CERAMIC FUEL CELLS LIMITED

13 June 2007

Submission No: 23

The Committee Secretary
House of Representatives Standing Committee
On Industry and Resources
PO Box 6021
Parliament House
Canberra ACT 2600

SUBMITTED BY EMAIL

Dear Sir / Madam,

Case Study into Renewable Energy in Australia

Ceramic Fuel Cells Ltd (**CFCL**) welcomes the opportunity to provide a submission to the Committee's case study examining the relative state of development of selected renewable energy sectors in Australia, namely solar, wave, tidal, geothermal, wind and hydrogen.

In the first section we make some general comments about the energy markets. We then consider some specific issues relating to renewable sources. We then describe a distributed generation alternative. Finally we offer a summary of CFCL and our fuel cell development.

General Energy Market Comments

CFCL notes that energy markets are under increasing pressure, from several forces: significant increasing global demand, limited supply, and environmental constraints. These pressures are now widely acknowledged.

In this respect we point out that ageing electricity infrastructure, especially high-voltage transmission and distribution (T&D) networks, is in many countries, including Australia and parts of the US, emerging as the 'weak link' in the electricity system. Investment in this infrastructure is expected to be significant: for instance, the European Commission forecasts that €1,000B is needed over the next 20 years and in April 2006 the German Chancellor announced €30B investment in energy infrastructure by 2012. We suggest that the comparable Australian infrastructure costs (and, conversely, savings) should be considered in any study of energy generation technologies.

There is also wide consensus that the most effective response to these challenges is a 'portfolio' approach - the future will see a network of differing generating technologies. Importantly, in the short term fossil fuel sources will continue to dominate Australia's energy generation mix.

Given these factors, we suggest the immediate priority should be to maximise efficiency and reduce emissions from fossil fuels.

One of the most promising ways of doing this is to move to 'distributed generation' technologies, particularly micro-combined heat and power (m-CHP) units. We provide more detail about distributed generation later in our submission.

Another priority should be to encourage technologies that increase energy efficiency, or, more broadly, reduce demand for electricity – both of which are cheap ways of cutting greenhouse emissions and reducing the need for new generating capacity.

Our final comment is that there should be a 'level playing field' for all energy generating technologies. Existing electricity infrastructure was, almost entirely, funded by the State. The costs of that investment, and more importantly the true environment and social costs of fossil fuels (especially brown coal) are not currently reflected in the market prices for power.

The reason serious action is now needed on climate change and greenhouse emissions is that the market treated (and in Australia's case, continues to treat) environmental effects as externalities. It must now be clear that these effects must be costed, to allow the market to efficiently allocate resources.

Comments on Renewable Energy Sectors

First, a clarification: CFCL's fuel cells can provide 'emission free' power when the fuel cells are powered by 'renewable' fuels – such as hydrogen, ethanol, biodiesel, bio-methane etc. However CFCL's fuel cells can also produce electricity from natural gas and other hydrocarbon fuels – in which case the fuel cells produce some emissions of CO2 (but no NOX or SOX). Due to the much higher efficiency of fuel cells, they produce up to 60% less CO2 than a coal fired power station.

CFCL is not qualified to provide detailed comments on all the renewable energy sources the Committee is studying. Our main comments are directed to hydrogen.

It is often assumed that only large-scale centralised generating plants can provide baseload power.[1] This is not correct. Emerging distributed generation technologies, including fuel cell powered m-CHP units, could also provide baseload power, with significant advantages over centralised plants like coal or nuclear.

The current debate on energy seems to have a collective blind spot toward the emerging move to distributed generation.

Large generating assets are risky investments. The capital costs are so large the plants need extremely long operating lives (30 years or more), with secure revenue streams, to make economic sense. In an increasingly uncertain energy market it is becoming too risky to make huge 'bets' on these assets. We would suggest a good way to mitigate this commercial risk is to invest in many more, smaller generating assets. Distributed generation units (eg residential m-CHP units) are low-cost and scalable: the investment risk can be mitigated by a phased roll out of new units, with improvements quickly being incorporated into the next version of the product. (In this respect the move from centralised to distributed power generation is analogous to the shift from centralised mainframe computing, to networked personal computers, and now 'embedded' computing power.)

CFCL suggests that small scale energy generating technologies such as fuel cells are in fact closer to commercial uptake than some other more high-profile technologies such as tidal and wave power. These technologies, like wind farms and large scale solar 'farms', also require considerable investment to transmit the electricity from where it is generated to where it is used – for instance, expensive new grid connections and transmission networks.

Whilst a lot of attention has been given to renewable energy sources – and we support government policies to support these sources – in the near term fossil fuel sources will continue to be the dominant sources of energy. Therefore the immediate priority should be to maximise

[1] Eg Switkowski report on nuclear energy, page 40: "baseload (low-cost, large-scale) plant".

efficiency and reduce emissions from fossil fuels. Technologies which can utilise the existing energy infrastructure (fuel sources, networks etc) can also be adopted more quickly than technologies which require significant new infrastructure (eg the 'hydrogen' economy).

Energy efficiency is far less 'newsworthy' or eye-catching than new renewable power sources (there is nothing 'sexy' about using less power) however many studies have shown that reducing energy usage, and using existing fuels more efficiently, is the cheapest and quickest way of reducing emissions.[2]

Distributed Generation and m-CHP units

In the near future, rather than relying on electricity from large, remote power stations, like coal-fired and nuclear, we believe there will be small electricity generating devices in our homes. In one scenario, for instance, gas hot water systems would be replaced by a unit that would look much the same, and as well as hot water, it would generate electricity via a fuel cell - and could even provide home heating and cooling as a free by-product. This *distributed* generation has a number of advantages over today's century-old *centralised* generation model.

