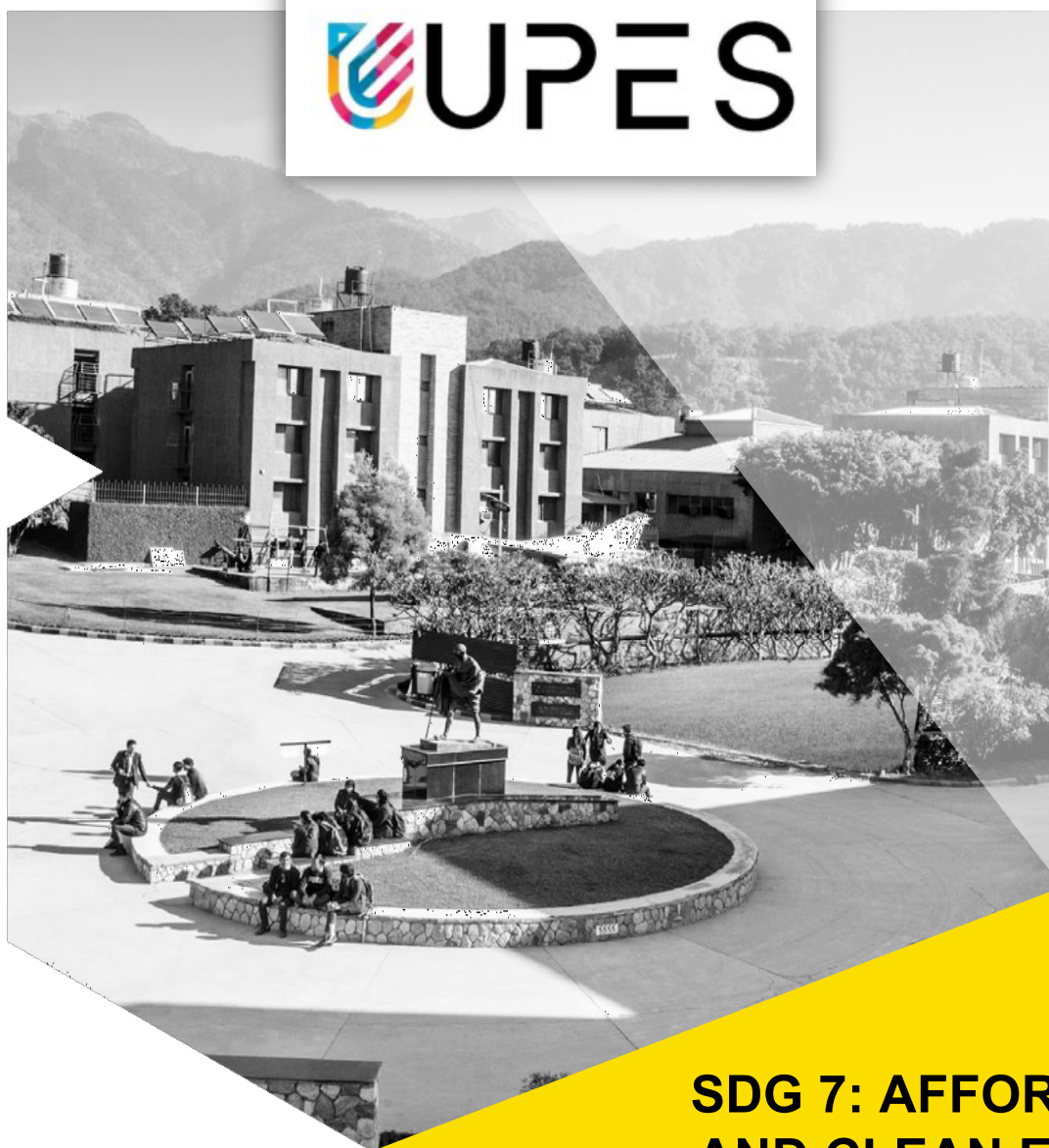




SUSTAINABLE DEVELOPMENT GOALS



**SDG 7: AFFORDABLE
AND CLEAN ENERGY**

2025

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SDG7: AFFORDABLE AND CLEAN ENERGY

UPES and SDG 7: Affordable & Clean Energy (2019–2024 Impact Report)

UPES (University of Petroleum & Energy Studies) in Dehradun, India has a core focus on the energy sector and is actively advancing **Sustainable Development Goal 7 (Affordable and Clean Energy)**. Over the past five academic years (2019–2024), UPES has implemented numerous initiatives on campus, fostered cutting-edge research and innovation in clean energy, engaged with communities to improve energy access, and empowered students to contribute to sustainable energy solutions. This report outlines UPES's key contributions to SDG 7, supported by data and evidence.

