ISSUE
04
February
2012

News From
Scheeser Buckley
Mayfield, LLC

THE ENGINEERING CONSULTANT

this issue

Preview of Upcoming Issues

- Commissioning
- Retro Commissioning

GROWING COLUMBUS OFFICE

Scheeser Buckley Mayfield is happy to announce that our Columbus Office is growing. Joe Ross has relocated from Akron to Columbus. Joe has been designing electrical systems for Healthcare, Higher Education, and other large scale buildings for over 11 years. He joined SBM in 2005.

Fuel Cell Technology

James E. Eckman, P.E., LEED AP, LC, CBCP

The last issue of The Engineering Consultant discussed the following items:

- Wind system components
- Wind system design rules of thumb
- Wind system design requirements
- Wind system design examples, system costs and payback

The third and final alternative energy source will be the fuel cell. A fuel cell is an electrochemical conversion device that combines hydrogen and oxygen to produce electricity. Several different technologies exist but in general the process is the same. The chemistry and operating temperatures are different in each technology. Everyday batteries are electrochemical devices with chemicals stored inside; when the chemicals are gone the device no longer produces electricity. Fuel cells act like a battery but use an external and renewable source of chemicals (hydrogen and oxygen). The fuel cell produces electricity as long as the chemicals are available.

A hydrogen containing fuel such as natural gas, propane, kerosene, methanol etc. enters a fuel processor called the reformer where it is converted into hydrogen gas or reformate. If pure hydrogen is used this step is not needed. The hydrogen gas flows into the fuel cell stack where the hydrogen molecules are separated from each other creating 4 protons and 4 electrons. In this process the electrons and protons are separated on the anode side and the electrons flow to the cathode side creating DC electrical power. The DC power generated is sent to a power conditioning module where it is converted to regulated DC or AC power. The protons combine with oxygen and produce water. The byproducts of this process using pure hydrogen are water and heat.

Types of fuel cells and applications

1. Proton Exchange Membrane (PEM) or Polymer Electrolyte Membrane Fuel Cell (PEMFC). One advantage to this type of Fuell Cell is it's quick warm up time. Applications include residential, light commercial and transportation.
2. Phosphoric Acid Fuel Cells (PAFC). Applications include hospitals, schools and medium to large commercial.
3. Molten Carbonate Fuel Cells (MCFC). This is a high temperature process. Applications would include factories.
4. Solid Oxide Fuel Cells (SOFC). This type is also a high temperature process. Applications would include factories.
5. Alkaline Fuel Cells (AFC). This is a very expensive type and currently has no commercial applications.
6. Direct Methanol Fuel Cells (DMFC). This technology is similar to PEMFC but is more expensive. Applications include residential, light commercial and transportation.

Benefits of fuel cells

1. Fuel cells produce energy through an electrochemical reaction with water and heat as the byproducts. No greenhouse gasses are produced in this process.
2. Waste heat produced can be used to supplement other processes making fuel cells even more efficient.
3. Fuel cells can be used as standby energy sources or can be paralleled with the utility grid.
4. Fuel cells can operate on multiple (hydrogen based) fuels.

