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Fuel Cell Today
Small Stationary Survey 2008

Dr. Kerry-Ann Adamson, March 2008

Summary

The past twelve months has seen the small stationary market, which we define as units under 10 kW, develop further into the two major markets of residential CHP and UPS. The total market saw a increase of 37% to just under 2500 units.

The technology split saw an increase in dominance of PEM units with SOFC accounting for less than 10% of units shipped. AFC technology remained on the fringes with only a handful of units produced.

In terms of market dynamics the UPS markets saw the largest increase in manufacture in North America and Europe and residential continued in increase in Asia, specifically Japan. Turning to diffusion and adoption government policy created new demand pull for UPS units in the US whilst the Japanese Large Stationary Demonstration Programme continued to increase fuel cell residential CHP demand in Japan.

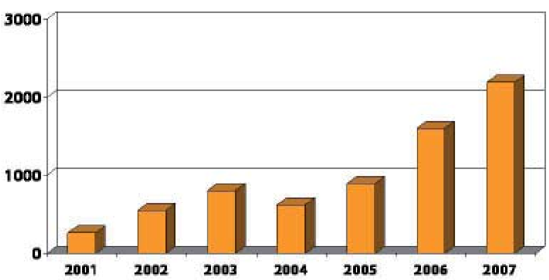
The number of companies involved in this space has remained stable over the last twelve months. The number of companies shipping over 100 units has gone up by a factor of two and a half and conversely the number of companies producing or shipping less than five units has also doubled. Parallel to this there has been a number of companies that can be classed as potential breakthrough companies which should see significantly increased levels of activity over the next period.

The small stationary sector remains stable and exhibiting sustainable growth rates and also shows little or no signs of the hype that still plagues some other applications. Companies are moving to increase funding either through private placements or stock market activity with the majority of the money raised being funnelled into new production, or expanded production capability.

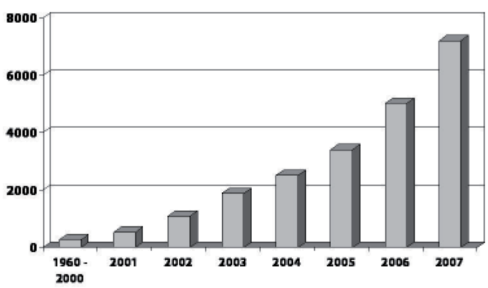
Market Developments

2007 saw an increase of 37% over 2006 with over 2000 new units shipped. Whilst this is lower than the 3000 we expected to see by this time many companies have reduced units shipped to focus money and effort on building manufacturing capability.

Graph 1 – New Annual Small Stationary Units

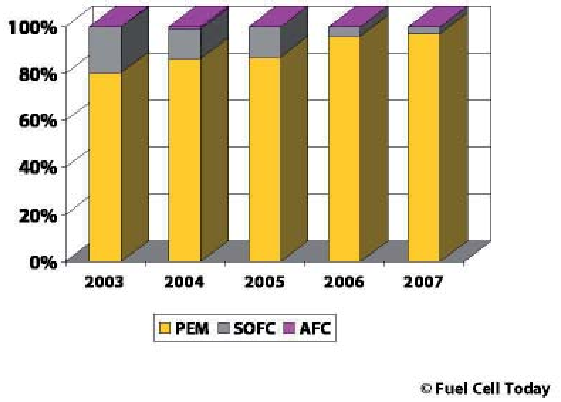


Graph 2 – Cumulative Small Stationary Units 1960 - 2007



Cumulative shipments to date have topped 7000 with the growth curve starting to exhibit a classic S-Curve diffusion pattern (note the long tail from 1960-2000 has been truncated).

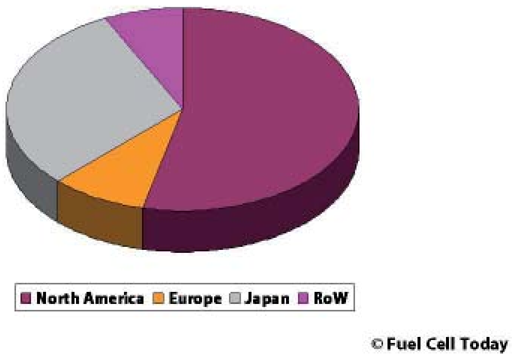
Graph 3 – Technology Adoption 2003 - 2007



Looking at technology development PEM units represented over 90% of units shipped with SOFC taking under 10% of this years shipment. AFC technology represents less than 1% of 2007 market shipments, though did increase from 2006.

Whilst UPS saw an increase of 64% units shipped the majority of new units are still being used in a residential CHP capacity

Graph 4 - Region of Manufacture 2007



Looking at region of manufacture the Rest of the World region saw the largest increase in units shipped. This trend is expected to continue with companies such as IdaTech completing manufacturing facilities in RoW regions. Japan saw an increase in units manufactured, part of this is from Ballard transferring manufacturing to Ebara Ballard in Tokyo as per their JV.

