Projects listing

CLEAN ENERGY SYSTEMS

Hydrogen, solar and biofuels; microgrids and social licence to operate

School or research area	Project title
The Centre for Hydrogen and Renewable Energy	**Optimising biomass and waste feedstock for zero emission fuel and energy**
	Cost effective and safe production, distribution and storage of zero emission liquid hydrogen and sustainable e-fuels and their use in heavy industry
	Maximising community benefit from the development of new energy and minerals projects
	Maximising the resilient supply and utilisation of zero-emission energy networks across diverse sectors
Civil Engineering	**Investigating hydrogen-derived bio-binders as a replacement for traditional bitumen in asphalt roads**
	Structural Design of Hydrogen Storage for Regional Infrastructure. This study aims to assess material selection and design for safe hydrogen storage facilities.
Centre for Machine Learning - Networking & Edu Tech	**AI-Driven Dynamic Economic Dispatch.** The goal is to develop an AI-powered optimization framework for Dynamic Economic Dispatch (DED) that effectively manages the variability and unpredictability of renewable energy sources.
	Increasing renewable hydrogen production for effective decarbonization
	Optimal planning of hybrid energy storage systems using curtailed renewable energy through deep reinforcement learning
	Quantum Machine Learning for Real-Time Cyber Threat Detection in Smart Grids. This research will focus on integrating quantum neural networks with classical cybersecurity frameworks to identify cyber intrusions in energy distribution networks faster and more accurately.
	Development of AI-Driven Maintenance Robots for Solar and Wind Farms Utilizing Starlink Connectivity. This research aims to explore cutting-edge technologies, including AI and satellite internet, to develop cost-effective and environmentally friendly maintenance robots for these renewable energy facilities.
	Optimization of Renewable energy integration to ensure grid stability
	Battery health prediction and performance optimization in electric vehicles
Centre for Railway Engineering (CRE)	**Digital Twin Framework and Platform for Hydrogen-Powered Heavy Haul Locomotive Design and Development.** Recently introduced digital twin solutions have limited capabilities, and it is envisioned that an optimal design solution requires further development of the digital twin framework and its application methodology for locomotive design.
	Optimising rail and road freight for lowest energy and productivity costs. This research will involve simulation modelling and optimisation of whole trip haulage routes with detailed applications of new zero-emission power plants.
	Energy regenerative technologies for heavy vehicles: innovative designs and comparative studies in autonomous rail wagons, regenerative trains and regenerative road train bogies.
Fuel and Energy	Performance, emissions and combustion characteristics of biodiels produced from different biomasses

Mechatronics	**Design and development of hydrogen powered UAV system replacing heavy-weight lithium batteries enhancing the capacity and efficiency**
School of Education and the Arts	**Renewable energy innovation in regional communities.**
SMART Grid Research Group	**A robust foundation for an AI-driven Digital Twin (DT): Insights for green hydrogen (GH) production investors**
	The challenge of integrating electric vehicles (EVs) into smart grids to accelerate the transition to energy-efficient and fossil-free transport
	Machine Learning and Power-line Communications for Green Energy Systems: Analysis, design, patenting and simulation of a novel energy-harvesting power-line communications coupler for the smart grid.
	Machine Learning and Power-line Communications for Green Energy Systems: Modelling of battery networks, including the state of charge, battery health, and battery topology in the smart grid.
	SMART Green Energy Systems: Communication performance requirements in power generation networks and their impact on energy network performance - an evaluation of various communication technologies in different scenarios.
	SMART Green Energy Systems: Mitigation of atmospheric pollution through maritime transport emitting harmful substances that impact the environment and human health using shore power solutions.
	Renewable energy and microgrids: Investigation and implementation of smart control algorithms to avoid stability issues of Grid forming (GFM) and Grid Following (GFL) inverters together with seamless transition strategies between grid-forming and grid-following modes for enhanced resilience.
	Renewable energy and microgrids: Investigate improving the performance of Microgrid based renewable energy capture and grid-connection while minimizing sub- frequency oscillatory behaviour of associated networks.
	Multi-Microgrids - Resilience, Management and Optimisation: a simulation-based platform to optimise multi-microgrid coordination strategies.
	Multi-Microgrids - Resilience, Management and Optimisation: leveraging AI to improve electricity forecasting, dispatching, and control within modern power grids.
	AI Based Condition Monitoring and Management of Energy System Components: An automated data-driven multi-motor industrial motor management system, through a deep neural network-based non-intrusive system.
	AI Based Condition Monitoring and Management of Energy System Components: Developing an intelligent battery health management system based on Deep Neural Networks.
	Digital Twin Modelling of Energy System Components: Estimating the remaining life of a power transformers using digital twin modelling techniques.

