

WINTERGREEN RESEARCH, INC.

**Fuel Cell Components Market Opportunities, Strategies,
and Forecasts, 2005 to 2013**

Fuel Cell Components



Picture by Susie Eustis

MOUNTAINS OF OPPORTUNITY

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

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CHECK OUT THESE KEY TOPICS

FUEL CELL COMPONENT MARKET SHARE ANALYSIS
FUEL CELL COMPONENT MEMBRANE ELECTRODE ASSEMBLY (MEAs) FORECAST
Market Driving Forces For Fuel Cell Components

Fuel Cell Component Description

Fuel Cell Aspects
Polymer Electrolyte Fuel Cell (PEFC)
FUEL CELL BASIC REACTIONS
FUEL CELL VEHICLE TECHNOLOGY
HYDROGEN FLOW
TYPES OF FUEL CELL TECHNOLOGY
FUEL CELL CHEMISTRY
DIRECT METHANOL FUEL CELL TECHNOLOGY
INSIDE THE PEM FUEL CELL
STORING HYDROGEN
FUEL CELL STACK ISSUES
HYDROGEN SUPPLY AND CONTAINER INFRASTRUCTURE

OPPORTUNITY ABOUND

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At the time the war in Iraq ended, the army and military had only a three-day supply of batteries left. The military had raided battery stores from bases all over the world; the battery factories were working 24 hours per day. There is significant incentive to develop fuel cells as a replacement for batteries. This fuel cell market will develop first.

The handheld digital device power markets will develop much faster because the units are disposable, the technology is easier, and the markets are likely to develop faster. Handsets for wireless communications are replaced on average every 19 months. Thus, the fuel cell power device does not have to have the reliability capabilities that the automotive fuel cells need to have to be competitive.

Micro fuel cells are used to replace batteries. Smart Fuel Cell AG SFC fuel cell cost reduction (SFC) has reached an important breakthrough in reducing the costs of micro fuel cells. A new membrane allows substitution of at least 50 percent of the expensive catalytic platinum.

The market driving force for fuel cells is the reality that fossil fuels are running out, and ultimately too expensive as an energy source. Wind and solar energy can be used to generate electricity, but the electricity is fleeting, it needs to be stored. Hydrogen is an effective storage means for electrical power. But hydrogen needs to be manufactured so that there is an energy source.

Manufacturing costs for fuel cell components make systems too expensive to be competitive at the current time. Investment is needed to decrease the component costs. Economies of scale are needed to make fuel cells competitive

Fuel cell components are enabling fuel cell commercialization. Strategic suppliers to Ballard Power Systems are the most important component market participants as Ballard is a world leader in the development and commercialization of PEM fuel cells.

The fuel cell component markets are expected to be \$171 million in 2004 as products being to teach the market commercially in all three categories of offerings: micro fuel cells to replace batteries, residential and backup power units, in busses, and in the personal transport markets. If the advances promised by current trends are accomplished, the fuel cell component markets reach \$100 billion in 2013 for the combined segments.

Companies Profiled

Market Leaders

PEMEAS
Johnson Matthey
Solvay
DuPont
W.L. Gore & Associates

Market Participants

Altair Nonomaterials
Ballard
E-TEK
Hoku Scientific
Millenium
NEC Corporation
Smart Fuel Cell

Asahi Glass
Dow Chemical Company
GrafTech Internatioal
ICM Plastics
Mechanical Technology Incorporated (MTI)
SGL Technologies
Toshiba

Fuel Cell Components Equipment Strategies and Forecasts, 2005-2013

REPORT METHODOLOGY

THIS IS THE *TWO-HUNDRED AND FORTIETH* 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

Fuel Cell Components Market Opportunities, Strategies, and Forecasts, 2005 to 2013

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