

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY



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SCNG REPORT

Fuel Cell Technology Benefits for Selected Industries

WEB LINK:

[www.netl.doe.gov/scng/policy/
planning/policy_refshelf.html](http://www.netl.doe.gov/scng/policy/planning/policy_refshelf.html)



FUEL CELLS SHOW VALUE FOR KEY INDUSTRIES

Description

Over the past several years, fuel cell technology has become a very popular potential solution to provide for America's future energy needs. The popularity of fuel cells comes from the numerous advantages of fuel cell technology in stationary power and transportation applications. These advantages include environmental friendliness, high efficiency, high reliability, premium power quality, compact size, fuel flexibility, and optional cogeneration of heat.

Four primary fuel cell technologies are being developed, proton exchange membrane (PEM), phosphoric acid (PAFC), molten carbonate (MCFC), and solid oxide (SOFC) fuel cells. Depending largely upon its temperature of operation and materials set, the advantages of each fuel cell technology differ, but all four technologies are suitable for stationary applications in the industrial sector.

Background

Based on the experience of the commercial United Technologies PC25 200 kW PAFC, which has over 245 installations worldwide, it is extremely likely that broad implementation of fuel cell technologies will achieve the anticipated benefits.

The Strategic Center for Natural Gas at DOE's National Energy Technology Laboratory completed a study (see sidebar for reference) that identified the opportunities and measured the value of near-term fuel cell technologies for the industrial sector. For 2010, the study selected five industrial sectors with excellent market potential for fuel cells, and for these five sectors estimated the fuel conserved, the cost savings, and the pollution avoided by full implementation of fuel cells to supply 100 percent of the power consumed by these industries.

*PC25 fuel cell power
plant installation at
South County Hospital,
Wakefield, RI*



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Significance/Potential Impact

The study considered all four major fuel cell technologies and projected the value of full penetration of the technologies into five industrial sectors, agriculture-livestock, educational services, hospitals, telecommunications support, and wastewater treatment plants. Together these sectors use nearly one-sixth of the electrical power required by U.S. industry. The results showed that by 2010 fuel cells could reduce the cost of electricity for these sectors from their rates of 6.3 to 8.0 ¢/kWh by between 0.1 and 1.8 ¢/kWh for a total savings of \$1.66 billion per year with full penetration.

Figure 1 shows the distribution of cost savings among the five sectors, with the largest savings in the agricultural sector at \$728 million per year. Compared to electricity generation from the grid, for these sectors, fuel cells in 2010 could displace 45 million tons of coal and 15.5 million barrels of oil and would reduce emissions by over 41 million tons of CO₂, 250,000 tons of SO₂, and 100,000 tons of NO_x.

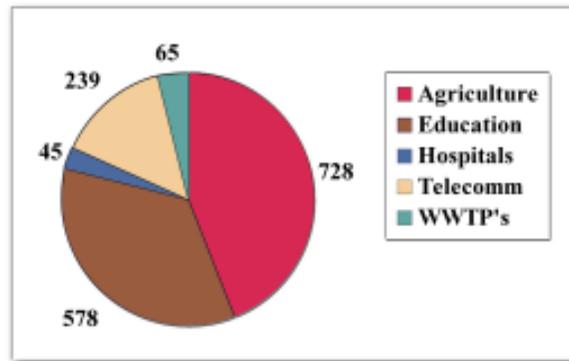


Figure 1. Cost Savings (\$M/yr)

Furthermore, the study shows that fuel cell technology could utilize biogas (methane) generated in the agricultural sector and biogas generated in wastewater treatment plants resulting in an equivalent savings of natural gas. These advantages resulting from the efficient, clean operation of fuel cells make a compelling argument for utilization of the technology in America's future.

Figure 2 shows the distribution among the five industrial sectors of the CO₂ avoided by the use of fuel cells. The distribution of SO₂ and NO_x avoided among the five sectors is similar to the distribution shown for CO₂.

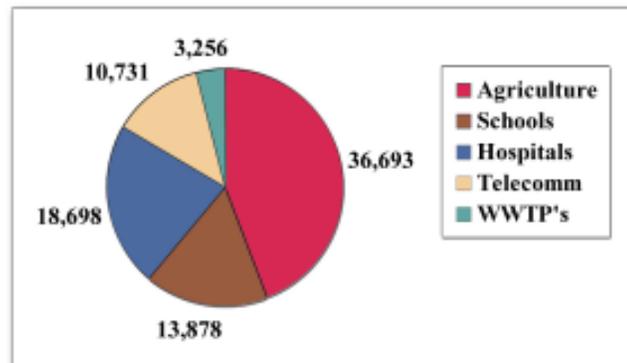


Figure 2. CO₂ Avoided (million pounds)

If fuel cells replace grid power in these industries, the advantages equate to:

- The avoided annual pollution from over 200 typical 100 MW power plants representative of the grid mix,
- Delayed coal usage equivalent to one-tenth of the annual coal production of Wyoming, the largest coal producing state, and
- Potential financial savings equal to 8% of the sectors' purchased electricity cost.