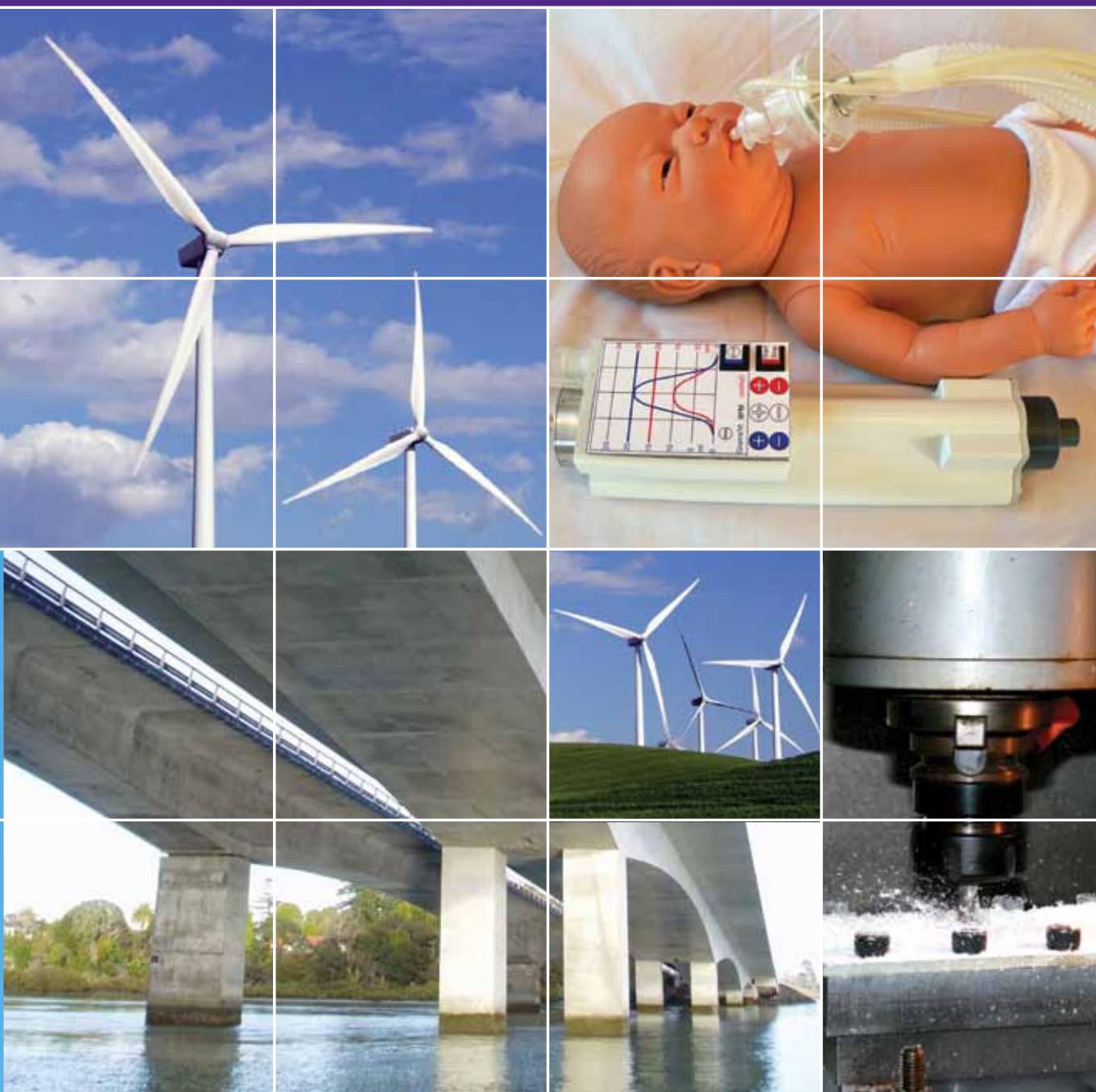
THE UNIVERSITY OF AUCKLAND
FACULTY OF ENGINEERING

