFL). The campus has 90% , 20 W LED lights.



Figure 9: 20W LED lights installed in the University

Use of more efficient water and air heating systems: The university has installed 8kW heat pump based water heating system in the international hostel and PTC air heaters to optimize and improve energy efficiency.



Figure 10: Energy efficient heat-pump based water heating system has been installed in the international hostel Shoolini University



Figure 11: Energy efficient PTC air heaters have been installed all international hostel rooms

Use of energy efficient architectural features: The university has incorporate various feature in the new buildings like use of natural lighting and solar energy, use of Autoclaved Aerated Concrete (AAC) blocks, ‘Rat Trap’ Builds i.e. cavity induced in wall which provides the advantage of thermal comfort.



Figure 12: Use of large windows for increased solar gain and increased use of natural lighting.



Figure 13: Walls using AAC blocks for better insulation and energy efficiency



Figure 14: Walls with Rat traps for better insulation and thermal comfort

12. Energy Policy of Shoolini University

Shoolini University is committed to United Nations Sustainable Development Goals through its innovative energy policy to make Shoolini University a sustainable, energy efficient green campus. This energy policy applies to all operations and activities of the University including building construction, renovation, transportation, and any other operations for improving energy efficiency through the installation of energy efficient systems and use of renewable energy sources. The environment protection, efficient water management and fossil fuel use reduction in various activities undertaken by the University are the linked aspects of this policy. The various measures are to be undertaken for the divestment of energy consuming, and fossil fuel based existing equipment/vehicles etc., with innovative energy efficient systems and to invest in Climate Change

solutions for a Carbon Neutral University Campus by 2025 (*Annexure-II- Energy Policy Shoolini University*).

12.1. Policy Goals

- To take measures to reduce greenhouse gas emissions to make Shoolini University as Net Zero or near Zero building Carbon neutral Campus preferably by 2025.
- To design and construct all the new buildings by incorporating energy efficient, solar passive building, water conserving and environment friendly building technologies.
- To discourage the fossil fuel-based power generation by utilizing renewable energy sources, solar roof-top PV /hybrid systems, waste to energy generation, to meet the energy requirements of the University.
- Measures will be taken to use solar water heating systems, solar steam cooking systems, in university hostels to save LPG and other conventional fuels.
- To take necessary steps to regulate public transportation inside the campus and, and to utilize electric vehicles inside the campus for essential transportation.

12.2 Initiatives already taken under the Solar Energy Policy – Summary

Energy Conservation: Energy conservation is major concern for planning the construction of buildings in a sustainable campus. Nestled in the green and salubrious clime of pine forests, the buildings have been constructed allowing maximum light, ventilation with natural air circulation in all rooms and halls, thereby saving on electricity consumption. There is a major endeavor at Shoolini University to conserve energy and promote the usage of alternate energy sources. Actions taken in this direction have helped in making the campus green, energy efficient and energy surplus. Apart from the measures described below, there are buildings like the Yogananda Knowledge Center (Central Library) that use the natural light during the day.

The faculty, employees and students lead initiatives also save significant electricity and have developed a policy for reducing electricity consumption by using LED and replacing the old florescent tube lights with energy efficient LEDs. All the computer monitors have been replaced with LED/LCDs displays. Replacement of old energy consuming appliances like lights, fans with energy-efficient appliances is underway.

- **Green Energy Campus:** Under the Ministry of New & Renewable Energy, Govt of India, the Campus of Shoolini University is a green energy Campus with maximum Solar Energy utilization & environmentally friendly technology use. The establishment of Centre of Excellence in Energy Science & Technology in 2019 focusses on energy Education and Research.

- **Solar Energy** is harnessed through Solar Photo Voltaic panels installed on the rooftops of most of the University building blocks and covered common areas exposed to sunlight, like the car park, part of the internal road etc., converting sunlight into electric energy. The University campus is connected to the State electricity grid through a grid interactive system. The generated electricity partially meets the requirements of the university and excess generated electricity is transferred to the grid sub-station.
- **Solar Steam Generating Cooking Systems (Scheffler Type) in Girls Hostel of Shoolini University:** A solar steam generating system based on Concentrated Solar Technology Solar radiation falling onto the dish is concentrated onto the receiver, which heats the water which is converted into steam to cook food for 500 students.
- **Solar Water Heating Systems for hostels:** Flat Plate Collector and evacuated Tube collectors are installed in all hostels of the University to provide hot water.
- **Sensor-Based energy Conservation** is being practiced. Most streetlights in the campus have photocell controllers, which switch the light on and off at the right natural light level, normally near dusk and dawn. They have time delays and hysteresis to prevent change-over too quickly. There is a plan to convert to 100% sensor-based street lighting/ outdoor lighting system to prevent wastage of electricity.
- **Use of LED Lighting:** University campus is using LED lighting system, far more efficient than incandescent light bulbs or compact fluorescent lighting (CFL).

13. Solar Passive building technology Policy Initiative-towards Net Zero and Zero Carbon Emission Buildings

Shoolini University has made it mandatory to design and construct all the buildings in its campus as per passive solar architecture and incorporating energy efficient building technologies and environment friendly building materials following the Solar House Action Plan & Policy adopted in the State of Himachal Pradesh.

- The feasibility of existing buildings for retrofitting of Passive Solar features/systems for improving energy efficiency and reducing energy consumption will be explored for urgent follow up action.

