

ElectroChem Inc.

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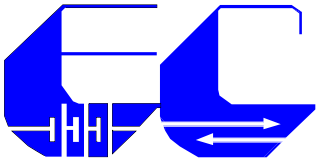
Hydrogen and Fuel Cell Summit

**Fuel Cell and Electrolyzer Energy Storage System for Backup Power**

**ElectroChem**

Worcester Polytechnical Institute

October 20<sup>th</sup>, 2004

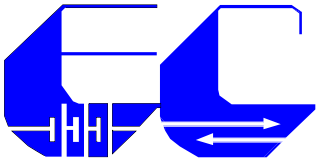


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# ElectroChem is ...

- A Global Supplier of Fuel Cell Test Stations, Supplies, and Fuel Cells for the R&D Market
- A Developer and Manufacturer of H<sub>2</sub>/O<sub>2</sub> Fuel Cells up to 5 kW
- A Developer of 5 kW UPS Back-Up Systems
- A Developer for a PEM Fuel Cell Powerplant for NASA's 2<sup>nd</sup> Generation of Reusable Launch Vehicles

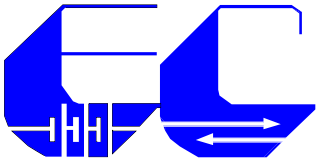


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# Our Strengths

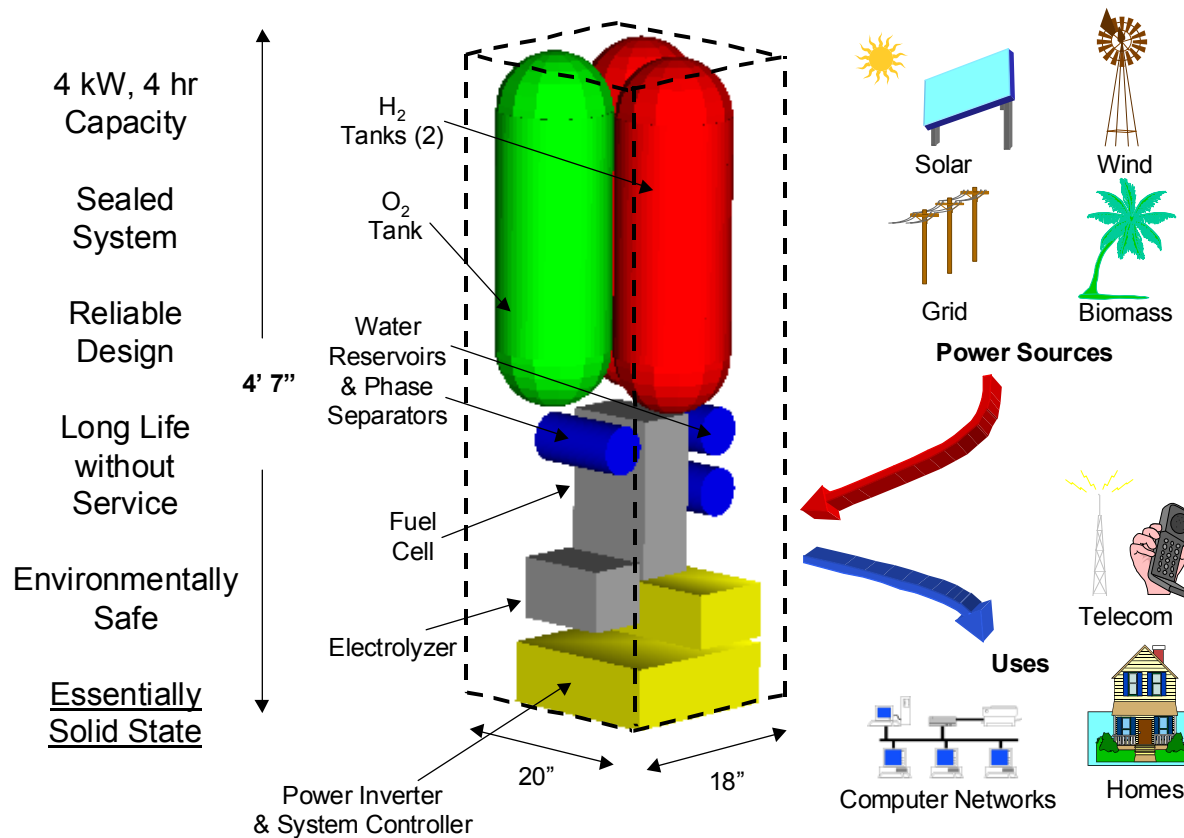
- Active in the Fuel Cell Business Since 1986 in Research and Product Development
- Market Awareness of What Works (and What Doesn't)
- Fuel Cell Stack Design and Fabrication Expertise
- Fuel Cell System Design and Fabrication Expertise
- Sales Experience With over 700 Customers in 70 Countries
- Unsurpassed Reputation in the Fuel Cell Industry

