Focus

The sun rises slowly for Australian solar

When scientists from the University of New South Wales' solar photovoltaic group fabricated their first solar cell in 1975, Australia was a world leader in the solar energy industry. More recently, a lack of political support for solar technology has seen some of those pioneering researchers leave Australia to take up opportunities overseas, and Australian solar companies become foreign-owned. Can we catch up to the rest of the world again? asks **Robin Taylor**.

Energetic founder and chairman of solar thermal startup company Ausra, Dr David Mills, says Australia still has a long way to go when it comes to supporting solar technology. After working as a solar energy researcher in Australia for more than 30 years, Dr Mills left last year for the US where he says there is greater support for his solar technology.

However, he highlights that the landscape in Australia has changed tremendously since he left, with federal and state governments now all expressing interest in solar technology.

'It has turned around in the sense that there is a lot of interest in solar, but it hasn't yet got the truly massive investments that are going on with projects overseas,' Dr Mills says. 'There are projects for solar plants of between 600 and 800 megawatts going on in California at the moment, which is much larger than anything in Australia.'

Dr Mills believes the government could do a number of things to help the emerging industry, such as offering loan guarantees and allocating low-cost land for solar plants.

And despite what doubters of the solar energy industry would have us believe, Dr Mills, like other industry experts, says there is no reason why solar power could not supply baseload[1] power. But, he says, this is not how the industry should operate.

'Initially we would want to supply peaking power where the most income is, using storage systems. After that, we would like to supply the whole grid system, but that is not baseload. Baseload is 24-hours-a-day where you have the same value night and day.'

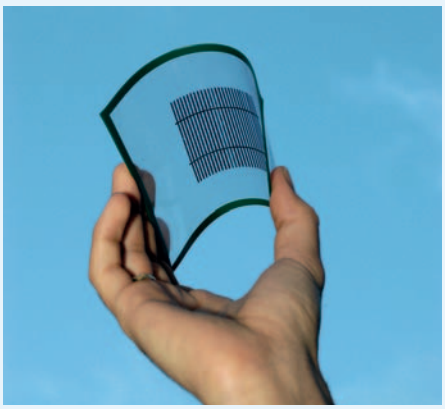
With so much sun, large areas of desert and vast energy resources, Dr Mills says Australia should be able to build up a new export economy around renewable resources with a bit of innovative thinking.

He has suggested building powerlines into Indonesia and South-East Asia from northern Australia, and also exploring opportunities for the mining and manufacturing industries to use clean power.

'We have natural advantages there but we are not really focusing on them very well. I think the government is only just realising that solar is an option on a very large scale,' says Dr Mills, who was in Australia recently for discussions with mining companies about using solar power to replace expensive diesel fuel.

The laboratory headed by Dr Mills at the University of Sydney developed and licensed evacuated-tube solar water heater technology, which comprises 60 per cent of the world's solar collectors and is now used widely throughout China for distribution of low-cost domestic hot water.

Throughout the 1980s and 1990s, Australian researchers continued to lead the world in solar thermal technology[2] and photovoltaics[3]. But lack of support from the previous federal government and large investments by other countries in their solar energy industries have seen Australia lose that lead.



Sliver cell technology creates thin flexible single crystalline solar cells that are more efficient and cost less than conventional cells, using far less silicon. Centre for Solar Energy Systems

1 Baseload is the minimum amount of power that a utility or distribution company must make available to its customers, or the amount of power required to meet minimum demands based on reasonable expectations of customer requirements.
2 Solar thermal technology harnesses solar energy for heat and power. Low-temperature solar thermal collectors are flat plates generally used to heat swimming pools. Medium-temperature collectors, usually flat plates, are used for creating hot water for residential and commercial use. High-temperature collectors concentrate sunlight using larger mirrors or lenses and are used for large-scale electric power production.
3 Solar photovoltaic technology converts solar energy directly into electricity using layered silicon film.

Dr David Mills took his leading solar technology to greener pastures overseas. Ausra

Co-founder of US-based Ausra, Peter le Lievre, now heads a new startup company, Chromasun, also based in the US, with a small presence in Australia. The company is commercialising technology developed by the Australian National University (ANU).

Mr le Lievre says it's important to consider the different sectors of the solar energy industry separately.

