



SDG 7 Affordable and clean energy

Overview

UQ plays a pivotal role in advancing SDG 7 through its commitment to clean energy research, sustainable operations, and community engagement. UQ strives to minimise energy consumption and promote efficient energy awareness by integrating renewable energy into its operations, with infrastructure such as solar research facilities and electric vehicle charging stations. The University also integrates energy-efficient design principles into all new buildings and renovations, guided by its comprehensive Design Standards.

Having access to state-of-the-art research facilities is allowing UQ's solar experts to make exciting new discoveries about clean energy generation and carbon emissions reduction. UQ's research excellence is reflected in innovations such as carbon-negative nanogenerators, lead-free perovskite solar cells, and next-generation battery technologies. These breakthroughs contribute to global efforts to reduce greenhouse gas emissions and improve energy efficiency. UQ also supports low-carbon innovation through start-ups like SolarisAI and ARTEH, which develop AI-driven solar diagnostics and net-zero transition services.

Community outreach is central to UQ's approach, with programs supporting energy transitions in regional Queensland and Timor-Leste. Educational initiatives, including the Sustainable Energy MicroMasters® and public lectures, empower individuals and industries with knowledge about clean energy practices. Collaborative projects like the Australian Research Council Centre of Excellence for Green Electrochemical Transformation of Carbon Dioxide (GETCO2) further demonstrate UQ's leadership in shaping energy policy and technology.

Through integrated efforts in research, education, and engagement, UQ contributes meaningfully to a sustainable energy future aligned with SDG 7.

Progress made in 2024 towards SDG 7 is reported here with reference to the following domains and enablers from UQ's Strategic Plan 2022-2025:

- Learning and student experience
- Research and innovation
- Enriching our communities
- Our global profile
- Securing our future.

Related SDGs

- [SDG 1 No poverty](#)
- [SDG 8 Decent work and economic growth](#)
- [SDG 9 Industry, innovation and infrastructure](#)

- [SDG 11 Sustainable communities](#)
- [SDG 13 Climate action](#).

Learning and student experience

UQ strives to deliver a distinctive research-informed curriculum and programs that enable students to connect with world-class research and researchers, are fit-for-purpose, are of the highest quality, meet market demands, and anticipate opportunities for program innovation. This aim is aligned with SDG 7 through the suite of programs and courses that UQ offers on renewable energy development, use and management.

Curriculum

UQ offers several courses within its undergraduate programs that equip students with the skills to work within the energy sector and understand and contribute towards the development of renewable energy. These include:

- As part of the [Bachelor of Engineering \(Honours\)](#):
 - [Hydro and Marine Power Renewable Energy Systems \(CIVL6112\)](#). This course enables students to gain fundamental knowledge of the multi-faceted approach of fluid powered energy generation and provides them with the ability to assess these systems based on their technical, regulatory and efficiency requirements as well as their interactions with the natural and built environment
 - [Thermodynamics: Energy and the Environment \(ENGG1500\)](#). This course provides basic concepts in thermodynamics and forms of energy at the heart of many engineering processes and many of the important technical and environmental problems that engineers tackle.
 - [Electrical Energy Conversion and Utilisation \(ELEC3310\)](#). This is a fundamental course in electrical power engineering, covering electrical energy conversion components of power systems as well as recent developments in electric power engineering such as renewables and distributed generation.

As part of the [Bachelor of Environmental Management \(Honours\)](#):

- [Carbon and Energy Management \(ENVM1522\)](#). This course is structured around 12 important understandings of carbon and energy management, including the links between carbon energy and sustainable electricity supply systems as well as key principles and terms, and issues of scale in sustainable electricity supply system design.

UQ also provides a suite of postgraduate programs in sustainable energy designed to equip students with the knowledge and skills to lead the global transition to low-carbon energy systems. The [Graduate Certificate in Sustainable Energy](#) and [Graduate Diploma in Sustainable Energy](#) provide students with a deeper understanding of energy systems, responsible business practice and ways to address the threat of rising global temperatures and broader climate change impacts. The [Master of Sustainable Energy](#) is designed to address complex problems across a range of disciplines and equips graduates to progress to leadership and management positions in the sector, including understanding the complex nature of energy generation, distribution and supply; the crucial roles of finance,

technology and regulation for energy project management and business development; and the critical importance of social licence for assessing the energy landscape. Students practically apply theory in the [Sustainable Energy Field of Study](#) in the [Master of Entrepreneurship and Innovation](#), with options to conduct sustainability analyses of real-life organisations, assess and present solutions to the energy challenges of an Australian community and to engage in problem-based learning (PBL) to perform strategic analyses of organisations in energy industries and systems.