FOOD PRODUCTION AND ENVIRONMENT SYSTEMS

Precision livestock and horticulture; agricultural education and extension; marine ecosystems

School or research area	**Project title**
The Centre for Hydrogen and Renewable Energy	**Developing optimal agrisolar systems for cropping and grazing communities**
	Coastal Ecosystem Restoration: Protoplast and Encapsulation Techniques for Zostera muelleri Propagation to enhance seagrass restoration.

CMERC - Coastal Marine Ecosystems Research Centre	**Coastal Ecosystem Restoration:** Flower production intensity and frequency modifications for increasing seed production in seagrass restoration nurseries.
	Coastal Ecosystem Restoration: Developing Seed Enhancement Techniques for seagrass seed storage and dispersal, to support large scale seagrass restoration.
	Sustainable Seaweed Project 1: Enhancing aquaculture strategies and conservation efforts for A. taxiformis.
	Healthy Rivers to Coasts: Invite projects examining catchment to reef nutrient management, water quality indicator development and monitoring.
CML-NET - Centre for Machine Learning - Networking & Edu Tech	Satellite image processing for Weed management in Livestock pastures
	Smart Farming with AI-Optimized Wireless Sensor Networks
	Smart robotic arm to enable networked drone for precision herbicide spraying based on weed coordinates
Centre for Railway Engineering (CRE)	Decarbonisation of primary industry tramway systems
Fuel and Energy	Waste to energy via thermo-chemical conversion processes
Institute for Future Farming Systems	**Development of an autonomous mango harvester:** Development and trialling of new arm designs and picking strategies.
	Tree fruit crop estimation system: Development of an in-field machine vision-based fruit size estimation tool
	Tree fruit crop estimation system: Development of hardware (LED strobing) and machine vision models for fruit counting in daylight
	Tree fruit crop estimation system: Development of a UGV solution for automated imaging of orchards
	Near infrared spectroscopy: New chemometric/deep learning approaches for calibration of proximal NIR based fruit sensors using an existing large data set
	Near infrared spectroscopy: Exploration of robustness issues for avocado NIR models
	Near infrared spectroscopy: Use of hyperspectral imaging for selective (maturity based) machine harvesting
	Near infrared spectroscopy: Design and testing of an improved optical design for estimation of fruit attributes using NIRS
	Human Factors Associated with Practice Change: This research considers the demographics, individual differences, attitudes, and beliefs that underpin practice change and investigates a range of malleable constructs that can support learning and knowledge transfer between a diverse range of actors within Australian agriculture.
	Technology Acceptance and Adoption in Australian Agriculture
	Attracting people to a research career pathway in the agricultural industry: barriers, motivations and key strategies to attract young people and established professionals, to conduct research in agricultural contexts.
	Integrating food and fibre across the school curriculum: how food and fibre can be integrated into different curriculums to have a sustainable existence in a school.
	The Future of Work in Agriculture: examining the adaptability of the workforce, and growing the talent pool that are attracted and retained in Australian agriculture.
	Human and Social Sustainability in Agriculture: enhancing healthy, safe and satisfying workplaces for individuals in agriculture, and growing connections between Australian agriculture and the community around them.
	Subtropical/Tropical Crop Physiology and Agronomy: development of improved production practices to generate greater understanding crop growth and development processes, with a focus on major horticultural crops grown in Bundaberg region and in protected cropping systems.