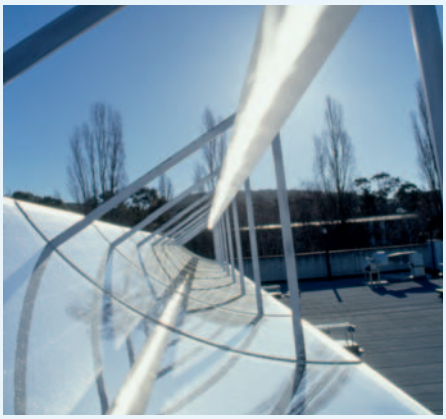
'Solar thermal is by far and away the world's largest solar industry. Ausra is one of the flagship companies and there are a couple of others gaining traction in Australia. We are competing well with Europeans and also with the US companies.'

In the area of photovoltaics, Australia was a world leader in the 1970s, '80s and '90s but fell behind, says le Lievre, due to the sheer amount of money invested in this technology by other countries.

'When you look at the way subsidies are flowing into photovoltaics, the Australian subsidies and market conditions are nothing compared to what is being offered in countries like Spain, Germany, Japan and Korea,' he says.

'We have seen a leakage or a decline in our pre-eminent position because of the weakness of market conditions in Australia.'

But, like Dr Mills, he believes the situation is changing, as much due to changes in the global economy – particularly the rising price of fossil fuels and natural gas – as to increased support from the new federal government.



ANU researchers are working with Chromasun to develop a rooftop hybrid microconcentrator as a renewable energy source for solar electricity, space heating, water and air-conditioning. Centre for Solar Energy Systems

Ausra went to set up in the US like a number of our solar pioneers. There, the investment funding has come steadily. Ausra

Mr le Lievre believes we will inevitably see nations adopt a portfolio of energy solutions as the most expensive forms of fossil fuel generation become less economic and the cost of renewable energy falls.

'Already we've seen most outback diesel power generation [markets] being penetrated by various types of renewable technologies. In the US we are seeing gas being replaced by solar generation.

'When we consider a portfolio approach of biomass, wind, hydro and solar all working together they do have potential to make large contributions to our energy needs.'

Another former Australian researcher-turned-offshore-solar entrepreneur, Dr Zhengrong Shi, believes we should be exploiting renewable energy and saving coal and gas resources for the future.

'Our coal and gas will become more valuable with time so why sell it off so quickly?' he says.

Dr Shi says although Australia has lost its world lead in developing a solar energy industry, it is not too late to catch up if we

Focus

think long term and in more creative ways. Dr Shi's company, Suntech, manufactures electricity producing solar cells in the city of Wuxi, near Shanghai.

The high cost of silicon wafers is a key limitation on the widespread use of photovoltaic solar cells. Dr Shi was part of a team in the Centre of Excellence for Photovoltaic Engineering at the University of New South Wales that pioneered a second generation of cells in which very thin silicon films are deposited on a glass plate, significantly reducing the cost. Thin-film technology uses 100 times less silicon than conventional cells.

In 1995 Pacific Solar, a cooperative venture between the university and Pacific Power, was established to commercialise the thin-film technology. Dr Shi became deputy director for research and helped develop the technology for the next six years.

A German company, CSG Solar, took over Pacific Solar in 2004, giving it worldwide rights to commercialise the thin-film technology.

