GRID & SILICON

Technology explainer

Fuel Cells: Making Electricity Through Chemistry

Can a chemical reaction help run a computer?

In the news

Some AI builders want to make power beside their computers while waiting for a grid connection. Reuters reported growing interest in fuel cells as one option. A fuel cell makes electricity through chemistry. Learning how fuel enters and electricity leaves helps explain both its use and its limits.

What is a fuel cell?

AI means computer programs that learn patterns from lots of examples. Those computers need electricity, as do systems around them. A **data center** is a building where many computers run. A power source must supply electrical energy for that work.

A **fuel cell** makes electricity through a chemical reaction. A chemical reaction changes substances into other substances. The cell uses a supply of fuel and oxygen. **Fuel** is a material that provides energy through a reaction.

What are its main parts?

The cell has two **electrodes**, surfaces where reactions take place. The fuel enters at one side, called the **anode**. Air enters at the other side, called the **cathode**. Air supplies the oxygen used in the reaction.

Between these sides is an **electrolyte**, a material that lets certain charged particles pass. A charged particle is a tiny piece of matter with electric charge. The electrolyte helps keep the paths for different charges separate.

How does it make electricity?

First, hydrogen reaches the anode side of this cell. A **catalyst** is a material that helps a chemical reaction happen. Here, it helps separate hydrogen into protons and electrons. **Protons** and **electrons** are tiny particles with different electric charges.

Protons pass through the electrolyte in this hydrogen-cell example. Electrons travel through the outside circuit, providing an electric current. **Current** is the flow of electric charge. Equipment in that circuit can use the electrical energy.

At the cathode, the particles join with oxygen. This hydrogen-cell reaction produces water and heat. The heat still needs to be managed. The cell makes useful electricity by controlling the routes taken during a reaction.

Why might a data center use it?

A fuel-cell system can make electricity near the computers using it. This is called **on-site power**, meaning power made where it is used. It can offer another supply option when a grid connection is delayed. The **grid** is the wider network that supplies electricity.

A fuel cell needs a continuing supply of fuel to keep producing power. Unlike a rechargeable battery, it receives fuel during operation. A battery instead holds a limited amount of stored energy between charges.

What are the limits?

The fuel cell does not burn fuel inside its cell stack. A **stack** is a set of cells joined to provide more power. But that does not make every fuel-cell system free of environmental effects. The fuel type and how it is produced also matter.

The water-and-heat result here describes a hydrogen-cell reaction. It should not be used to describe every natural-gas fuel-cell system. Making and delivering fuel are separate parts of the energy path.

A complete project still needs fuel connections, electrical equipment and required permits. A **permit** is official permission for certain activities. If fuel stops arriving, the cell cannot keep making power from that supply. The technology offers an option, not power without resources or limits.

A battery and a fuel cell both use chemistry, but a fuel cell needs ongoing fuel. Like a kitchen receiving ingredients, that supply must continue while it is used.

Many data-center fuel cells use natural gas. Natural gas contains carbon, and these systems give off some **carbon dioxide**, or CO2, a gas that warms the climate. The hydrogen example in our diagram has different outputs from a natural-gas system. Fuel choice matters as well as the cell itself.

A fuel cell makes electricity through a chemical reaction.

The anode receives hydrogen in this example.

The cathode receives air in this example.

Key ideas

- A fuel cell makes electricity through a chemical reaction.
- The anode receives hydrogen in this example.
- The cathode receives air in this example.
- Fuel-cell outputs depend on the fuel, not only the equipment's name.

Why this matters to you: The fuel behind online services affects resources and emissions.

Lesson online · Source article: AI data centers are turning to fuel cells for faster power