1. On-Campus Energy Initiatives

UPES has transformed its campus operations to prioritize renewable energy and energy efficiency. Key on-campus initiatives include:

Renewable Energy Infrastructure

The university installed a **100 kW solar photovoltaic power plant**, which over 2019–2024 supplied about **8% of total campus electricity demand** [1]. This solar plant also serves as a live training facility for students' projects and research [1]. Additionally, UPES deployed solar thermal systems with **61,500 liters of solar water heating capacity** to provide hot water in campus hostels and facilities [2]. These investments directly replace fossil-fuel-based power with clean solar energy.

Energy-Efficient Buildings & Systems

UPES follows green building practices and has retrofitted its infrastructure for efficiency. **100% of conventional lights have been replaced with LED lighting** to cut power consumption [2]. Modern **smart energy management systems** (e.g. occupancy sensors, automation for HVAC) are in use to minimize wastage [3]. The campus electrical system maintains a **unity power factor (PF=1.0)** to eliminate reactive power losses, ensuring **zero energy loss** in power distribution [2]. These measures have significantly improved campus energy efficiency.

Policies to Reduce Fossil Fuel Use

UPES's sustainability policies and Climate Action Plan emphasize reducing reliance on fossil fuels. The university sources a **significant portion of its power from renewables** [3] and continuously monitors its carbon footprint. Initiatives like phasing out diesel generators, optimizing cooling systems, and promoting energy audits are part of the action plan (as per green audit reports). The **campus is "Zero Water Discharge"** and integrates energy goals with water and waste management for holistic

sustainability [2]. Together, these policies align campus operations with national clean energy targets and climate commitments.

Sustainable Campus Transport

To further cut carbon emissions on-site, UPES encourages electric mobility and non-motorized transport. Mechanical engineering students designed and built “U-BAHN,” an electric cart for on-campus use [1]. The prototype runs on an 85 Ah battery with a brushless DC motor and IoT-based tracking, and at a cost of only ₹2 lakh it provides an **eco-friendly alternative to gasoline golf carts** for campus transit [1]. UPES has also introduced e-bicycles and pedestrian-friendly zones – a **solar-powered tree** charging station and an electric-assist bicycle were developed as pilot projects to facilitate green short-distance travel [1]. These efforts demonstrate UPES’s commitment to a low-carbon campus through innovative student-led solutions.

On-Campus Energy Metrics (2019–2024)

Initiative / Metric	Details & Impact
Solar PV Capacity	100 kW on-campus solar plant; supplies ~8% of university’s electricity demand [1].
Solar Water Heating	61,500 liters total solar hot-water capacity for dorms and facilities [2].
LED Lighting Coverage	100% of campus lighting is energy-efficient LED (all fixtures retrofitted) [2].
Energy Management	Smart HVAC and lighting controls; Unity power factor (PF 1.0) maintained to avoid energy losses [2].
Electric Campus Vehicle	“U-BAHN” electric cart (85Ah battery, IoT enabled) deployed for campus transit – zero-emission mobility [1].

2. Research and Innovation in Clean Energy

UPES leverages its academic and R&D strength to drive innovation in affordable, clean energy technologies and policy. The university’s research contributions (2019–2024) span multidisciplinary projects, patents, and collaborations focused on sustainable energy:

Dedicated Research Center

UPES hosts specialized centers of excellence that spearhead clean energy research. The **Centre for Energy, Environment, and Sustainability Studies (CEESS)** in the School of Business conducts interdisciplinary research on energy economics, environmental policy, and sustainable development [1]. CEESS provides informed analysis to support clean energy policies, aligning with India’s environmental goals and building networks with industry and government for joint research [1]. On the technology front, the **Centre for Alternative Energy Research (CAER)** brings together experts from engineering, science, and management to develop next-generation energy solutions [4]. Current CAER projects include **biofuel production from waste biomass (agricultural and forest residues)** via thermal and biological routes, **conversion of plastic waste to energy** and value-added fuels, and **microalgae-**

based biofuels, among others [4]. These centers position UPES at the forefront of research in renewable energy and sustainability.

