



Kentucky Hybrid Electric School Bus Program

Principal Investigator and Presenter:

Leah Settle, Kentucky Department of Education (KDE)

Additional Presenter:

Melissa Howell, Kentucky Clean Fuels Coalition (KCFC)

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ARRAVT062

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Kentucky Hybrid Electric School Bus Program

- **Timeline:**

- Start: December 29, 2010
- End: December 31, 2013
- Percent complete: 47%

- **Budget:**

- DOE share:
\$12.98 million
- Recipient share:
\$15.34 million

- **Barriers:**

- Request for Application (RFA) processing time and lag time (approx. 90-100 days) between school bus order and delivery (when KDE is invoiced and funds can be drawn).
- One of two bus manufacturers experienced battery issues delaying delivery of buses from Cycle 1 and Cycle 2 RFA processes. Funds cannot be drawn until successful delivery of buses.

- **Partners:**

- Kentucky Department of Education (KDE), local school districts, Kentucky Department of Energy Development & Independence, Kentucky Finance & Administration Cabinet, Kentucky Department for Air Quality, Kentucky Clean Fuels Coalition, KY National Energy Education Development program, and hybrid electric school bus manufacturers (Thomas – Cummins ISB, Freightliner; IC Corp – MaxForce 7, International).
- Project Lead: Kentucky Department of Education



Kentucky Hybrid Electric School Bus Program

Relevance

Objectives:

- To replace approximately 213 diesel-powered school buses statewide with Type C-charge sustaining hybrid electric school buses through KDE's Request for Application (RFA) process.
- To increase the use of advanced technology vehicles as a means to reduce U.S. dependence on imported petroleum, increase fuel economy and improve vehicle based emissions per ARRA.
- To ensure that vehicles are deployed in a manner that maximizes petroleum displacement to the greatest extent possible.
- To provide appropriate training for those associated with this project and in the larger community about the benefits of advanced technology vehicles and provide them with strategies that will help them to maximize these benefits.
- To collect data on the success of the project through collection of vehicle and training information.
- To create and retain jobs per ARRA.



Kentucky Hybrid Electric School Bus Program

Approach

- **Master Agreements:** The state of Kentucky (through the Finance and Administration Cabinet) has current Master Agreements with local vendors for Wayne Supply (Thomas Built) and International (Bluegrass Truck), enabling local school districts to purchase buses with funds awarded through the competitive grant process (RFA).
- **RFA:** The RFA process for the Kentucky Hybrid Electric School Bus Program is directed to local school districts to submit grant applications for available federal funds. The RFA results in multiple awards. The evaluation of grant applications is focused on identifying the greatest need as well as the strength and sustainability of the proposal.
- **Data Collection:** After awards are determined and upon deployment of the buses, performance data is tracked on a quarterly basis. The data will be incorporated and presented in such a way as to clearly demonstrate beneficial aspects enabling other schools around the country to make hybrid school bus procurement decisions based on current, credible performance data gathered in Kentucky.



Kentucky Hybrid Electric School Bus Program

Approach

- **Technical Barrier:** Request for Application (RFA) processing time and lag time (approx. 90-100 days) between school bus order and delivery (when KDE is invoiced and funds can be drawn). Program is addressing this by posting multiple RFA's in order to produce orders multiple times throughout the year.
- **Environmental Safety Plans:** Addressed in training of drivers, Superintendents, Transportation Directors and First Responders.
- **NEPA Status:** NEPA documentation submitted for 100% of vehicle purchases.



Kentucky Hybrid Electric School Bus Program

Approach

Milestone:	Date:	Status:
Award	Dec. 1, 2009	Completed
Cycle 1 Procurement	Feb. 24, 2010	Completed
Cycle 1 Bus Orders	March 17, 2010	Completed
Outreach	Oct. 29, 2010	Completed and Ongoing
Cycle 1 Delivery	Dec. 1, 2010	12 of 22 Buses Delivered
Cycle 2 Procurement	Oct. 1, 2010	Completed
Jump on Board Campaign	August 15, 2010	Completed
Cycle 2 Bus Orders	Nov. 1, 2010	Completed
Cycle 2 Delivery	April 2011	Scheduled
Cycle 3 Procurement	March 25, 2011	In process



Kentucky Hybrid Electric School Bus Program

Technical Accomplishments and Progress

- Kentucky Hybrid Electric School Bus Program Project Team (including partners) met to plan and coordinate project activities; schedule.
- KDE finalized Personal Service Contract with the Kentucky Clean Fuels Coalition to secure services for project outreach/marketing, as well as data reporting.
- Kickoff meeting was held with the U.S. Department of Energy (US DOE) Project Officer.



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Technical Accomplishments and Progress

- Sub-recipient agreements were finalized with 31 school districts vs. 22 last year.
- As opposed to one RFA last year, two RFA's have been posted this year, and one more will be posted before the end of the year, bringing total to 4 procurement cycles.
- Orders placed for 34 hybrid electric school buses last year. Total is now up to 101 out of the goal of 213. Placing 213 hybrid electric school buses on Kentucky roads will reduce greenhouse gas emissions and diesel fuel consumption; and extend the bus life-cycle from 14 to over 18 years. Bus manufacturers anticipate a 30% – 40% reduction in fuel demand. The hybrid electric systems will also raise miles per gallon from 7.5 to 12 over traditional diesel-only engines.



