



# Advanced Technology Vehicles in Service

Advanced Vehicle Testing Activity



## Indianapolis Public Transportation

DIESEL HYBRID ELECTRIC BUSES

### THE INDIANAPOLIS PUBLIC TRANSPORTATION CORPORATION (INDYGO)

provides transit service in the Indianapolis Metropolitan area, using 226 vehicles to serve 28 fixed and demand response routes. IndyGo vehicles accumulated more than 9 million miles and transported 11 million passengers in 2003. In August 2003, IndyGo introduced the Blue Line, a new circulator route in downtown Indianapolis. The 4.3-mile route provides service to cultural and commercial attractions such as the Indianapolis Zoo, the Circle Centre Mall, and the State Capitol. The route's average speed is 12 mph, with maximum speeds of 35-40 mph.

Five hybrid electric buses serve the Blue Line, with three buses on the route at a time. The hybrid buses were acquired as part of an effort to reduce air and noise pollution in Indianapolis and to develop the hybrid electric technology used in the buses. Funding for purchase of the hybrid buses was provided in part by a Congestion Mitigation and Air Quality (CMAQ) grant obtained by the Indiana Department of Transportation and IndyGo. The CMAQ program, jointly administered by the Federal Highway Administration and the Federal Transit Administration, aims to alleviate traffic congestion and emissions in non-attainment air quality areas. The City of Indianapolis also provided funds for the hybrid bus project.

### TESTING ADVANCED VEHICLES

The role of the U.S. Department of Energy's (DOE) Advanced Vehicle Testing Activity (AVTA) is to bridge the gap between R&D and commercial availability of advanced vehicle technologies. AVTA supports DOE's FreedomCAR and Vehicle Technologies Program in moving these technologies from R&D to market deployment by examining market factors and customer requirements, evaluating performance and durability of alternative fuel and advanced technology vehicles, and assessing the performance of these vehicles in fleet applications.

The Fleet Test & Evaluation team at the National Renewable Energy Laboratory (NREL) supports AVTA by conducting medium- and heavy-duty vehicle evaluations. The team's tasks include recommending types of alternative fuel and advanced technology vehicles to test, identifying fleets to evaluate, designing test plans, gathering on-site data, preparing technical reports, and communicating results on its Web site and in print publications.



NREL/PIX 13504, 13505, 13583

INDIANAPOLIS PUBLIC TRANSPORTATION ♦ DIESEL HYBRID ELECTRIC BUSES

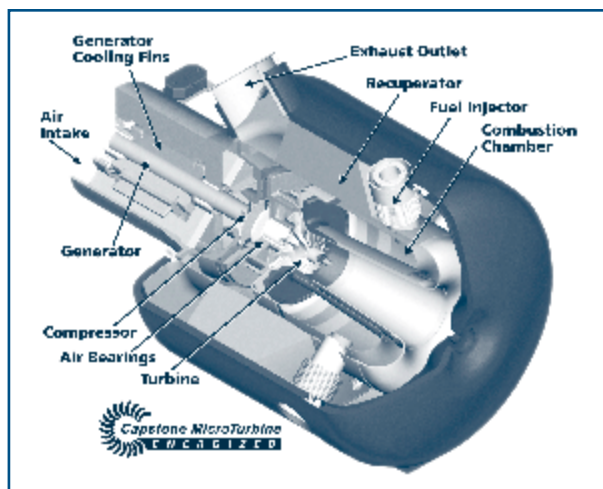


U.S. Department of Energy

Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

<b>Buses: Ebus, Inc. Transit Bus</b>	
Model Year	2003
Length/Width/Height	22 ft /92 in/103 in
GVWR/Curb Weight	19,500/14,500 lb
Passenger Capacity	22 (1 wheelchair)
Maximum Forward Speed	40 mph
Service	Indianapolis, Indiana
<b>Propulsion: Series Hybrid-Electric</b>	
Motor	Reliance AC Induction, air cooled
Energy Storage	48 NiCd, liquid-cooled, "fast charge" batteries, 288 V total
Opportunity Charging	SAE J-2293 Fast Charging
Regenerative Braking	Yes
<b>APU: Capstone Model 330 MicroTurbine</b>	
Rating	30 kW, 250-700 V DC
Fuel	Diesel
Fuel Storage	50 gal



**INDYGO SELECTED 22-FOOT, LOW-FLOOR SERIES HYBRID ELECTRIC** buses manufactured by Downey, California-based Ebus, Inc. for the Blue Line. The Ebus hybrid electric system propels the buses using an electric motor powered by a battery pack. The nickel-cadmium (NiCd) batteries are recharged by a low-emission, diesel-fueled Capstone MicroTurbine™ auxiliary power unit (APU), which extends the range of the buses. A digital power controller monitors and controls recharging of the batteries by the MicroTurbine. This system is charge sustaining, meaning that the batteries will have power as long as the APU has fuel.



NREL/PIX 13582

The bus design also incorporates regenerative braking, which provides additional energy to recharge the battery pack. In this system, the electric motors that drive the bus become generators during deceleration, and the electricity produced by the generators is stored in the batteries. This technology is particularly effective for routes, such as the Blue Line, that encounter stop-and-go traffic. When the bus is not in operation, it can be plugged into a fast charging station to "top off" the batteries in approximately 1 hour.

**NREL'S EVALUATION OF THE INDYGO BUSES** began in mid-2004 and will continue for approximately 6 months. Information being collected and analyzed includes operational data such as vehicle use, fuel consumption, and maintenance performed, as well as descriptions of IndyGo's experience implementing this new technology and the public's perception of it. The objectives are to provide credible data and results that show the progress of these hybrid electric bus and infrastructure technologies.

#### Contacts

##### NREL Fleet Test & Evaluation Team

Robb Barnitt, Engineer  
1617 Cole Blvd.  
Golden, CO 80401  
Phone: 303-275-4489  
Fax: 303-275-4415  
E-mail: robb\_barnitt@nrel.gov

##### Web Sites

Ebus: [www.ebus.com](http://www.ebus.com)  
IndyGo: [www.indygo.net](http://www.indygo.net)  
Capstone Microturbine: [www.capstoneturbine.com](http://www.capstoneturbine.com)  
NREL: [www.nrel.gov/vehiclesandfuels/fleetest](http://www.nrel.gov/vehiclesandfuels/fleetest)

##### IndyGo

Morris Frye, Director of Vehicle Maintenance  
1501 West Washington St.  
Indianapolis, IN 46222  
Phone: 317-614-9309 • Fax: 317-266-9163  
E-mail: [morris@indygo.net](mailto:morris@indygo.net)

##### Produced by the

**National Renewable Energy Laboratory (NREL)**  
NREL is a U.S. Department of Energy National Laboratory  
Operated by Midwest Research Institute • Battelle

#### For more information contact:

**EERE Information Center**  
**1-877-EERE-INF (1-877-337-3463)**  
[www.eere.energy.gov](http://www.eere.energy.gov)

#### A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

DOE/GO-102004-1986 • December 2004

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 20% postconsumer waste.

Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.