The University of Auckland

Faculty of Engineering

Research Themes



The Faculty of Engineering

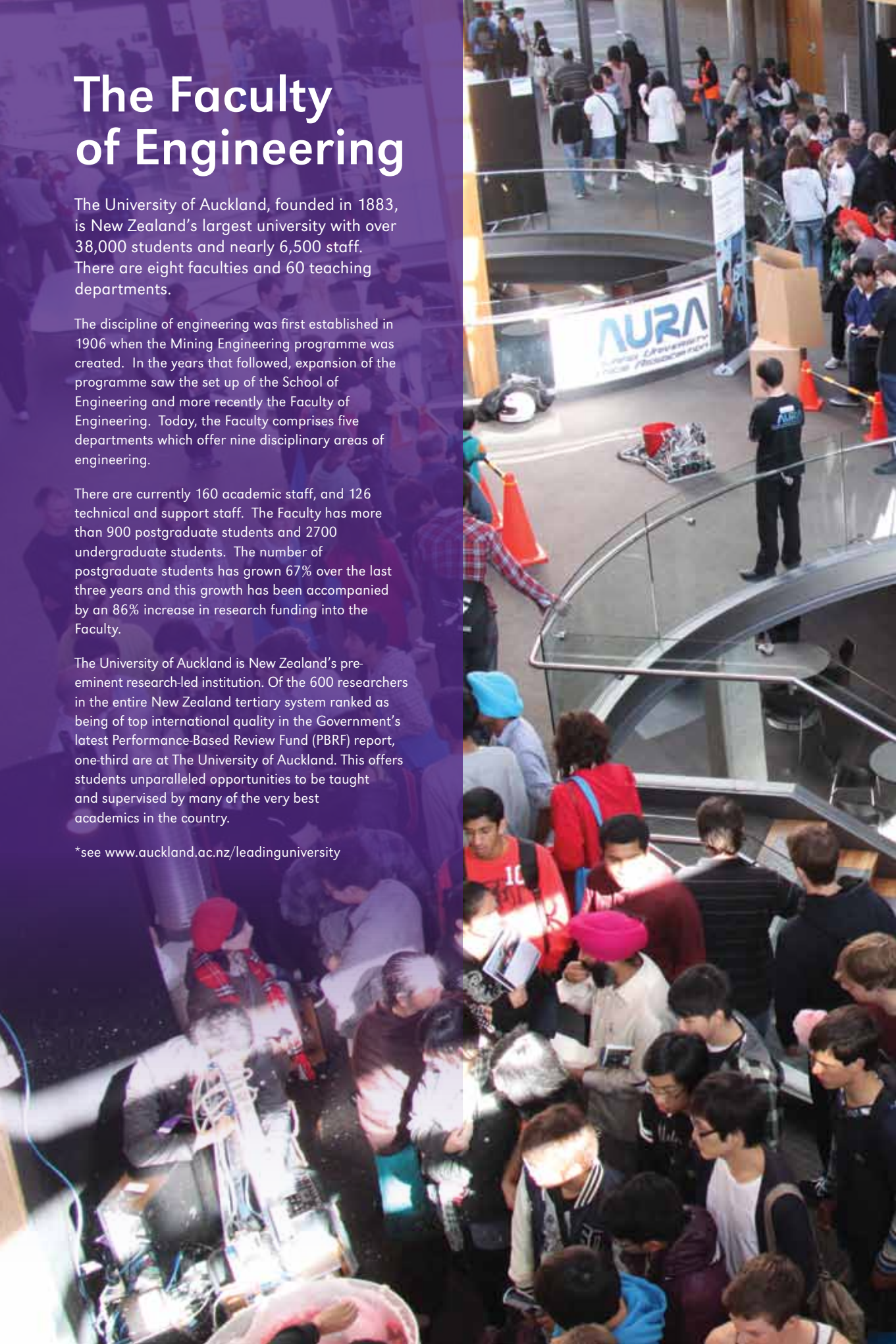
The University of Auckland, founded in 1883, is New Zealand's largest university with over 38,000 students and nearly 6,500 staff. There are eight faculties and 60 teaching departments.