Research and innovation

UQ advances SDG 7 through interdisciplinary and innovative research initiatives aimed at expanding access to clean, reliable, and affordable energy for a sustainable, net-zero future. These span technological development, policy support, and community engagement, with benefits for both local and global energy challenges. Through these projects, UQ fosters collaboration with industry, government, and international partners to accelerate the transition to renewable energy and improve energy efficiency.

How we are achieving this

- **[ARC Centre of Excellence for Green Electrochemical Transformation of Carbon Dioxide \(GETCO2\)](#)**. Officially launched in 2024 and led by UQ, the Australian Research Council funded GETCO2 aims to efficiently convert carbon dioxide into valuable products such as chemical and fuels. The Centre will catalyse a green manufacturing and export revolution for Australia while paving the smartest and cleanest path to net zero. In 2024 GETCO2 launched flagship research programs targeting multi-carbon and organonitrogen compounds, hosted its first retreat, and formed international partnerships, including with Japan's Research Center for Advanced Science and Technology (RCAST). GETCO2's vision is to position Australia as a global leader in carbon dioxide transformation and generate long-term economic, social and environmental benefits nationally and internationally.
- **Policy lessons for just transitions**. In 2024, researchers from UQ's Centre for Social Responsibility in Mining (CSRMin) published research that explored the application of learnings from Australia's automotive industry closures for the country's coal-fired power transition. Drawing on expert consultations and applying just transitions and transition management thinking, the publication "[Just transition out of coal-fired power: Policy lessons from Australia's automotive sector closure](#)" identifies 4 key insights from the auto sector closure experience. These offer compelling pointers to guide socio-economic transformations in frontline regions that are likely to face challenging, often deeply personal, impacts resulting from the closure of coal-fired power stations over the coming decades.
- **Battery innovation at the Australian Institute for Bioengineering and Nanotechnology (AIBN)**. Researchers at UQ's AIBN are pioneering advanced battery technologies to support a cleaner, net-zero future. Their work includes redox flow batteries for long-duration energy storage, next-generation lithium-ion systems, and innovative approaches like screen-printed rechargeable inks. A standout project repurposes harmful PFAS chemicals – captured from water – into high-performance battery materials. These efforts aim to create safer, more efficient, and environmentally friendly batteries, positioning Queensland as a leader in energy innovation.

Collaborations with industry and government are helping scale these technologies for real-world impact and sustainable energy solutions.

- **Industry Laureate to drive battery production.** In 2024 Professor Lianzhou Wang, a senior group leader at AIBN with appointments in the School of Chemical Engineering, secured \$3.6 million of funding as part of an ARC Industry Laureate Fellowship to help position Australia as a leading supplier of superior batteries for electric vehicles. The research, undertaken in collaboration with Pure Battery Technologies and Lithium Australia, allows design of new robust single-crystal microstructure to overcome the challenges currently hindering state-of-the-art lithium metal oxide cathode materials. The research hopes to support local industry partners to move up the battery value chain and position Australia as the global leading battery market supplier while also reducing environmental impact from battery waste.
- **Nanogenerator for sustainable power.** Researchers from UQ's Dow Centre for Sustainable Engineering Innovation developed a groundbreaking nanogenerator that absorbs carbon dioxide (CO₂) and turns it into electricity. The technology goes further than being carbon neutral as it consumes CO₂ as it generates energy. Following the success of the laboratory tests, there are 2 potential applications for the nanogenerator in the future – making a slightly bigger portable device to power a mobile phone or a laptop computer using CO₂ from the atmosphere, and, on a much larger scale, integrating the technology with an industrial CO₂ capture process to harvest electricity. This innovation, published in *Nature Communications*, could revolutionise clean energy production and transform how CO₂ is viewed – from a problem to a valuable resource for sustainable power generation.

Case study: UQ Energy Transition Network

The [UQ Energy Transition Network](#) is a multidisciplinary initiative that brings together expertise across engineering, science, health, social sciences, economics, and policy to address the complex challenges of global energy and resource transitions. The Network's research spans several focus areas including transition pathways, people and communities, policy and markets, resources, technologies, and systems and supply to deliver actionable outcomes. In 2024 [UQ advanced several impactful projects](#) including:

- Industry 4.0 Energy TESTLAB, a digital twin of the electricity network for system analysis and cybersecurity
- a collaboration with Redback Technologies to develop a smart energy monitoring platform for real-time energy control
- ARENA-funded Project SHIELD, which supports energy distributors in managing behind-the-meter assets.

In 2024 the Network played a key role in the UN Thirteenth International Forum on Energy for Sustainable Development in Bangkok, co-hosting a session on Just Transition experiences in Thailand and Australia. In partnership with Chulalongkorn University, this session featured industry, government and academic experts from Australia, Thailand, and China and explored the social, economic, and technical dimensions of transitioning energy systems. UQ also contributed to sessions on clean cooking and post-mining transitions, reflecting its broad engagement in sustainable development.

