The heat is on

WE COULD BE USING HOT ROCKS TO MEET OUR FUTURE ENERGY NEEDS, REPORTS ANDREW DAWSON.

IN the remote South Australian desert, deep underground, a new energy source is being harnessed. Five kilometres below the surface of the vast Cooper Basin, hot rocks could help produce as much clean, green energy as would be generated by 15 Snowy Hydro schemes. And that's got scientists, energy companies and politicians excited.

A visiting geothermal expert from the Massachusetts Institute of Technology in the United States, Professor Jefferson Tester, recently told a parliamentary inquiry into renewable energy that Australia looms large in the field of hot rock technology.

"What's exciting in Australia right now is this major project in the Cooper Basin, which is being looked at by virtually the entire international geothermal community," Professor Tester says.

"It's the largest enhanced geothermal site in the world that is active right now. So in many ways you are the leaders at this point and we are looking to you to see how that project goes."

The geothermal power plant of the future will operate by pumping water into a bed of super hot granite rock. As this water is forced through the cracks in the fractured hot granite, it becomes superheated to more than 250 degrees Celsius before being piped back to the surface.

Above ground, the superheated water passes through a heat exchanger. This heats up another type of fluid that drives the power station's turbines and generates a continuous baseload supply of electricity without any of the greenhouse gases that dog coal power plants. Water use is kept to a minimum because all of the ground water is continually recirculated through a closed system.

Geothermal energy site, Cooper Basin (South Australia). Photos: Geodynamics and AAP

Nineteen Australian companies are already pursuing this interest in geothermal energy, with seven listed on the stock exchange. These companies believe within a decade or two they will be generating thousands of megawatts of electricity from water heated up by these hot granite rocks.

"Geothermal energy is being used in roughly 70 countries for generating electricity or providing heat for homes, or both," Professor Tester told the House of Representatives Industry and Resources Committee.

"There is about 10,000 megawatts of electrical generating capacity around the world right now. In many ways Australia is very similar to the United States—it's a large country with a very large part of it that has an extremely high heat load so the future looks very bright for Australia."

The geothermal venture in outback South Australia attracting the most attention is a hot fractured rocks project near the remote town of Innaminka being run by Geodynamics. This Brisbane-based company, which lists Origin Energy and Woodside Petroleum as shareholders, is at the forefront of the Australian geothermal energy sector. It has already begun drilling deep into one of the hottest non-volcanic spots on earth.

Geodynamics believes the Cooper Basin has enough geothermal energy potential to provide all of Australia's electricity needs at current consumption rates for 70 years.

Chief executive Adrian Williams estimates the geothermal resource they already have identified is capable of producing 10,000 megawatts.

"That's absolutely huge—the equivalent in annual power output to 15 Snowy Hydro schemes," Dr Williams says.

To exploit this potential, Geodynamics has recently purchased a $32 million state of the art drilling rig that began work in July on a new production well to be called Habanero Three. Dr Williams says this could turn out to be the most significant onshore well ever drilled in Australia.

"Why? Because it will first of all prove the concept of generating power from hot rocks, and it will launch a whole new industry in this country," Dr Williams says.

"By the end of the year, we will have completed drilling Habanero Three, we will have completed doing a circulation test between Habanero

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Three and Habanero One, and we will have formally proven reserves."

He says it is the first time this will have been done in Australia.

"Then we launch into a 40 megawatt commercial development that will enable us to be delivering power into the national grid by the end of 2010. And that in itself will be a very important milestone because once that's done, there is no stopping us.

"We then plan our next project of 500 megawatts to be delivering power into the national grid by 2015."

Such is its confidence in the technology, Geodynamics has already taken out exploration licences for more than 2,000 square kilometres of the Cooper Basin.

Professor Tester says the United States is also beginning to realise the possible long-term benefits of expanding its own geothermal energy supplies.

"Widespread deployment of geothermal in the United States would have a very positive impact on our energy security, our environment and our economic health," he says.

"In the US we are talking about moving from 3,000 megawatts to perhaps 100,000 megawatts in half a century, which would represent about 10 per cent of our current generating capacity."

The National Generators Forum represents 22 major power generators. Executive director John Boshier shares Professor Tester's enthusiasm for geothermal energy.