Distributed generation is no pipe dream. In 2005 it accounted for about 25% of new generating capacity worldwide[3], and is well established in northern Europe - for example, more than half of Denmark's electricity comes from distributed generation. Products that will quickly extend distributed generation, particularly in homes, will start rolling off the production lines in the next three years. Distributed generation also makes good economic sense, and will not require large government subsidies to be cost-effective.

The benefits of distributed generation become clear when visiting Hazelwood, a coal-fired power station in Victoria's Latrobe Valley. The massive cooling lake surrounding the facility – about 500 hectares - is heated to a balmy twenty-three degrees every day. The electricity bill to heat an outdoor pool of that size to those temperatures all year round would be staggeringly high. But at Hazelwood the heat comes free; it is a by-product of the electricity generation. That is the key to why distributed generation is so attractive. If the power was generated in the households where it is eventually used anyway, and not in the Latrobe Valley, that waste heat would no longer have to be wasted. It could warm the house, or cool the house via a process that uses heat to make cool air – for free. There are huge amounts of waste heat available for use: about 70% of the energy generated at a coal-fired power station is squandered as heat.

A further efficiency gained by generating electricity close to where it is used is that there are no longer energy losses through kilometres of unsightly high voltage transmission lines. Add all the improvements together and distributed generation can give more than one and a half times the energy for the same amount of fuel, compared to a gas-fired power station, and more than double a coal power station.

The way the electricity is generated in the home is via a fuel cell, which is small enough to install inside a hot water service. The cell consists of a stack of chemically-coated ceramic and metallic sheets. Natural gas is passed over the sheets, and a chemical reaction takes place, which produces electricity. No fuel is burnt in the process so there are no noxious waste gases, and with no moving parts the fuel cells are completely silent and emit up to 60% less greenhouse gas than a coal-fired power station. The fuel cells plug into the existing natural gas network – and can also run on bottled gases like LPG and renewable fuels like ethanol.

Distributed generation will not mean each home will generate electricity only for itself. Rather, houses would still be connected to the electricity grid, but it would be a *two-way* connection.

[2] For example, http://www.mckinseyquarterly.com/article_abstract.aspx?ar=1911&l2=3&l3=41&srid=297&gp=0
[3] 'World Survey of Decentralised Energy 2006', May 2006, www.localpower.org

When your home is generating more electricity than you need, the excess is pumped back into the grid for others. When you need extra electricity, you simply draw it in from the grid.

Distributed generation through fuel cells is a much more reliable source of energy than wind or solar power. Fuel cells distributed throughout homes will operate constantly, providing baseload power. The fuel cell home generators will have intelligence built into them and be hooked up to the internet, which means an electricity company can individually monitor and control them.

Distributed generation is also far more secure than the old centralised generation paradigm. This is particularly important in these times of terrorism, for example, where large nuclear reactors could be a target. Instead, distributing the power generation over millions of homes makes the energy network far less vulnerable to attack – or breakdown for that matter.

Distributed generation will not completely replace centralised power stations. However a study for the UK's Department of Trade and Industry predicted that 30% - 40% of all UK electricity could come from 'microgeneration' by 2050[4].

Rather than outlaying significant capital to set up new centralised power stations, like nuclear power stations, it makes more sense to embrace the distributed generation revolution.

The benefits of fuel cells and distributed generation have been recognised by several Government reports:

> *"Fuel cells have a number of advantages over conventional power generating equipment including high efficiency (around 70 per cent), reliability, low chemical, acoustic and thermal emissions, low maintenance, fuel flexibility, siting flexibility, modularity, and excellent part-load performance. They have relatively few moving parts and thus have the potential for quiet operation and long working lives."*[5]

> *"Increased uptake of renewable and distributed generation (R&DG) has the potential to deliver a range of important benefits including improved efficiency, system security, emissions reductions, regional and rural development, and new business and export opportunities."*[6]

About Ceramic Fuel Cells Limited

CFCL is a leader in developing solid oxide fuel cell (SOFC) technology to provide reliable, energy efficient, high-quality, and low-emission electricity from widely available natural gas and renewable fuels. CFCL is developing SOFC products for on-site micro combined heat and power (m-CHP) and distributed generation units that co-generate electricity and heat for homes.

CFCL was formed in 1992 by the CSIRO, several government bodies and leading energy and industrial companies. In 1998 CFCL received a Federal Government R&D Start grant of $15 million.

The Company is publicly listed on the Australian Stock Exchange and the London Stock Exchange AIM market. The company's market capitalisation at 13 June 2007 is approximately $300 million.

CFCL is currently demonstrating units in field trials in Australia and New Zealand, and with EWE, one of Germany's top five energy suppliers. CFCL has also signed product development agreements with utility and appliance partners (including Gaz de France, Europe's largest gas

[4] 'Our Energy Challenge', UK DTI Microgeneration Strategy, March 2006, www.dti.gov.uk
[5] Renewable Energy Technology Roadmap, October 2002, page 46.
[6] 'Impediments to the Uptake of Renewable and Distributed Energy', Discussion Paper, Ministerial Council on Energy Standing Committee of Officials, February 2006, page 5.

distributor) to design and develop fully integrated m-CHP units for the French and German markets.

CFCL has extensive R&D, testing and manufacturing facilities in Noble Park, Melbourne, and a sales office in the UK.

With over 110 skilled staff and extensive patented technology (50 patents in 29 patent 'families' to date), CFCL is pursuing partnerships for manufacture, production and use of its fuel cells in delivering clean power to homes.

We appreciate the opportunity to provide a submission to the Committee.

Should you have any questions or comments regarding our submission, please contact us.

Yours sincerely,

Brendan Dow
Managing Director
Ceramic Fuel Cells Limited