



# CT-TRANSIT Hybrid Electric Fuel Cell Transit Bus Demonstration

Hartford, Connecticut, USA

Designed by UTC Power, with a fuel cell system using the Pure Motion® Model 120 fuel cell power system, New England's first hybrid electric fuel cell transit bus debuted in Hartford, CT, on April 10, 2007. A year prior, the Greater Hartford Transit District had contracted with UTC Power to make the demonstration project possible: CT-TRANSIT would operate the fuel cell bus, and UTC Power would provide two years of support that included the use of UTC Power's hydrogen refueling stations at its headquarters in South Windsor, CT. The hydrogen supplied here is renewably produced.

## Objectives

Through this demonstration project, CT-TRANSIT and UTC Power aimed to gain experience and lessons learned regarding emerging fuel cell technology. Operational data would be obtained from the fuel cell bus and compared to three diesel buses.

In addition, increased public awareness has been a significant goal of the project. CT-TRANSIT has received requests throughout the project to demonstrate the fuel cell bus at various community and local events;

and it fulfills as many requests as possible. Between January 2008 and February 2009, CT-TRANSIT showcased the fuel cell bus at a total of 22 events.

## Approach

This particular fuel cell bus is considered a prototype technology that is in the process of being commercialized. From January 2008 through February 2009, it comprised part of a study that collected operating data on four buses: the fuel cell bus and three diesel buses—all operating in the Hartford, CT, area. The results of this study, published by the National Renewable Energy Laboratory (NREL) in May 2009, are meant to serve as lessons learned in operating fuel cell buses. The results are intended to help in evaluating hydrogen and fuel cell systems and infrastructure in transit applications, as well as to assess progress toward technology readiness.

In order to assess the project goal to increase public awareness, CT-TRANSIT conducted two surveys in the fall of 2008. One survey was targeted at passengers, while the other was targeted at bus operators.

## Project Overview

### What

CT-TRANSIT Hybrid Electric Fuel Cell Transit Bus Demonstration

### Who

CT-TRANSIT  
UTC Power

### When

Bus Debuted: Apr. 2007  
Evaluation Started: Jan. 2008  
Evaluation Completed: Feb. 2009

### Participants

United States

### Renewable Technology

This project uses hydrogen refined from chemical company by-products.

### Application

Buses

### Website

<http://www.cttransit.com>  
<http://www.utcpower.com>



## Accomplishments

UTC Power's PureMotion Model 120 system is the result of more than six years of R&D and partnership among UTC Power, the Department of Defense through the U.S. Army Tank-Automotive and Armaments Command, and the Department of Transportation through the Northeast Advanced Vehicle Consortium (NAVC). This system is based on Proton Exchange Membrane (PEM) technology and maximizes the benefits of fuel cells by employing a compact, ambient pressure, hydrogen fuel cell system. The ambient pressure technology allows the system to deliver the highest level of efficiency, no emissions, and quiet operation.

Overall, the benefits of the fuel cell-powered hybrid bus include high efficiency and reliability, energy cost savings, zero emissions, and low noise. Its clean operation has had an immediate positive impact on street-level emissions.

The fuel cell bus has accumulated 12,115 miles and the fuel cell system clocked

2,049 hours. According to the evaluation results, the fuel cell bus had a 46% overall higher fuel economy over the diesel buses studied.

CT-TRANSIT has reported high community and regional interest since the start of the fuel cell bus demonstration. Two surveys were conducted during this demonstration to measure public awareness and perception of the fuel cell technology. Of the passengers who were surveyed, 82% were first-time fuel cell bus riders. More than 60% were aware that they had boarded a fuel cell bus. More than 60% were unaware that the hybrid fuel cell bus produced zero emissions and that it charged its batteries with energy converted from braking. The majority of passengers surveyed felt that the fuel cell bus noise, acceleration, braking, and vibration were all improved over a standard bus. Finally, 81% of respondents said that riding the fuel cell bus had improved their opinion of the technology, and 84% even preferred the fuel cell bus to a standard bus.

## Renewable Hydrogen Production

CT-TRANSIT used hydrogen from UTC Power headquarters to power the fuel cell bus. Praxair supplied this hydrogen, producing it renewably by refining by-product hydrogen from chemical companies in the Niagara Falls area.

## Future Plans

Future plans for the fuel cell bus include reduced operation to limit operating costs and extend the life of the bus to an additional two to two-and-a-half years. CT-TRANSIT plans to receive up to four new fuel cell buses from Van Hool and UTC Power as part of the Federal Transit Agency's National Fuel Cell Bus Program through the NAVC and UTC Power. In addition, CT-TRANSIT plans to purchase a fifth new fuel cell bus under a state grant.



Left to Right: Pure Motion 120 fuel cell system; hybrid fuel cell bus on the streets of Hartford, CT; and illustration of the hybrid fuel cell bus

