ZTEK CORPORATION

Company Overview

ZTEK Corporation is committed to developing and commercializing the world's cleanest fossil-fuel-to-electrical-energy conversion devices. Founded in 1983, the company is engaged in the business of developing, manufacturing, selling and servicing fuel processing and Solid Oxide Fuel Cell (SOFC) based energy systems, which reform natural gas and generate electricity cleanly via electrochemical reactions.

With more than 150 U.S. and international patents, ZTEK has greatly advanced the research and development on SOFC's initiated at the Massachusetts Institute of Technology's Lincoln Lab in the 1970's. The company's proprietary technology represents a giant leap forward in economical, environmentally-friendly power production.

ZTEK has successfully demonstrated a 1-kW fuel cell stack, logging in more than 16,000 hours of operation, and currently has a 25kW system utilizing natural gas as a fuel stock. This unit is currently located in Woburn and is in operation addressing balance-of-plant component reliability issues.

The company's revolutionary reformer extracts hydrogen from unleaded gasoline or natural gas at an energy efficiency rate of 85 percent and is capable of isolating greenhouse gases for sequestration.

ZTEK Corporation is located in Woburn, Massachusetts.

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ZTEK Products Under Development

ZES 4000H and ZES 2000H/75E

Ztek's commercial hydrogen reformers will convert gasoline, natural gas or methanol to hydrogen at 85 percent efficiency, meaning that 85% of the energy contained in the fuel will be converted into useful hydrogen. ZES 4000H will produce 4000 standard cubic feet of hydrogen per hour while ZES 2000H/75E will produce 2000 standard cubic feet of hydrogen per hour plus 75kW of electricity for distributed power generation applications.

Each individual model will fit in a 10' by 10' by 10' space. This size will allow easy integration into existing gasoline fueling stations and will give station owners tremendous flexibility in scaling the size of their hydrogen supply. Ztek reformers also will enable true zero-emissions operation by allowing for the separation and sequestration of carbon dioxide, the only by-product of its fuel-to-hydrogen conversion.

DG 200E

The DG 200E combines a solid oxide fuel cell with a gas turbine for distributed generation applications. Replacing the combustor of a traditional microturbine with a high temperature solid oxide fuel cell will allow system efficiency to reach 60 percent and reduce greenhouse emissions by 50%. The unit is compact, fitting in a 10' by 10' by 10' space. The DG 200E can be run on natural gas, methanol or gasoline.

DG 150E/50AC

DG 150E/50AC is a cogeneration system incorporating an advanced solid oxide fuel cell and an absorption chiller/heater. It produces electricity and simultaneously provides heating or air-conditioning for buildings. Thermal efficiency will exceed 90% because the system captures high temperature exhaust heat from the fuel cell. DG 150E/50 AC will help mitigate the peak load of electric utilities in the summer when air-conditioning usage is highest. Natural gas, methanol or gasoline can be used as fuel.

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ZTEK 25kW Solid Oxide Fuel Cell

Demonstration Unit

Ztek Corporation is developing fuel cell systems for distributed electrical generation applications with or without the capability to provide heating and air conditioning. All models will provide low-cost, clean and efficient energy production. Commercial models will be available in 2003.

Features of the demonstration unit include:

- **Size** – 6'x 6'x 6'.
- **Weight** – 4,000 lbs.
- **Electrical Production** – 25 kW at 120V/200V A.C.
- **Efficiency** – Approaching 45%; 65% when waste heat is utilized to generate electricity; 90% when waste heat is utilized for heating and cooling.
- **Fuel stocks** – Natural gas or gasoline.
- **Emissions** – Extremely low levels of SOx and NOx with potential to capture CO_2.
- **Fuel process** – Internal steam reforming of natural gas or gasoline. Fuel provides two thirds of energy, steam provides one third.
- **Fuel cell type** – Solid Oxide.
- **Initial Installation** – Dinosaur State Park in Rocky Hill, CT in partnership with The Renewable Resources Group, LLC and certain departments of the state of Connecticut. Expected Fall 2002.
- **Cost** - $600,000 (note: Ztek is contributing significant costs of the demonstration unit to the initial installation).

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ZTEK PREPACKAGED REFORMER / FUEL CELL

CTU-600H

Ztek Corporation has operated a system (*Model CTU 600-H*) featuring steam reforming for more than 22,000 hours, much of that in the field. The prototype employs a combined reformer/fuel cell system and has been developed as a near-product hardware, which is utilized for operation refinements and customer training.

