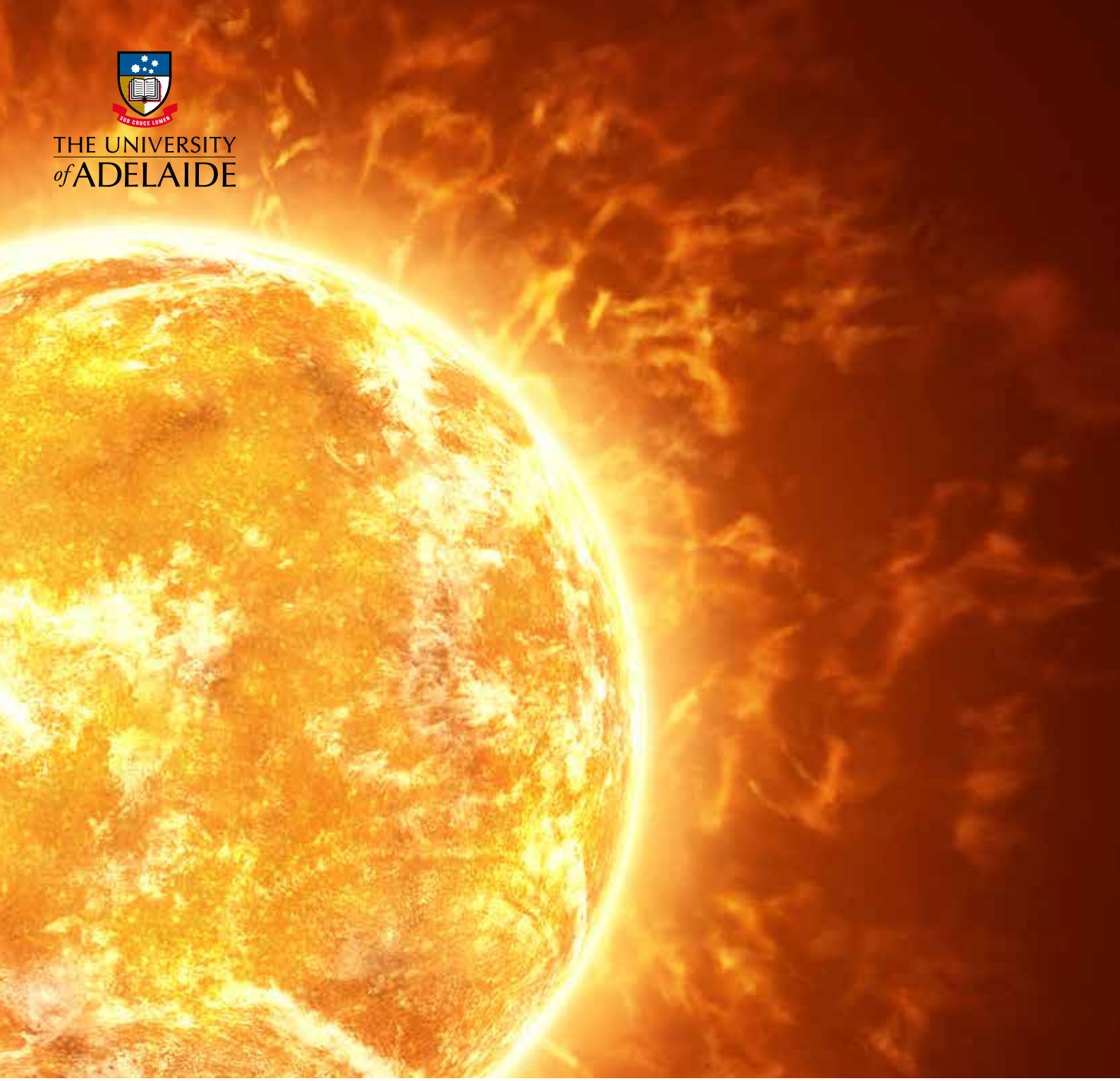


THE UNIVERSITY of ADELAIDE

Institute for Mineral and Energy Resources

Centre for Energy Technology

adelaide.edu.au

seek LIGHT

About us

The mission of the University of Adelaide's Centre for Energy Technology is to drive the development of innovative clean energy technology through world-leading, interdisciplinary research. This is undertaken collaboratively with leading research organizations, industry and government agencies at State, National and International levels.