In 2024 a tech start-up from UQ, SolarisAI, began work on efficiencies in the renewable energy sector by detecting faults in solar farm panels. The system uses machine learning algorithms to analyse data and detect faulty and underperforming solar panels, and to recommend targeted maintenance. This is a critical improvement for the management of remote and urban power systems where local technical expertise is often limited.

With the accelerated adoption of electric vehicles across the regions, UQ researchers outlined 5 key steps needed to speed up Australia's [transition to electric vehicles \(EVs\)](#), and by extension inform policy development of other countries. The 5 measures include improving charging infrastructure, enabling EVs to supply energy back to the grid, creating local supply chains for EV batteries and parts, upskilling an EV sector workforce and replacing fuel excise revenue through appropriate usage charges.

These initiatives are supported by cutting-edge facilities and data analytics capabilities, enabling UQ to inform policy, support industry innovation, educate the future energy workforce, and build capability and capacity across the Asia–Pacific region. The Network exemplifies UQ's commitment to shaping a sustainable, inclusive, and technologically advanced energy future.

Enriching our communities

In 2024 UQ's research and outreach activities worked towards benefitting Queensland communities across academia, industry, government and civil society. Energy transition and decarbonisation initiatives, input into future planning and R&D, and training opportunities all contributed towards improving environmental sustainability while maintaining productive economic and social outcomes for Queensland and Australia.

How we are achieving this

- **Resources supporting transition of remote communities to renewable energy generation.** UQ's Sustainable Energy program enhanced its collaboration with Ergon Energy, the Queensland Government's electricity distributor in remote and regional Queensland, by developing authentic real-world case studies for students. The resulting assessment in 2 courses produced community engagement plans and detailed investment decision-making reports, focussed on the transition of remote communities from diesel to more renewable energy generation. These outputs were shared with Ergon Energy in 2024 to assist with the development and implementation of transition plans.
- **Sustainability of mega events – energy and carbon management of the Brisbane 2032 Olympic Games.** UQ is actively involved in the sustainability of mega events such as the Olympic and Paralympic Games, with a particular focus on energy and carbon management of the Brisbane 2032 Games. UQ researchers have been active in collaborations with the Queensland Government's Brisbane 2032 Organising Committee, the Lucinda Alliance (a private sector think tank organisation, with many UQ alumni) and the University of Lausanne, Switzerland. Outputs have included article in *The Conversation* in 2024 demonstrating thought leadership on the sustainability of mega events.
- **[Renewable Energy Integration: CPD course](#).** On 13 November 2024 the Power, Energy and Control Engineering discipline at UQ's School of Electrical Engineering and Computer Science (EECS) held a 2-day face-to-face CPD course focusing on

renewable energy integration. Aimed at engineers and professionals from both electrical and non-electrical backgrounds working on power systems, the course facilitated dialogue and knowledge sharing to better understand renewable energy technologies and their integration in terms of renewable generator modelling, control techniques, frequency, and voltage regulation aligning with grid codes. Participants were taught theoretical background information and provided with hands-on experience through industry standard simulation platforms and experimental test benches to understand renewable energy integration.

- **UQ's Executive Education [Climate Change Program](#)** equips leaders in industry and the public sector with the knowledge to address climate risks, develop mitigation strategies, and drive sustainability across sectors. Participants engage with world leading researchers and practitioners to explore topics such as climate science, net-zero pathways, climate reporting and corporate strategy for climate change.
- **[Universitas21 Early Career Researcher \(ECR\) Workshop on Inclusive Energy Transitions](#)**. From 8-12 July 2024 UQ hosted the U21 ECR Workshop on Inclusive Energy Transitions which aimed to deepen understanding of how inter-disciplinary research across the social and behavioural sciences, business, economics, and public policy can intersect and support an equitable and inclusive energy transition. The program was designed to support cross-disciplinary knowledge exchange, skills-sharing and networking via small group workshops, lightning talks and poster sessions by ECRs, talks by established researchers, and panel sessions that include international and interdisciplinary perspectives. The workshop offered a unique opportunity for researchers from across all disciplines to share knowledge, experiences, and current projects with an international community of ECRs from across the world, including Chile, South Africa, Hong Kong, the UK, Canada and Korea.

Our global profile

UQ is striving to advance the UN SDGs and leverage the University's development expertise to support capacity building beyond Australia by collaborating and sharing knowledge to help solve energy challenges by guiding improved access and efficiency, and cleaner production.