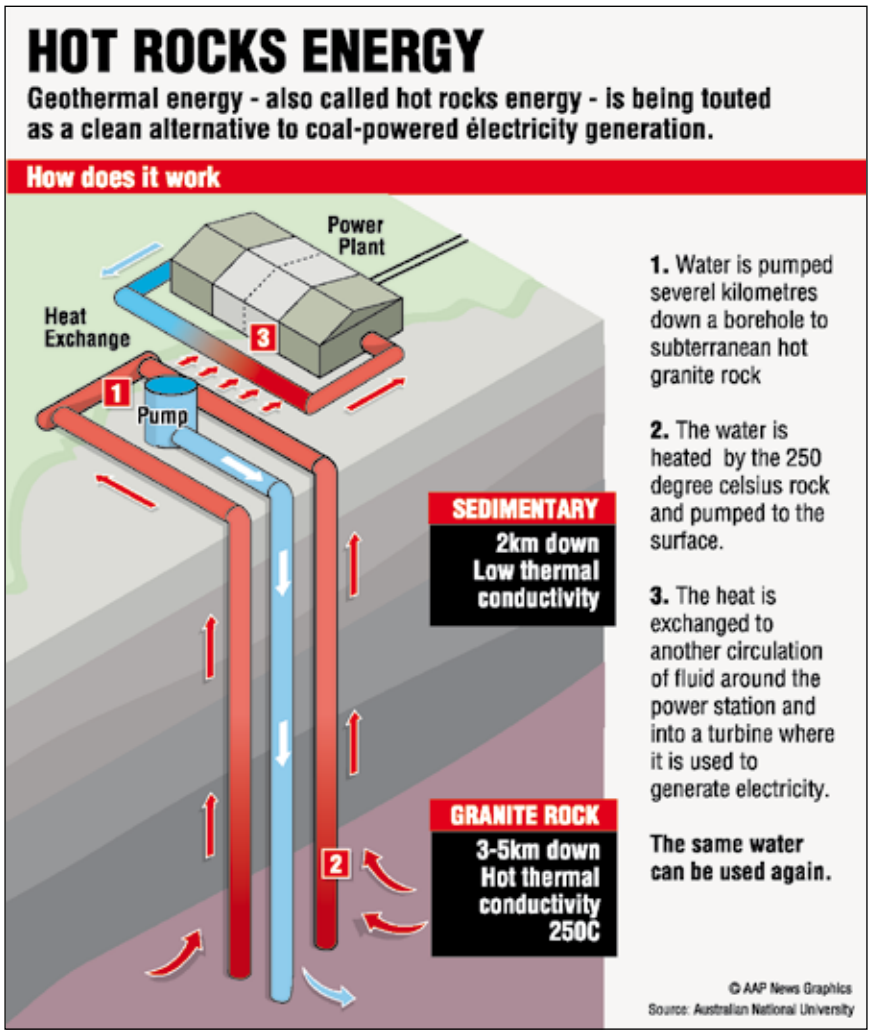
"It will take some time to develop. At the moment it is quite costly but it has got very large potential," Mr Boshier says.

While acknowledging that start up costs will be high, Mr Boshier says geothermal energy will become cheaper as more and more power plants are developed.

"Affordability has to be measured against the cost of carbon dioxide, so if we are going to have emissions trading and we are going to have a price on carbon dioxide, which looks like being the case, then geothermal energy will become much more economic.

"I would say geothermal will be cheaper than solar energy and certainly comparable with wind energy."

Based on renewable energy incentives established in Australia, Geodynamics also believes geothermal energy can compete with wind and



hydro power. The cost of electricity generated by geothermal power plants will also be independent of future rising fossil fuel costs such as coal, gas or oil.

The main capital costs of development in a geothermal power plant are in deep drilling, in the development of the underground heat exchanger, and in the building of the power plant. Geodynamics says the underground costs make up about 50 per cent of the total capital required for a small-scale plant.

These underground costs decrease to 20 per cent or less of the total capital for much larger power plants. The cost of developing a demonstration geothermal energy power plant with an electrical output of 10 to 15 megawatts has been estimated at nearly $50 million for a stand alone system.

But, according to Geodynamics, on a cost per megawatt this demonstration geothermal power plant producing baseload electricity 24 hours a day compares well with the $45 million price tag for one of the biggest wind power projects in Australia, the Albany Wind Farm.

Dr Williams sees the ability of geothermal to deliver continuous baseload power as its main advantage over wind turbines.

"An individual wind turbine can provide three megawatts of power but, since it turns for only 30 per cent of the day, it may be only one megawatt, whereas geothermal is continuous. So a 40 megawatt geothermal generator is equivalent in output to about 40 wind turbines," he says.

Mr Boshier sees two significant hurdles facing prospective geothermal electricity producers in Central Australia—its relative isolation and a lack of water.

"The problem with the Cooper Basin is that it is a long way from the east coast where the main cities are so that means there is a lot of electricity transmission over to the east coast going to be needed, which can be expensive," he says.

Geodynamics believes these transmission costs will be quite manageable. "The right technology is high voltage direct current lines—that's the established technology for transmission of large amounts of power over long distances—as used in China's Three Gorges hydro project," Dr Williams says.

"Geothermal leaves a small environmental footprint."

"The point is if the resource is big enough or of high enough quality, then you take the infrastructure to the resource."

As for concerns about access to water, which is critical for operating a geothermal energy reservoir, Professor Tester believes the water aquifers under the Cooper Basin should suffice.

"The Cooper Basin is somewhat fortunate in that they have natural water in the reservoir itself," he says.

Geodynamics has no concerns about running out of water to drive its generators because the water is constantly recycled.

"Geothermal leaves a small environmental footprint—we have already proven in the Cooper Basin that we do not need an external supply of water because it's a closed system," Dr Williams says.

Ultimately, whether the potential of geothermal energy will be realised will depend on issues of cost and technology.

"There is increasing recognition that geothermal and natural gas are emerging as the most cost effective energy sources as soon as there is a cost on carbon factored in," Dr Williams says. "If you are not going to cut emissions then you keep using coal, but if you are, then cost will be important.

"All the core technology required already exists such as the drilling and managing the geothermal reservoir. We still have a bit to learn but we are waiting on technological breakthroughs to go forward."

Professer Tester knows geothermal can compete economically with the wind or solar renewable energy sectors.

"The US has 3,000 megawatts of capacity and all of it is competing in today's energy markets without subsidies," he says. "The new geothermal that comes online will benefit to some extent in the US from production tax credits because it's now officially regarded as a renewable source.

"The future is bright at the high grade end and, if we can make the technology work better to bring down some of the costs a bit, it will open up the vast potential of lower grade resources as well."

But Professor Tester warns Australians to be patient about tapping into this renewable energy source.

"These are big investments—even if the technology was in place, the capital investment to put in 100,000 megawatts capacity is a significant number—it's like building 100 nuclear plants." ■

For more information on the case study into selected renewable energy sectors by the House of Representatives Industry and Resources Committee, visit www.aph.gov.au/house/committee/isr/renewables or email ir.reps@aph.gov.au or phone (02) 6277 4594.

The annual power output from geothermal energy could equal 15 Snowy Hydro schemes. Photos: Geodynamics