

**Stationary Fuel Cell Market Opportunities, Strategies,
and Forecasts, 2006 to 2012**

Stationary Fuel Cell



Picture by Susie Eustis

MOUNTAINS OF OPPORTUNITY

**WinterGreen Research, Inc.
Lexington, Massachusetts**

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STATIONARY FUEL CELL MARKET SHARES
STATIONARY FUEL CELL MARKET FORECASTS
Stationary Fuel Cell Market Development
Market For Continued Fuel Cell Commercialization

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Fuel Environmental Issues
POWER OF A FUEL CELL
HYDROGEN FUEL CELL TECHNOLOGY
ON GRID AND OFF GRID ISSUES
IMPACT OF DEREGULATION
FUEL CELL ISSUES
FUEL CELL RELIABILITY
LAWS AND REGULATIONS
SOLID OXIDE FUEL CELLS (SOFC)
ALKALINE FUEL CELLS (AFC)
STATIONARY POWER APPLICATIONS

OPPORTUNITY ABOUNDS

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Stationary Fuel Cell Market Opportunities, Market Forecasts, and Market Strategies, 2006-2012

Industrialization Requires Sustainable, Highly Efficient Energy.

Stationary fuel cell company analysis indicates that markets targeted, cost targets, and power ratings have enormous similarity between companies. Generally the target cost is \$300 per Kilowatt and the current cost is \$4,500 per Kilowatt.

Economies of scale and new materials are needed to bring the units within target costs. With the cost of crude oil climbing toward \$100 per barrel, it really does not matter what the cost of the fuel cell is, people need to start buying and using them. They provide energy independence off grid, cogeneration of heat, air conditioning, and electricity, and operate in a manner that is more environmentally appropriate.

NETL anticipates eventual mass-production of fuel cells from solid ceramic materials, dramatically reducing costs. Trial installations have moved to provide incentive to invest in the stationary fuel cell market as it begins to mature.

Industrialization requires sustainable, highly efficient energy. Fossil fuel generation needs to be replaced by clean, renewable energy. Fuel cells run on hydrogen that in turn needs to be manufactured. Hydrogen can be manufactured from nuclear, wind, and solar power. Nuclear power run at 100% capacity can be used to generate hydrogen with the unused electricity. Stationary fuel cells promise to use that energy stored as hydrogen.

For homeowners seeking true electrical grid independence, SOFC micro-power plants take away the dependence and limitations of the electric distribution grid, in a remote standalone package that can also provide heat for the home. This lets the homeowner live just about anywhere, in the mountains or deep woods, in the desert or on an island. Fuel cells run on hydrogen that in turn needs to be manufactured. Hydrogen can be manufactured from wastewater treatment plants, landfill gasses, nuclear, wind, and solar power. Stationary fuel cells promise to use that temporary energy stored as hydrogen.

Because hydrogen can be manufactured from landfill and wastewater treatment plants, many units are being located close to those energy sources. Giving fuel for stationary campus fuel cell units is a priority. Nuclear energy is also used to generate hydrogen from its excess capacity. The reactors in the world used for nuclear electricity generation in 2005 created 2,626 billion kilowatts of energy.

Stationary fuel cells are being implemented as cogeneration units that produce electricity and heat. They can also be used as air conditioners. United Technologies PureComfort™ systems consist of four, five or six 60kW microturbines and a double-effect absorption chiller / heater from United Technologies sister company Carrier Corporation, a global leader in building heating, cooling, and control networks. These systems can reach efficiencies up to 90 percent and are operating in a wide variety of commercial buildings.

The UTC Power PureCell™ 200 has operated in 19 countries, delivering clean, highly efficient power to end users. Clean and energy-efficient, the PureCell™ 200 is a combined heat and power unit that produces 200kW of electricity and up to 925,000 BTU/hr of heat. With the capacity to operate grid-connected or grid-independent, it transitions power instantaneously with no interruption in service.

The system meets the strictest emission standards and operates quietly on site. Globally, UTC Power has installed more than 275 PureCell™ 200 units with more than 1 billion kilowatt hours of operating time. The PureCell™ 200 has an overall efficiency of 90 percent in combined heat and power mode, compared with 30 percent for the electric grid. Because power is generated onsite, transmission losses are avoided.

