CERAMIC FUEL CELLS LIMITED
Creating the energy to succeed™

Productivity Commission enquiry into Energy Efficiency

"Appropriate use of distributed energy systems has the potential of doubling the efficiency of energy use compared with grid networked power. In the case of distributed energy, there will be a progression from the use of gas engines to microturbines to fuel cells, accompanied by increasingly sophisticated control and waste heat utilisation…"

> Dr John Wright, Director Energy Transformed Flagship Program, CSIRO, in his submission to the Victorian Greenhouse Energy Challenge, 2003[1].

Ceramic Fuel Cells Limited requests that the Australian Government establish policies similar to those in Europe which encourage development and early adoption of fuel cell based distributed generation products.

We also recommend that Australia should take advantage of increasing energy conversion efficiency by supporting local development and demonstration of micro-CHP products and enabling legislation and energy price signals that facilitate widespread implementation of small-scale distributed co-generation.

Why fuel cells?

Fuel cells promise to be one of the most important energy conversion technologies of the 21st century. Because of their high fuel efficiency they can make a significant contribution to reducing greenhouse gas when running on readily available fuels such as natural gas. Overall fuel efficiency is further boosted by capturing waste heat and using it to create hot water in domestic and commercial environments.

We believe there is a significant future market opportunity for residential Combined Heat and Power (micro-CHP) units in which a fuel cell based electricity generator of between 1 and 5 kW is integrated into a gas fired domestic water heating system.

Europe is embracing this concept, especially in Germany and the UK, where governments are actively encouraging the development and adoption of micro-CHP technology. Japan is also strongly engaged in fuel cell development aimed at the domestic heat and power market.

Key drivers identified by the British Government and others for this emerging market are the high overall energy conversion efficiency, increased power security and lower carbon energy supply which can be gained by locating power generation at or close to the consumer so that waste heat can be usefully captured – this is known as *distributed co-generation*.[2] The natural gas powered high-temperature fuel cell is recognised by the European Commission as being among the most efficient and environmentally friendly means of achieving this[3].

Energy efficiency of micro-CHP

We believe micro combined heat and power units powered by solid oxide fuel cells have the potential to:

- Achieve up to 50% electrical conversion efficiency – compared with approximately 30% for current coal fired power stations;
- Achieve up to 85% overall energy conversion efficiency through heat recovery, and
- Reduce carbon dioxide emissions by up to 60% - compared with current coal fired power stations.

[1] http://www.greenhouse.vic.gov.au/submissions_challengeforenegergy.html
[2] "The Government's Strategy for Combined Heat and Power to 2010" DEFRA, UK, May 2002 http://www.defra.gov.uk/environment/energy/chp/index.htm
[3] "Hydrogen Energy and Fuel Cells" European Commission, June 2003 – p.11, p.14 http://europa.eu.int/comm/research/energy/pdf/hlg_vision_report_en.pdf

170 Browns Road, Noble Park, Victoria 3174 Australia Tel: 61-3-9554 2300 Fax: 61-3-9790 5600
www.cfcl.com.au ABN: 82 055 736 671

Overseas government support

The UK Government recognised the potential importance of micro-CHP in their 2003 Energy White Paper, which also proposes mandatory installation of high efficiency (condensing) boilers from 2005.[4] High efficiency water heating benefits the end-user through lower energy bills but comes at a price premium so the UK Energy Savings Trust has recommended that micro-CHP systems should be subject to VAT at only 5% to assist their introduction, which they estimate could be up to 1 million units by 2010.[5]

In order to rapidly promote market adoption of high efficiency distributed generators, the German Government has introduced a CHP law, which regulates the purchase and remuneration of electricity exported to the grid. The law provides the largest subsidy of €0.0511/kWh for electricity generated by small CHP plants of 50 kW (electrical output) or smaller.[6]

In the USA the Department of Energy has recently initiated a working group to review opportunities for the development and introduction of micro-CHP technologies[7]. The DoE is already providing strong support for SOFC development via its Solid Energy Conversion Alliance (SECA)[8].