	Farming Systems: how biophysical and socioeconomic factors interact in farming systems. This research includes use of model simulations including digital twins, sustainability of farming systems and system resilience in the face of a changing climate.
	Assisting growers to adopt applicable agtech products and services: this research explores the translation of emerging agtech products and services into application on farms, including the processes and factors influencing agtech adoption including the performance of the technologies in commercial situations.
	Unlocking the potential of tropical legumes through investigating elite genetics in northern Australia: this research will identify viable legume species that enhance soil health, provide alternate protein sources and contribute to resilient farming systems for northern Australia.
	Tropical spices in northern Australia – new opportunities for diversification of northern cropping rotations. The research will assess the suitability of a group of spice crops for domestic production, the impact of pests and diseases on production and the potential for profitability for northern producers.
	Precision Livestock Management Research: Industry-relevant research delivering practical solutions to the challenges for producers.
	Poultry Health and Productivity: improving the immune response of animals by controlling the pathogens in the gut in order to enhance nutrient retention and reduce the need for antibiotics
Mechatronics	**Machine Learning-Powered Automation for Agave Harvesting: development of** an intelligent automated system for agave harvesting using machine learning
	Seaweed Restoration Robotic System with Machine Learning: This project focuses on developing an autonomous robotic system to support large-scale seaweed restoration efforts using machine learning and advanced robotic technologies.
School of Education and the Arts	**Citizen Science - science education for community**
Centre for Regional Economies and Supply Chains (CRESC)	**Agriculture and environmental economics, agri-food supply chains**

RURAL AND REGIONAL PUBLIC HEALTH

Patient care, aged care, simulation studies, health quality and safety

School or research area	Project title
Appleton Institute	**Health in the regions** - active living, restful sleep: co-designing tools and programs to support health behaviours in regional and rural areas.
CML-NET - Centre for Machine Learning - Networking & Edu Tech	**Quantum Internet of Things-based Telemedicine and patient monitoring for regional, rural, and remote areas: this research will** develop an innovative telemedicine and patient monitoring system that leverages quantum computing, IoT, and AI to enhance healthcare access, reduce medical errors, and enable early disease detection and management.
Fuel and Energy	**Renewable and solar thermal energy:** hybrid renewables through nanofluid application in solar collectors and/or solar energy storage (STES) system using different nanoparticle-augmented phase change materials.
Mechatronics	**Development of assistive exoskeleton for aged care workers: this research will** enhance the physical capabilities of aged care workers, reducing strain and injury risks, by prioritising ergonomic support, ease of use, and integration into daily caregiving tasks.
School of Business and Law	**Community-based interventions for patient care management in rural and remote areas:** Developing effective models that combine different healthcare services and engage community partners to enhance access, quality, and affordability of healthcare in rural areas.
	Community-based interventions for patient care management in rural and remote areas: Leveraging digital health solutions to address healthcare disparities in rural/remote areas.

	Community-based interventions for patient care management in rural and remote areas: Challenges and opportunities in workforce retention for rural/remote healthcare providers.
	Community-based interventions for patient care management in rural and remote areas: Telehealth and mobile health clinics: enhancing access to care in rural/remote regions.
	Community-based interventions for patient care management in rural and remote areas: The impact of digital health records on patient safety and quality of care.
	Community-based interventions for patient care management in rural and remote areas: Health workforce well-being and burnout: implications for patient safety.
Centre for Regional Economies and Supply Chains (CRESC)	**Health economics and pharmaceutical supply chains**