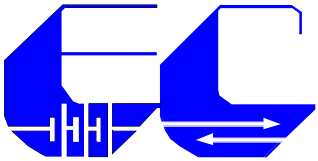


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# ECcell™ - A Fuel Cell & Electrolyzer Energy Storage System

## ElectroChem's ECcell™ Power System



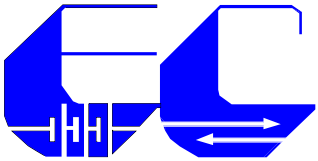


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# What is ECcell™ ?

- ECcell™ is a Product to Provide Clean, Electrical Power Anywhere in the World
- ECcell™ is Designed to Provide Power On-Demand. Examples Include:
  - Backup Power for Telecommunications, Computers, etc.
  - Primary Power for Remote Sites, Homes, etc.
- ECcell™ May be Configured for Different Application Requirements
  - Power Levels (1-10 kW)
  - Operating Run Times (4 to 72 hrs)
  - Recharging Methods (Grid, Solar, Wind, Biomass)

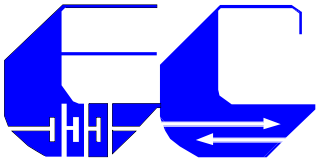


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## Key Features of the ECcell™

- ECcell™ is Designed for High Reliability for a 10 Year Lifetime
- Modular Design Allows Tailoring for Various Applications
  - Vary Fuel Cell Size to Affect Power Level
  - Vary Electrolyzer Size to Affect Regeneration Time
  - Vary Gas Storage Size to Affect Run-Time
- ECcell™ Provides its Own Hydrogen Gas Fuel by Electrolyzing Water
- System is Deployable Now
  - Entry Opportunity Into Premium Backup Power Markets
  - Does Not Require Automotive or Residential Fuel Cell Manufacturing Volumes to Meet Low Costs

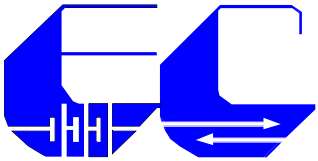


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# ElectroChem's H<sub>2</sub>/O<sub>2</sub> System Approach

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- Oxygen Usage Gives a Better Product
  - Trade-off is Oxygen Generated During Electrolysis Versus an Air Compressor and Filter
  - Supports Our Vision of Using “Water” as a Fuel
- Advantages of Using Oxygen Include:
  - No Air Compressor (Reduces Cost, Increases Life)
  - No Air Filter (Lower Maintenance)
  - Rapid Startup (100% of Rated Power)
  - Higher Fuel Cell Efficiency (20% Greater than With Air, Less Fuel to Store)
  - 20% Less Waste Heat to Remove From Stack (Reduces Heat Removal Equipment)
  - Eliminates Requirement for Humidification Water Source



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# ElectroChem's Competitive Advantages

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- H<sub>2</sub>/O<sub>2</sub> Fuel Cell Experience
  - Product Differentiation
  - Developed and delivered hundreds of cells and stacks
  - 20 kW H<sub>2</sub>/O<sub>2</sub> Fuel Cell System was Developed for NASA's Reuseable Launch Vehicle
- Process Reduction
  - MEA Fabrication
  - Stack Design Amenable to Fast Assembly
  - Bipolar Plate/Cooling Integration
  - Passive Balance of Plant Operation
- System Design
  - Few Components in System That Increase Lifetime and Decrease Cost
  - Novel Component Designs that Have Industrial Performance and are Cost Effective with Today's Market Size