



CERAMIC FUEL CELLS LIMITED

Clean power for your home

Materials Development for CFCL's Metal-Ceramic Stack

Summary of a Paper Presented to the

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Lucerne

by

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Overview

- **Advanced anode supported fuel cell**
 - High power density
 - High electrical efficiency
 - Longer stack lifetime
- **Significant advances in 2007/08**
 - Cell power output at commercial level
 - Glass seals
 - Commercially available stainless steel
 - High performance protective coatings on metals
 - Advanced connectivity from cell to interconnect
- **Developing Commercial low cost product**



High Performance Cells

Increased power output

>500mW/cm²

50% increase in 12 months

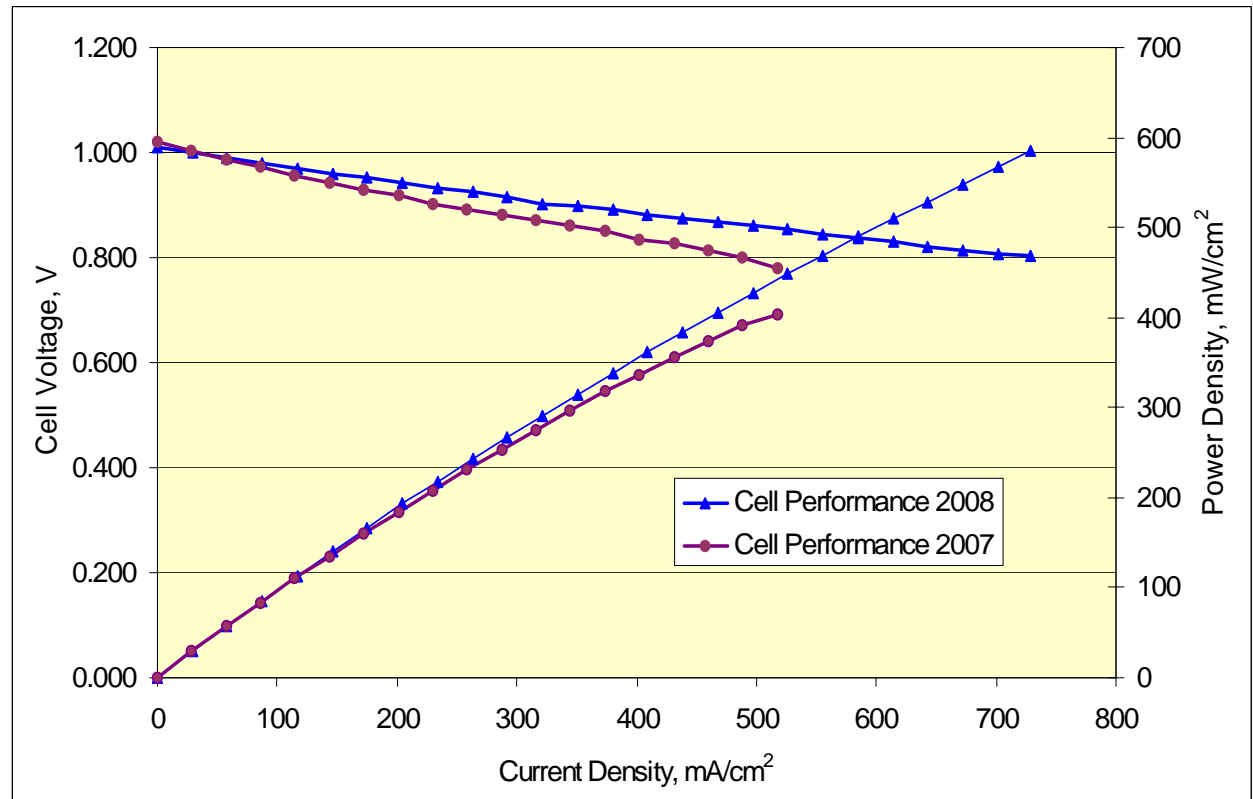
More powerful cells

=

more powerful stacks for the same BoP

=

Lower cost per kW, more carbon savings





High Electrical Efficiency

- February 2008, 1kW stack = 50% electrical efficiency
- June 2008, mini stack = 66% electrical efficiency
- 1-2kW stacks can achieve >50% electrical efficiency

