



## Growth industry profile: addressing climate change



Liddell solar farm (image courtesy of Ausra)

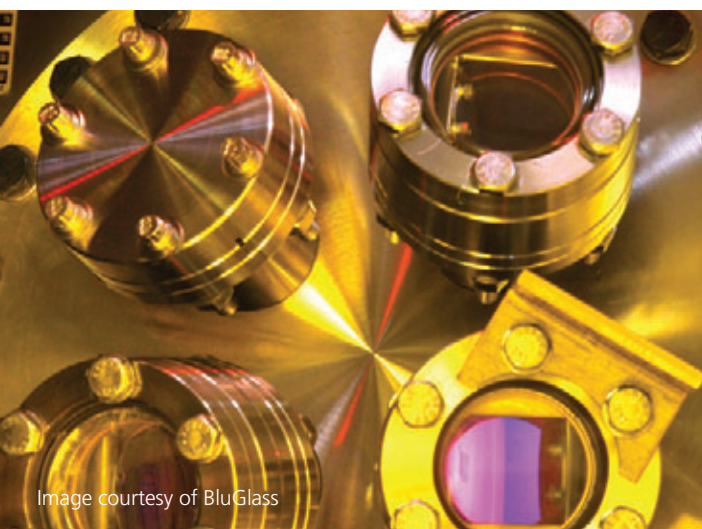


Image courtesy of BluGlass

The transition to a low-carbon economy will create opportunities for NSW companies.

Actions by governments to address climate change will bring both challenges and opportunities to the business sector. Government initiatives have the potential to create new markets and expand existing demand in energy-related industries. While the effects of these policies will reach into many areas of the NSW economy, this profile covers four key sectors:

- **Zero or low emissions energy generation:** Solar, wind, wave/tidal, clean coal, biomass, biofuels, geothermal
- **Energy efficiency technologies:** Building materials, lighting, heating and cooling, 'green collar' building services
- **Business services:** Carbon auditing, advisory, legal, risk management
- **Carbon trading:** Carbon registry, carbon market

### NSW Government action

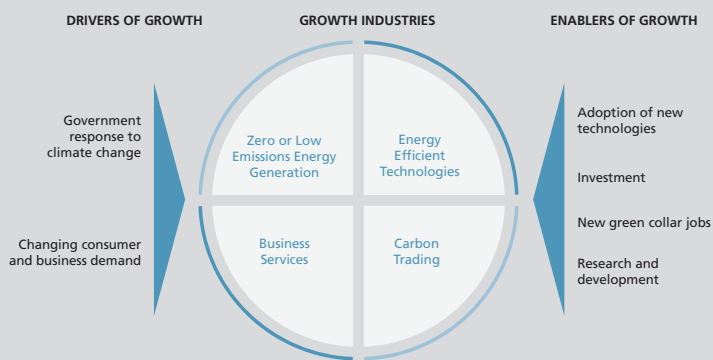
- In June 2005 the NSW Government became the first Australian jurisdiction to commit to long term carbon reduction targets. The NSW Government has set a target of a return to year 2000 greenhouse gas emission levels by 2025 and a 60 per cent cut in greenhouse emissions by 2050.
- Under the State Plan, the NSW Government has set a target of achieving 15 per cent of energy consumption from renewable sources by 2020.
- NSW led Australia in the introduction of a mandate requiring ethanol-blended petrol to be widely available. Since 1 October 2007, petrol companies have had to ensure that two per cent of the total volume of petrol sold in NSW is ethanol.

### Australian Government action

- The Australian Government's proposed emissions trading scheme, the *Carbon Pollution Reduction Scheme*, is expected to be the most significant economic structural reform since the 1980s.
- The Australian Government has proposed an increase to the existing Mandatory Renewable Energy Target (MRET) to ensure that 20 per cent of Australia's electricity supply comes from renewable energy sources by 2020.



## Settings



### Without action to address climate change, NSW will become increasingly warmer and drier

- The CSIRO and the Bureau of Meteorology estimate that without action to limit carbon emissions NSW can expect a warming of between 0.2 to 2.1°C over the next three decades and a tendency for decreasing annual average rainfall, particularly in spring and in south-western NSW.

### Electricity markets are changing

- The Australian Government's Low Pollution Future report forecasts residential electricity prices to increase by 17 to 24 per cent in 2010 as a result of the introduction of the Carbon Pollution Reduction Scheme.
- By June 2008 there were 221,000 residential and business GreenPower customers in NSW, with 53,000 new customers acquired over the previous 12 months.