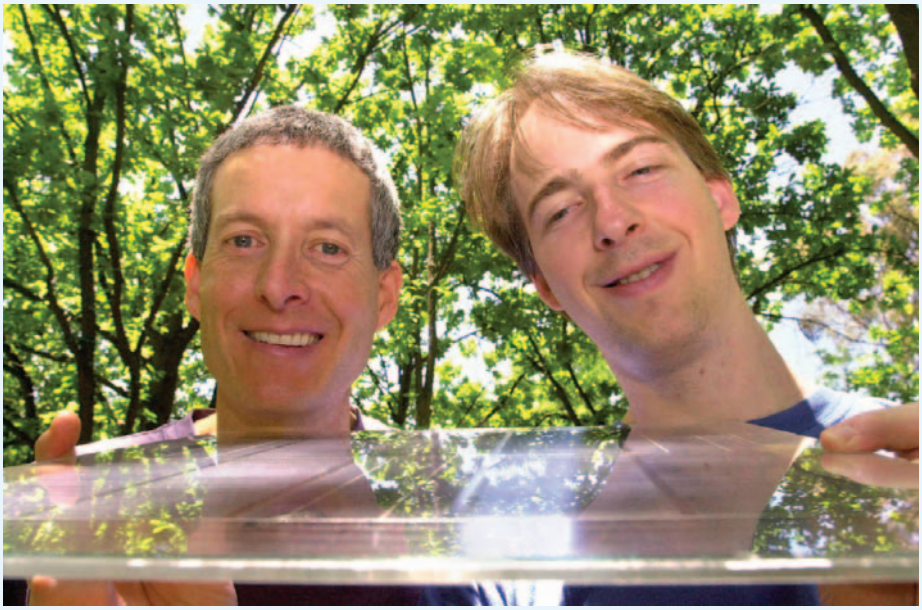
Since then, Dr Shi's company, Suntech, has become one of the world's top 10 solar cell manufacturers. About 80 per cent of its sales are to Germany, where the government has made a long-term commitment to promoting the introduction of photovoltaics and other renewable energies.

Dr Shi says although current Australian demand for solar power accounts for less than one per cent of the total world market, there are many positive indications for the future of the industry in Australia. He agrees with other industry experts that with growing interest and public support for renewable energy solutions, the industry has the potential to grow extremely rapidly.

'European countries are really leading the way and Germany, Spain, Italy and France in particular all have substantive policies that are generating a hive of activity in solar. With similar policies, Australia could encourage the development of many solar companies all along the solar value chain,' he says.

Dr Shi believes that the rapid advances that have taken place in the industry over the past five years can make the cost of solar-powered electricity comparable to coal-fired power within the next three to five years.

'The second area that requires further investment is electricity storage. If solar energy can be stored, transported and easily accessed then this will facilitate solar becoming a base load energy provider. This is our long term goal and we are confident that we will be able to achieve it.'



Inventors of the sliver cell Professor Andrew Blakers (left) and Dr Klaus Weber from the ARC Centre for Solar Energy Systems at the ANU. Centre for Solar Energy Systems

Director of the ARC Centre for Solar Energy Systems at the Australian National University (ANU), Professor Andrew Blakers, is looking forward to being part of the government's promised Australian Solar Institute, which will involve the ANU, the University of NSW and CSIRO.

He believes Australia's solar industry is languishing compared to the rest of the world because of the policies of the previous government.

Professor Blakers believes the change to the means test for a rebate on solar installation in the last Federal Budget caused a reduction in the market and also a loss of confidence.

'I think everyone would rather a lower level of support that is locked in than high levels of support interspersed with no support,' he says.

However, he would prefer to see the rebate replaced altogether with a feed-in tariff as the best way to achieve large-scale connection of renewables into the grid. A feed-in tariff works by offering above market rates for electricity from renewable energy sources that is fed back into the grid.

'You get a rebate when you have solar panels installed, whether they are good or bad, whereas you only get the benefit of a feed-in tariff if you produce the electricity, so it ensures good systems are installed,' Professor Blakers explains.

Professor Blakers and his team are working on a large project with Origin Energy to develop sliver solar cells with much less silicon than current technologies. Origin Energy has invested about $60 million into the project to build a pilot plant in Adelaide, where they have recently started small-scale production.

The ANU centre is also working with Chromasun on developing a rooftop hybrid microconcentrator that will produce solar electricity, space heating, water and air conditioning, thus reducing domestic greenhouse gas emissions. They hope to start early stage commercial production in the next 12 months.

While he is relatively optimistic about the future of solar energy globally, Professor Blakers says he is less optimistic that Australia will take a leadership position and contribute significantly to the technology. However, he believes that, with the right encouragement, it would be easy for Australia to have a 100 per cent renewable energy supply.

'If the new government decides we are going to go renewable quickly, it would be quite easy for us to do so. We have so many options – excellent wind, excellent solar, geothermal and biomass.

'It's a matter of deciding we are going to go to 100 per cent renewables by 2040 and let's figure out the best ways to do that. It would be remarkably easy and cheap compared to what vested interests would have you believe.'