The Centre harnesses research expertise from a team of over 150 academic staff, research staff and PhD students from across the disciplines of Engineering, Sciences, Business and Economics.

Strategic, coordinated and well-connected

We have worked hard over the past decade to build a model of collaborative engagement facing outwards to industry and Government. We coordinate and manage our research capability through strategic research programs under the guidance of an industry Advisory Board chaired by former Federal parliamentarian, Ms. Susan Jeanes, with leading industry specialists drawn from across the country.

Focused on real solutions

The CET targets innovative technologies with strong potential to lower the cost of CO_2 mitigation in the near- to mid-term in partnership with industry. We have a strong track record in this process, having developed twelve thermal energy technologies to commercial implementation. These include the Olympic torch and stadium flames for the Sydney, Athens and Rio Games and a low-NOx kiln burner.

New technologies currently under development include solar thermal-combustion hybrid receivers, solar thermal gasification technology, low drag heliostat arrays, high performance wind-turbine blades, improved frequency control in networks using energy storage and alternative fuels. A spin-off company, Muradel, has also been established to commercialise the University's intellectual property for micro-algae production for bioenergy.

Founding Director

Professor Nathan is an ARC Discovery Outstanding Researcher who specialises in thermal energy engineering in systems supplied by solar, geothermal and the combustion of fossil and bio-fuels, but also works with hydrogen, wind and wave power. His recent work has focussed on novel approaches to integrate and optimise these different energy sources. He has played a leading role in the development of six patented technologies. He was principal leader of the Chief Design Team for the award winning fuel and combustion system for the Sydney Olympic Relay Torch and was co-inventor of the patented combustor that was subsequently also used in the torch and Stadium flame for the Athens Games. He has also jointly led the development of low NOx "Gyrotherm" burner being commercialised by partner FCT Combustion in rotary cement kilns and in the development of a technology to enhance the capture of ultra-fine particles and mercury in partnership with Indigo Technologies.

Major research at a glance

Australian Solar Thermal Research Initiative (ASTRI)

This initiative brings together 97 researchers with 13 research partners around the world to transform Australia into a global leader in concentrated solar thermal and thermal storage technologies. With a total of $87 million in funding ($35 million from ARENA), ASTRI is developing solar thermal systems at scales suitable for stretched Australian networks (~50MW) and novel solar fuels programs, led by the CET. More info: www.astri.org.au

Australian energy storage knowledge bank

Industry partners including SA Power Networks have partnered with CET and three other research partners to build a mobile energy storage test facility and develop an online energy storage knowledge sharing platform. The $3.3 million project (including $1.4 million ARENTA funding) will be delivered over two years.

Power grids and markets

The South Australian electricity market is at the forefront of renewable energy penetration and the University is working in partnership with industry to deliver programs in power quality, grid stability and network control. The University's Power System Dynamics Group (PSDG) consults to the power industry in modelling plant and control systems, analysis of the transmission network, system design, and integration of renewables into the network. They have developed software known as 'Mudpack' for analysing performance and optimal grid design used by all network service providers in Australia, and also software to assist in determining secure transfer limits on the interconnector between South Australia and Victoria. Such tools are an essential component of a low-cost, low-carbon future.

Solar thermal for mineral processing project

The CET is leading this project, which is targeting the development of novel approaches to introduce up to 50% renewable solar thermal energy into the Bayer alumina process to reduce emissions and lower the cost of alumina production. Industry partners include Alcoa of Australia and Hatch while three other research partners are working together in this $15 million project ($4.5 million from ARENA) to be delivered over four years.