As the dollars per kilowatt for stationary fuel cell utility units decline to \$4,500 in 2009, markets start to pick up with grid utility power company units shipped.

The stationary fuel cell markets at \$98 million have been at stasis for several years, due to the high cost per kilowatt that is not competitive with existing utility technology. As the price of fuel rises, environmental concerns become more compelling, and demand for reliability more intense, the markets become more mature.

This is because the demand picks up for reliable units that can run on hydrogen from excess electricity generated by wind power. Solar power begins to be a factor as well, with nanotechnology breakthroughs giving solar photovoltaic power a cost competitive position in the energy chain. Fuel cells are needed to level out the power distribution. Wind power is plentiful in the ocean, and can be used to generate electricity there, that can be transmitted to reforming stations where the electricity is stored as hydrogen for use in stationary fuel cells used by utility companies.

2-megawatt fuel cell power plants demonstrate the feasibility of fuel cell research. Monitoring and down time to replace parts are issues. More work needs to be done to reduce the costs and develop a better catalyst to drive machines. Research is concentrated on making units smaller and easier to use.

For homeowners seeking true electrical grid independence, residential PEM and SOFC micro-power plants take away the dependence and limitations of the electric distribution grid, in a remote standalone package that can also provide heat for the home. This lets the homeowner live just about anywhere, in the mountains or deep woods, in the desert or on an island.

Planning for disasters is part of large enterprise risk analysis. Quarantine in the event of a pandemic may go on for a while, so companies may be willing to pay for residential fuel cells to support business in isolation so people can work at home.

Fuel cells run on hydrogen that in turn needs to be manufactured. Hydrogen can be manufactured from wastewater treatment plants, landfill gasses, nuclear, wind, and solar power. Stationary fuel cells promise to use that temporary energy stored as hydrogen.

Total stationary fuel cell markets at \$98.6 million in 2005 are comprised of revenue from trials that are being put in place, with market acceptance a certainty and timing dependent on price performance improvements. Markets are expected to reach \$16.98 billion by 2012.

In the stationary power market, fuel cells could become competitive if they reach an installed cost of \$1,500 or less per kilowatt. Companies aim to decrease costs to \$400 per kilowatt in that time frame. The cost is in the \$4,000+ range per kilowatt in 2005. In the automobile sector, a competitive cost is on the order of \$60 - \$100 per kilowatt, a much more stringent criterion.

Companies Profiled

Market Leaders

UTC Power
Fuji Electric

Market Participants

Acumentrics	Acal Energy
Adaptive Materials	Adelan
Agni	Alca Torda Applications
ALLPS Fule Cell System GMBH	Anglo Platimun / Johnson Matthey
Angstrom Power	Ansalado Fuel Cells SpA-AFC
Apollo Energy Systems	Aperion Energy Systems
Astris Energi	Air Liquide / Axane Fuel Cell Systems
Finmeccanica Group / Ansalado Fuel Cells	Ballard
Ball Aerospace & Technologies	Baxi Group
BCS Technology	Ceramic Fuel Cells Limited (CFCL)
Celex Power	CellTech Power LLC
Cellennium	Cenergi Corporation
Ceramater	Ceres Power
Clean Fuel Generation	CMR Fuel Cells
Connecticut Clean Energy Fund	Coval H2
CTP Hydrogen	Daimler Chrysler / MTU / CFC-MTU Soluions (German)
Delphi	DENORA s.p.a.
Dias Analytic	Donaldson Company
DTI Energy	Dupont
EBZ Entwicklungs-und Vertriebsgesellschaft Brennstoffezelle mbH	
ESL Electric Auto Science	Electrotec
ElectroChem	Element 1 Power Systems
Electric Power Research Institute	Electronic Machining s.r.l.
Emprise	Entegris
Eneco	ENRG
Engelhard	Esoro