Clean Energy Research Projects

UPES faculty and students engage in numerous projects to advance clean energy technology and its applications. Notable innovations in the past five years include:

- *Wastewater-to-Biofuel*: Developing a **microalgae-powered wastewater reclamation plant** that purifies sewage while producing valuable bio-oil, biogas, and bio-manure – a **zero-waste clean energy solution** [5]. This project, inspired by the Swachh Bharat Mission, tackles sanitation and energy together by turning waste into renewable fuels.
- *AI-Optimized Biofuels*: Using artificial intelligence and machine learning, UPES researchers have worked on predicting and enhancing **biodiesel properties** to improve biofuel quality [5]. In collaboration with international partners (e.g. Don State Technical University and FSAC-VIM in Russia), the team applied AI/ML algorithms to **revolutionize biodiesel production**, earning global recognition for UPES in sustainable energy research [5].
- *Biogas and Biomass Innovations*: Efforts to design **portable biogas units for cold regions** (to provide clean cooking fuel in high-altitude rural areas) and to develop **biomass pellet fuels as sustainable alternatives to coal** have been pursued under UPES's societal research initiatives [6]. These projects address energy access and pollution by leveraging locally available waste resources for clean energy.
- *Solar and Efficiency Technologies*: Research in solar energy at UPES includes work on improving photovoltaic systems and novel solar applications (e.g. the “**solar tree**” prototype on campus is also an R&D outcome). Other investigations target energy efficiency, such as low-cost **efficient cooling systems** and waste-to-energy technologies [3], often developed as part of student capstone projects or faculty-led studies.

Publications and Patents

The university's overall research output has grown rapidly, with 10,900+ Scopus-indexed publications and 1,950+ intellectual properties (including 134 patents granted) as of 2024 [6]. A significant share of these publications and patents are in energy-related fields, reflecting UPES's domain focus. For example, research on renewable energy solutions (biogas, biofuels, solar) and energy efficiency appears in high-impact journals, and multiple patents in green technology have been filed. (Notably, 52% of UPES research publications involve international collaborators [5], enhancing the impact and quality of its clean energy research.) The robust R&D ecosystem – supported by internal SEED grants and an IPR cell – ensures that innovations in affordable clean energy move from labs to real-world applications.

Industry & Government Collaborations

UPES actively collaborates with industry partners, government agencies, and global institutions to amplify its sustainable energy research and impact. CEESS, for instance, partners with energy industry think-tanks and government ministries to align research with national policy needs [1]. UPES

researchers have contributed expertise to **United Nations Development Programme (UNDP)** clean energy projects, providing research inputs and policy support for initiatives that expand energy access [2]. In 2024, UPES's School of Law co-hosted an *International Conference on Environmental Sustainability and Energy Laws* with the **Uttarakhand Forest Department and Pollution Control Board**, bringing together legal experts, policymakers and scholars to discuss frameworks for renewable energy and climate change mitigation [3]. Over 66 Indian and several foreign institutions participated, underscoring UPES's convening role in sustainable energy dialogue [3]. The university also engages in industry-sponsored research: for example, it received a major corporate grant (₹20 crore) to establish advanced labs (in robotics, IoT, etc.) which indirectly support energy innovation (e.g. smart grids, automation) [5]. These partnerships ensure UPES's clean energy innovations are relevant and rapidly scalable, bridging the gap between academia, industry, and government.

Academic Programs for Clean Energy

Aligning education with SDG 7, UPES offers **specialized degree programs in sustainable energy**. Notably, the university launched courses such as **MBA (Power Management – Green Energy and Transition to Sustainability)**, **M.Tech. in Renewable Energy**, **B.Tech. in Clean Energy Technologies**, **BBA in Green Energy & Sustainability**, and even a **PG Certification in Renewable Energy (online)** [1]. These programs (initiated during 2019–2024) equip students with cutting-edge knowledge in renewable energy, energy policy, and energy business. The curriculum integrates practical projects and case studies on solar, wind, bioenergy, etc., ensuring graduates are prepared to tackle global energy challenges. By embedding clean energy in its teaching and research missions, UPES is cultivating a new generation of energy leaders and innovators [3].