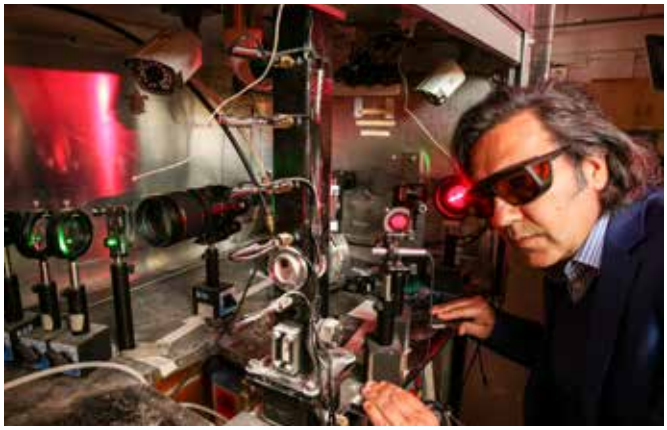
Biomass waste to energy

CET is targeting the utilisation of biomass residues, both raw and torrefied, after more than 20 years developing novel biomass to energy technologies. We are developing technologies for the clean combustion, gasification and solar gasification of biomass including forestry, agriculture and horticulture residues with a special focus on their conversion to alternative fuels.

Alternative liquid transportation fuels

CET is developing new technologies to replace the long-term need for low-carbon liquid fuels for air transportation, heavy freight and agriculture. It is partnering with Muradel - a spinout from the University of Adelaide, Murdoch University and SQC - to develop commercial-scale hydrothermal liquefaction of sustainable wet feedstock including biosolids and algae to produce biocrude-oil. Tests are being performed both in our laboratories and at Muradel's pilot-scale facility in Whyalla, South Australia. This work complements the ASTRI program, in which we are targeting low-carbon Fisher-Tropsch liquids produced by the solar gasification of dry solids including forestry waste and the residues from agriculture and bio-refineries.

ASTRI Solar Tower (photo courtesy of CSIRO)



Associate Professor Zeyad Alwahabi

CO2 to fuels using solar energy

We are making solar fuel through using new chemical catalysts and solar energy to turn CO_2 and H_2O to hydrocarbons. Developed in collaboration with Flinders University, the University of Canterbury and Victoria University of Wellington with the support of the SA Government and our own strategic funding, we have progressed this exciting technology for over three years.

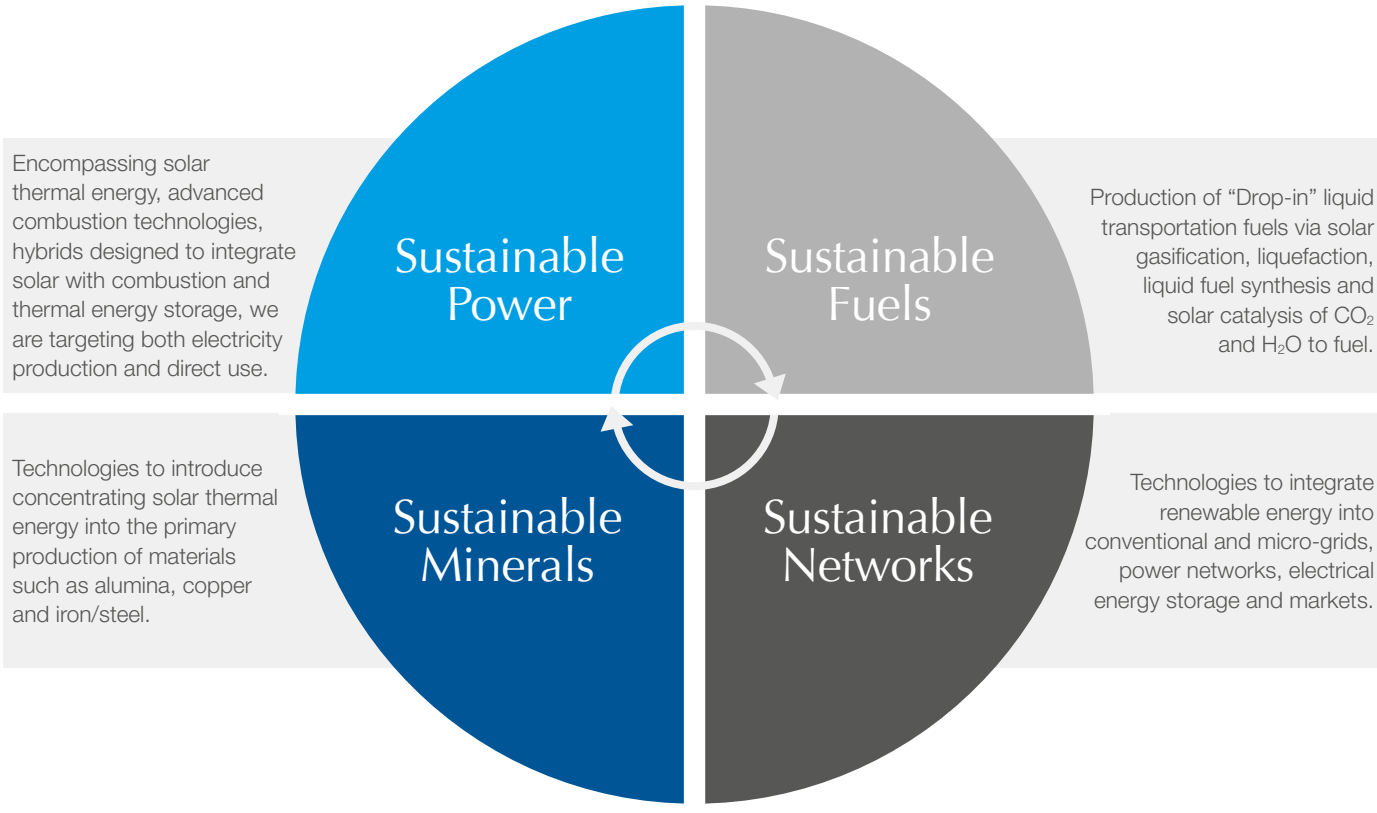
Low carbon materials (O2, H2, NH3, water)