Evonyx-e Vionyx	Five Star Technologies
Fuel Cell Component and Integrators	Fuel Cell Control
FuelCell Energy	Fuel Cells Ltd.
Fuel Cell Technologies Canada	Fuel Cell technologies Ltd.
Franklin Fuel Cells	GE
GenCell	General Hydrogen
Gesellschaft Fur Angewandte Technik mbH Greifswald (GAT)	GeenVOLT™
Global Thermoelectric!	Hoku / Sanyo
GTI – Gas Technology Institute	HydroGen
Honda	IDACORP / Ida Tech
Idaho National Laboratory	Ion America
Impala Platinum	McDermott International
LOGANEnergy	Mesoscopic Devices
Matsushita Electric Industrial Co., Ltd.	Mitsubishi
Millennium Cell	Nu Element
NanoDyamics	Palcan
Nuvera Fuel Cells	Pacific Telepoint
Plug Power	Praxair / Rivoira
Parker Hannifin	PEMEAS Polymer Electrolyte Membrane (PEM)
Power Air Corporation	Protonex Technology Corporation
Protonetics	ReliOn
Proton Energy Systems	RWE AG, Essen / RWE Fuel Cells
Rolls Royce Group	Siemens
Solid aState Energy Conversion Alliance (SECA)	Takagi Industrial Co., Ltd.
Sulzer Group / Sulzer Hexis	TOTO
Toshiba – Polymer Electrolyte Fuel Cells (PEFC)	Umicore
Ultracell	United Technologies
Unitec Ceramics	ZTEK
Viaspace / Direct Methanol Fuel Cell	
ZAO Independent Power Technologies	

Stationary Fuel Cell Strategies and Forecasts, 2006-2012

REPORT METHODOLOGY

THIS IS THE 282ND REPORT IN A SERIES OF MARKET RESEARCH REPORTS THAT PROVIDE FORECASTS IN COMMUNICATIONS, TELECOMMUNICATIONS, THE INTERNET, COMPUTER, SOFTWARE, TELEPHONE EQUIPMENT, HEALTH EQUIPMENT, AND ENERGY. THE PROJECT LEADERS TAKE DIRECT RESPONSIBILITY FOR WRITING AND PREPARING EACH REPORT. THEY HAVE SIGNIFICANT EXPERIENCE PREPARING INDUSTRY STUDIES. FORECASTS ARE BASED ON PRIMARY RESEARCH AND PROPRIETARY DATA BASES. FORECASTS REFLECT ANALYSIS OF THE MARKET TRENDS IN THE SEGMENT AND RELATED SEGMENTS. UNIT AND DOLLAR SHIPMENTS ARE ANALYZED THROUGH CONSIDERATION OF DOLLAR VOLUME OF EACH MARKET PARTICIPATION IN THE SEGMENT. INSTALLED BASE ANALYSIS AND UNIT ANALYSIS IS BASED ON INTERVIEWS AND AN INFORMATION SEARCH. MARKET SHARE ANALYSIS INCLUDES CONVERSATIONS WITH KEY CUSTOMERS OF PRODUCTS, INDUSTRY SEGMENT LEADERS, MARKETING DIRECTORS, DISTRIBUTORS, LEADING MARKET PARTICIPANTS, OPINION LEADERS, AND COMPANIES SEEKING TO DEVELOP MEASURABLE MARKET SHARE. OVER 200 IN DEPTH INTERVIEWS ARE CONDUCTED FOR EACH REPORT WITH A BROAD RANGE OF KEY PARTICIPANTS AND INDUSTRY LEADERS IN THE MARKET SEGMENT. WE ESTABLISH ACCURATE MARKET FORECASTS BASED ON ECONOMIC AND MARKET CONDITIONS AS A BASE. USE INPUT/OUTPUT RATIOS, FLOW CHARTS, AND OTHER ECONOMIC METHODS TO QUANTIFY DATA. USE IN-HOUSE ANALYSTS WHO MEET STRINGENT QUALITY STANDARDS. INTERVIEWING KEY INDUSTRY PARTICIPANTS, EXPERTS AND END-USERS. OUR RESEARCH INCLUDES ACCESS TO LARGE PROPRIETARY DATABASES. LITERATURE SEARCH INCLUDES ANALYSIS OF TRADE PUBLICATIONS, GOVERNMENT REPORTS, AND CORPORATE LITERATURE.

YOU MUST HAVE THIS STUDY

Stationary Fuel Cell Market Opportunities, Strategies, and Forecasts, 2006 to 2012

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