



# Auxiliary Power Unit Cuts Emissions, Fuel Use in Railroad Locomotives

ENERGY EFFICIENCY AND RENEWABLE ENERGY

OFFICE OF FREEDOMCAR AND VEHICLE TECHNOLOGIES

## Transportation FOR THE 21ST CENTURY

### Background

New U.S. Environmental Protection Agency (EPA) regulations are forcing locomotive manufacturers and railroads to reduce pollutant emissions from locomotive operation. All new locomotives, and those overhauled after January 1, 2002, are required to meet strict standards for oxides of nitrogen (NOx) emissions. These emissions can be reduced either by adjusting combustion parameters, which incurs a fuel penalty, or by turning the diesel engine off when the train is not moving and would otherwise be idling. Just as heavy-duty trucks are left idling to keep the engine and coolant warm enough to start, railroad locomotives are often idled overnight and during much of the day.

The impacts of locomotive idling are significant, both in terms of energy use and emissions, as well as in terms of dollars. For a switcher locomotive (2,300 horsepower and below) that idles 75% of the time, 27% of its fuel is consumed, and 25% of its NOx emissions are produced at idle. Unregulated locomotives have been estimated to contribute almost 5% of the total nationwide emissions of NOx, making them one of the largest remaining unregulated sources.

In order to meet the challenge of reducing fuel use and NOx emissions, CSX Transportation (Jacksonville, Florida) teamed up with International Road and Rail (London, Ontario) to develop a revolutionary new locomotive operating system. The new system incorporates an auxiliary power unit (APU) that automatically shuts down the main locomotive engine idle while maintaining all vital main engine systems at greatly reduced fuel consumption. Argonne National Laboratory provided independent confirmation of the validity of the original APU idea.

### The Technology

The new system, called the K9™ APU, consists of a compact unit mounted on a

skid which includes an EPA-emissions certified 48 hp, 4-cylinder turbocharged diesel engine. The engine is coupled to a 16KW, 240V, 60Hz single phase generator, with an automatic main engine shutdown timer circuit. Upon shut down, electric immersion heaters maintain the main engine's coolant water and lubrication oil temperatures, making it easier to restart the locomotive. A battery charger maintains the locomotive's 74 VDC system, making it possible to operate an air conditioning unit or space heaters. Use of the K9™ unit has been shown to reduce fuel consumption at idle by as much as 80% and locomotive emissions of nitrogen oxide by 91%; hydrocarbons by 94%; carbon monoxide by 96%; and particulate matter by 84%. An added benefit is a substantial reduction in noise levels in neighborhoods located near freight terminals and large railroad yards.

### Commercialization

EcoTrans Technologies LLC, headquartered in Jacksonville, Florida was formed to introduce the K9™ APU system to the railroad industry. EcoTrans is a joint venture of CSX Transportation Inc., a unit of CSX Corp., Richmond, Virginia, and London, Ontario-based International Road and Rail Inc.

In April 2002, the U.S. Department of Energy awarded one million dollars to the State of Maryland to demonstrate the K9™ technology, which was originally developed, installed, and tested with the involvement of CSX's Cumberland, Maryland locomotive shop.

Other companies, such as Kim Hotstart, also design and manufacture electric-powered gas and diesel engine heating equipment. These products heat engine coolant, lube oil, diesel fuel, hydraulic systems, gensets, and other engine-related components. Similarly, other railroads are now installing APUs on their locomotives to take advantage of the fuel savings they provide.

### Benefits

- Estimated total savings to the railroad industry of 230 million gallons of diesel fuel per year
- Reduces locomotive fuel consumption at idle by 80%
- Cuts NOx emissions at idle by 91%
- May enable compliance with EPA Tier 0 air quality standards for hydrocarbons, carbon monoxide, NOx, and particulate matter (PM)
- Substantial reduction in railroad yard noise levels



EcoTrans' K9™ auxiliary power unit is saving fuel while cutting locomotive exhaust emissions

### Contacts:

**Sid Diamond**  
Office of FreedomCAR and Vehicle Technologies  
(202) 586-8032  
sid.diamond@ee.doe.gov

**David P. Miller**  
EcoTrans Technologies  
(904) 359-4978  
dave\_miller@csx.com