Co-ordination & Implementation Guidelines

- i. The Centre of Excellence in Energy Science & Technology (CEEST), established in 2019 at the Shoolini University coordinates the Solar Building Action Plan for Shoolini University.
- ii. A technical Project Management Cell (TPMC) has been established in the CEEST with Director (Energy) as the Principal Coordinator along with expert team in solar building design, renewable technology analysis, Director (Estate) & building maintenance in charge

with concerned architect, civil/electrical engineer team for the construction implementation and maintenance.

- iii. A Computer Aided Solar Passive Design Cell with architect, design engineer [structural], executive engineer, a computer programmer well versed in building design software, AutoCAD, seismic analysis software, along with Solar radiation data & building performance monitoring, forecasting load analysis using Artificial Intelligence techniques will be established.
- iv. The constructed buildings will be live laboratories for energy education, research and development for CEEST.
- v. Systematic efforts will be made by CEEST to orient & train University's technical. Architecture and engineering sections for adopting the innovative technologies.
- vi. The CEEST will also promote the technology around nearby villages to help design their houses as social obligation to the communities along with providing technology inputs for the State of Himachal Pradesh Housing Agencies for effective implementation & Policy formulation.

13.1 Constructing low carbon footprint buildings -use of environment friendly Building materials

Under the mandatory Net Zero Energy and Passive Solar housing Policy, the university has developed a Yoga Nanda Ville with a number of solar huts in the campus using sustainable building materials like wood, bamboo, slate, stone, mud, stabilized mud blocks etc. shown in figure-10 to 14.



Figure 15: Wooden huts /houses in Yogananda Ville at Shoolini University.



Figure 16: Bamboo and slate Roof E-Studio for online lectures constructed during COVID times



Figure 17: Living with Nature - Eco friendly Bamboo Tree Houses in the campus for student interaction



Figure 18: Use of Traditional and Climate responsive Building Materials -Two storeyed Guest House.



Figure 19: Sustainable energy building in Yogananda Ville at Shoolini University.



Figure 20: Sustainable energy building in Yogananda Ville at Shoolini University.



Figure 20: Sustainable hut near academic blocks(left) and a tree house in the campus (right)



Figure 21: Interior of one of the residential guest huts

14. Environment Policy for Shoolini University

Shoolini University is committed to United Nations Sustainable Development Goals (SDGs) through its innovative Environment Policy which makes Shoolini University a sustainable, energy efficient and environment friendly green campus. This Environment Policy applies to all the operation and activities of the University including building construction and renovation, transportation, water, waste management and all its operations and activities undertaken by the university. (*Annexure-III- Environment Policy Shoolini University*).

14.1 Policy Goals

- To protect environment in and around Shoolini University
- To develop a systematic waste management mechanism
- To develop rainwater harvesting system for water conservation and recharging
- To provide training and information on energy & environment protection measures
- To create awareness among students, faculty, employees and public to engage in initiatives those contribute for environment protection
- To reduce, reuse and plastic in any manner inside the University campus
- To create awareness on single use plastics impact on environment and encourage use of natural alternatives
- To explore production of energy from waste
- To take measures for the effective utilization of wastewater recycling
- To take measures to protect the forest and environment from forest fires

15. SDG 7 related Society Awareness Campaigns & Webinars organized on Evidence

15.1 Webinars on Sustainable Energy and Energy Environmental issues and solutions

Four webinars were organized by the CEEST on March 4,11,18 and 25, 2021 about Sustainable Energy and Energy Environmental issues and solutions focused on Bioenergy, emission reduction, Batteries, Electric Vehicles, Nano-porous Materials by experts in the field (*For details refer Annexure-IV: Conferences, Webinars and External Lectures*).



Meet the energy experts on our webinar series
Sustainable Energy & Environmental Issues & Solutions



Dr Vivekanand
Assistant Professor
MNIT Jaipur, India

On March 4th
11:00-12:00 AM



Arpit Sharma
Senior Manager
Aranca Mumbai Pvt.Ltd.
Mumbai, India

On March 11th
4:00-5:00 PM



**Dr. Aneesh
Parbhakar**
Assistant Professor
MNIT Jaipur, India

On March 18th
4:00-5:00 PM



Dr. Pawan Rekha
Assistant Professor
MNIT Jaipur, India

On March 25th
4:00-5:00 PM

Webinar Coordinator
Prof. S.S. Chandel

Webinar Scheduled for the
Month of March 2021

fb.com/ShooliniCEEST

Figure 22: CEEST Official Webinar Series Flyer March 2021

15.2 Exhibition on the implementation of all UNSDGs by Shoolini University

An exhibition was organized on the Implementation of UNSDGs by the University by the Centre of Excellence in Energy Science & Technology during Nov 26-27, 2021, which was attended by North Zone Vice Chancellors, faculty, officials, students. This exhibition is being displayed from time to time and is permanently kept in the library of the university for public (*Annexure -V Exhibition for AIU Conference*).

15.3 Awareness Campaign on 17 SDGs w.e.f International Earth Day

A Campaign was organized by CEEST on 17 SDGs in collaboration with the IT department and Dean Student Welfare for students and faculty of Shoolini University, held starting from the Earth Day on Apr-22, 2022 onwards for 17 days daily. The campaign aimed to spread awareness among the students, faculty and staff about the 17 United Nations Sustainable Development Goals. Posters were published daily on the mobile phones daily for all students/faculty and staff talking about the SDGs (*Annexure VI – Awareness Campaign on UN SDGs*).

16. Support for new technology development and entrepreneurs

CEEST, Shoolini University also hosts Technology Incubation Centre of Ministry of Micro, Small and Medium Enterprises (MSME) and supports innovative ideas from students, entrepreneurs and startups in the state of Himachal Pradesh and encourages use of new sustainable technologies to contribute towards SDGs.