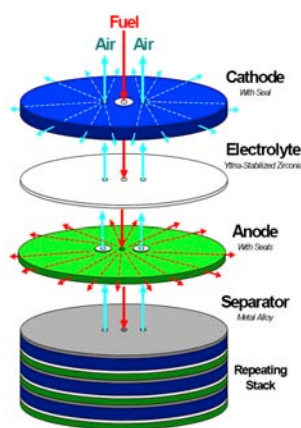


Technology Management, Inc. (TMI), developer of the Anywhere Energy system, is Ohio's oldest independent fuel cell systems developer; commercializing a proprietary, low-cost, solid oxide fuel cell (SOFC) technology originally developed in Cleveland at the world R&D laboratories of SOHIO (later BP America).

Our vision is twofold: first, to develop our fuel cells as a proprietary technology platform which generates cleaner, more efficient power than any other known form of distributed generation; and second, to use this platform as a backbone for a wide range of manufactured products for industry, commercial businesses and consumers.

What is a Fuel Cell?

Fuel cell systems generate electricity through an electrochemical reaction, not from a combustion process like an automobile engine. Oxygen from air and a hydrogen-rich fuel combine to form electricity, with heat and water as byproducts and virtually no pollution. Compared to a battery, which uses an electrochemical reaction to produce a finite amount of energy, fuel cells produce electricity continuously as long as they are provided fuel. Individual fuel cells have two electrodes, (the anode and cathode) and an electrolyte, which are then stacked in multiples to obtain larger amounts of electricity.



As a source of power generation, fuel cells are unique:

- **Modular:** Unlike solar, wind, diesel or natural gas generators, fuel cells are compact in size and can be placed anywhere there is a fuel supply. And only fuel cells can be operated indoors.
- **Clean:** Compared to generators, which produce noise, odor, and air pollution, including lethal carbon monoxide, fuel cells are clean, quiet and safe indoors.
- **Efficient:** Fuel cells are at least twice as efficient as a gas engine or turbine at producing electricity. In addition to electricity, fuel cells produce clean heat which can be used for cooling as well as heating. When fully utilized, combined heat / power efficiencies can exceed 90-percent.
- **Scalable:** Fuel cells are modular which means each individual system enjoys the same high efficiency regardless of size and can be used as "energy building blocks." In contrast, wind turbines and engines must be bigger to be more efficient. With fuel cells you simply add more to get more power. Bigger is not always better and fuels cells are a great example.

A New Ohio Industry.

The manufacturing and deployment of "many small-scale" (vs. fewer large-scale) fuel cell systems can spawn an entirely new Ohio industry. Fuel cells are a disruptive technology which have the potential to "re-cluster" mature Ohio supply chain manufacturers and existing channels of distribution into an industry anchored in Ohio. Using the same ingredients which anchor the automotive cluster - deep regional R&D, a network of assembly and parts manufacturing companies, a skilled workforce accustomed to low cost, high volume production, and geographical location - small, residential-scale fuel cell systems from TMI can take advantage of the same regional strengths. In addition, the ability of proprietary fuel cell systems integrators to "write the specifications" will only add to and deepen the natural co-location of OEM parts suppliers and the distribution pathways to create a core asset for economic growth in Ohio.

TMI Facts & Firsts

Compact, 1 kW system can be shipped by common carrier.

Indoor siting for high security and point-of-use cogeneration.

Appliance-like simplicity with no precious materials for low-cost mass production manufacturing.

"On the fly" fuel changeover from liquid-to-liquid, gas-to-gas and liquid-to-gas.

Proven operation on commercial grade (untreated) gas and liquid fuels including:

- Natural Gas and Propane
- Diesel, Kerosene and JP-8* (military logistics fuel)
- Ethanol, Biodiesel, Vegetable oil (Soybean Oil*), Used Cooking Oil, Digester Biogas (simulated), Ammonia and Jatropa*

1990

TMI founded

1996

1st sulfur tolerant cell & reformer

2004

1st full systems operation on JP-8*

2005

1st multi-kW system operation on Natural Gas & Propane

2006

1st system operation on vegetable oil*
1st system operation on truck diesel

2009

1st on-farm 30-day system demo on soybean oil*
1st system operation on Jatropa*
1st public demonstration of fuel cell running on JP-8*

* 1st known in the world

Federal and Industry Funders



TMI has utilized collaboratives to achieve numerous milestones on its path to commercialization. Here is a summary of three of those programs.

Remote, Renewable Power



TMI is partnered with The Ohio State University Ohio Agricultural Research & Development Center in the Third Frontier Biomass to Energy Program. This collaboration is producing another Ohio first — integrating anaerobic digester biogas (from farm and food processing wastes) as fuel for TMI's Anywhere Energy system to produce clean, electricity and heat for on-site use. Through the Ohio Third Frontier Program, the shared OSU/TMI vision showcases a small-scale system converting biomass waste into clean, renewable energy.

This project bridges between Ohio's two largest industries, manufacturing and agriculture and provides a pathway for the home and small business owner to become part of the solution, as a supplier and consumer of clean, renewable energy. Building on Ohio Third Frontier Program investments in both TMI and the OSU Biomass to Energy program, implementation of this vision could leapfrog Ohio to the forefront of the emerging distributed bioenergy industry.

This small scale system could be placed on thousands of small farms in rural America or tens-of thousands of rural villages in the third world bringing clean, renewable distributed power to remote customers or end-of-line grid fortification.



On-Farm Distributed Generation



Funded by the Ohio Soybean Council, TMI conducted a first-in-the-world 30-day demonstration of an unattended, solid oxide fuel cell system running on liquid biofuels.

In May 2009, just a few miles from the birthplace of Thomas Alva Edison, Ohio's first name in electricity innovation, a TMI fuel cell generated power inside a barn on a 7th generation family soybean farm and provided another first in energy innovation for Ohio. For 30 days, a TMI Anywhere Energy system provided clean, renewable power on a working farm in Wakeman, Ohio fueled by soybean oil.

This groundbreaking demonstration built upon another first established in 2007 when, through the support of checkoff funds from Ohio soybean farmers and research funding from the USDA, TMI became the first fuel cell company in the world to convert raw vegetable oil into electricity.

U.S. Senator George Voinovich views first-in-the-world soybean oil demonstration.



Efficient, Reliable Battlefield Power



In partnership with Lockheed Martin MS2 Defense and Surveillance Systems of Akron, Ohio and Stark State College of Technology, TMI is supported through Ohio's Third Frontier Program to develop solid oxide fuel cell generator sets (gensets) for military applications.

A Defense Science Board report, *More Fight – Less Fuel* outlines the military's heavy dependence on fuel on the modern battlefield; a former top US commander in western Iraq asserted, "By reducing the need for [petroleum] at our outlying bases, we can decrease the frequency of logistics convoys on the road, thereby reducing the danger to our marines, soldiers, and sailors." Reducing fuel needs saves lives. The fuel cell genset being jointly developed by TMI and Lockheed Martin could reduce fuel usage by 1/3 to 1/2.

As one Lockheed Martin executive said; "We believe the high fuel efficiency of TMI's fuel cell system and its ability to operate directly on untreated military logistic fuel will solve some of the most urgent and important power generation problems faced by the United States Department of Defense (DoD), Lockheed Martin's major customer."

Ohio Governor Ted Strickland at first-in-the-world public demonstration fueled by untreated military JP8.



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Ohio Collaborators and Funders

