



**UNSW**  
SYDNEY

Australia's  
Global  
University



# MINERALS AND ENERGY RESOURCES ENGINEERING

PARTNERING WITH INDUSTRY ● INNOVATING IN EDUCATION



# WELCOME FROM THE HEAD OF SCHOOL

Welcome to the School of Minerals and Energy Resources Engineering. The School has been a provider of innovative world class engineering education and research in both petroleum and mining for more than 70 years. Our school continues to thrive with highly sought-after undergraduate and postgraduate programs, along with an increase in our internationally acclaimed research output.

Our vision for the School is one of global leadership in teaching and research excellence in the minerals and energy sector of the economy. We will drive the national agenda across the breadth of Minerals and Energy Resources Engineering, and in doing so will enhance the quality of life for humanity in a sustainable way.

I encourage you to find out more about our diverse and extensive teaching programs, our advanced research and our strong links with industry and alumni. If you have any further enquiries, we would be delighted to hear from you.

## **Professor Ismet Canbulat**

Head of School  
School of Minerals and  
Energy Resources Engineering  
UNSW Sydney

# WHAT WE DO

The School of Minerals and Energy Resources Engineering is a leading provider of world class education and research; specialising in education for both undergraduate and postgraduate students. The School also continues to produce internationally acclaimed research, working closely with industry to provide innovative solutions to the mineral industry.



Our researchers are working with industry partners and government organisations to help solve the most complex problems facing the sector

53%

Gas, petroleum, mining and minerals industries represent 53% of Australia's export income, equating to approximately \$190 billion a year



5-star rating for the past four years for employability, teaching and research

Source: QS World University Ranking



We offer the largest range of teaching programs and comprehensive research interests



Our academics are world experts in their fields and internationally respected and recognised



Our mission is to provide education and research to support future cleaner energy and sustainable supply of mineral resources

# A RESEARCH POWERHOUSE

## RESEARCH STRENGTHS



### SUSTAINABLE MINING PRACTICES

We focus on the long-term health of the industry. Our expertise includes:

- Remote sensing to detect environmental impacts, subsidence and illegal mining
- Mine site water, groundwater and seepage barriers.



### GEOMECHANICS

Our strength includes fundamental and applied research in the field of mining and petroleum geomechanics. We have developed unique technologies in ground support, ground control, mine safety, productivity, advanced visualisation, numerical modelling and a physics-based approach aimed at forward predicting instabilities such as fracture network formation, fault reactivation, borehole stability and reservoir damage.



### MINING SYSTEMS AND MINERAL PROCESSING

Improving efficiencies in mining systems and mineral processing through novel techniques, technology developments and new approaches. This field works on:

- Longwall top coal caving
- Mass mining (block cave)
- Froth flotation as a mineral separation technique
- Off Earth mining on asteroids, Mars and the Moon.



### CARBON CAPTURE, STORAGE & UTILISATION

A means of reducing emissions from stationary sources of greenhouse gasses. We research the economics of CCS and the reservoir engineering of carbon dioxide (CO<sub>2</sub>) storage sites. We focus on:

- CO<sub>2</sub> storage as part of enhanced recovery of oil and gas
- Modelling of CO<sub>2</sub> storage in aquifers and depleted oil and gas reservoirs
- Economic analyses of linking different sources and storage sites
- The economics of different CO<sub>2</sub> injection strategies and improving storage reservoir performance
- The methodology for estimating CO<sub>2</sub> storage capacity
- Risk analysis of carbon capture and storage projects
- Support to the CO2CRC Otway and South-West Hub storage demonstration projects.



### NATURAL GAS

Natural gas will increasingly become the energy source of the near future. It is a fuel with the smallest environmental impact capable of also delivering power on the scale needed by humanity. Our research plays a role in reducing the vast financial and technical commitments needed to deliver such developments.



### ENHANCED GEOTHERMAL

Geothermal energy uses the heat stored in the Earth to produce sustainable energy. Recently, there has been significant investment in this resource globally. The exploitation of these resources has a large overlap with petroleum engineering methods including reservoir characterisation and drilling methods.



### DIGITAL ROCK PHYSICS

Our new techniques give unprecedented insight into the properties of oil, gas and mineral resources which helps to reduce risk and saves millions of dollars. We also characterise rock samples by revealing their internal micro and nanostructure and perform numerical simulation for estimating physical properties of the samples.



# RESEARCH HIGHLIGHTS

Each year our academics and research centres work with businesses, government and community organisations on specific projects, transferring our research into practice. We are making an impact that matters with the following research:

## 1 FUTURE “SMART” MINING Integration of Advanced Technology

To assist in sustaining the Australian mining industry's comparative advantage of cost-competitive, safe and environmentally responsible operations. Our research aims to be a catalyst for transforming mining systems through integration of advanced technology and mining operational excellence. Our objective is to create smart mining outcomes which generate expanded research capability and knowledge, to improve productivity with greater safety while creating new jobs and to reduce mining's environmental footprint. This will help sustain and grow the mining industry in Australia in response to global megatrends.

We are focused on four key technical themes supported by our industry partners:

- Technology Integration
- Machine Learning & Robotics
- Mine Internet of Things (MIoT)
- Automation



## 2 CLEAN ENERGY TECHNOLOGY RESEARCH LABORATORY

Our facility is unique as it enables researchers and industry to measure and characterise complex material structure and properties in 3D at high resolution under reservoir pressure conditions.