### Investment in the clean technology sector is growing rapidly

- The market capitalisation of the 73 stocks in the Australian CleanTech Index exceeds A\$14 billion. Of these 73 listed companies, 40 per cent are NSW based.
- Between 1999 and the first quarter of 2007, 77 'cleantech' venture capital deals were secured by NSW companies, with a total value of over A\$200 billion. This was 44 per cent of the national total.

### Firms will need to adopt both Australian and overseas technologies

- In order to respond to the challenges presented by a low-carbon economy, firms will need to absorb new innovations created by the growing Australian and overseas clean technology and low emissions industries.
- According to the Cutler Review of the National Innovation System, most new knowledge is generated from outside of Australia and the majority of all Australian firm innovation is made up by the uptake, adoption and adaptation of overseas technologies and services.

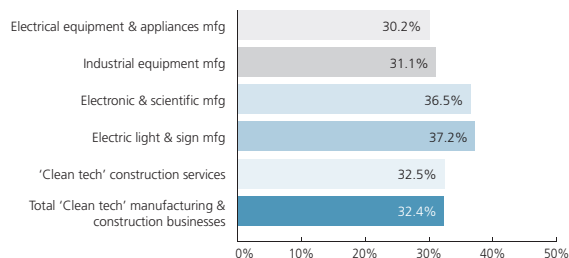
### The transition to a low-carbon economy will require new skills

- According to the CSIRO, demand will increase for the design and construction of energy and water-efficient buildings and infrastructure, renovations and refits, and the installation and maintenance of efficient appliances and machinery. Restructuring of the energy system to decentralised and renewable systems will require more know-how and skills than are currently available.
- The NSW Green Skills Strategy has identified priority industries that have strategic importance to greenhouse gas abatement and is improving the capacity of the vocational education and training sector to provide the required skills. Key industries will be manufacturing, electricity and gas, and construction.

*"The advantages of having BluGlass located in NSW is its proximity to leading Australian universities, critical in providing the skills, support and expertise in bringing this unique technology to market."* GILES BOURNE, CEO, BLUGLASS LIMITED

## Energy efficiency technologies

### NSW share of businesses in possible 'clean tech' industries



Source: ABS, Count of Australian Businesses, 8165.0, June 2007

Improvements in lighting, commercial air handling, air conditioning and residential water-heating systems offer significant potential to reduce carbon emissions. Research by McKinsey & Company shows that these sources could deliver a 60 megatonne reduction in Australian emissions.

NSW is well placed to take advantage of the demand for energy efficiency technologies. The State has 32 per cent of the nation's manufacturing businesses in the areas of light manufacturing, electronic equipment, and heating, ventilation and air-conditioning equipment (HVAC).

NSW firms operating in these industries include *BluGlass Ltd* and *Ilum-a-Lite* (lighting); *Air Change* and *Wireless Monitors Australia* (HVAC); *CAP-XX*, *Lloyd Energy Systems* and CSIRO spin-off *Smart Storage* (energy storage).

Macquarie University spin-off **BluGlass Ltd** is commercialising an Australian-bred manufacturing technology known as Remote Plasma Chemical Vapour Deposition (RPCVD) to reduce the cost of Gallium Nitride (GaN) semiconductor wafers. GaN wafers are a core component of high brightness light-emitting diodes (LEDs).

LEDs are expected to slash carbon emissions and greenhouse gas emissions from electricity generation because they are 4–5 times more energy efficient than incandescent bulbs and last up to 50 times longer. Applications for LEDs include mobile appliances, signs/displays, automotive, signals and illumination.

**Air Change Pty Ltd** produces a patented heat exchanger that has no moving parts and does not wear out or rust, as well as a range of heating, ventilation and air conditioning units incorporating the heat exchanger.

This technology is capable of producing significant energy savings. When combined with other innovations and technologies such as heat reclaim, direct coupled fans and motors with variable speed drives and sandwich panel cabinets for superior insulation, these energy savings can be as high as 75 per cent, compared to more conventional systems.

*“The company is based in NSW because of access to a highly skilled workforce and the Sydney offices of global suppliers, the convenience of time zones in Asia plus the stable political and economic environment and the great lifestyle.”* ROBERT DANE, CEO SOLAR SAILOR HOLDINGS LTD



## Zero or low emissions energy generation

NSW has a dynamic, emerging industry in low emissions energy generation, across a number of energy sources.

