

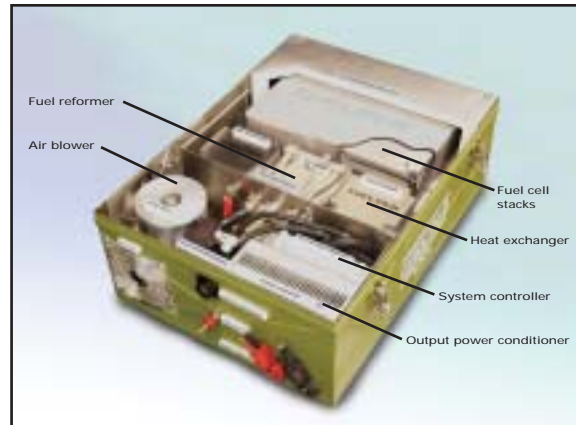
## Delphi Solid Oxide Fuel Cell Auxiliary Power Unit

**Description** – Delphi's solid oxide fuel cell (SOFC) auxiliary power unit (APU) will be a high-efficiency generator of electricity, delivering up to 5 kW of energy. It converts chemical energy in fuels such as diesel and gasoline directly into electricity, without combustion. The electrochemical process combines fuel and oxidant gases across an ion-conducting ceramic membrane. The solid oxide cell consists of two electrodes and an electrolyte. Reformate consisting of hydrogen and carbon monoxide is fed to the anode, and oxygen in the form of air is fed to the cathode. This process generates electric voltage at the electrodes and can continuously supply electric power to external loads.

**Typical Application** – Delphi's new SOFC APU is expected to serve both transportation and non-transportation markets.

On heavy-duty trucks, Delphi's SOFC APU will help eliminate the need for engine idling. On-board convenience features such as power air conditioning, heater, televisions, radios, computer, and other electronic devices can be powered by the SOFC APU without the need to run the main engine. Other "power on demand" accessories (e.g., cooling fan, water pump, etc.) can also be operated by the SOFC unit.

Because of its quiet, emission-free operation, Delphi's SOFC APU is also suitable for military vehicle and recreational vehicle applications.



**Performance Advantages** – In a vehicle application, Delphi SOFC APU provides a clean, highly efficient supply of electrical power that is also independent of engine operation. Thus, a steady supply of electricity is available without the need to idle the engine or draw on the vehicle's battery. It operates at twice the fuel efficiency of a traditional engine-driven generator. During engine operation, it can also be a source of reformate to the engine and exhaust aftertreatment, to enable lower-emission cold starts and transient operation.

In all applications, Delphi SOFC APU operates quietly and with virtually zero emissions.

**Availability** – Delphi plans to make available prototype samples of its SOFC APU by late 2005.

# DELPHI

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# D e l p h i   S o l i d   O x i d e   F u e l C e l l   A u x i l i a r y   P o w e r   U n i t

Features	Benefits
High electrical efficiency	– Can attain fuel-to-electric efficiency of >50%
Ability to use a variety of hydrocarbon fuels (e.g., gasoline, natural gas)	– Greater choice of price-competitive fuels
SOFC can use carbon monoxide as a fuel and is relatively more tolerant of impurities like sulfur than other conventional fuel cells	– No need for carbon monoxide cleanup in the reforming process
No need for noble or precious metals	– Greater cost-effectiveness per unit of electrical energy
Dry electrolyte	– No humidification of reactants necessary – No water management system is required
Unit operates in a dry, solid-state environment	– Can operate at maximum efficiency whether the engine is on or off – Current trials suggest savings of approx. \$1,000 per year in burned fuel during idling for the average heavy-duty diesel truck
Operates independently of the vehicle's engine and electrical system	– Will not draw power from the vehicle's battery