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## Bringing home the future energy vision

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**A research view out to 2050 has the partnerships of the Energy Transformed Flagship delivering targeted innovations that evolve us towards greener and smarter living.**



Credit: CSIRO

The Australian of the not-too-distant future could be living in a house with an energy system programmed to make the most efficient use of its all-green energy. The house could be heated and cooled by solar energy, with even the windows acting as solar cells.

In the wardrobe might hang ordinary-looking clothes fitted with [Flexible Integrated Energy Devices](#) that generate power from vibrations as the wearer moves, driving small electronic devices such as mp3 players.

In the garage, the [hybrid-electric car](#) powered by an [UltraBattery<sup>1</sup>](#) could be charging, or feeding energy back into the household system.

Outside in the streets and up in the skies, cars and planes could be powered by biofuels produced from algae, from plant waste using termite enzymes, or by [SolarGas<sup>2</sup>](#). At home, in the office, on the community level and at the power stations, [sophisticated grids](#) could optimise energy use.

All these innovations use renewable energy, reduce greenhouse gas emissions, and are products in the pipeline of CSIRO's [Energy Transformed Flagship](#).

‘The solution we require to transition to a prosperous, clean and energy secure future is actually multi-pronged,’ says Flagship Director, Dr Alex Wonhas. ‘We probably need all of these different elements in place to achieve that in the most cost-effective way.’

The Flagship has a \$40 million budget and 140 researchers. In partnership with dozens of Australian companies, it is working to shift national energy use from a high dependence on fossil fuels to smarter, more efficient, greener systems. Dr Wonhas says the Flagship is focusing on projects in areas that will have the greatest benefit for the nation.

According to Dr Wonhas, CSIRO research will also underpin new businesses and new industries.

‘There is a range of different exports we can consider,’ he says. ‘There is the export of technology. In maybe a 10 to 20 year time horizon we might even be exporting renewable energy. We have plenty of it.’

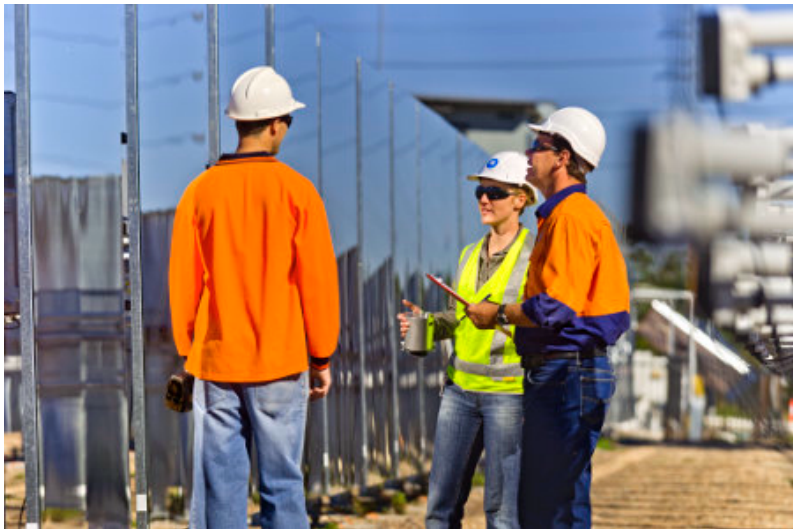
Moving to a cleaner energy future is a pressing task. Australia's per capita greenhouse gas emissions are the highest in the developed world: around 27 tonnes of carbon dioxide equivalent per person, which is more than four times the world average.<sup>3</sup> In the year to March 2011, Australia produced 542 million tonnes of greenhouse gases,<sup>4</sup> of which electricity and transport together account for 69 per cent.

That's why [Sustainable Energy Association of Australia](#) CEO, Professor Ray Wills, argues – like other experts – that Australia must transform its energy use.

‘The International Energy Agency has now acknowledged that we have passed peak oil from conventional sources in 2006,’ says Prof. Wills. ‘Even if we can continue to source liquid hydrocarbon fuels, they will be more expensive. Australia imports around \$27 billion worth of oil and oil products a year. That will only go up, because our own oil production is going down.’

The Energy Transformed Flagship has three research areas: identifying pathways to reduce Australia's carbon footprint, renewable energy for electricity and transport, and increased energy efficiency.

‘We have a goal,’ says Dr Wonhas. ‘We would like to see 20 million tonnes of carbon abated by 2030 from the technologies we develop, and 50 million tonnes by 2050.’



Credit: CSIRO

Prof. Wills thinks that through CSIRO's research and partnerships, Australia will have a vital role in transitioning energy sources and industries. He says Australia must have the capacity to respond to the change in energy markets that is coming, and would like to see a much larger investment in the Flagship.

‘We need knowledge, we need skills, we need capacity in our work force, we need an opportunity for professional services to respond and be a part of that market,’ he says.