Understanding heterogeneity is important, as it can lead to uncertainties in reservoir performance parameters. This is imperative to understand as a single well can cost up to \$270 million.

The technique has other significant advantages, including:

- it is faster, reducing analysis to weeks instead of months
- it enables researchers to carry out numerical experiments where standard laboratory experiments are impossible



# STATE OF THE ART FACILITIES



## THE VIRTUAL REALITY SIMULATOR

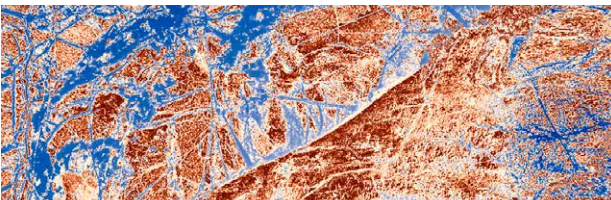
Developed for student use and industry training it consists of floor-to-ceiling screens and casts 360 degree, 3D images with cinematic clarity. Staggeringly realistic underground mines and scenarios are available for exploration that steps beyond the boundaries of traditional education into experiential learning.

The VR simulator offers a range of modules from open-cut to underground, and across all mining sectors.

Within the safe confines of a simulator, potential hazards can be safely experienced, evacuation procedures tested, and feasibility studies consolidated, resulting in a cost-effective, low risk, high impact learning experience.

## TYREE MICRO-CT FACILITY

Our lab offers bespoke X-ray and neutron beam transparent flow and deformation cells with 4D-Material Characterisation down to the molecular level. What makes us unique is the range of reservoir conditions and time lapse imaging capability. Various materials such as rocks, cement, sand, composite, coal, steel, coral, battery and biological samples (insect, animal tissues and bones) can be imaged.



## MULTIPHYSICS GEOMECHANICS LABORATORY

An advanced experimental geomechanical setup investigation into fluid flow through porous media in next generation high temperature triaxial flow cell. This laboratory allows seamless integration to the Micro-CT imaging and is equipped with the infrared and optical cameras to investigate multiphysics processes.



# CREATING LEADERS & INNOVATORS

## PROGRAMS

### Undergraduate

- Bachelor of Engineering (Honours) in Mining Engineering
- Bachelor of Engineering (Honours) in Petroleum Engineering
- Bachelor of Engineering (Honours)/Bachelor of Engineering Science – with Mining and/or Petroleum and other Engineering disciplines

Plus a range of other dual degrees in Arts, Science, Commerce and Law.

### Post Graduate

- Master of Mining Engineering
- Graduate Diploma of Mining Engineering
- Graduate Certificate of Mining Engineering
- Master of Mine Geotechnical Engineering
- Graduate Diploma of Mine Ventilation
- Statutory Coal Mine Ventilation Officers Course
- Master of Engineering Science (Petroleum Engineering)
- Master of Engineering Science (Petroleum Engineering Open Learning)
- Master of Engineering Science (Geothermal Engineering)
- Graduate Diploma of Engineering Science (Petroleum Engineering)
- Graduate Diploma of Engineering Science (Petroleum Engineering Open Learning)
- Graduate Certificate of Petroleum Engineering



## CUSTOMISED PROFESSIONAL DEVELOPMENT PROGRAMS

We are able to bring together the brightest minds in research and industry to create bespoke development programs to suit you.

## OUR ALUMNI



“The resources industry is a fantastic place for an engineer to put design into practice. You’re not in an office all day – you’re out in the field, seeing real-time issues and working to solve them.”

**Nicole**  
**Bachelor of Mining Engineering**  
**General Manager**  
**Business Development and Technical Services, Coal Assets Australia at Glencore**



“At UNSW, I developed my critical thinking skills. It provided my first real opportunities to learn how to work and achieve success with diverse teams. I met a huge variety of people who would go on to achieve astoundingly impressive feats that make the world a better place.”

**Sarah**  
**Bachelor of Engineering**  
**(Petroleum Engineering)**  
**Business Advisor Canada & USA,**  
**Woodside Energy (International) Canada Ltd**

# INDUSTRY PARTNERS

- Anglo American
- Baker Hughes
- BHP
- Centennial Coal
- Chevron
- Exxon Mobil
- Glencore
- Mitsubishi Development Corporation
- Peabody Energy
- Rio Tinto
- Santos
- Saudi Aramco
- Shell
- Sino Pec
- South 32
- Woodside

## INDUSTRY SPONSORED CHAIRS

These senior positions are held by our academics who have a strong research reputation in their area of expertise:

- **Kenneth Finlay Chair**  
in Rock Mechanics  
Professor Ismet Canbulat
- **Chair in Mining Engineering**  
Professor Bruce Hebblewhite

## GET IN TOUCH

### Industry Partnership & Collaborations Enquiries

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- ✉ [mere.admin@unsw.edu.au](mailto:mere.admin@unsw.edu.au)

### Future Student Enquiries

Ask a question [unsw.edu.au/ask](https://unsw.edu.au/ask)  
Call 1300 UNI NSW (1300 864 679)  
Visit [engineering.unsw.edu.au](https://engineering.unsw.edu.au)