

EPA Coalbed Methane Outreach Program Technical Options Series
COAL MINE METHANE USE IN FUEL CELLS



200 kW solid oxide fuel cell (SOFC) sited at AEP Ohio Coal LLC's Rose Valley Mine Site in Hopedale, Ohio.

(Photo courtesy of FuelCell Energy Inc.)

COAL MINE METHANE POWERED FUEL CELLS CAN...

- ◆ Operate on methane from mine pre-drainage and medium quality gob gas
- ◆ Use methane at near atmospheric pressure, avoiding compression costs
- ◆ Use methane diluted with air and/or carbon dioxide
- ◆ Generate electricity for distributed power generation systems
- ◆ Lower NO_x and SO₂ emissions, and virtually eliminate particulate emissions
- ◆ Reduce emissions of methane (a greenhouse gas)

Coal mine methane can be used in fuel cells to generate low cost power for mining operations, trimming operating costs

Powering fuel cells with coal mine methane provides economic benefits, as well as the environmental benefits already associated with fuel cells

Coal mine methane often lacks heavy hydrocarbons, making it better suited to fuel cell power production than natural gas

WHY CONSIDER COAL MINE METHANE POWERED FUEL CELLS?

At present, fuel cells are economically competitive with conventional forms of electricity generation only in certain cases. Fuel cells are, however, making steady progress toward the goal of widespread commercial use. Use of methane in fuel cells, recovered from gassy coal mines, may be an economical approach to on-site power generation or local use.

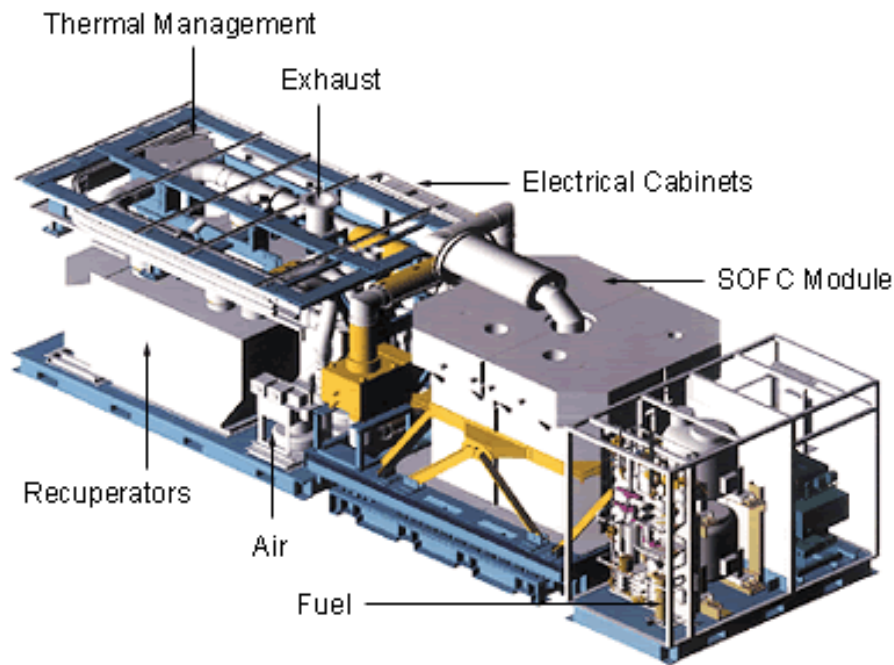
Gob areas (collapsed rock over mined-out areas) release large volumes of gas and subsequently vent it to the atmosphere. Much of this gas is medium-quality and unsuitable for pipeline injection. However, fuel cells can operate on medium-quality gas, reducing methane emissions to the atmosphere while producing electrical power for on-site use. Because of their high efficiency, the use of fuel cells for power generation emits less carbon dioxide per kilowatt-hour of electricity produced than conventional turbine and internal combustion power generation methods. Solid oxide fuel cell (SOFC) power systems have already demonstrated extremely low emissions (less than 0.5 ppm NO_x, no SO_x, CO or unburned hydrocarbons), making permitting easier and less expensive.

Solid Oxide Fuel Cells (SOFCs) are currently being demonstrated in sizes from 1kW up to 250-kW plants, with plans to reach the multi-MW range. SOFCs utilize a non-porous metal oxide electrolyte material. SOFCs operate between 650 and 1000°C, where ionic conduction is accomplished by using oxygen ions.

SOFCs offer the stability and reliability of all-solid-state ceramic construction. High-temperature operation, up to 1,000°C, allows more flexibility in the choice of fuels and can produce very good performance in combined-cycle applications. SOFCs approach 60 percent electrical efficiency in the simple cycle system, and 85 percent total thermal efficiency in co-generation applications.

SOME FACTS ABOUT POWER GENERATION USING FUEL CELLS...

- ◆ Modular design allows for custom power generation and generation close to the load, reducing transmission and distribution losses
- ◆ Better efficiency than turbine generated power (efficiencies between 40-60%)
- ◆ Short permitting and licensing schedules due to clean, quiet, safe operation
- ◆ Capable of using thermal output for heating (cogeneration), raising potential efficiency to over 80 percent
- ◆ Highly efficient and low maintenance
- ◆ Air-cooled, water needed only for start-up



Major Components of a 100 kW SOFC Currently Operating in Essen, Germany
(Diagram courtesy of Seimens Westinghouse Power Corp.)

FIRST COAL MINE METHANE POWERED FUEL CELL DEMONSTRATION PROJECT BEGINS OPERATION

FuelCell Energy, Inc. has announced that the first fuel cell power plant is now operating at AEP Ohio Coal LLC's Rose Valley Site in Hopedale, Ohio. The project, which is co-funded by the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL), was designed to demonstrate the feasibility and advantages of using coal mine methane to generate electricity cleanly and efficiently.

The solid oxide fuel cell uses approximately 55 to 80 mcf/d of coal mine gas containing approximately 45 percent methane. The 200-kW power plant generates enough electricity to supply an average of 40 homes. American Electric Power (AEP) is purchasing the electricity generated under a power purchase agreement between the operator, Northwest Fuel Development, and AEP.

DOE's Assistant Secretary for Fossil Energy, Carl Michael Smith states that "This demonstration supports President Bush's long-range goals for energy, environmental and economic security on terms that deliver new jobs and rising prosperity. It is innovation of a high order. It recovers the methane gas that is a hazard in coal mining and a strong agent of possible climate change and turns it into a useful energy resource. In this way, it expands our Nation's inventory of useable energy reserves, supports miner safety and contributes to the President's Clear Skies, Climate and National Energy Policy Initiatives."

For More Information...

Recent developments in fuel cell technology are expanding the options for coal mine methane use. Use of coal mine methane in fuel cells can increase mine profits while reducing methane emissions to the atmosphere.

To obtain more information about using coalbed methane in fuel cells for power generation, contact:

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Or contact U.S. EPA's Coalbed Methane Outreach Program for information about this and other profitable uses for coal mine methane:

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