The discipline of engineering was first established in 1906 when the Mining Engineering programme was created. In the years that followed, expansion of the programme saw the set up of the School of Engineering and more recently the Faculty of Engineering. Today, the Faculty comprises five departments which offer nine disciplinary areas of engineering.

There are currently 160 academic staff, and 126 technical and support staff. The Faculty has more than 900 postgraduate students and 2700 undergraduate students. The number of postgraduate students has grown 67% over the last three years and this growth has been accompanied by an 86% increase in research funding into the Faculty.

The University of Auckland is New Zealand's pre-eminent research-led institution. Of the 600 researchers in the entire New Zealand tertiary system ranked as being of top international quality in the Government's latest Performance-Based Review Fund (PBRF) report, one-third are at The University of Auckland. This offers students unparalleled opportunities to be taught and supervised by many of the very best academics in the country.

*see www.auckland.ac.nz/leadinguniversity



Engineering Research

– Addressing Tomorrow's Challenges

The Faculty of Engineering has a long tradition of excellence in research – from biodegradable nanocomposites to novel power transmission to sail aerodynamics for high performance yachts. This research comes from a solid grounding in discipline-based expertise. Scientific research is changing. As engineers we have an increasingly urgent role in addressing the important issues facing our communities – sustainable energy, quality of life, a vibrant economy. Major research breakthroughs are unlikely to come from single individuals toiling away in the lab. They will come from teams where the interplay of ideas from across disciplines can be combined to design innovative solutions.

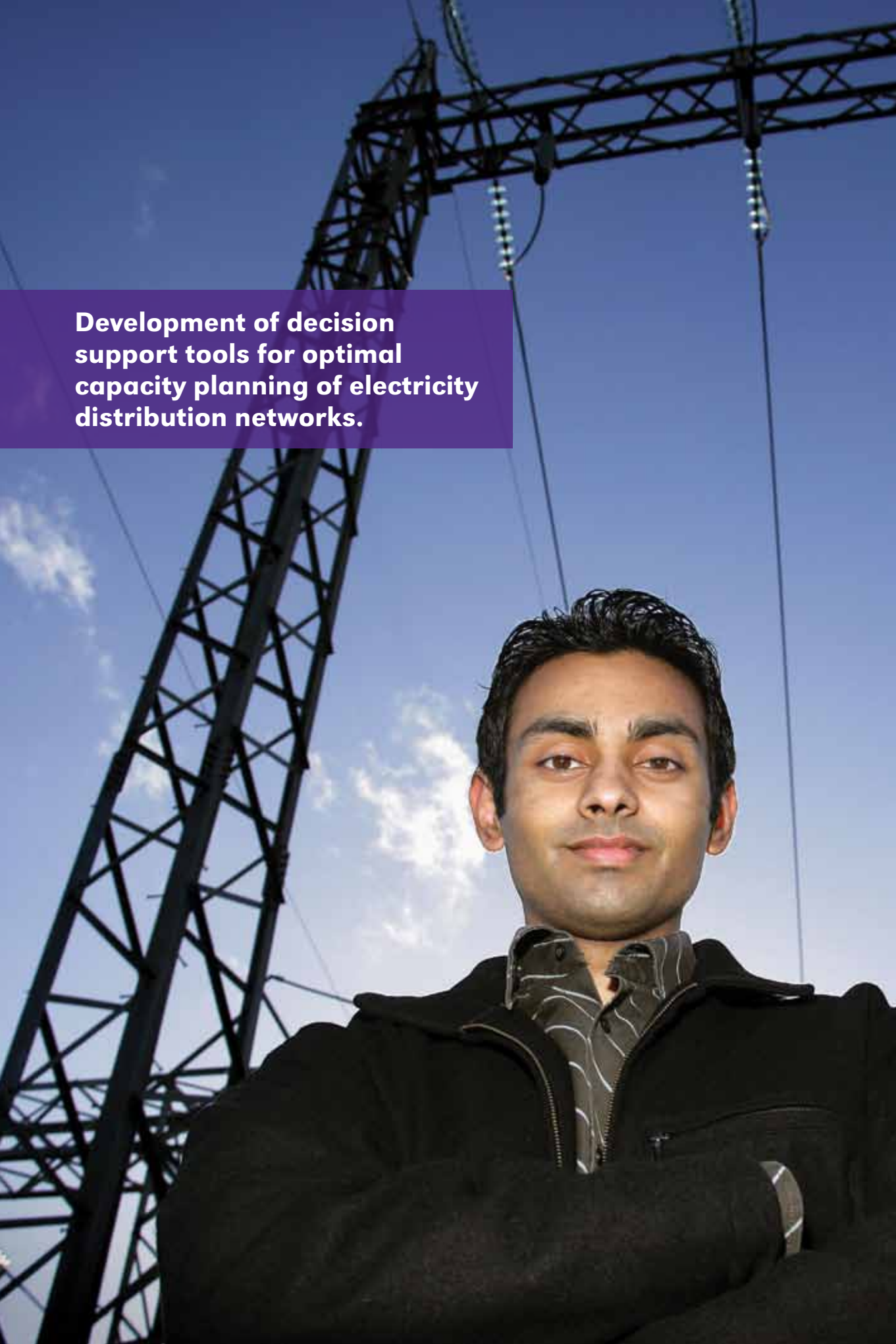
The Faculty of Engineering is responding to these challenges by overlaying our existing expertise-based strengths with four outcome based, cross-disciplinary research themes:

- Energy
- Technologies for Health
- Infrastructure and Environment
- Innovation in Manufacturing and Materials.

The themes will help create 'critical mass' in strategically important areas and provide an environment which supports world class research. The themes bring together expertise across the Faculty's five departments, its institutes and centres. The integrated programmes of research also link our researchers with researchers in other faculties, research institutions and New Zealand businesses.

The Faculty of Engineering is positioned to address tomorrow's challenges – to maximise our contribution to the health of our nation, the growth of our economy and the future of our cities.

In the pages that follow you will find details of the Faculty's four research themes together with details of how to contact us if you wish to learn more or partner with us in addressing tomorrow's challenges.



Development of decision support tools for optimal capacity planning of electricity distribution networks.

Energy

The Energy Theme targets improved energy supply and use. This incorporates new sources of energy, sustainability of current forms of energy supply, and novel low energy usage technologies.

Core areas of interest for the theme include:

Energy Supply

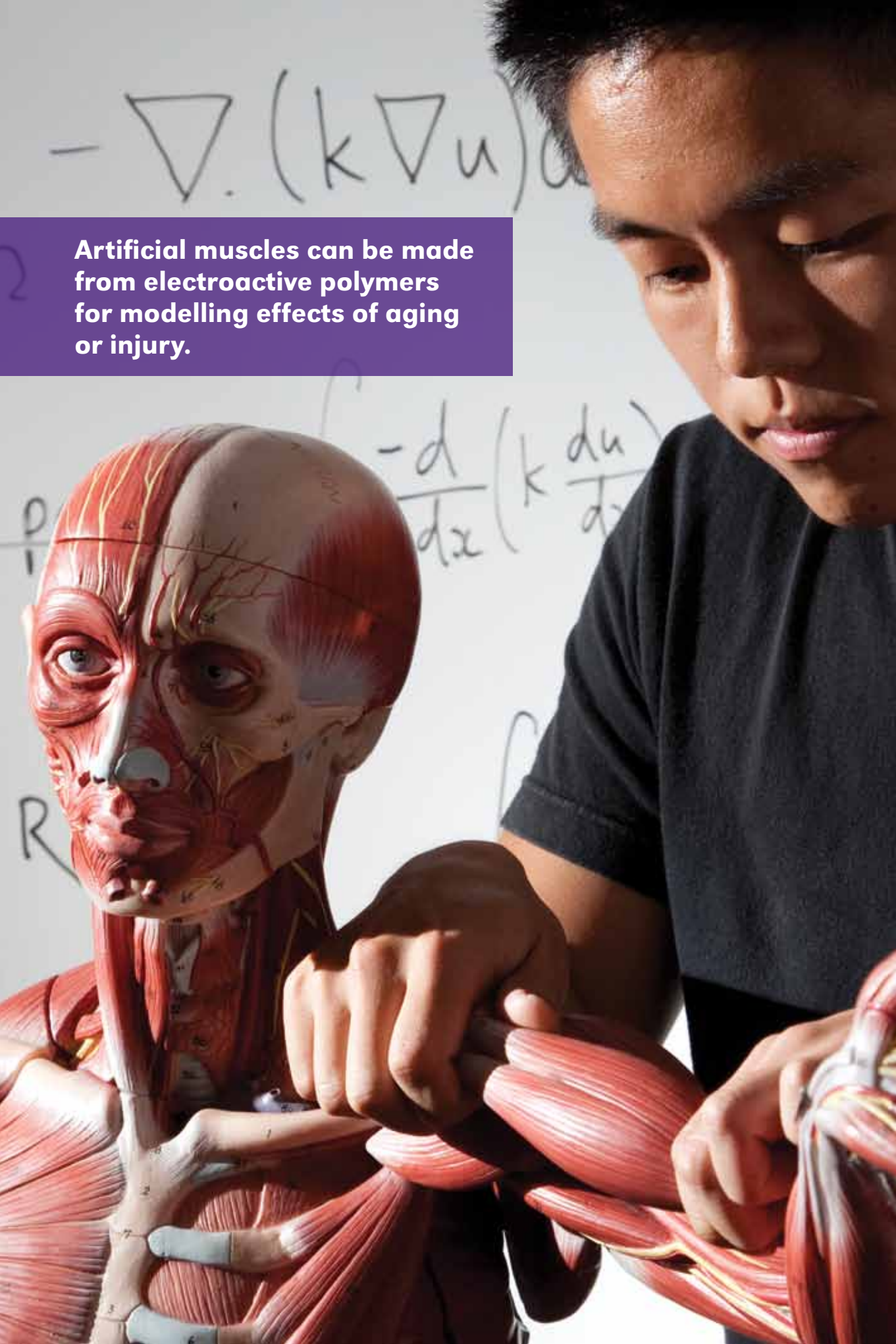
- Coal-bed methane
- Electricity generation
- Electricity infrastructure and markets
- Gas hydrates
- Geothermal energy
- Oil and gas production
- Solar power
- Wind energy

Energy Use

- Energy efficiency
- Fuels and biofuels
- Heat transfer
- Refrigeration
- Sustainability/complex systems
- Energy use in industries such as aluminium smelting.
- Smart grids

Some examples of projects undertaken in the Energy theme:

- Improving performance of wind farms using predictive load control
- Telescopic wind turbine blades designed to alter their length in response to wind conditions
- Understanding modern electricity markets and analysis and development of methods for efficient generation schemes and demand-side participation
- Biofuels for transport addressing engine performance, emissions and durability issues, and biofuel production from waste sources
- Resource optimisation in geothermal and petroleum reservoir engineering
- Fundamental and applied research dealing with refrigeration systems including domestic refrigerator/freezers, heat pumps, liquid chillers and supermarket refrigeration systems
- Inductive power technology which transfers energy across air, and is suitable for charging hybrid and pure electric vehicles.



Artificial muscles can be made from electroactive polymers for modelling effects of aging or injury.

Technologies for Health

This theme is focused on improving quality of life by developing practical technologies for the prevention, treatment and management of illness, and the preservation of mental and physical wellbeing. The theme includes product design, prototype development, testing and optimisation.

Goals include integrating research and commercial interests across medical experts, engineers, healthcare companies, health information technology (IT), and medical devices.