Market Dynamics

The dynamics of any market are a key indicator as to the health of the industry. The fuel cell industry in still going through a phase of consolidation, buy-outs or JVs and now to add to this is increased shareholder stakes, creation of market pull and increased regulatory pressure. Also we have continued to see the trend of near to, or at, market companies focusing down on core markets for the technology. For small stationary fuel cells this appears to be technologically driven, with some exceptions.

Notable developments of the past twelve months include:

- Sanyo Electric and Nippon Oil setting up a JV to manufacture residential fuel cells. Nippon Oil will take an 81% equity stake in the new company whilst the remaining 18% will be held by Sanyo. The manufacturing of the units is expected to take place at Sanyo's Sanyo Tokyo Manufacturing subsidiary.
- Manufacturing of Ballard fuel cell stacks for Ebara Ballard switching to Japan.
- Ceramic Fuel Cells receiving an order for 50,000 SOFC stacks for residential units from Dutch company Nuon. The deal could see production of the units starting in June 2009 and will cost £1,500 - £2,000 each with the overall integrated product cost being in the region of £3,000. The deal is contingent on Ceramic doubling its current stack life from two to four years.
- British firm Centrica (British Gas) taking a 9.999% stake in Ceres Power and placing a forward purchase order for 35,000 units, escalating over a four year period. The price of the unit has not yet been agreed upon. The order is contingent on an initial phase of field trails being successful.
- The US government launching the Katrina Panel Order requiring all base stations in the US to have extended run-time backup power modules installed.

Demand Pull

There is growing demand pull for small stationary fuel cells both for residential and UPS / Back-up power units. These are coming from either government induced markets, such the Japanese Large Residential Fuel Cell Programme, or from commercially driven markets, such as the recently announced Nuon deal with Ceramic Fuel Cells.

Government Induced Markets:

Residential:

In *Germany* the National Development Plan, "Hydrogen and Fuel Cell Technology Innovation Programme" was realised during 2006 and received the go ahead and funding early 2008. As part of this plan the government has set out a number of technical and adoption based targets for residential (1-5kW; PEM, SOFC) fuel cells. The 2020 vision is to have 72,000 residential units produced per annum at a cost of €1,700 / kW.

Korea: At present Korea is still in the R&D phase for residential fuel cell development.

Japan: Japan is very much the leader in terms of clear government support for fuel cells. It Large Scale Residential Fuel Cell Programme has taken a clear step forward to creating market demand by switching government subsidy away from the technology developers to the adopters.

UPS

Over the past year the largest government created market for fuel cell UPS systems has been in the USA with the Katrina Panel Order.

Katrina Panel Order

After Hurricane Katarina an independent panel was set up to review the Hurricanes impact on the telecommunications and media infrastructure in the areas affected and the sufficiency and effectiveness of the recovery effort with respect to the communications infrastructure.

The Panels major findings regarding the hurricane were that power was lost primarily due to fuel running out, not infrastructure damage. Also due to the gasoline supply chains being disrupted, either through flooding or enforced requisition by other government departments refueling of the back-up generators that were in place was hampered.

The suggestions by the Panel, relevant to this document, which has been incorporated into the Proposed Rulemaking are three fold:

1. Base stations must adopt a proactive approach to disaster planning by including on site a back-up power supply,
2. Generator technology should be employed with longer run time, and
3. Caches of power and communications equipment and fuel should be created by State and Local jurisdictions across the US

In October 2007 the Commission release the Katrina Panel Order stating that:

Once the final version of the ruling is adopted within one year of implementation the vast majority of the 30,000 base stations registered in 2007 and covered by this ruling will have to have in place an extended run-time back-up power unit.

Whilst it is expected that fuel cells will only take a fraction of this market due to a number of current cost and supply constraints, they do have in their favour an ability to have an extended run-time facility without major expansion of system footprint and do not rely on gasoline based fuels which may be needed elsewhere, as was evidenced in during Katrina.

Consumer Demand

Residential

2007 saw the seeds of demand by consumers for residential fuel cells that could also act in a back-up generator function (re-sUPS). Hydra Fuel Cells (USA) reported the sale and installation of two 8kW units installed in homes. One in the Hurricane belt of Florida with the fuel cell allowing the residence to be independently powered off-grid. Although costs are still prohibitive for wide spread diffusion of this type the sign that first adopters are now coming onboard shows the shift from technology to market focus.

UPS

Over a dozen major telecomm companies have now tested fuel cell UPS systems. The majority of these tests have reported as being successful. These results have seen an increase in activity in terms of distribution deals by integrator and stack manufactures in traditional and non-traditional regions. We expect to see further disaggregation of this market into larger datacentre units and smaller ruggedized field units within the next twenty four months.

Company Profiles

In this section we focus on a small number of companies that have or could make a big impact in the next year.

