

Mining and Energy

The minerals and energy sector represents the State's biggest export industry. Major international companies have established headquarters or significant offices in Perth and have invested heavily in science and research development. Research is undertaken through active collaboration between industry, universities and technical institutions, and Government, leading to the establishment of world-class research centres and underpinning Western Australia's reputation as a global hub for scientific and technological innovation.

Minerals

The **Australian Resources Research Centre**, established to enhance petroleum and mining exploration and extraction research and development, is a major initiative of the State Government, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Curtin University, and The University of Western Australia (UWA), developed in collaboration with the petroleum and mining industries.

The **National Resource Sciences Precinct** (NRSP), launched in April 2014, is a collaboration between CSIRO, Curtin University and UWA. The NRSP is a portal through which companies and government can readily connect with world-leading expertise and gain access to infrastructure to tackle some of the most complex challenges facing the resources industry. It has already attracted almost \$20 million in research funding for state-of-the-art



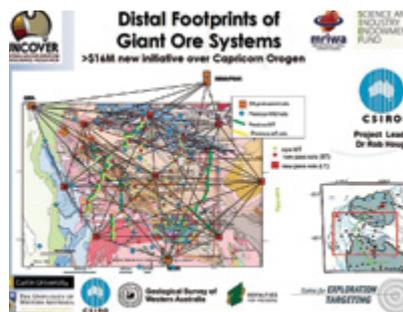
Credit: CSIRO

▲ Infrastructure and expertise at CSIRO is available to the resources industry, through the National Resource Science Precinct. This CSIRO researcher is working on ways to recover gold, by using non-toxic thiosulphate instead of cyanide.

minerals characterisation and distal footprint capability, supported by the Commonwealth Government's Science and Industry Endowment Fund.

One of the projects being progressed through the NRSP is the **Distal Footprint of Giant Ore Systems** project. This project is a collaboration between CSIRO, UWA, Curtin University, the Department of Mines and Petroleum's Geological Survey of Western Australia (GSWA) and the Australian Research Council Centre of Excellence for Core to Crust Fluid Systems. It is supported by the Commonwealth Government's Science and Industry Endowment Fund, the Minerals Research Institute of Western Australia and industry.

Credit: Minerals Research Institute of Western Australia



▲ The Distal Footprint of Giant Ore Systems project will identify signatures of deposits under covered terrain, inevitably increasing exploration success.

The Distal Footprints project will identify new methods of accurately predicting underground rock properties to help with mineral exploration. Australia is an old continent, with much of its remaining mineral endowment obscured by a thick cover of weathered rock, sediment and soil materials.

The project will help develop mineral exploration technologies and processes to identify the tell-tale 'footprints' or mineral signatures of deposits under covered terrain. This will increase exploration success and lower costs.

The **John de Laeter Centre for Isotope Research** is a collaboration between Curtin University, UWA, CSIRO and GSWA. It hosts over \$25 million in world-class analytical and mass spectrometry infrastructure in key facilities supporting research in geosciences, environmental science, forensic sciences, marine science, and nuclear science. The Centre has been identified as the world leader in zircon geochronology, research that now forms an integral part of the State's geoscience mapping programs.



Credit: John De Laeter Centre for Isotope Research

▲ World-class mass spectrometry instruments at the John De Laeter Centre provides unique quantitative data on the way the Earth works. The Centre was established under the Western Australian Government's Centre of Excellence Program in 1999.

The **Minerals Research Institute of Western Australia** (MRIWA) was established in 2013 as a statutory authority to focus on the research and development needed by the Western Australian minerals industry to ensure it remains an engine of economic growth for the State.

SNAPSHOTS OF SCIENCE IN WESTERN AUSTRALIA

MRIWA invests State Government funds through competitive grants that fall within five priority research themes: Find More Resources; Expand the Mining Envelope; Increase Recoverable Value; Improve Productivity; and Develop New Products and Markets.

Perth is also home to the technology divisions of major mining, energy and associated services companies, and numerous research and development initiatives such as the remote operations centres for BHP Billiton, Rio Tinto and Roy Hill. The world's first fully autonomous heavy-haul long distance rail system, Rio Tinto's AutoHaul rail system, had its first proper trial in Pilbara in late 2014. This follows the use of driverless trucks in Western Australia by major mining companies Rio Tinto, Fortescue Metals Group and BHP Billiton.



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▲ Rio Tinto's Autonomous Haulage Trucks are operated from a single Perth Operations Centre equipped with visualisation tools providing real-time information to optimise mining, activities.

Energy

The **Western Australian Energy Research Alliance**, established in 2003, is a key collaboration between research partners CSIRO, Curtin University and UWA, with key industry partners Woodside, Chevron and Shell. This renowned alliance is conducting research in the areas of gas technologies, geosciences and subsurface technologies and facilities and innovative technologies.

The **National Geosequestration Laboratory** (NGL) is a world-class facility that will advance carbon capture and storage technologies. The facility will operate as a 'hub and spoke' model and be centred at the Australian Resources Research Centre at Technology Park.

The first NGL research node will be built at UWA and house a geophysics and geochemistry research facility.

The NGL will undertake critical research and support Australia's first Carbon Capture and Storage (CCS) Flagship, the \$52 million **South West Hub** project. The South West Hub is an alliance between government and industry. Research into CO₂ storage is being funded by the Commonwealth Government and the State Government through the Department of Mines and Petroleum and the commercial aspects of CCS are being investigated by the South West Hub Joint Venture which is a collaboration of industry involving Alcoa Australia, Perdaman Chemicals and Fertilisers, Synergy, Premier Coal and Griffin Coal.

Credit: Australasian Joint Research Centre on Building Information Modelling, Curtin University



▲ Project Echo researchers are running real trials to help reduce the potential for cost and schedule overruns on liquefied natural gas construction projects.

Project Echo is a collaboration between Curtin University, Woodside and other partners with the aim of enhancing technology-enabled productivity in the liquefied natural gas industry. Research arising from Project Echo will also provide flow-on benefits to mining and infrastructure construction. Through Project Echo, Woodside have developed the world's first radio frequency identification tag for use in energy and mining. It was launched at the Woodside Karratha Gas Plant in 2014.

The State Government has provided \$10 million to support **Carnegie Wave Energy Limited** in the development and testing of wave energy technology that converts ocean swell into zero-emission renewable power and desalinated

freshwater. Carnegie has raised over \$80 million to fund the development of its technology and employs unique rapid prototyping utilising computational simulation, wave tank testing, scaled in-ocean testing at its private Wave Energy Research Facility and offshore test site at Garden Island.



Credit: Carnegie Wave Energy

▲ In 2015 Carnegie Wave Energy successfully installed the final step in the delivery of the Perth Wave Energy Project. The CETO 5 technology converts ocean wave energy into zero-emission electricity and desalinated water while remaining fully submerged beneath the ocean surface.

UWA's Engineering Zone (**EZONE UWA**) project will be its largest ever infrastructure investment that will consolidate its engineering teaching and research (covering remote operations, offshore oil and gas processing, whole of life asset management and biomedical engineering). EZONE UWA will create a collaborative environment that allows for world class teaching, learning and research spaces, bringing together students, teachers, researchers and industry to deliver outstanding graduates and innovative solutions in the field of engineering, computing and mathematics.

Major petroleum operators have established research and development centres in the State. These include **Chevron's Global Technology Centre**, established in 2007, and the **Woodside Innovation and Technology Hub** to be established in 2015.