Vs centralised generation, 25-40% electrical efficiency in the home

Higher electrical efficiency = lower energy costs, lower emissions

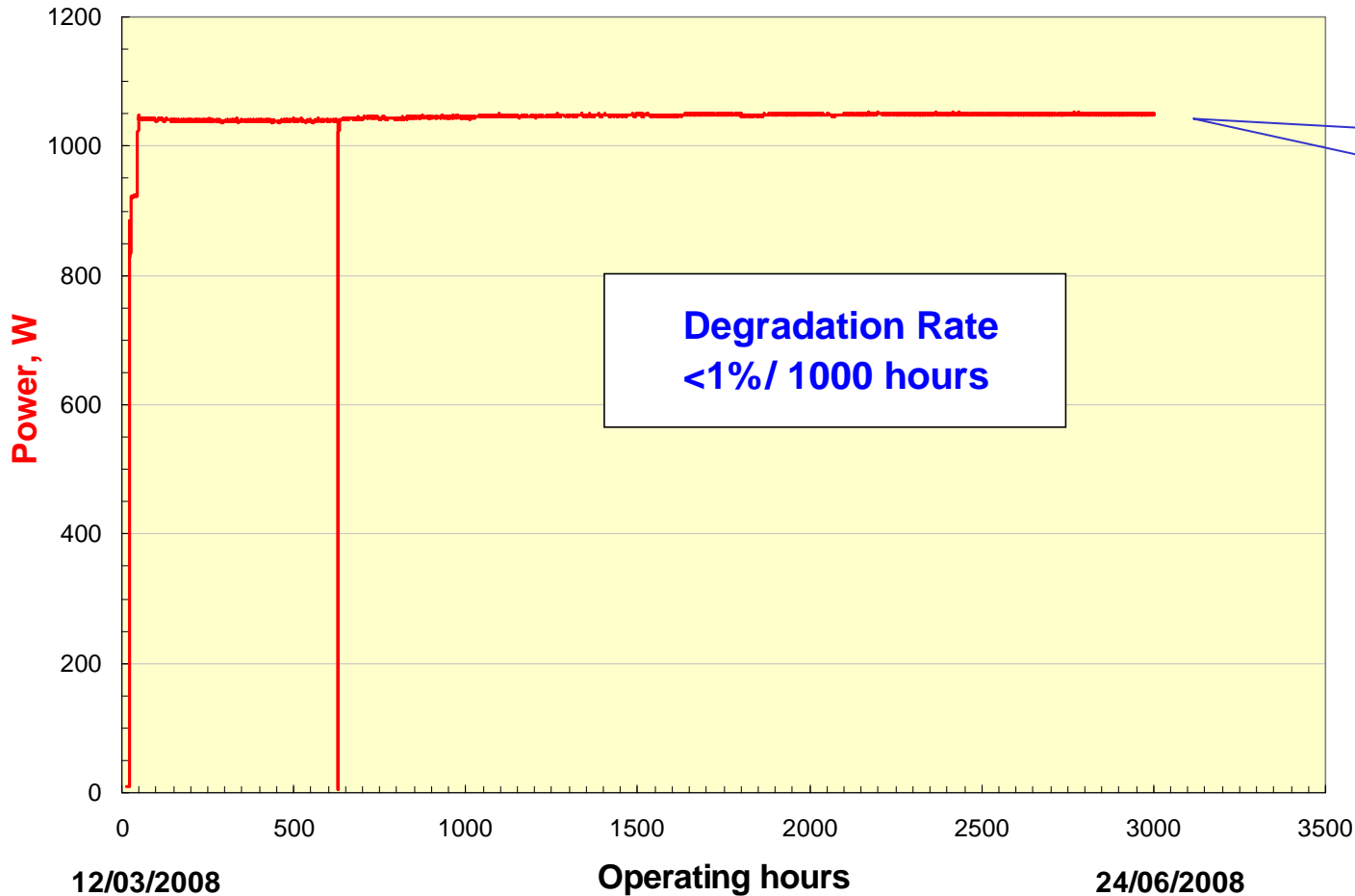
“In future, fuel cell-based Micro-CHP systems may offer higher carbon savings due to their potential to operate with higher electrical efficiencies....The generation of electricity is the key to the carbon saving performance of Micro-CHP ”

UK Carbon Trust, Micro-CHP Accelerator [Interim Report](#), November 2007



Longer Lifetime

1kW Stack Test @ 750C in Natural Gas



Test is Continuing

35% improvement in 4 months

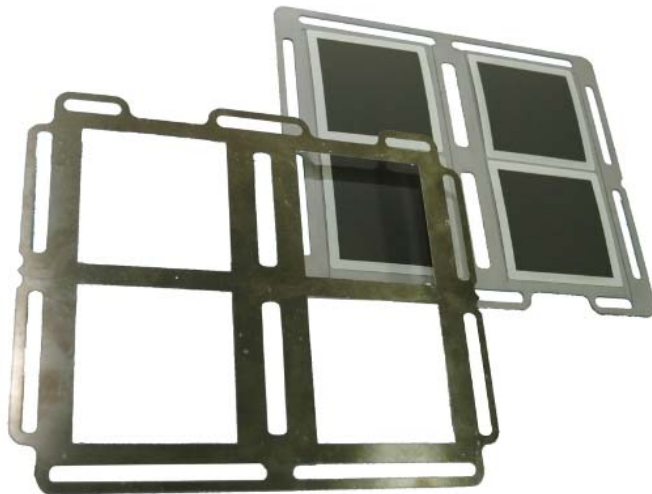
(1.53% / 1000 hours in February 2008)

