

Turning on the heat

SOLAR technology has come a long way since the ancient Greeks used energy from the Sun to heat their homes.

Now the energy can be harnessed and stored to provide heat at any time and at any temperature, or to cool, provide light and power for a variety of uses.

The advances in solar energy have been made possible through scientific discoveries which date back almost 200 years, as well as common sense which dates back millennia.

The ancient Greeks were aware that orienting their houses towards the winter sun, and away from the summer sun, had a significant impact on the interior temperature.

But it wasn't until 1839 that French physicist Alexander Edmond Becquerel first discov-

The Sun is the greatest single source of power on our planet. The quest to harness this energy has only just begun, writes Cara Jenkin.

ered the basics of how to generate electricity from sunlight.

He claimed that if light was shone on an electrode in a conductive solution, an electric current was created. It was another 100 years until American scientist Russell Ohl patented the first working solar cell.

Further development was stimulated in the late 1950s by the need to power communication satellites in orbit around the Earth.

Since then, scientists have been working on ways to utilise this discovery worldwide.

Solar cells work because the material used to make a cell - a type of semi-conductor - absorbs

light and increases the activity of electrons.

This allows electrons in the material to move about, producing an electric current.

While solar power is increasingly being taken up by households and commercial buildings to heat water and provide electricity, scientists are still working on ways to improve the technology's efficiency.

Australian and New Zealand Solar Energy Society SA chair Dr Stewart Martin says there are significant developments in this area under way in Australia. One focus of this research is how to reduce the amount of silicon used in solar

panels. Nearly all cells are currently made from silicon.

Previously most of the silicon came from offcuts and waste from the manufacture of electronic circuits.

That source is now almost exhausted and the demand for cells continues to rise.

"This shortage has restricted the growth of the industry and is holding up the price of solar panels," he says.

One research effort into reducing the amount of silicon in solar cells is being conducted in Adelaide at Origin Energy's Regency Park pilot plant.

They are developing a new type of cell, called a SLIVER

cell, which contains only about 10 per cent of the silicon used in a conventional cell.

"Another interesting area under research is the use of mirrors or lenses to focus the sunlight and concentrate the sun by a factor of several hundred," Dr Martin says.

"A much smaller area of cells is then needed to make a given amount of power."