**Solar thermal and photovoltaics:** NSW has the top three solar installations in the country. The *Photovoltaic Centre of Excellence* is based at the University of New South Wales and is a leading research centre in this field. At the Liddell Power Station in the Hunter Valley, *Macquarie Generation* and *Ausra* have combined to develop Australia's first project to integrate solar thermal into a coal-fired power station. The NSW Government is helping develop the next generation of solar arrays at Liddell.

**Ausra Pty Ltd** develops solar thermal electric power stations that provide large-scale low-cost, reliable, renewable energy. The company also owns a 100 passenger commercial ferry on Sydney Harbour which uses the technology. It is now being refined and built at large scale around the world.

Ausra's zero-carbon power plants generate electricity at current market prices for fossil-fired power without the emissions caused by burning fuels. Solar concentrators boil water with focused sunlight, generating high-pressure steam that drives conventional turbine generators. Low-cost thermal energy storage systems now under development by Ausra will allow solar electric power to be generated on demand, day and night.

**Solar Sailor Holdings Ltd** has developed and owns multiple patents for 'solarsail' and hybrid power technology for applications varying from small unmanned vessels, to ferries, superyachts, cruisers and tankers. The company also owns a 100 passenger commercial ferry on Sydney Harbour which uses the technology.

The company has its first contracts for hybrid solar ferries in Asia and is developing the technology for use on tanker ships. The company's USA minority owned subsidiary UOV LLC in Virginia has a contract with the US Navy for the development of unmanned ocean vehicles. Solar Sailor won the 2001 Australian Engineering Design of the Year.

**Tidal and wave energy:** NSW companies, such as *Oceanlinx* and *BioPower Systems*, are developing innovative tidal and wave energy generation technologies for deployment in Australia and worldwide.

**Geothermal energy:** The NSW Government is assisting *Geodynamics* to develop a commercial hot rock geothermal project, to be located in the Hunter Valley.

**Clean coal technology:** Clean coal research is a priority in the NSW Government's Statement on Innovation which includes resources, especially coal, as one of five target sectors that will make a significant contribution to growth in the State's economy.

Approximately 90 per cent of NSW's electricity is generated from coal-fired power stations and the State provides 13 per cent of global coal exports.

The NSW Clean Coal Council was established in April 2008 to support the development and acceleration of low-emission technologies in NSW. The Council administers the NSW Clean Coal Fund, to which the State Government has committed \$100 million in new funding.

As home to the world's largest coal exporting port, the Hunter region will benefit from the emergence of clean coal technologies. The CSIRO's *Energy Technology Centre*, located in Newcastle, is developing these technologies to dramatically reduce greenhouse gas emissions in combination with techniques to clean carbon from emissions and store it safely.

Two clean coal technology pilot plants are being developed in the region – by *UCC Energy* in the Hunter Valley, and a joint initiative between *Delta Electricity* and the *CSIRO* on the Central Coast.

**Wind:** Background wind speeds in NSW are comparable to northern Europe, where a large portion of international wind generation is currently installed. NSW has an estimated potential for over 1,000 megawatts of wind energy with 17 megawatts of capacity currently installed.

The NSW Government has signed Australia's biggest accredited renewable energy contract for the supply of energy to the desalination plant at Kurnell. The Capital Wind Farm is expected to have an installed capacity of 132 megawatts, with long-term energy production of over 400 gigawatt hours per annum.

**Biofuels and biomass energy:** According to McKinsey & Company, greenhouse gas abatement measures in the transport sector will account for 23 megatonnes of potential emissions reductions Australia-wide by 2030, largely through the use of biofuels and increased fuel efficiency. The NSW Government's mandated ethanol level in petrol is leading the nation in encouraging the supply of biofuels. NSW is already a major producer of biofuels through companies such as *Shoalhaven Starches* (part of the Manildra Group) and has a number of biomass power generators including the *Condong and Broadwater sugar mills* in northern NSW.

Developments in this area include energy generated from wood mass and algae. Australia has around three million dry tonnes of wood waste potentially available each year, which could be used to generate clean, green power.

# Research and development

## NSW business and university investment in R&D is significant

Research and development expenditure on energy supply by universities in NSW exceeded \$20 million in 2006, representing 41 per cent of the national total.

In 2006-07, business expenditure on research and development in NSW in electronic and electrical equipment and industrial machinery manufacturing, electricity, gas and water supply, and scientific research totalled \$404 million, representing 33 per cent of the national total.