1kW stack in test station



Interconnects

- **Low contact resistance = high efficiency**
- **Consistent layer connections**
- **Durable coatings**
 - Many thermal cycles
 - Long lifetime



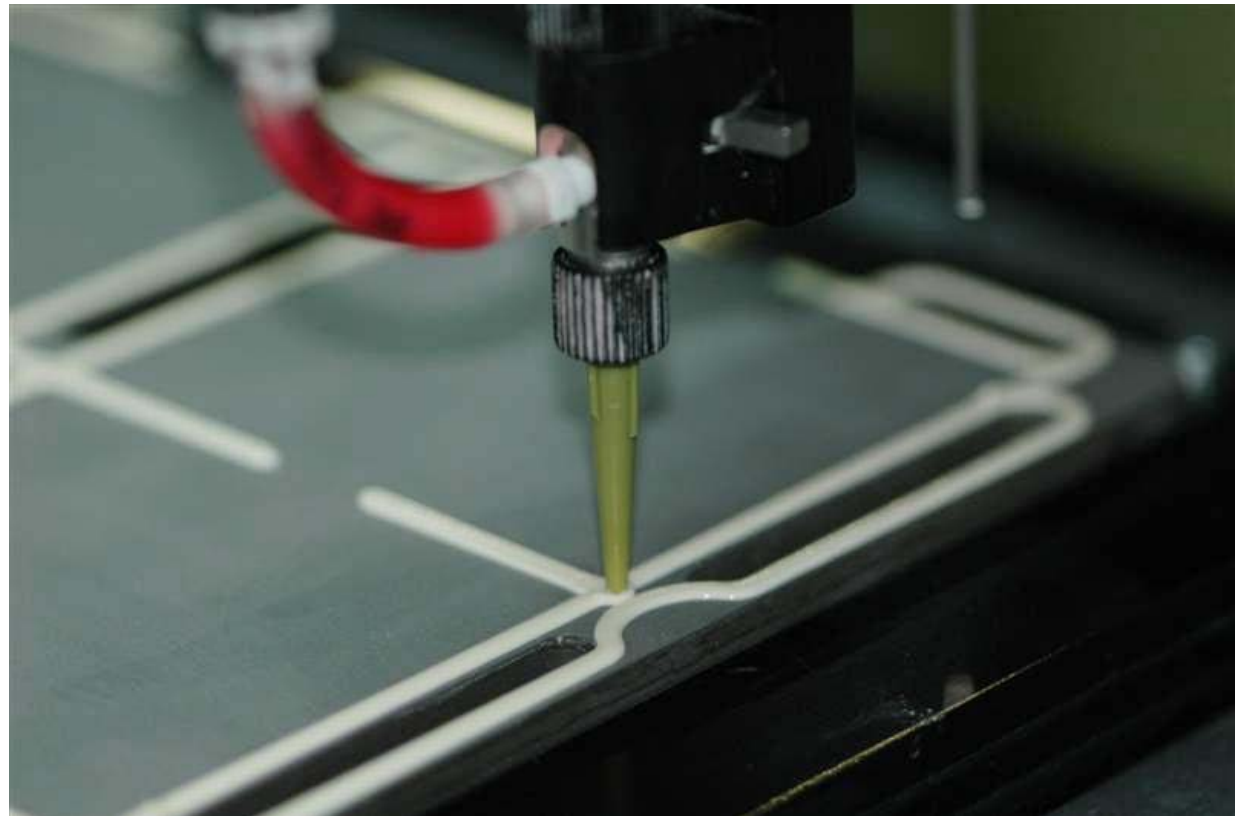


Advanced Glass Seals

**Mechanically
robust**

**Proprietary sealing
formulae**

**Automated
dispensing**





2008/09

- **Commercial low cost fuel cell module**
- **Integrate low cost outsourced components**
 - Cells from H.C. Starck and CeramTec
 - Commercially available steel interconnects
- **Proprietary seals and coatings**
- **Commission volume manufacturing plant in Germany**
- **Accelerated lifetime testing**
- **Collaboration with FZ Jülich and other industry leaders**