

SIPHONING THE SUN



EnviroMission Ltd

The breathtaking solar tower project near Mildura stands out as an innovative Australian commitment to finding alternative energy solutions. Graeme O'Neill reports the latest progress on a facility that could power 200 000 homes from the planet's tallest man-made structure.

IN THE LAND where bulldust often lies thick upon the landscape, a small Melbourne company's proposal two years ago to construct a kilometre-high tower in the Outback to siphon power from the Sun, risked generating more scepticism than electricity.

But the winds of change – global climate change – are blowing through the international energy markets, and Roger Davey, CEO of renewable energy company EnviroMission Ltd, says his company's plans for 'the most radical technological advance in renewable energy in decades' are very much on track.

German engineer-inventor Professor Jorg Schlaich conceived the Solar Tower principle nearly a quarter of a century ago, and demonstrated it by building a 200-metre tall prototype near the Spanish town of Manzanares in 1983. It ran trouble-free until it was decommissioned five years later, producing a peak output of 50 kilowatts of electricity.

Time magazine recently rated the Solar Tower as one of the world's best inventions in 2002.

EnviroMission, which listed on the Australian Stock Exchange in August 2001, had already secured the exclusive Australian rights to commercialise Schlaich's invention. It immediately announced plans to build the first of what it hopes will be five Solar Towers in Australia by 2010. Schlaich's Stuttgart-based engineering company, Schlaich Bergermann and Partner, is an active partner and consultant.

The height of engineering challenge

The one kilometre high tower will be the world's tallest man-made structure with a diameter of 120 metres – approximately the diameter of the Melbourne Cricket Ground's playing surface. Each of the 32 huge pressure-staged turbines arrayed around its base will produce up to 6.25 MW of power in hot, sunny weather, for a total output of 200 MW.

Unlike the forests of wind turbines that have sprung up around coastlines in Australia, North America and Europe to harvest perennial onshore breezes and gales, the Solar Tower creates its own wind. EnviroMission's Davey likens it to a hydro-electric power station that uses rising warm air, rather than descending cold water, as a working fluid.

'the most radical technological advance in renewable energy in decades'

EnviroMission has already chosen the materials for the vast greenhouse 'skirt' surrounding the tower, which will extend out to a radius of 3.5 km from its base.

Tough glass and tough polymers like polycarbonate, designed to withstand occasional severe hailstorms that sweep across the semi-arid zone, will cover an area of nearly 40 square kilometres, making it the world's largest greenhouse. The materials have been selected for their heat-transmission properties – they will be highly transparent to incoming longer wavelengths of infra radiation, but relatively opaque to shorter infra-red wavelengths re-radiated from the soil beneath.

The greenhouse skirt will slope gently upwards from its periphery, then rise sharply to contact the tower around 45 metres above its base. It will trap and warm the air beneath it to at least 15 degrees above ambient

An artist's impression of the 1 km-high EnviroMission tower to be built 25 km north-east of Buronga in NSW.

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temperatures, directing it through large portals in the base of the tower, and then through the turbine array.

The flow will be further accelerated by the natural 10-degree differential between the air temperature at ground level, at the tower's exit one kilometre up. During the day the rising column of air inside the tower will reach a velocity of around 45 kilometres per hour.

Unique advantages

Unlike high-temperature solar power stations that vaporise water to steam by focusing the Sun's rays with huge mirrors, or use arrays of semi-cylindrical collectors to vaporise water, the Solar Tower continues to produce a steady supply of energy on cloudy days, and even at night.

Davey says one of the system's outstanding advantages over rival solar-power technologies is that the tower's energy output closely matches the typical pattern of energy consumption during the day-night cycle.

EnviroMission has chosen a site on Tapio Station 25 km north-east of Buronga, in south-western NSW, for its first Solar Tower. The choice of site was constrained by geology, an absolute requirement for a hot, dry climate, and the need for a large population centre nearby that could provide a labour force of 1200 people to build the tower.

Victoria's third largest inland city, Mildura, population 30 000, lies just over the Murray River from Buronga; the Solar Tower could supply the total electricity needs of the horticultural region that extends along the Murray River from Wentworth, 20 km west of Mildura, to Swan Hill.