3. Community Engagement and Impact

UPES extends its sustainable energy efforts beyond campus through community outreach, public education, and support for social initiatives. These engagements help bring affordable, clean energy to local communities and build awareness in society:

Improving Energy Access in Rural Communities

UPES runs outreach programs in Uttarakhand's rural areas to promote modern, sustainable energy solutions. Faculty and students have visited neighboring villages to **demonstrate solar lighting systems and clean cooking technologies**, addressing energy needs in off-grid or energy-poor households [3]. Through the university's initiatives, villagers have learned to install and maintain solar lanterns and home lighting kits, and adopt **clean cookstoves** in place of traditional wood-fired stoves. Such **energy literacy camps** and demonstrations empower communities with knowledge to reduce health-hazardous fuels and improve their quality of life [3]. These efforts contribute to UPES's goal of ensuring **affordable, reliable energy for all**, starting with its surrounding community.

Capacity-Building & Policy Support

As a thought leader, UPES contributes expertise to broader sustainable energy programs and policies. UPES researchers have partnered with **UNDP** and other organizations to provide technical assistance and **capacity-building workshops** on clean energy [2]. For example, UPES conducted training programs on renewable energy project management for local government officials and NGOs, and helped in **social impact assessment studies** for clean energy deployments. By lending its knowledge in this way, UPES helps scale up renewable energy adoption and ensures that development programs (like solar electrification schemes) are effective and community-oriented. The university's policy research (through CEESS) has also proposed reforms to improve energy access and efficiency at regional and national levels [1], reinforcing India's progress toward SDG 7.

Sustainable Livelihood Projects

UPES integrates clean energy into community development projects that enhance livelihoods. One notable initiative is **Project UK (India Sustainable Development & Research Collaboration)**, where UPES experts and partners work to **revive and modernize traditional watermills in Uttarakhand's hill villages** [2]. By upgrading these small hydro-powered mills (gharat) with improved technology, the project provides villages with a sustainable source of energy for grinding grain or even generating electricity, while boosting local income. This addresses both rural poverty and clean energy access. Other community projects include deploying **solar dryers** for farmers (to preserve crops and medicinal herbs using solar heat) and training women in making **bio-briquettes (biochar)** as a cooking fuel, reducing dependence on wood. These interventions not only bring affordable energy solutions to remote areas but also create economic opportunities, exemplifying the spirit of **"energy for sustainable development"**.

Energy Awareness & Education Campaigns

UPES actively raises awareness about energy conservation and sustainability among the public and youth. The university has organized events like **"Energy Conservation Week"** on campus, inviting school students and local residents to learn about saving energy at home [3]. During these campaigns, demonstrations on topics such as efficient appliance use, importance of LEDs, and renewable options are held. UPES's annual **Sustainability Fair** (e.g. in 2022) also showcased student projects in clean energy and was attended by industry, government, and community members [1]. Through workshops and science exhibitions, the university disseminates knowledge on clean energy technologies (solar panels, biogas units, etc.) to the wider community. These outreach and educational efforts help build a culture of energy responsibility and inspire other institutions in the region to follow suit.

Support for Clean Energy Startups and Social Enterprises

UPES nurtures entrepreneurship that drives innovative energy solutions for society. In 2021, the university launched **Runway, a start-up incubator program**, which by 2025 has supported **250+ start-ups** with funding and mentorship [7]. Many of these ventures address sustainability challenges; for instance, at UPES's 2025 "The Pitch" competition, student founders secured funding for *Envinova Smartech*, a startup providing innovative **solar energy solutions** [7]. By providing seed funding (over £1.7 million from agencies like DST and NITI Aayog) and expert guidance, UPES helps clean energy

entrepreneurs turn ideas into reality. The university also has ties with over **600 NGOs for social internships** [2], enabling students to work on energy access projects and clean technology deployment in communities. This ecosystem of innovation and social enterprise support amplifies UPES's impact on affordable and clean energy beyond the campus – as start-ups and NGOs scale up renewable energy access, more communities benefit in the long run.

4. Student Involvement in Clean Energy

UPES students are at the heart of the university's SDG 7 initiatives, actively participating through academic work, clubs, and competitions that focus on renewable energy and sustainability:

Energy-Focused Student Clubs

The campus hosts numerous student-led clubs and chapters that channel student passion into sustainable energy activities. For example, the **Association of Energy Engineers (AEE) Student Chapter** at UPES engages members in energy audits, efficiency drives, and technical talks on clean energy trends. Students also contribute to the **Sustainability Cluster** and related committees that organize green campaigns. Through these clubs, students gain leadership experience while promoting energy conservation on campus and beyond (such as conducting LED bulb drives in adopted villages, etc.). *Life@UPES* revolves around such initiatives, ensuring that energy awareness is woven into co-curricular life.