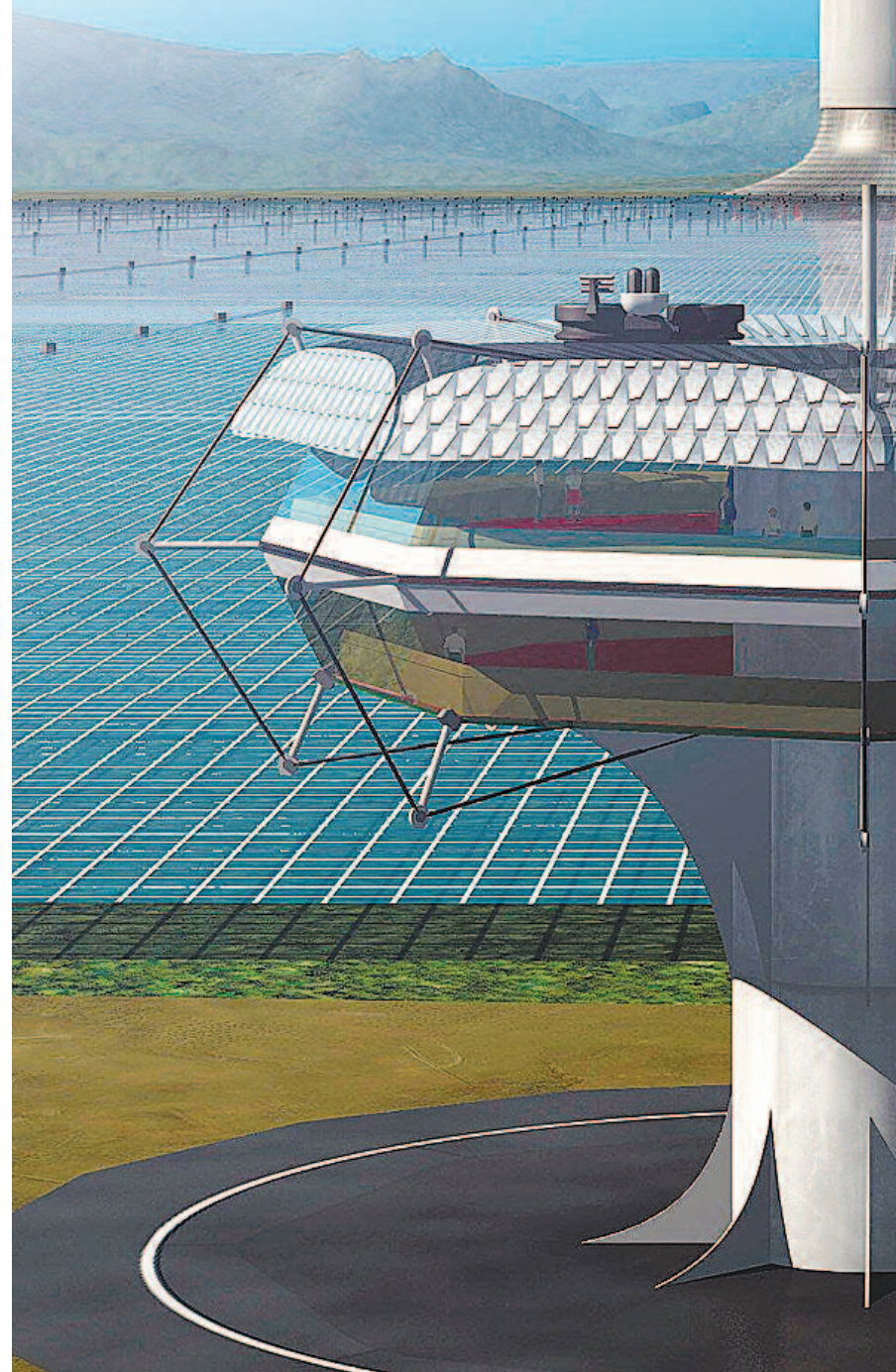
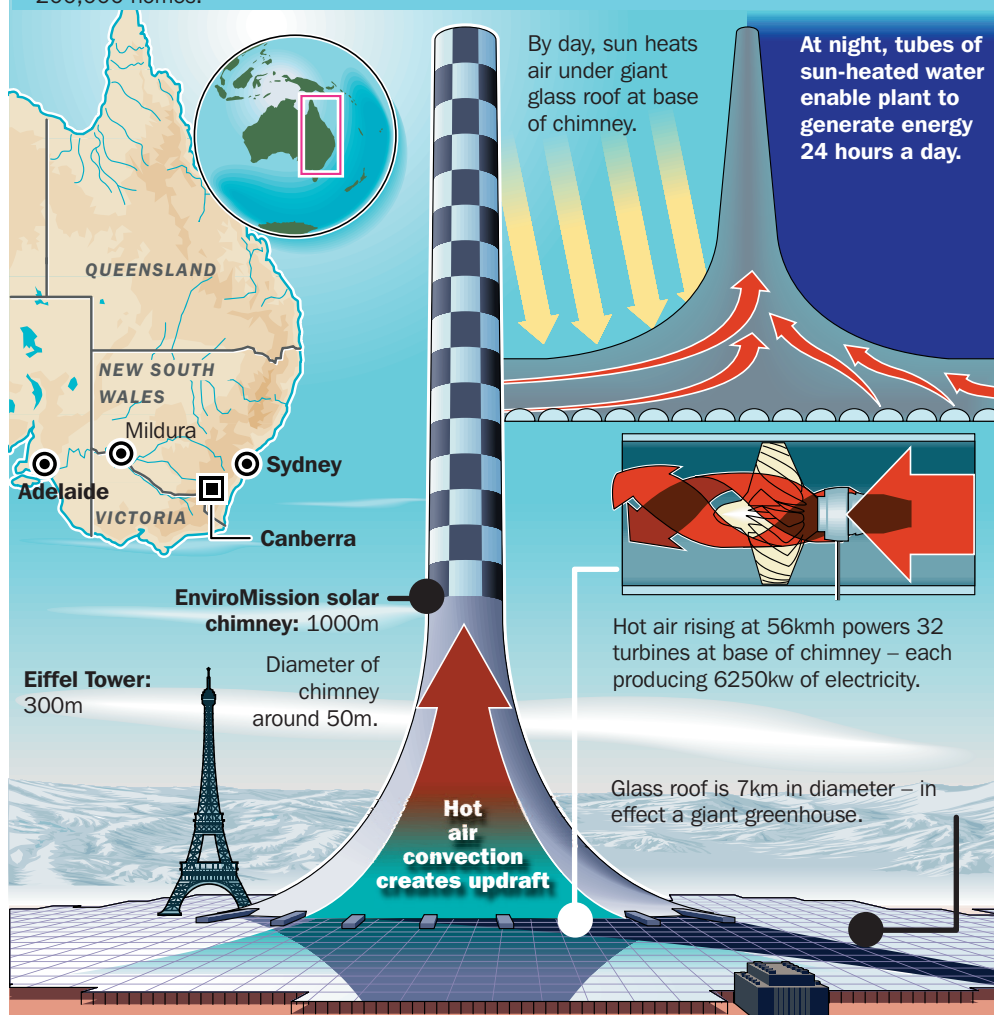
Both advances in technology would eventually lead to a significant reduction in the price of solar panels, he says.