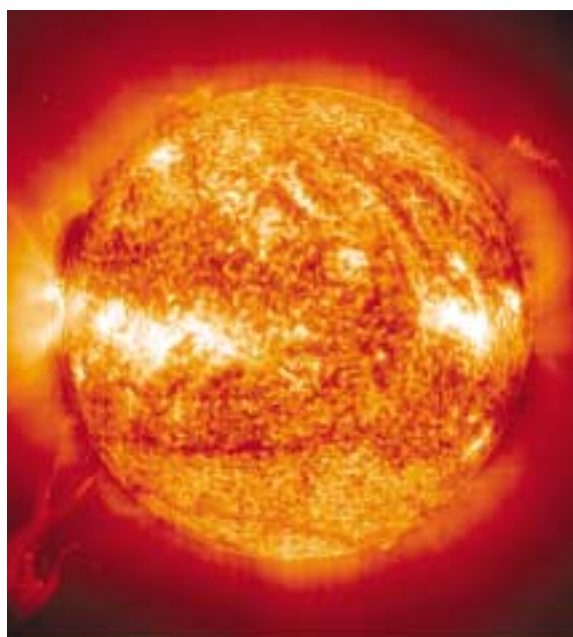
Another important factor in the choice of the Tapio Station site was its proximity to the national power grid, which will reduce capital costs and save energy. The further a high-tension power line extends from a power station, the more energy it 'leaks' to the environment as heat radiation.

Private and government sector buy-in

The Australian Government has recognised the concept's potential to reduce Australia's greenhouse-gas emissions, and to boost regional employment and economic growth, by according it Major Project Facilitation (MPF) status. The NSW Government has also recognised the importance of the project, by giving it State Significant Development ranking, streamlining the state's planning approval process.

Experts with Leighton Contractors Pty Ltd, one of Australia's largest construction companies, spent six months confirming that modern engineering and construction techniques are well up to the task of building the tower – in fact, Davey says, Leighton will be involved subject to proving commercial viability.

EnviroMission and Leighton are working through a complex matrix of engineering, logistical and economic factors before a final decision is expected, probably by



The Mandatory Renewable Energy Target Scheme aims to have as much as 9500 GWH of Australia's energy produced from renewable sources – including solar – by 2010.

year's end, on whether the project is financially viable.

'We're very close to proving its financial viability,' Davey said. 'We're getting the capital cost down, whilst in some instances actually improving its performance.'

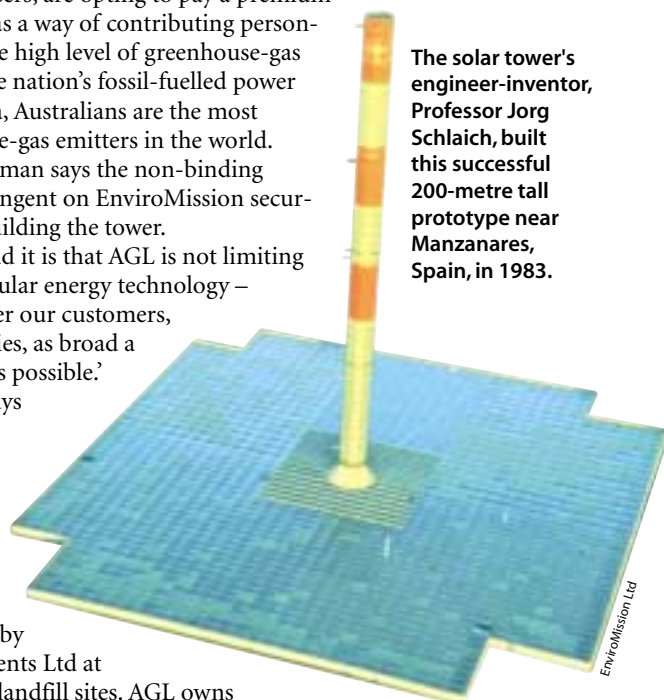
Davey says the project's financial viability has been boosted by the recent decision of one of Australia's biggest energy companies, Australian Gaslight Ltd (AGL), to sign a memorandum of understanding that gives it the option to purchase the tower's entire energy output when it comes on line.

A growing number of Australians, particularly domestic power users, are opting to pay a premium for 'green' power, as a way of contributing personally to reducing the high level of greenhouse-gas emissions from the nation's fossil-fuelled power stations. Per capita, Australians are the most prolific greenhouse-gas emitters in the world.

An AGL spokesman says the non-binding agreement is contingent on EnviroMission securing finance and building the tower.