Hackathons, Competitions & Summits

UPES encourages its students to solve real-world energy problems via competitions. The university's annual **UHackathon** often features tracks on sustainability, challenging students to prototype solutions for energy, water, and climate issues. Students have participated in and won prizes at national contests – for instance, a UPES team developed a **portable solar phone charger** that won a **CleanTech challenge**, and another group's project on smart grids earned recognition at an IEEE competition (2019). The **Energy Summit 2022** organized by the School of Engineering saw **1,200+ participants and 200+ project demonstrations** by students, who interacted with global energy experts and industry leaders on topics of energy transition. Such events and hackathons provide a platform for students to showcase innovations (from IoT-based smart meters to energy analytics software) and network with stakeholders in the energy sector [8]. The competitive spirit and exposure help students refine their ideas for practical implementation.

Student Projects & Innovations

Hands-on projects are integral to every energy student's journey at UPES. Many of the on-campus clean energy solutions have been **conceived and built by students** under faculty mentorship. Aside from the U-BAHN electric cart and solar tree mentioned earlier, students have also engineered an **"Electric Cycle" prototype** (battery-assisted bicycle) for eco-friendly commuting [2], designed low-cost **solar dryers** for preserving food in rural areas [2], and fabricated a **non-tracking solar tree** equipped with LED lights and USB charging ports for public use [2]. These projects often serve as final-year

capstone projects or competition entries, and they underscore students' ability to create affordable clean energy gadgets with immediate social utility. The university highlights such projects as "flagship engineering projects," underlining their innovation and impact.

Academic Engagement (Internships & Thesis)

With dedicated programs in renewable energy (B.Tech, M.Tech, MBA, etc.), students immerse themselves in the clean energy domain academically. **Curriculum-linked projects** are common – e.g., an M.Tech student's thesis on wind turbine blade optimization, a group of MBA (Power Management) students formulating a solar microgrid business plan, or engineering students undertaking internships at renewable energy companies (such as NTPC Renewable Energy or Tata Power Solar). UPES's industry connections help place students in **internships and field projects** where they contribute to solar farm development, energy audits for companies, or rural electrification schemes. Through the **Srijan social internship program**, many students have also interned with NGOs on solar home system distribution and biogas installation in villages [2]. These experiences, combined with strong faculty mentorship, ensure that by graduation, UPES students have already addressed real clean energy challenges and developed solutions in the field.

Recognition and Student Impact

UPES students' involvement in SDG 7 has earned accolades and built a culture of sustainability on campus. Student teams have secured awards in national energy innovation contests and published papers in student research conferences on topics like solar PV optimization and waste-to-energy. Importantly, the enthusiasm is infectious – student-led awareness campaigns (e.g. flash mobs on energy saving, poster drives on "Switch Off for an Hour") have significantly reduced energy consumption in hostels and influenced peers' behaviors. A testament to this culture is that **UPES was ranked among the top universities in India for "Energy & Resource Efficiency" research output** [6] and was recognized in the **Times Higher Education Impact Rankings** for its progress in SDG 7. Such achievements reflect not just institutional efforts, but the **collective action of students** rallying for a sustainable energy future.

Conclusion

Over the five-year period 2019–2024, UPES University has demonstrated a holistic and effective approach to advancing **Affordable and Clean Energy (SDG 7)**. On campus, the university has cut fossil fuel use and embraced renewables and efficiency, serving as a living lab for sustainable energy. In the realm of research, UPES's innovations – from biofuels to solar tech – contribute valuable solutions and knowledge, often in partnership with global experts. The university's community engagement ensures that the benefits of clean energy reach underserved populations, while its support for startups helps amplify impact through entrepreneurship. Crucially, UPES's students are deeply involved at every step, gaining skills and driving projects that underscore their commitment to a greener future.

By integrating **education, research, operations, and outreach**, UPES is not only aligning with SDG 7 but also nurturing the next generation of energy leaders. The university's efforts over 2019–2024 have led to tangible outcomes (clean energy installations, publications, community projects) that testify to

its role in **promoting affordable, reliable, and sustainable energy for all** [1]. As UPES continues on this trajectory, it stands as a model for how universities can innovatively contribute to global sustainability goals through combined academic excellence and social responsibility.

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