SUSTAINABLE BUSINESS, SUPPLY CHAINS AND REGIONAL ECONOMIES

School or research area	Project title
Appleton Institute	**Mentally healthy workplaces** - designing work for psychosocial health and safety, wellbeing and retention.
	Designing rosters and work for safety, health, performance and productivity
Civil Engineering (School of Engineering and Technology)	**Circular Economy approaches in pavement engineering: d**eveloping a life cycle assessment (LCA) for incorporating waste materials into road construction.
	Low carbon concrete for sustainable regional infrastructure: this study aims to investigate alternative materials, particularly locally available materials to reduce carbon emissions in construction.
CML-NET - Centre for Machine Learning - Networking & Edu Tech	**Quantum-Blockchain (QB) based dynamic and real-time scheduling framework for futuristic supply chain network**: leveraging a Quantum-supported blockchain network to optimise the transport routes and traceability of the agriculture products supply chain.
	Cyber Security Risk in Smart Farming: Regional Australia: analysing the potential cybersecurity threats facing smart farming and propose robust cybersecurity frameworks tailored for Australian farms.
	Integrating AI and Blockchain for Next-Generation Supply Chain Management: Enhancing Transparency, Security, and Efficiency throughout the entire logistics process. This research will combine advanced predictive analytics with immutable, decentralised record-keeping, the system provides real-time tracking and fraud prevention, enabling seamless decision-making and trusted operations across supply networks.
Centre for Railway Engineering (CRE)	**Flexible container transport for regional railways:** the application of virtual coupling and dynamic coupling technologies to enhance the flexibility and efficiency of container transport in regional railway networks.
Fuel and Energy	**Building energy management: hybrid and** low energy cooling, roof top greening systems and phase change materials in the building envelope.
School of Business and Law	Developing business, ethical and legal models that have a positive impact on economic, social and environmental outcomes for society.
	Promoting the sustainable use of resources, reducing waste, promoting automation and creating social innovation, in business, the law and the legal profession.

	Social innovation and entrepreneurship, corporate social responsibility, community law and justice, public law.
	Regional Economies and Supply Chains: Strengthening regional economies and fostering environmental sustainability in Northern Australia through the application of resource and economics frameworks to resource and sustainability issues within the regions.
	Regional Economies and Supply Chains Project 2: Improve supply chains, particularly in the agricultural and other regional industries.
	Regional Economies and Supply Chains Project 3: Rural and regional economies, resource and environmental economies, agricultural economics, supply, value and block chains.
Centre for Regional Economies and Supply Chains (CRESC)	Rural and regional supply chain operation and management, supply chain design and network optimization, logistics and transportation management, value and block chains, supply chain risks management, agricultural economics and business innovation.

DATA SCIENCE

Artificial intelligence, machine learning and big data

School or research area	Project title
CML-NET - Centre for Machine Learning - Networking & Edu Tech	Development of an AI-enabled mobile application to empower growers to detect and quantify plant-parasitic nematodes hidden in soil and plant roots: This project will develop an Artificial Intelligence (AI)-enabled mobile application based on image analysis using machine/deep learning models to detect and count nematodes in soil and plant samples.
	A faster and integrated Deep Neural Network and reinforcement learning for Real time decision making.
	Smart Farming with AI-Optimized Wireless Sensor Networks: Enhancing Efficiency, Sustainability, and Automation - developing an AI-driven optimisation framework for WSNs in smart agriculture.
	Multi-Modal Deep Learning for Crop Yield Prediction and Agricultural Decision Support - The aim is to Investigate the integration of diverse data sources, such as satellite imagery, weather data, soil properties, and historical yield records, using multi-modal deep learning models to enhance the accuracy of crop yield predictions and develop an intelligent decision support system that optimises planting, fertilisation, and harvesting strategies.
	Exploring AI, Machine Learning, and Quantum Computing for Disaster Prediction – developing quantum-enhanced models that analyse complex data streams, such as satellite imagery, drone footage, and environmental sensor data, to uncover hidden patterns.
	Using Multimodal Data for Aquatic Weed Management-- integrating satellite, drone, IoT, and water quality data to accurately detect and monitor aquatic weed growth, enabling more precise management strategies and timely interventions to reduce ecological and economic impacts.
	Event-based decision-making for intelligent and secure cyber-physical systems with modelling, scheduling, control and networking.
	Intelligent mobile app to create a weed map using drone images in near real-time with the help of Quantum processing. In this project, students need to overcome the proprietary nature of the