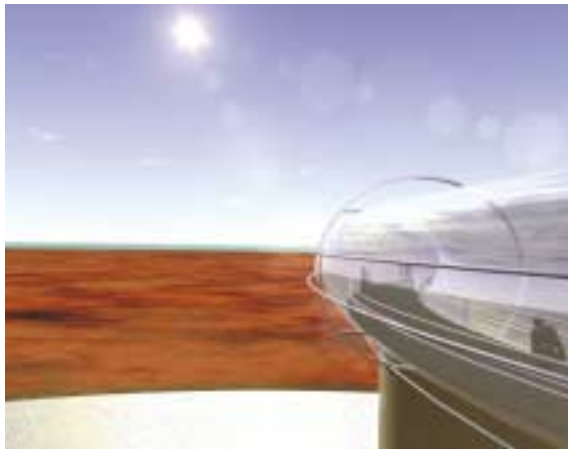
'The idea behind it is that AGL is not limiting itself to one particular energy technology – we're trying to offer our customers, the end beneficiaries, as broad a range of options as possible.'

AGL already buys energy from the Starfish Hill wind farm in South Australia, operated by Tarong Energy, and from methane gas-fired generators owned by Energy Developments Ltd at several municipal landfill sites. AGL owns several such installations itself, and also generates power with methane-rich sewage gas.



The solar tower's engineer-inventor, Professor Jorg Schlaich, built this successful 200-metre tall prototype near Manzanares, Spain, in 1983.

An observation deck planned for the top of the tower would give commanding views of the Sunraysia region and generate tourism revenue.



EnviroMission Ltd

Renewable energy achievements

The Federal Government's Mandatory Renewable Energy Target Scheme aims to have as much as 9500 GWH of Australia's energy produced from renewable sources by 2010. It offers energy companies substantial subsidies to produce or purchase 'green' energy, to encourage the development of renewable energy companies like EnviroMission.

EnviroMission estimates the cost of its first Solar Tower will be in excess of A\$800 million. The company aims to build five 200 MW Solar Towers in Australia by decade's end; the Tapio project will prove the engineering feasibility of the concept, and its viability as a source of renewable energy – and not just in Australia.

EnviroMission's long-term plan is to build Solar Towers in other hot, sunny locations around the world; big international companies and overseas investors have already recognised the potential for a new, multi-billion dollar global industry, and are showing keen interest. EnviroMission's Nevada-based US major shareholder, SolarMission Technologies Inc, is looking at potential sites for Solar Towers in Nevada, Arizona, Texas and California.

With the economics of scale, the experience gained from constructing the first tower, and the development of a skilled core workforce, Davey believes the cost of subsequent towers would fall considerably.

EnviroMission calculates the tower will recoup the energy costs embodied in its materials and construction in 30 months, and every year thereafter will abate the equivalent of more than 700 000 tonnes of carbon diox-

ide that would have been emitted by a coal-fired power station of equivalent output.

With the question of whether the tower can be built resolved, the question becomes *how* best to build it – Davey says a UK-based company has already come forward with a proposal for a revolutionary, robot-assisted construction technique that would build the tower from prefabricated panels, allowing construction to proceed 24 hours a day, seven days a week. The quick and safe technique could significantly reduce the tower's cost and construction risk.

Davey says global corporations are negotiating to supply materials for the turbines and the solar collector, both of which will be the largest of their types in the world.

'We're going ahead in leaps and bounds,' he says. 'We're aiming to begin construction in the first quarter of the 2004/05 financial year, as long as the numbers stack up.'

A regional boost

The numbers will depend, in part, on capitalising on the obvious tourism potential of the world's tallest man-made structure. Already the gateway to the Australian outback, the location will provide commanding views of the Sunraysia irrigation district and the surrounding flat, semi-arid landscape. Its long line-of-sight view also gives it obvious potential as a platform for microwave telecommunications.

The tower would be visible above the horizon out to a distance of 80 kilometres, although Davey says that, viewed from the main street of Mildura, 27 km away, it would project only a little way above the local street trees.

Davey says EnviroMission is also considering the possibility of growing horticultural crops in the warm atmosphere beneath the vast greenhouse 'skirt'. Up to a certain threshold, the humidity generated by irrigation and evapotranspiration would increase the density of the air mass converging on the tower, spinning the turbines more rapidly.

'There was certainly some scepticism when we listed in September 2001,' says Davey. 'But since that day, we haven't taken a backward step.' 🌐

MORE INFORMATION: <http://www.enviromission.com.au/>

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