Features include:

- **Size** – 6'x 6'x 6' or 3'x 6'x 12'
- **Production** - 600 scf of hydrogen an hour (enough hydrogen for sustained service to 30 cars)
- **Efficiency of hydrogen conversion** – Approaching 80%
- **Fuel stocks** – natural gas, propane, gasoline
- **Emissions** – water vapor – CO_2 can be sequestered
- **Hydrogen purity** – 99.999%

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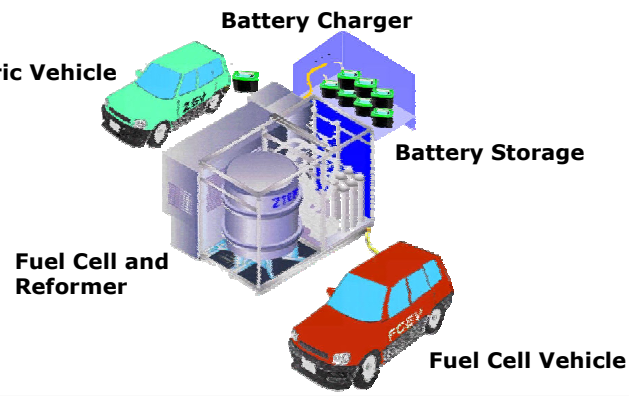
ZTEK PREPACKAGED STEAM REFORMER

The Commercial Product - Model ZES

(Zero Emission Station)

Ztek ZES 2000H/50E

One system to fuel both ZEV's and FCEV's!



Ztek's commercial product Model ZES offers the following attributes:

- **Size** – 10'x 10' x 10'
- **Weight** - 10,000 pounds
- **Production** – 4,000 scf of hydrogen an hour
- **Efficiency of hydrogen conversion** - 85%
- **Fuel stocks** – natural gas, propane, methanol, gasoline
- **Emissions** – water vapor – CO_2 can be sequestered
- **Hydrogen purity** – 99.999%

We expect that this product will be available for delivery in 2003.

ZTEK CORPORATION

MICHAEL S.S. HSU, PH.D.

CEO and President

Dr. Michael Hsu formed Ztek Corporation in 1983 and oversees the company's fuel cell product development and its outreach to key players in the energy field including utility companies, the U.S. Departments of Defense and Energy, and the Electric Power Research Institute.

Prior to founding ZTEK Corporation, Dr. Hsu performed research at the Lincoln Laboratory at MIT. As a staff scientist and project leader, he participated in mechanical engineering efforts in several defense projects including the development of high-energy laser systems under the sponsorships of the Departments of Advanced Research Project Agency, Army, Navy and Air Force. He has served on numerous program review committees related to high power laser systems and communication satellites.

Dr. Hsu has written many papers and reports in the fields of advanced energy systems, re-entry systems, satellite communications, and high energy laser systems related to defense applications.

He performed his Ph.D. work at MIT specializing in MHD power generation. In addition, he visited the West German Nuclear Research Center for one-and-a-half years to further his research in advanced energy conversion in conjunction with nuclear reactors.

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KEVERN R. JOYCE
Senior Advisor

Kevern has more than 20 years experience in the energy industry.

From 1982-1990, he worked as assistant controller with Public Service of New Hampshire, the Granite State's largest electric utility, providing service to more than 400,000 homes and businesses. In 1990, Kevern moved to Arizona taking the positions of Senior Vice President and Chief Operating Officer at Tucson Electric Power Co. where he remained until 1994. Moving east, but staying in the southwest, he became Chairman, President and Chief Executive Officer of Texas-New Mexico Power Company until 2001. Kevern remains a senior advisor for the Texas-New Mexico Power Company.

Over the years, Kevern has also been active outside the workplace. He has been a board member for the Fort Worth Zoo, Association of Electric Companies of Texas, Fort Worth Chamber of Commerce, Texas Independent College Fund, Boy Scouts of America and the Edison Electric Institute. He currently resides on the boards of AZZ, Inc. and Ztek Corporation.

Prior to entering the energy field, Kevern spent four years working as a certified public accountant for Arthur Andersen & Co.

Kevern received an M.B.A. from Babson College in 1978.

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