	drone's communication protocol and processing limitation of mobile devices to achieve a weed map application.
	Onboard Artificial intelligence with optimised path trajectory of an herbicide spraying drone for smart farming. In this project, Students will work on our in-house drone to attach an onboard AI processing unit to process collected images and develop an optimisation model to optimize the drone's trajectory based on identified weeds' geo-location.
Centre for Railway Engineering (CRE)	Data driven model for complex Computational Fluid Dynamics in railway brake systems. This research aims to develop a data-driven model that enhances the efficiency and accuracy of Computational Fluid Dynamics (CFD) simulations for railway brake systems.
	Secure and intelligent train driving controller for multiple autonomous trains by leveraging AI, machine learning, and cybersecurity measures.
	Development of Hybrid Classic-Quantum Machine Learning Framework and Platform for Rail Vehicle Operational and Maintenance Studies.
	A Quantum-Enhanced Framework for Railway Operations: Integrating Big Data and Digital Twins.
School of Business and Law	Investigating the intersection of digital transformation and management practices: the impact of emerging technologies on leadership, decision making and strategic innovation.
	Examining the transformative role of AI in human resource management in areas such as staff recruitment, performance, and talent management.
Centre for Regional Economies and Supply Chains (CRESC)	

REGIONAL WORKFORCE, EMPLOYMENT AND EDUCATION

Employee attraction/retention, distance-based learning and educational technologies

School or research area	**Project title**
Civil Engineering (School of Engineering and Technology)	Machine Learning for Predictive Pavement Maintenance – This study aims to use AI to analyse road condition data and optimise maintenance schedules.
	AI-powered Flood Risk Mapping for Regional Road Networks – The project is focused on deep learning models to predict flood-prone areas based on topography and climate trends.
	Digital Twins for Sustainable Infrastructure Management – The study aims to build virtual models of road networks and bridges to optimise maintenance and operations.
CML-NET - Centre for Machine Learning - Networking & Edu Tech	
Centre for Railway Engineering (CRE)	Development of AI-infused distance-based learning educational system for railway operational workforce.
	Development of a distance-based learning educational system for railway rollingstock and infrastructure design and manufacturing sector in Australia.
	Development of a distance-based learning system for railway signalling education in regional Australia.
School of Business and Law	Project 1 Human Resource Management: · Regional workforce development, talent management and succession planning to identify, attract, and retain top talents in regional settings · Organisational behaviour in the contemporary business environment · Diversity, equity, and inclusion (DEI) initiatives and their impact on organisational behaviour and performance

	· The role of leadership in driving organisational change, culture, and employee engagement, including implications for workforce development and HRM strategies · How organisations foster agility and resilience within their workforce in the context of future work and dynamic markets.
	Project 2 Workforce Transition, migration and labour mobility, workforce and technology advancement Learning innovations · Use of AI in accounting education · Sustainability education and research in accounting · Academics' perceptions about use of AI in teaching and research · Academic integrity and assessment practices in Gen AI era · Employability skills for future success · International students: professional year requirements in accounting and Engineering
School of Education and the Arts	STEM Central - STEM education for improved workforce.
Centre for Regional Economies and Supply Chains (CRESC)	Workforce transition, migration and labour mobility, human resource management, workforce and technology advancement

REGIONAL COMMUNITIES

Psychosocial wellbeing and the arts

School or research area	Project title
Centre for Railway Engineering (CRE)	Optimised solution for relocating railway lines outside of Rockhampton's CBD: Community benefits and psychosocial wellbeing.
School of Education and the Arts	Community partnerships - social networks and community partnerships in regional locations.
Centre for Regional Economies and Supply Chains (CRESC)	

FIRST NATIONS RESEARCH

School or research area	Project title
Jawun Research Centre	How well-being needs language: a First Nations perspective. This project focuses on discourse on disease and well-being (including grammar and lexicon) in conceptualizing health in focal areas of First Nations and across tropical societies, and how they may change over time and under the impact of social upheavals such as COVID, and on the mutually supportive relationship between language maintenance and good health.
	The dynamics of young people's language: structures, evolution, and well-being. This project involves qualitative research with focal language communities, focusing on First Nations and peoples of the tropics.
School of Education & the Art	STEM Central - embedding Aboriginal and Torres Strait Islander perspectives in the Australian primary classroom.