Once the price reduces, the use of solar energy can be much more widespread and affordable, allowing many more home-owners to buy small systems for their homes.

Dr Martin says once the electricity is generated, it can be used to power anything, including cars.

A tall alternative

The world's tallest man-made structure could soon be towering countryside just north of Mildura. EnviroMission is finalising its Solar Tower feasibility study. The solar chimney will use heated air to drive turbines, generating up to 200 megawatts of clean, green electricity, enough to supply 200,000 homes.



I'd put my money on the Sun and solar energy. What a source of power. I hope we don't have to wait until oil and coal run out before we tackle that.

- Light globe inventor Thomas Edison



1 Harvesting sunlight

WHEN a major solar photovoltaic plant is completed in northern Victoria in 2013, it will be the world's largest solar facility.

That title, however, is not expected to be held for long.

Solar farms are being constructed in large numbers all over the world, in countries where sunlight is plentiful and limited.

A solar farm is a larger-scale version of the residential solar panel package South Australians can now install on their roof.

A farm can span an area of hundreds of hectares and harnesses the energy from the Sun to power customers connected to the local electricity grid.

Currently the world's largest solar farms produce about 11MW of power, such as a farm at Lisbon in Portugal which has panels on 60ha of land and powers 8000 homes.

Germany is home to about half the number of solar plants that operate or are under construction in

the world, despite its cloudy skies. Its newest plant, announced in May, 2007, will produce 40MW of power at Bavaria, which is enough to power 400,000 homes.

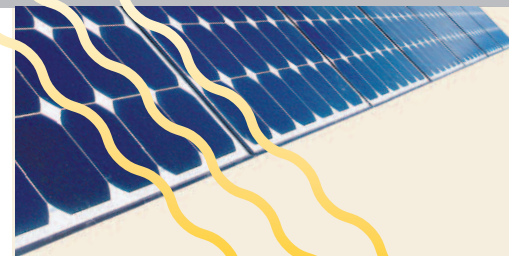
A 40MW plant is also being built in Canada.

The Victorian solar farm is expected to produce three times as much power at 154MW from 800ha - enough power for 45,000 homes. It is the first farm of its type in the world and will be much more efficient than existing technology because it concentrates the light on the solar panels.

Several sites are under investigation but construction will not begin until 2009. It will start as a demonstration facility until the technology is proven.

In South Australia, a 100kW plant was completed in 1998 to power Wilpena Pound Resort and Flinders Ranges National Park buildings.

A 15MW plant was proposed earlier this year near Leigh Creek.



How solar power works

[1] Solar panels

Light from the Sun consists of photons. As photons are absorbed by the solar panels, the photoelectric effect causes the flow of free electrons.

[2] Amp meter

There is a measure of instantaneous solar current output. The current will decrease as cloud cover increases.

[3] Interactive inverter

A device where direct current (DC) from the solar panels is transformed into 240-volt alternating current (AC) at 50 hertz suitable for running household appliances.

[4] Kilowatt-hour meter

This meter is a cumulative measurement of solar electricity represented in kWh. It is the total amount of electricity produced by the solar panels.

[5] Main switchboard

The common link in the entire grid interactive solar system.

