

# PLUG-IN HYBRID ELECTRIC SCHOOL BUS

*project*



**Furthering the market development and deployment of plug-in hybrid vehicles.**

[www.hybridschoolbus.org](http://www.hybridschoolbus.org)

## **Project Sponsors**

### ENTIRE PROGRAM FUNDING

- ▶ Dominion North Carolina Power
- ▶ Duke Energy
- ▶ Iowa Energy Center
- ▶ N.C. Electric Membership Corp.
- ▶ N.C. State Energy Office
- ▶ Progress Energy

### BUS SPECIFIC FUNDING

- ▶ Arkansas Energy Office
- ▶ Austin Energy
- ▶ Austin Independent School District Transportation Department
- ▶ Jennings Transportation
- ▶ Killeen Independent School District Transportation Services
- ▶ Lake Chelan School District #129
- ▶ Napa Valley Unified School District
- ▶ N.C. Department of Environment and Natural Resources
- ▶ N.C. Department of Public Instruction
- ▶ Nevada Community Schools
- ▶ N.Y. Power Authority
- ▶ N.Y. State Energy Research and Development Authority
- ▶ Pennsylvania Department of Environmental Protection
- ▶ S.C. Dept. of Education
- ▶ Sigourney Community School District
- ▶ State Technologies Advancement Collaborative [STAC]
- ▶ U.S. Environmental Protection Agency's Clean School Bus USA Program

## **About Advanced Energy**

Advanced Energy's mission to create economic and environmental benefits through innovative approaches to energy. This project mobilized communities into action, coordinated and secured funding for the buses, helped drive the design to plug-in for optimal efficiencies and transformed the school bus marketplace.

*cleaner vehicle technologies for cleaner air*

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## Successful Commercialization

“Many projects never make it across the ‘Valley of Death’ that exists between technology development and commercialization ... due to bad timing, poor knowledge transfer, and lack of marketing support.”<sup>1</sup>

The plug-in hybrid electric school bus project is now entering a crucial phase. When school districts in 12 states receive the first of these buses offered by a major manufacturer, the first phase of commercialization will be complete. The timing of this project is ideal because of advances in battery technology, media attention on oil security and climate change. Market support, however, is still uncertain. Successful commercialization of plug-in hybrid electric school buses is dependent on support from the nation’s electric utilities.

## Factors for Marketplace Success

- ▶ **Manufacturer support** :: Issues will arise with these first buses that require quick resolution to improve product quality.
- ▶ **Performance monitoring** :: Actual data on bus fuel economy and emissions will be used in future marketing.
- ▶ **Market education** :: Reliable and unbiased information will help school systems with their purchasing decisions. School systems will also need decision support to analyze the benefits of plug-in hybrid electric school buses specific to their particular system needs.
- ▶ **Funding** :: School districts need help finding incremental funding through government grants, tax credits for the dealers and other sources.
- ▶ **Additional manufacturers** :: A competitive market will rapidly reduce the product cost and increase market penetration.
- ▶ **Infrastructure** :: Bus charging and future vehicle to grid [V2G applications require coordination between school systems and electric utilities].

## Problem Defined

Plug-in hybrid electric school buses have many benefits dispersed among many beneficiaries [see chart]. Few of these beneficiaries are able to provide market development support and knowledge transfer needed for successful commercialization. What is needed

is a consortium of beneficiaries to further the market development and deployment of plug-in hybrid vehicles.

## Utility Support

Our vision is to create a center that fosters the market development for multiple plug-in hybrid vehicle platforms, of which school buses are the first. The goal of this center will be to ensure that factors for marketplace success are in place. The role of the center is not to conduct research, nor to engage in product sales, but to develop market support mechanisms to enable plug-in hybrid technologies to successfully transit the “Valley of Death.”

The center will be funded by utilities, manufacturers and the manufacturing supply chain. A steering committee, comprised of individuals representing such organizations, will provide oversight and strategic direction to the center.

Feature	Benefit
Lower fuel consumption and brake maintenance	Reduced operating costs for school systems
Reduced diesel particulates [zero in all-electric mode]	Improved health of school children [e.g. fewer asthma attacks and less lung cancer]
Improved efficiency / reduced carbon footprint	Reduction in global warming and opportunity for carbon trading
Displace petroleum fuel with electricity	Move toward energy independence and greater energy security
Emissions moved from daytime, urban, mobile source to nighttime, central power plant	Help for regional clean air management authorities to meet air quality standards
Batteries large enough to operate most of a typical bus route in all-electric mode	Off-peak energy sales for utilities and the potential to develop vehicle-to-grid [V2G] applications for managing peak loads

**MORE INFORMATION** :: [www.hybridschoolbus.org](http://www.hybridschoolbus.org)

<sup>1</sup>“Technology Management Report,” Spring 2007, Center for Innovation Management Studies, N.C. State University, Raleigh