How we are achieving this

- **Energy as a service for improved food production and security in Timor-Leste.** In 2024 the Energy Poverty Research Group from the UQ School of Chemical Engineering continued their engagement with energy stakeholders and local communities in Timor-Leste, where high levels of electrification are accompanied by low levels of development. The research team interviewed stakeholders to explore the concept of energy as a service that could improve agricultural output and food security,
- **Global Bioeconomy Alliance (GBA).** From 30 September-4 October 2024 UQ was a major contributor to the Key Technologies in Bioeconomy (KTB) conference, an annual event hosted by the Universidade Estadual Paulista (UNESP) in Brazil. By fostering cross-disciplinary collaborations between academia, industry, policymakers, and NGOs the GBA aims to refine research questions that drive real-world impact, connect industry R&D needs with cutting-edge research, and facilitate the implementation of innovative technologies. A focus area of the conference was decarbonisation and the

provision of clean and affordable energy solutions. The network also advocates for government support, helping to establish green policies and funding programs that will accelerate the deployment of bioeconomy solutions at scale.

- **UQ-Indian Institute of Technology Delhi (IITD) Research Academy Symposium 2024: Research partnerships working to solve challenging problems** This event in Delhi from 23-24 September 2024 focused on fostering collaboration between the UQ-IITD Research Academy, industry partners, and government and non-government organisations to address global issues with innovative solutions. The symposium showcased the power of partnerships in research and innovation through keynote speeches, panel discussions, and presentations by government representatives, industry leaders, and UQ and IITD faculties and students. Affordable and clean energy was a thematic focus in the symposium via sustainability research areas.
- **Scaling SMART Solar Bio-Manufacturing Processes**. A collaboration between UQ and the Technical University of Munich, this project aims to develop an overarching efficient automated process control for integrated light-driven microalgae production and downstream processes to produce sustainable products from high-value biopharmaceuticals to renewable fuels. The project will develop automation protocols to develop next generation high-efficiency solar biotechnology systems that integrate media supply, bioreactor operation, cell separation and product refinement.

Securing our future

UQ is a large energy consumer. Electricity accounts for 92.4% of its overall energy consumption and represents 97.8% of its overall Scope 1 and 2 emissions. Energy is the University's second biggest operating expense. UQ is adopting a comprehensive approach to enhancing energy efficiency and reducing energy consumption across new construction projects, existing buildings, and all refurbishment and upgrades.

Energy efficient building

UQ is committed to enhancing energy efficiency through a range of strategic initiatives. UQ's Design Standards mandate the selection of high-efficiency equipment such as chillers and cooling towers and the implementation of chiller management systems to optimise the performance of centralised plants. These requirements apply to all new constructions, refurbishments, and system upgrades.

The standards also promote advanced design strategies, including Demand Controlled Ventilation (DCV) in teaching spaces with high outside air requirements, and the use of efficient heat recovery systems such as heat exchangers and run-around coils. The preference for heating is for heat pumps and heat recovery systems rather than electric duct heaters, due to their superior efficiency.

To minimise environmental impact, UQ specifies the use of low Global Warming Potential (GWP) and low Ozone Depletion Potential (ODP) refrigerants such as hydrofluoroolefins (HFOs). Water conservation is also a priority, with cooling tower operations monitored to maintain higher cycles of concentration (CoC), reducing water usage.

UQ runs an active asset replacement program, upgrading end of life chillers and cooling towers with more efficient models. Additionally, energy audits are conducted across various buildings to identify and implement efficiency improvements. These efforts are

supported by advanced metering and building management systems (BMS) to ensure optimal control and performance.

UQ is currently delivering an LED lighting upgrade program to replace legacy fittings with new high efficiency LED fittings with smart controls. This program will continue to expand across all UQ sites. Through fitting replacement and new controls systems, energy savings of up to 50% are expected for lighting loads across UQ.

The targets and requirements articulated in the [UQ Design Standards](#) have been derived from several different sustainability initiatives, rating programs and the National Construction Code (NCC) standards. Sustainability initiatives are embedded holistically into all projects through good design practice.

Reducing energy consumption and wastage

UQ is committed to reducing its energy consumption through several ongoing projects and initiatives including meter rooftop solar and behind-the-meter battery installation.

Additionally, UQ is reducing carbon emissions by:

- improving efficient use of energy
- enabling extensive and comprehensive metering with detailed, live energy data
- reporting detailed energy utilisation through the [National Greenhouse and Energy Reporting \(NGER\)](#)
- implementing targeted energy reduction initiatives.

Low carbon energy use

In 2024 UQ embarked on a building audit program to identify energy saving opportunities. The first building's audit identified potential savings of 3% through standardisation and optimisation of cooling and heating setpoints and alignment of automation time scheduling on HVAC assets.

UQ also undertook a major chiller replacement in the Queensland Bioscience Precinct complex. The new chillers are substantially more energy efficient and forecast to save approximately 800 MWh per annum or 0.6% of the University's total usage.