[6] Electricity load

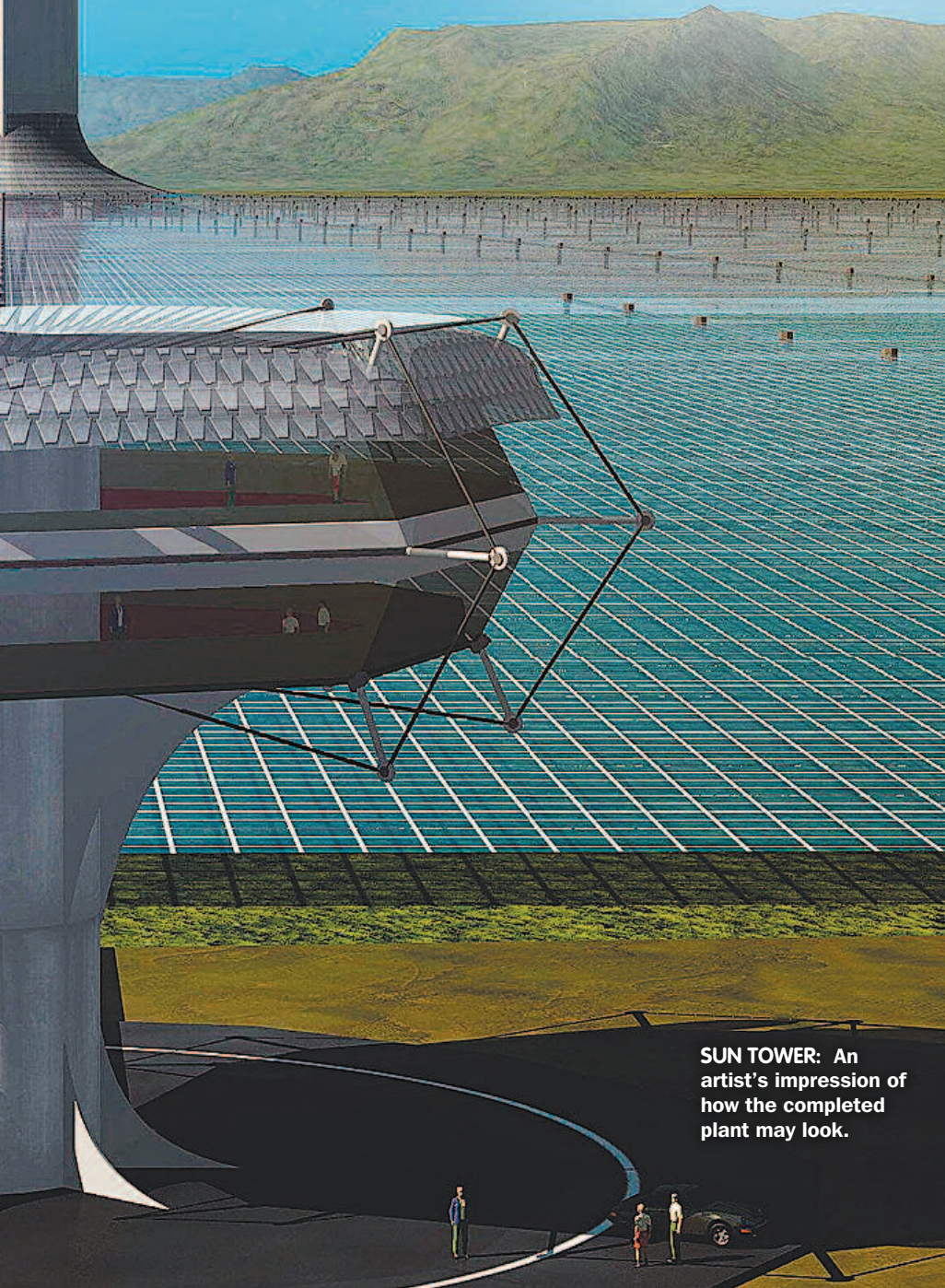
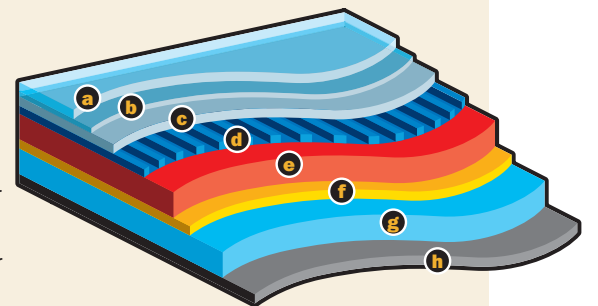
Electricity that appliances such as lights, computers and fridges are consuming. Electricity is supplied to the appliances via the switchboard.

[7] Electricity grid

When the solar panels are generating more electricity than electricity load, the excess power is exported to the electricity grid. The grid supplies electricity to the switchboard on a cloudy day or during the evening when the solar panels are not generating electricity. Additionally, the grid supplies electricity to the switchboard when consumption of electricity is greater than the amount of electricity the solar panels are producing.

The solar panel

- [a] Cover glass
- [b] Transparent adhesive
- [c] Antireflection coating
- [d] Front contact
- [e] n-type semiconductor
- [f] p-n junction
- [g] p-type semiconductor
- [h] Back contact



SUN TOWER: An artist's impression of how the completed plant may look.