Research and development organisations in NSW include:

The **Priority Research Centre for Energy (PRCfE)** at the **University of Newcastle** fosters interaction between industry, government agencies and university researchers interested in the growing field of clean and sustainable energy production. PRCfE members undertake research and development across a range of fields including clean coal, renewable energy and other greenhouse gas abatement technologies. One of the Centre's speciality research programs, 'Renewable Energy Systems', focuses entirely on advancement of technologies suitable to generate heat, power and chemicals from renewable sources such as biomass, geothermal, solar (solar thermal) and wind.

**CSIRO's National Solar Energy Centre (NSEC)** in Newcastle is developing solar thermal technologies that use mirrors to harness the sun's energy and transform solar power into a gas that can be stored and transported. As well as solar thermal research, the CSIRO is also investigating the next generation of organic photovoltaic solar cells, which will be made from plastic materials.

The CSIRO energy storage research program is working to overcome the key challenges of producing viable energy from both solar thermal and photovoltaic solar cell technologies. The program includes research on the use of a breakthrough technology, the UltraBattery. This is an advanced system which has the potential to store and regulate electricity produced from solar thermal and photovoltaic cells.

The mission of the Australian Research Council (ARC) **Photovoltaics Centre of Excellence** at the **University of New South Wales** is to advance silicon photovoltaic research and it is at the forefront of research on first, second and third generation solar cells. The Centre currently has over 50 PhD students conducting research in this field.

Rapidly growing business interest in photovoltaics as a sustainable and marketable energy source has led to commercial success for the Centre. A Centre partner, Suntech Power, a partly Australian-owned company operating in China, floated on the New York Stock Exchange at the end of 2005. Two other Centre-linked companies, Trina Solar and Solarfun Power Holdings, completed successful initial public offerings in 2006. JA Solar, Sunergy and Yingli Green Energy floated in 2007. Combined 2007 revenues of these companies exceeded \$2 billion.



National Solar Energy Centre, Newcastle  
(image courtesy of CSIRO)

The **Primary Industries Innovation Centre** is a joint venture partnership between the **University of New England** and the NSW Department of Primary Industries. Its strategic priorities include developing tools for the implementation of a sustainable and regionally-based biofuels industry and developing crop, pasture and livestock technologies that capture carbon, reduce emissions and are adapted to climate change.

The Centre is researching second generation biofuel technologies that have the potential to supplement fuel supplies in a sustainable manner by deriving biofuel from low-cost, non-food materials or "waste" materials such as crop residues, forestry residues, algae, or tropical grasses. They may also be more readily adapted to land unsuitable for traditional food crops. Producing fuels from these materials has the potential to significantly improve the cost effectiveness of biofuels.

The **BioEnergy Research Institute (BERI)** headquartered at the Lismore Campus of **Southern Cross University** is developing technologies in the sustainable production of biofuels that contribute significantly to reduction in greenhouse gas emissions. The Institute leverages world-wide efforts through collaborations with partners in the US, Europe, Brazil and Asia. The Institute develops Australian plant species as biofuel crops suitable for widespread production in Australian environments, so as to minimise competition with food production.

Five priority areas have been identified as biomass targets for the development of biofuel technologies: eucalypts, Australian grasses, sugarcane, sorghum, and agricultural wastes.

The **University of Wollongong's Energy Futures Network** is a new initiative that brings together researchers from a range of disciplines to maximise the effectiveness of UOW's involvement in the global effort to develop sustainable energy supply systems and to better understand how energy use impacts upon the environment.

Key areas of research are:

- development of energy production and transformation technologies, such as new materials for photovoltaic conversion, hydrogen production and superconductors
- energy storage systems and renewable energy technologies
- decentralised power technologies.

## Business services

The implementation of a national emissions trading scheme and the resultant trade in carbon pollution permits is expected to lead to demand for new services in record keeping, reporting, compliance, audit and monitoring. KPMG estimates that there could be up to \$100 million in advisory revenue for the whole Australian market. Other services growth will be in carbon market services such as carbon pools, brokerage, exchanges, legal advice, and risk management.

NSW makes up 35 per cent of the national employment in the professional, scientific and technical services industry and so is well placed to take advantage of expected growth in this sector.

While many of the opportunities in this area will fall to larger accounting and consultancy firms based in NSW, there is also potential for growth in the SME sector. Companies such as **Energy Action** and **Energetics** are helping other firms incorporate greenhouse emissions reduction and efficiency programs into their business.