Flagship projects now range from the \$66.5 million SolarGrid Australia project associated with the proposed [Moree Solar Farm](#) – the biggest planned photovoltaic solar power plant in the world<sup>5</sup> – to personal energy transformation.

The [Energymark program](#), for example, helps people reduce their carbon footprint, lower their energy use and save on power bills. Participants meet in community-based discussion groups, working through information provided by CSIRO.

Mr Tony Gleeson, from Broadwater on the north coast of NSW, has been an Energymark convenor. He became involved because ‘it is much healthier to be part of the solution than worrying about the problem’. While he has made his own improvement as result of his involvement, what he really loves is ‘the interactions between the people and watching their awareness grow. It is definitely worthwhile and I can't sing its praises loudly enough.’

A big driver of the increased demand for electricity is the growing number of air conditioners, with electricity usage now nearly doubling on the hottest days.

Dr Stephen White leads CSIRO's [solar cooling research](#), which is developing technology that ingeniously uses heat from the sun to power air conditioners.

Dr White says the team have been capturing heat from solar thermal energy, and converting the heat to cooling using several methods. The team has been focusing on developing new desiccants, which are materials that take moisture out of air. The dry air then goes through an evaporative cooling process.

His team is currently installing 80 kilowatts of solar cooling for the commercial kitchens at the Newcastle campus of TAFE New South Wales. 'We have 400 square metres of solar collectors on the roof; it is a big installation,' explains Dr White. 'We are just starting to build the desiccant air conditioning system to go into the plant room,'

CSIRO, with funding from the Asia Pacific Partnership program on Clean Development and Climate<sup>6</sup>, has also built a prototype solar air conditioner that is suitable for residential home installation.

'We have got it to a point now where we think we have something that is commercially pretty interesting,' says Dr White. 'It is reducing greenhouse gas emissions, which addresses the climate change problem, and at the same time it is also addressing some of our electricity networks issues. It kills two birds with one stone.'

Dr Wonhas thinks life in a more sustainable Australia of the future will still look a lot like it does today. But, our day-to-day companion will be technology – produced by CSIRO and other researchers – that will help us live more sustainably.

'The air conditioner might be controlled by CSIRO technology,' says Dr Wonhas. 'The power out of the power point might come from an electricity grid or renewable power station based on CSIRO technology. The fuel in your car or the battery in your hybrid vehicle might be from a piece of technology that we have developed.'

'It [will be] a lot of little things that will ultimately help you live your life the way you want to live it, with a smaller carbon foot print, but also with an enhanced security of energy supply.'

## More sustainable power, cooling, transport and fuel

CSIRO runs several other focus projects under the Energy Transformed Flagship.

1. The [Virtual Power Station](#) aggregates energy generated from many solar and wind generators into a single power supply, improving the cost effectiveness and reliability of renewable energy generation.
2. [Dye-sensitised solar cells](#), which convert energy from sunlight and act as electrical conductors, can be incorporated into windows and on buildings.
3. Australia's largest solar thermal research facility is also the first of its kind in this country. Based at the CSIRO [National Solar Energy Centre](#) in Newcastle, New South Wales, the large-scale demonstration site will be an international hub for researching and commercialising concentrated solar energy technologies. It boasts two solar thermal towers that are currently being used to research solar fuels, solar air turbines, solar energy storage and solar steam.
4. [OptiCool](#) technology for balancing thermal comfort, running costs and greenhouse gas emissions associated with commercial air conditioning systems has been licensed to BuildingIQ.
5. The [Electric Driveway Project](#) aims to integrate electric

vehicles into household power systems.

6. Second and third generation [biofuel research](#) is focusing on plant waste. Biodiesel from algae is looking particularly promising.
7. The '[Flightpath to Sustainable Aviation](#)' report states a new jet biofuel could be produced in Australia that would reduce our reliance on imported fuel by \$2 billion a year and reduce the aviation sector's greenhouse gas emissions by 17 per cent.
8. The [CSIRO Home Energy Saving Handbook](#) contains advice on how to halve household carbon emissions.



The [Electric Driveway Project](#) is discovering how to best integrate electric vehicles into households and the electricity grid. CSIRO

1 The Ultrabattery is an efficient, low-emission power source for hybrid electric vehicles that could also feed into the grid.

2 SolarGas™ combines solar energy with natural gas to yield an energy-enhanced storage gas. Used for power generation or for transport, SolarGas gives extra energy performance.

3 See [www.climatechange.gov.au/government/international/global-action-facts-and-fiction/australia-problem-solution.aspx](http://www.climatechange.gov.au/government/international/global-action-facts-and-fiction/australia-problem-solution.aspx)

4 See [www.climatechange.gov.au/en/climate-change/emissions.aspx](http://www.climatechange.gov.au/en/climate-change/emissions.aspx)

5 The Moree solar farm will have 650 000 photovoltaic panels, produce enough power for 45 000 households, and save 400 000 tonnes of carbon dioxide annually.

6 See <http://www.asiapacificpartnership.org/english/Default.aspx>

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