Name: *Altergy* (USA) Technology: PEM

The last twelve months saw Altergy open new fully automated production facilities which is claimed could produce up to 10,000 units per year. Parallel to this was a deal with Eaton Corporation whereby Eaton will integrate the Altergy PEM units into its own telecomm and datacentre product range.

Altergy does not have VC investment but has been reported to have raised more than US$24 million from about private individual investors.

Name: *Bloom Energy* (USA) Technology: SOFC

Bloom Energy appears to be starting to come out of its self imposed "stealth mode". Bloom Energy is a privately held company producing regenerative SOFC units.

The company employs 200 and has private investment from Kleiner Perkins and NEA.

Bloom Energy has been one of the top SOFC fuel cell patents filing companies during 2007. For more information on this see the Fuel Cell Today Patent surveys.

Name: *CellKraft* (Sweden) Technology: PEM

CellKraft have released its S-Series of fuel cells which have been developed for the UPS market. True to the companies Swedish roots the units have proven cold weather capability.

Current cost structure shows a 2kW units for €50,000 (per unit) dropping to approximately €15,000 for a bulk order of 30 units or more.

Name: *Ceres Power* (UK) Technology: SOFC

2007 saw Ceres Power demonstrate its first integrated fuel cell CHP unit, income top £1 million (primarily from long term development contracts and government grants) and announce two highly significant deals.

EDF Energy Networks – Echoing the Hydra Fuel Cell resUPS installation Ceres Power and EDF Energy Networks announced a development deal to product residential fuel cell UPS systems. The first prototype units are expected during 2008 / 2009.

Centrica (British Gas) – Contingent on successful field trails, further technical milestones and agreement on 'commercial terms' such as price, Centrica have agreed to pay £5 million to Ceres Power for a minimum of 37,500 fuel cell CHP units. These will be integrated into Centrica products. Centrica will take a 9.999% share in Ceres and holds the exclusive right to supply and distribute rights to to the residential UK market subject to British Gas purchasing at least the minimum annual order volumes for each year of the forward order. Ceres retains the right to distribute and market its fuel cell units outside of the UK. Increased manufacturing capability is expected to come online in 2008/2009.

Name: Ceramic Fuel Cells (Australia, UK) Technology: SOFC

CFCL has announced a number of new partners and contractors in its supply chain. As well as opening up a Zirconium power plant the company has contracted HC Starck (Germany) to manufacture the individual cells in the fuel cell and CeramTec (Germany) for the development and supply of specific components. At the other end of the chain CFCL now has integration agreements in place with Gaz De France (France), De Dietrich (France), EWE (Germany), Bruns (Germany), e.on (UK), Gledhill (UK), Nuon (Netherlands), De Dietrich-Remeha (Netherlands) and Paloma (Japan).

Nuon – CFCL has signed a contract, contingent on the successful completion of a number of technical commercial related targets, to supply Nuon with 50,000 fuel cell systems over a five year period from mid 2009. CFCL's manufacturing plant will be initially sized to match the order.

Name: *Electro Power Systems* (Italy) Technology: PEM

The Italian product integrator has announced the results from a small number of successful field trails and the launch of a new UPS system.

In its last funding round (June 2007) ElectroPS raised €5 million from 3600 Capital Partners, an Italian / French VC. Under the terms of the agreement, 360° Capital Partners will invest in ElectroPS in two phases, the first of which provides immediate funding to the company of about two million euro with the remaining funds to be delivered within the next 12 months. In return, 360° Capital Partners will obtain a significant minority stake of Electro Power Systems.

ElectroPS plans to install a number of further test systems in a number of regions including, potentially, in Pakistan to test its Electro7 (7kW) unit.

Name: *Helion* (France) Technology: PEM
2007 Company Highlights:

Helion is a part of the Areva (France) Renewable Energies Business Unit. It is working on a range of uses for its technology including a system integrated with renewable energy, and a mCHP unit.

How far from being commercially available these units are is yet to be seen.

Name: *Hydra Fuel Cells* (USA) Technology: PEM

Hydra Fuel Cells is a subsidiary of American Security Resources developing UPS and resUPS systems. Last year saw the installation of two resUPS HydraStax systems in the US. More recently it has seen a purchase order from its distribution partner Conexa for a further 50 5kW HydraStax units. This is believed to be worth US$1,100,000. A further order worth a similar amount is also on the books with both being scheduled for fulfilment by Q2 2008.

Name: *P21* (Germany) Technology: PEM

P21 is one of only a small number of European companies focusing solely on the UPS base station market. To date it has tested, with telecommunications partners, units in Europe, Africa, the Middle East and Asia and is in serial production. 2008 is planned to be worldwide roll out of the product.

P21s funding partners include Goldman Sachs, Target Partners and Conduit Ventures.

About the Author

Kerry-Ann Adamson is the Principal Analyst and Manager of Fuel Cell Today and has interests in the socioeconomics of distributed generation and alternative fuels / technologies for vehicles.

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