**Energy Action Pty Ltd** has established itself as an award winning energy exchange. The company's team of specialists came together in 2000 to provide products and services to help businesses secure the best deal for their energy supplies.

Drawing on a combined background in procurement management, energy markets, consultancy, engineering and technology, Energy Action's team manages the delivery of a suite of integrated energy management services.

The company has successfully facilitated over 2,700 auctions and settled over \$1.5 billion in energy contracts. Energy Action's customers comprise commercial and industrial firms throughout Western Sydney and across Australia, with diverse energy needs and site requirements.

Based in Parramatta since 2003 and with revenue in excess of \$7 million last year, Energy Action employs 26 full-time staff. Last year it invested 3.5 per cent of its revenue in R&D to support its customers' needs.

## Carbon trading

Globally, the value of the carbon market is roughly doubling every year and was worth US\$64 billion in 2007.

Sydney's unique strengths and capabilities in financial services place it in a very strong position to take a lead role in facilitating the new Carbon Pollution Reduction Scheme.

Sydney is the Australian centre for financial services, with the largest concentration of major financial services market players in Australia and 42 per cent of all employment in the finance and insurance industry. Financial services is one of five high-value industry sectors identified for innovation-led growth by the NSW Government's Statement on Innovation.

The NSW Greenhouse Gas Reduction Scheme, the world's second largest carbon market in terms of both volumes and value of carbon credits transacted, is based in Sydney.

Sydney is also the national headquarters of the Australian Securities Exchange (ASX). According to the ASX, key to the success of Australia's emissions trading scheme will be the introduction of a futures market for emission permits and any tradeable carbon-related products. A futures market will generate the short and long-term price signals and the risk mitigation mechanism required to underpin investment.

The NSW Government aims to have the Australian carbon registry, the new regulator and the carbon market established in Sydney.



## Government action and assistance

In addition to setting far reaching targets for carbon reduction, renewable energy generation and biofuel mandates, the NSW Government is committed to collaborative alliances between government, business and research to ensure a smooth transition to a low-carbon economic environment.

The NSW Government has a number of business programs providing assistance for companies to grow and to sustain competitive manufacturing, including:

- investment facilitation and advocacy support for major projects and initiatives that help sustain the State's competitive manufacturing sector
- customised business improvement programs for manufacturing enterprises
- business skills development targeted to start-ups, inventors and young entrepreneurs
- export programs, including support through trade missions and independent market visits
- support for innovation clusters to encourage technology diffusion and best practice
- promoting locally-developed R&D and technologies through the **Australian Technology Showcase**.

The NSW Government also plays a role in helping local industry to access supply chain and project opportunities through the **Industry Capability Network (ICN)**. This includes assisting the proponents of major low carbon energy and energy efficiency projects to identify local manufacturing and service capabilities.

For more information on these programs and initiatives visit [www.business.nsw.gov.au](http://www.business.nsw.gov.au)

For a directory of innovative NSW companies in the environmental sector visit [www.business.nsw.gov.au/industry/environmental](http://www.business.nsw.gov.au/industry/environmental)

**GreenPower** is a national accreditation program that was started and managed by the NSW Government. The program is dedicated to driving investment in renewable energy in Australia and increasing the sustainability of our electricity supply. As a voluntary program, GreenPower now boasts three quarters of a million residential and business customers and 28 retail partners around Australia.

For more information visit [www.greenpower.gov.au](http://www.greenpower.gov.au)

The **NSW Climate Change Fund**, established in July 2007, includes:

- the **NSW Green Business Program** – providing assistance for projects that will save water and energy in business operations in NSW
- the **Renewable Energy Development Fund** – supporting projects which are expected to lead to large scale greenhouse gas emission savings in NSW by demonstrating renewable energy technologies and supporting the early commercialisation of renewable energy technologies in NSW
- the **Residential Rebate Program** – providing rebates for hot water systems, insulation, rainwater tanks and washing machines
- the **Public Facilities Program** – providing funding for water and energy saving projects in facilities which are open to, and frequently accessed by, the public including schools, community buildings, sporting facilities, museums and art galleries
- the **Schools Energy Efficiency Program** – assisting NSW public high schools in reducing greenhouse gas emissions.

For more information on these and other climate change assistance programs visit [www.environment.nsw.gov.au/climatechange](http://www.environment.nsw.gov.au/climatechange)