Emerging CHP technologies

Fuel cell based CHP systems are being field trialled by several European energy companies such as RWE, EoN and EnBW in Germany, who sees significant added value from small scale fuel cell based Distributed Generation with high efficiency, low noise and vibration and minimal emissions.[9]

Apart from fuel cells, other micro-CHP technologies under trial include Stirling engines, although these can only operate for a limited number of hours a year because they are essentially heat generators with very low electrical efficiency which must be turned off when hydronic heating is not required during the summer.[10]

By comparison, the solid oxide fuel cell based micro-CHP is designed to run all year round as it is primarily an electricity generator with useful waste heat. Additional water heating energy is supplied by an auxiliary burner.

Ceramic Fuel Cells Limited (CFCL)

CFCL is a developer of fuel cell systems based on solid oxide fuel cell (SOFC) technology that deliver reliable, energy efficient, high-quality, low-emission electricity from natural gas, LPG, methane and other alternative and renewable fuels. The company is acknowledged globally as a leading developer of flat-plate, all-ceramic, SOFC and stack technology.

In its 2004 energy policy White Paper the Australian Government has recognised our solid oxide fuel cells as being "world-leading" and offering "...significant potential for moving to more distributed electricity generation"[11].

CFCL has built a proof-of-concept micro-CHP system and is currently building prototypes of a pre-commercial version for field trials in Australia, New Zealand and Europe during 2005.

We believe that Australian Government support is crucial in the field trial demonstration phase of commercialisation.

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[4] http://www.dti.gov.uk/energy/whitepaper/wp_text.pdf p.35
[5] "Fiscal Incentives for Home Energy Efficiency" Energy Savings Trust, UK Nov 2003 www.est.org.uk
[6] http://www.cogen.org/Downloadables/Publications/Press_Release_1Feb2002_German_CHP_Law.pdf
[7] http://www.eere.energy.gov/de/cfml/news_detail.cfm/news_id=8165
[8] http://www.seca.doe.gov/main.html
[9] Innovation Report 2002, EnBW, p.14 http://www.enbw.com/content/en/press/publications_and_speeches/ (German & English) and www.enbw.com/brennstoffzelle (German)
[10] http://www.est.org.uk/est/documents/Potential_market_for_micro_CHP_2002.pdf
[11] "Securing Australia's Energy Future", Australian Government, June 2004 – pp172-3 http://www.dpmc.gov.au/energy_future/docs/energy.pdf

Conclusion

Fuel cells promise to be one of the most important energy conversion technologies of the 21st century.

Because of their high fuel efficiency they can make a significant contribution to reducing greenhouse gas when running on readily available fuels such as natural gas. Overall fuel efficiency is further boosted by capturing waste heat and using it to create hot water in domestic and commercial environments.

Through the work done by CFCL over the past twelve years Australia is at the forefront of solid oxide fuel cell development for stationary power.

To capitalise on this window of opportunity the Federal Government is requested to establish policies similar to those in Europe which encourage development, demonstration and early adoption of fuel cell based micro-CHP and other distributed generation products.

For further details please contact:

David Peck, FIEAust CPEng, Business Development Manager – E-mail: davidp@cfcl.com.au
Ph: 03 9554 2832 Fax: 03 9554 2910 Mobile: 0419 309 727

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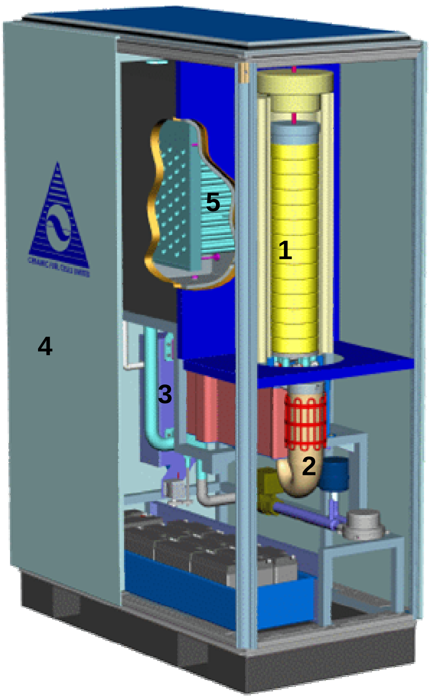
CFCL micro-CHP pre-commercial design

1kW solid oxide fuel cell generator, integrated with a domestic hot water service and fuelled by natural gas.



1. Fuel cell stack
2. Stack thermal management
3. Waste heat recovery
4. Mains power converter & controls
5. Hot water storage tank