The focus of the theme covers three broad areas:

Bioinstrumentation and sensing

- Electronic devices for measuring biological signals, signal analysis and implants and their power supply

Biomechanics and modelling biological systems

- Modelling and analysing all parts of the body, prostheses and implant design, implant materials

Healthcare and medical robotics and automation

- Medical and rehabilitation robotics, robots to help care for older people, wearable rehabilitation devices, optimisation of treatment (e.g. radio and drug therapy), processing methods for biomaterials, health IT systems.

Some examples of projects undertaken in the Technologies for Health theme:

- Robot assisted therapy for injury rehabilitation
- Modelling aging of the vocal tract and its impact on speech
- Modelling food breakdown in the stomach
- Designing implantable medical devices such as heart pumps
- Sophisticated data analysis for prediction of epilepsy and cancer prognosis
- Using nanoindentation technology to measure bone density
- Optimising hospital procedures to reduce waiting time
- Mechanobiology to understand joint degeneration.

Testing different materials and plants on Auckland City's first green roof project on the Faculty of Engineering rooftop.

Infrastructure and Environment

The Infrastructure and Environment theme has a broad approach bringing together research on: transport systems; building materials and intelligent buildings; efficient delivery of water, power and telecommunications; understanding and mitigating the impact of infrastructure on the environment; and increasing the resilience of the built environment.

Target areas for the theme include:

Buildings and Structures

- Improved resilience of infrastructure to the effects of climate change and extreme natural events
- Standard, agreed tools and systems for life cycle costing and measurement of energy efficiency
- Developing more energy efficient building materials

Transportation

- Ensuring the safe and efficient movement of people and goods by land, sea and air
- Planning, design, construction, maintenance and operation of transport systems and infrastructure

Water, Power and Telecommunications

- Improving power generation and transmission, better storm water management and water quality, improving telecommunications design, delivery and management

Environment and Sustainability

- Improving sustainability assessment and technology, clean technologies, waste minimisation, sustainable use of natural resources.

Some examples of projects undertaken in the Infrastructure and Environment theme:

- Managing the recovery and reconstruction of the built environment following a natural hazard event
- Developing improved design provisions for buildings subject to extreme events
- Improved wireless communications
- Operational efficiency of different intersection types
- River basin modelling and flood risk mitigation
- Improved building energy efficiency through use of new light weight composite structural materials
- Environmental impact assessment and treatment technologies for endocrine disrupting chemicals
- Living roofs for stormwater management.

Research into an intelligent and adaptive de-burring process.

Innovation in Manufacturing and Materials

The Innovation in Manufacturing and Materials theme aims to develop new manufacturing technologies and novel materials for new and value-added products. The theme provides a 'one stop shop' from product design, materials, analysis, and manufacturing to commercialisation.

Our focus is in the four key areas of manufacturing and materials:

Products

- Innovative and commercially viable products arising from newly developed and purposely engineered materials

Design

- Integrative and systematic approach to designing and analysing new materials, new products and new fabrication techniques

Process

- Process optimization and intelligent control of manufacturing facilities

Service

- Production planning and scheduling for manufacturing businesses, advanced operations research and service innovations.

Some examples of projects undertaken within the Innovation in Manufacturing and Materials theme:

- Innovative technologies for removing protein from wine, thereby improving yields and enabling flavour optimisation
- Development and manufacturing of sustainable composites with characteristics such as light weight, high strength and stiffness, and low environmental impact
- Cognitive robotic systems that cooperate with humans to carry out tasks such as materials handling, part inspection, assembly, and online order filling
- Innovative thermal food processing technologies
- Enabling innovation from product design to manufacturing
- Advanced human interface technology for decision making and process control in manufacturing plants.

Contact
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Further information on the research theme areas can be obtained from the following:

Energy
Foe-energy@auckland.ac.nz

Technologies for Health
Foe-tech-for-health@auckland.ac.nz

Infrastructure and Environment
Foe-infra-env@auckland.ac.nz

Innovation in Manufacturing and Materials
Foe-IMM@auckland.ac.nz

Cover photo of Auckland Upper Harbour Bridge Duplication Project courtesy of Fletcher Construction Company.

www.engineering.auckland.ac.nz/research