

AN ENVIRONMENTAL "CRADLE-TO-GRAVE" ANALYSIS OF FUEL CELL APPLICATIONS

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BACKGROUND

There have been many driving forces behind the development of fuel cells as an alternative to conventional energy production. For example, the environmental movement of the past three decades has provided ever-increasing opportunities for the development of fuel cell technology, most notably because of its potentially superior power conversion efficiency and its environmental advantages over

conventional power sources such as coal-fired power plants and diesel-powered vehicles. Fuel cells have even demonstrated their capabilities in the manned space vehicle programs. Nevertheless, the technology has not been commercialized on a wide scale for various reasons.

Although extensive research activities of fuel cell technology development have been undertaken by private industry, very limited studies have been conducted on the "macro" scale to determine the environmental impact of fuel cell deployment (Proceedings of 2000 Fuel Cell Seminar, October 30 - November 2, 2000, Portland, Oregon). Fuel cell technology has been considered to be almost pollution free, especially during the operation of this technology. However, a key question is how clean the fuel cell technology is during its entire life cycle (i.e., during the production of the fuel cells themselves, during their operation, and during their disposal). Therefore, there is a research need to determine how clean the fuel cell technology is from the point of view of a "cradle-to-grave" analysis (which, of course, is also known as a life cycle analysis).

It is worthwhile to mention that this same method of analysis has been used to stress, for example, the attributes of nuclear power stations in comparison with gas and coal power stations. One must take into account the production of the nuclear fuel, the burial of the radioactive waste and so on. Possible risk of accidents must be also analyzed. Analysis of the impact on the environment during a complete cycle of the fuel cell's life also must take considerations such as these into account. Attention must be also paid to the large-scale hydrogen production that is associated with fuel cell power plants whether they be for stationary or mobile power production applications.

#### EPA FUEL CELL PROGRAM GOAL

EPA's prospective on the fuel cell technology is that it is an example of "green power" that can help significantly reduce the Nation's dependence on petroleum and coal and that, as such, it represents a form of sustainable technology. EPA's fuel cell research program goal is to quantify how clean the fuel cell technology is from "cradle-to-grave", compared to conventional power production processes.

Specifically, the program goal can be sub-divided into two sub-goals, namely:

- 9 Sub-goal 1: Development of "Comparative Pollutant Models (CPMs)." The models will predict the pollution load from the deployment of fuel cell technology for stationary electricity generation and for automobile power supply, compared to the load from the use of conventional methods for these energy/power applications. The purpose of the EPA Fuel Cell Workshop (scheduled for Cincinnati in June, 2001) is to generate the data needed for the CPMs.

1. Sub-goal 2: Development of "Comparative Risk Assessment Models (CRAMs)."  
This is to use the information generated under Sub-goal 1 to conduct risk assessments under various scenarios.

#### APPLICABILITY OF THE OUTPUTS FROM THE EPA PROGRAM

The outputs of this Fuel Cell Program can be used by various end-users for their different applications. For example:

1. Regulators and regulatees: The information will be useful in assisting Federal and State governments in developing adequate environmental regulations to guide the development of fuel cell technology and in permitting the establishment of fuel cell facilities.
1. The public: For obvious reasons, the outputs of this Program will assist the public in accepting the construction and operation of fuel cell facilities.
1. Technology developers: Currently there are several major types of fuel cell technologies. The output data of this Program will assist technology developers in evaluating the environmental and risk aspects of their individual technologies.

#### OBJECTIVE OF THE EPA FUEL CELL WORKSHOP

The objective of the EPA Fuel Cell Workshop is to assist EPA in achieving the overall goal of their Fuel Cell Program. Specifically, the Workshop will strive to generate the data or to recommend the approaches to produce the data needed for EPA's Comparative Pollutant Models (CPMs), those Models which will compare the emissions from fuel cell power production with those from conventional technologies for the production of power for both stationary and mobile applications.