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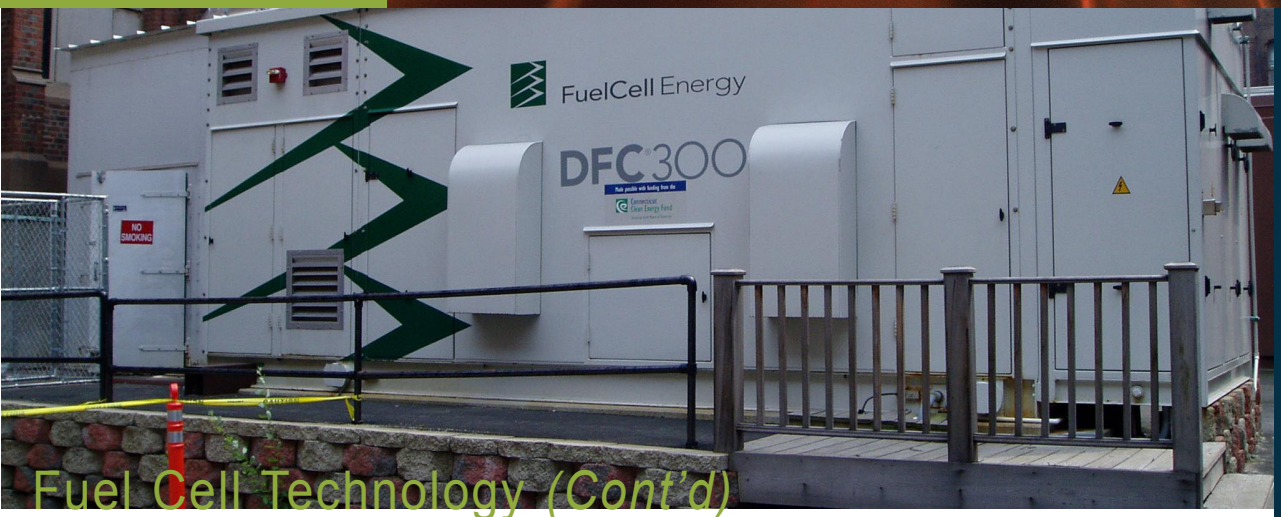
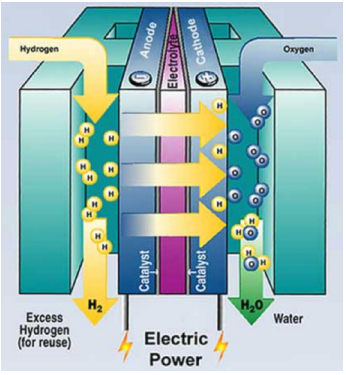


Fuel Cell Technology *(Cont'd)*



Individual Fuel Cell Diagram

System components

- Fuel Cell(s)
- Inverter or grid tie inverter
- Transfer switch

Fuel cell design rules of thumb

- Fuel cells themselves are about $25,000 per 5kw
- Energy produced by fuel cells costs about 10-15 cents per kwh to produce.

Fuel cell system design example

As with the solar and wind systems that were evaluated in previous editions of The Engineering Consultant, the fuel cell system we will evaluate will be a 10 kw, 120/240 volt single phase system. This system could consist of fuel cells in parallel (to create DC power), inverter (to convert DC to AC) and transfer switch to start fuel cell reaction and transfer AC power to house loads upon loss of utility power. Again, we would not propose batteries because of cost and maintenance issues. With out batteries, the fuel cell approach would be similar to an on site diesel generator for back up power. This system would not be used to supplement or reduce utility power like the Solar and Wind Power examples we discussed in previous issues, and would not have an associated payback.

Fuel cell system cost

Cost FOR MATERIAL ONLY:
To do 10kw back up we would need:
(2) 5kw PEMFC systems paralleled
10 kw inverter
Automatic transfer switch
Material cost would be **$69,000**

The fuel cell system would require hydrogen tanks for fuel and would be good for about 2000 hours of stand by power.

Fuel cell system payback

There would not be a payback if the system is used as back up power only. If used as a grid tie system the payback would depend on the cost of the hydrogen based fuel source. The real benefit of the fuel cell system is in locations that have natural gas but do not have electric utility power and the fuel cells provide the needed electricity.

SBM Expands Services

Kevin Noble, principal at SBM recently became a licensed Fire Protection Engineer in the state of Ohio. We are happy to have Kevin's expertise in this discipline. Accordingly, SBM has expanded its range of engineering services to include Fire Protection Engineering. While this term has historically been used interchangeably with Fire Suppression design, it includes much more than just sprinkler systems. Fire Protection Engineering includes fire and life safety planning, identification of code and design criteria, analysis of existing and proposed hazardous material control areas, and performance criteria for many of a building's systems as they relate to fire and life safety. Many state and federal government projects require the services of a licensed Fire Protection engineer, but it can add value to virtually any design team.

Additional Services we now offer include:

- Life Safety Code Analysis and Design Criteria
- Identification of Code Compliance Issues in Design Plans
- Assessment of Existing Sprinkler Protection
- Fire Protection Analysis for Change in Building Use or Hazard
- Fire Safety Plans
- Performance Based Fire Protection Design Solutions
- Fire Protection Litigation Support
- Fire Protection System Commissioning

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