

# creating fuel from fumes

Ford Rouge Center will be a world-class workplace where innovation will thrive

As part of its mission to pilot sustainable technologies, Ford is testing a system that generates electricity from paint fumes created as vehicle bodies are sprayed in the Rouge Paint Shop.

### Reducing paint fume emissions

Paint fumes contain volatile organic compounds (VOCs). Because VOCs can impact air quality, they are trapped by filters and burned.

This operation reduces emissions by at least 95 percent. But it is costly, consumes lots of natural gas, and creates carbon dioxide.

### Turning waste into wattage

That's why a small team of Ford and DTE Energy engineers looked at the problem of paint fumes from a new angle. Could fumes be converted into clean electricity?

Working with funds from the Rouge Heritage project and a grant from the State of Michigan (Public Service

Commission), the team built a small prototype. In January, 2003, paint fumes were successfully fed into a test fuel cell at the Ford Scientific Research Laboratory. The fumes were converted into clean power inside the fuel cell.

### Inventing a sustainable system

Ford's Fumes-to-Fuel System works in three stages. The first stage concentrates paint fumes. The second stage, called a reformer, converts concentrated fumes into a hydrogen-rich mixture. The third stage feeds hydrogen gas into fuel cells, where hydrogen reacts chemically with air to create electricity, hot water, and a only tiny bit of carbon dioxide.

Unlike power generators, fuel cells produce no harmful emissions. They cost less to install and maintain, and run more efficiently and quietly. Fuel cells provide "clean" power and stable voltage levels.

A pilot system has been installed at

"For years we've been incinerating the fumes coming out of paint booths, to protect air quality. Now we have a more efficient system, one that protects air quality by converting paint fumes into fuel for fuel cells. Making power from waste is a great example of sustainable manufacturing and the spirit of innovation coming out of the Rouge revitalization."

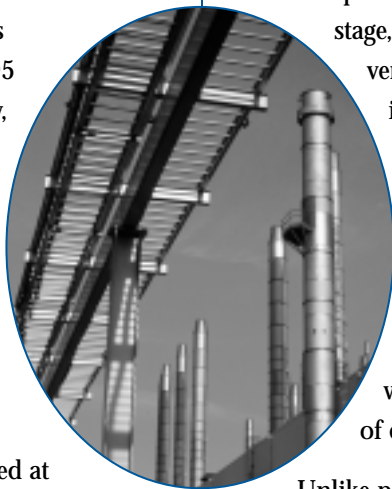
*Jay Richardson  
Heritage Project Manager  
Vehicle Operations*

the Rouge Paint Shop. A larger system will be installed in 2004 that will remove up to 99% of the solvents while it generates 20 times more power than the pilot system.

### Looking towards the future

In the future, this sustainable system may be installed at other Ford paint shops to reduce emissions, cut costs, and produce clean power from what was once considered waste.

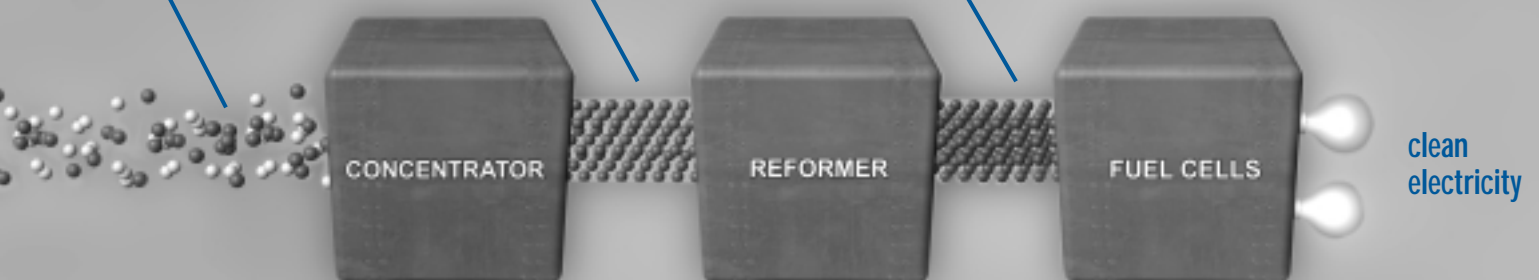
**Paint fumes are converted into a hydrogen-rich gas and fed into fuel cells to generate electricity.**



VOC exhaust

hydrocarbons

hydrogen



Are fuel cells that can run on paint fumes the same as fuel cells used in vehicles?

Ford's Fumes-to-Fuel System design uses a solid oxide fuel cell (SOFC). It runs at a higher operating temperature (up to 1000°C) than the proton electron membrane (PEM) fuel cell used in motor vehicles. Solid oxide fuel cells last longer than PEM fuel cells, running more than 40,000 hours without interruption.

How much power will the Ford Fumes-to-Fuel System generate?

The pilot system (see photo below) generates about 5,000 watts of electricity. That's enough to power an average household. A larger version will be installed in 2004. It will have the capacity to generate more than 100,000 watts, which is enough to power a residential neighborhood.

What happens when the paint shop is closed at night and on weekends?

One of the ingenious aspects of the system is that it can use *either* paint fumes or natural gas as a source of

## By the numbers...

20 percent

The projected reduction in operating costs for the Ford Fumes-To-Fuel System, compared to natural gas-fired incinerator systems, is 20 percent.

\$100,000

The projected annual energy cost savings for the full-sized system when installed at the Rouge Paint Shop in 2004 is at least \$100,000. Half of the savings will come from reduced natural gas use. The other half will come from using less electricity.

1,600 tons

Carbon dioxide emissions from the Rouge Paint Shop could be reduced by 1,600 tons annually.

300,000,000 cubic feet

Natural gas consumption could be reduced by 300 million cubic feet annually if all Ford paint shops in Michigan used the new system.

10 million kilowatt hours

Electricity use could be reduced by 10 million kilowatt hours annually if all Ford paint shops in Michigan used the new system.

fuel. When the shop isn't spraying paint, the system will automatically reform natural gas into hydrogen to keep the fuel cells running. Once the paint shop starts up again, the system will automatically switch back to using paint fumes as fuel.

Who are the main collaborators behind this project?

This innovation exemplifies the spirit

of partnership behind the Rouge revitalization. Participants include the Ford Rouge Center, Vehicle Operations Paint Engineering, Ford Environmental Quality Office, Ford Scientific Research Laboratories, Ford Motor Land Development Corporation, DTE Energy, Fuel Cell Technologies Ltd., and the State of Michigan (Public Service Commission Energy Efficiency Grant). Ford and DTE Energy have jointly patented the groundbreaking Fumes-to-Fuel System technology.

Can this technology be used by other industries?

Industries that use paint, ink and other solvents could benefit from the Ford Fumes-to-Fuel System technology. Potential users include other vehicle manufacturers, automotive parts factories, furniture makers, chemical plants, and large print shops.