We are developing novel technologies to produce industrial materials such as oxygen, nitrogen, hydrogen, ammonia, power and water using low carbon alternative methods. With these technologies we aim to increase the viability of resource recovery and value addition to commodities that are presently wasted.

World first Solar Thermal Simulator supplying 30,000 suns

The CET's laser diagnostics group led by Associate Professor Alwahabi, has built the world's first Solid-State Solar Thermal Simulator. This simulator delivers 30,000 suns by a flexible fibre optical cable, which provides flexible operation and ease of alignment to the target that avoids the complex task of co-aligning multiple large ellipsoidal reflectors to the same point, as is required for the conventional electric-arc solar simulators. It also provides a more precise radiation source to allow accurate ray-tracing and, in turn, better validation of models. With this system, we can now heat a cloud of micron-size-particles and directly measure the temperature of each. The unique characteristics of the simulator, namely the uniformity, high power and flux, efficiency, ease of delivery and precise control of the radiation flux, will lead to new knowledge in fields such as minerals processing and gasification.

Key research areas



Case study: the hybrid solar receiver combustor

Patented hybrid energy system

The world's transition away from fossil fuels to renewable energy sources is well under way. But changing to renewables, especially in industrial and electricity generation systems, doesn't happen in one sudden leap.

At the CET, we understand the need for transitional change, and that's why we have targeted the development of novel hybrid systems, such as the hybrid solar receiver-combustor (HSRC).

This patented system (a solar receiver and a combustor are integrated into a single device) offers efficient, cost effective and modular cavity receivers integrating concentrated solar thermal (CST) and natural gas combustion in a design that allows the system to operate in three modes: solar-only, combustion-only (in absence of solar energy, with natural gas or renewable fuel as the energy source) and a mixed-mode (a combination of both solar and combustion, to manage the variability of the solar resource).

Once developed, the HSRC should be suited to both industrial process heat and electricity generation systems. Because the gaseous fuel is always available, the users can manage both short and long term variability of the renewable energy source in a single unit to reduce losses and supplement the thermal energy storage.

Laboratories and facilities

The CET has established advanced technical research infrastructure worth over $12 million to support the development of clean energy technologies.
Key facilities include:

- World leading laser diagnostic systems for investigating reacting and multi-phase flows;
- Micro-algae cultivation and processing facilities for biofuels;
- Australia's second largest wind tunnel;
- The South Australian Coal Research Laboratory;
- A solar simulator laboratory;
- An energy storage testing facility, and
- A small scale technology testing laboratory

Muradel Algae Pond, Whyalla

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