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Technical Accomplishments and Progress

- NEPA documentation submitted for 100% of vehicle purchases.
- Jobs: Number of jobs created/retained: 4.40
- Outreach and Training: Project education and outreach to the general public, teachers, local officials, first responders, local media etc. began to support the project. Training of bus operators and maintenance personnel was coordinated by KDE and the Kentucky Clean Fuels Coalition and facilitated by bus manufacturers as detailed in the master agreement with the Commonwealth of Kentucky. Education, outreach and training ensured that vehicles were deployed in a safe manner that maximized potential petroleum displacement and emissions benefits.



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Technical Accomplishments and Progress

Hybrid Technical Training:

2010 Training

22 Superintendents

22 Transportation Directors

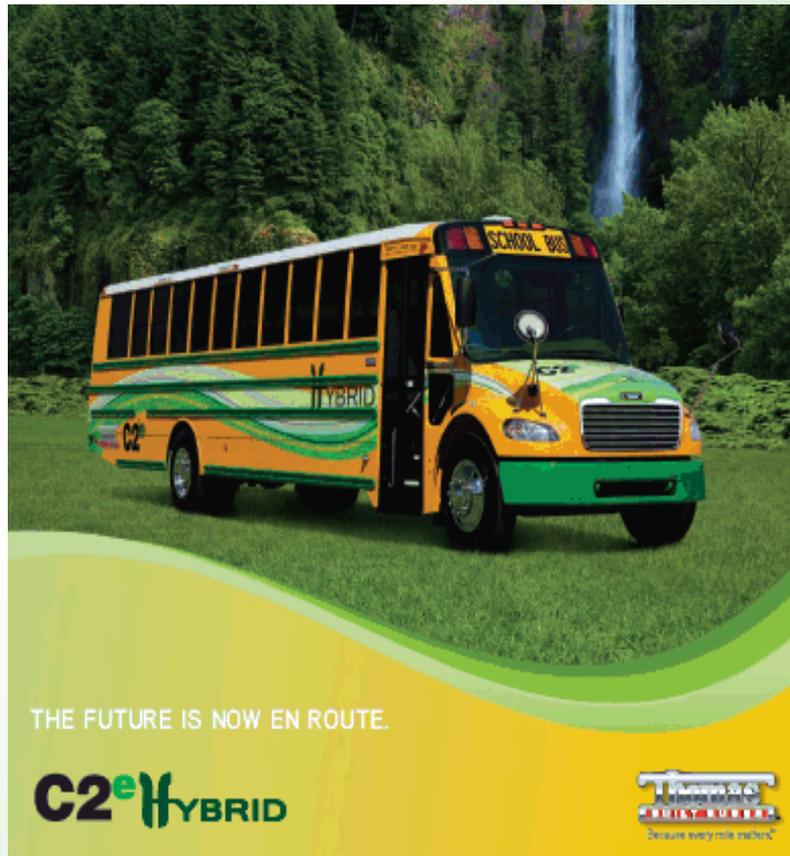
100 Technicians & First Responders

2011 Training Projections

25 Superintendents

25 Transportation Directors

250 Technicians & First Responders





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Technical Accomplishments and Progress

Technicians get hands on training from hybrid system specialists.



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Data Collection Form – KY Hybrid Electric Bus Grant - Purchasing Cycle 1

Please set up and complete one data sheet for each bus. Data must be collected **monthly** by the school district and submitted **quarterly** to:

Melissa M. Howell: kyleanfuels@insightbb.com (Paperless reporting only.)

Hybrid Bus VIN # – Last 8 Digits	Body Side No.	Make (I or T)	Year
Is there a bus that has a similar route to the hybrid bus? YES ___ NO ___			

School District: _____
Contact Name: _____
Phone Number: _____
Email Address: _____

Month	Miles Traveled	Gallons of Diesel Used	MPG for Hybrid Bus*	MPG for similar diesel bus	Total Routes Missed Due to Mechanical Breakdown	Total Routes Traveled for the Month
January						
February						
March						
Submit Data to Melissa Howell						
April						
May						
June						
Submit Data to Melissa Howell						
July						
August						
September						
Submit Data to Melissa Howell						
October						
November						
December						
Submit Data to Melissa Howell						

*MPG is calculated by dividing the number of gallons into the number of miles: Example: 100 gallons / 1000 miles = 10.0 MPG

Terrain _____

Weather _____

Technical Accomplishments and Progress

Manual Data Report:

Prior to direct downloading of data, mpg was recorded by hand.



Kentucky Hybrid Electric School Bus Program

PowerSpec - Engine Trip Information Report

Report Date: 2/28/2011 2:05:12 PM

Engine Type	ISB 2010	ECM Code	BZ90023.11	Last Tool Used	VEPS
Engine Serial Number	73109571	Software Phase	5.3.4.4	Customer Name	Customer Came**
Unit Number	x03BBBBBBB	ECM Runtime	344:04:40	PowerSpec Version	4.2.2.11

Trip Data Since Last Reset

Trip Summary	Value	Unit
Average Fuel Economy	7.3	mpg
Drive Average Fuel Economy	9.95	mpg
% Idle Time	23.3	%
% PTO Time	29	%
% PTO Non-Moving Time	29	%
% Top Gear Distance	65	%
% Gear Down Distance	14.9	%
% Cruise Distance	0	%
Maximum Vehicle Speed	65	mph
Number of Sudden Decelerations	0	
Trip Distance	3582.18	miles
Total Engine Hours	321:58:47	hh:mm:ss
Trip Time	322:01:47	hh:mm:ss
Trip Complete Regenerations	0	
Trip Desired Regenerations	0	
Trip Fuel Used For Dosing	0	gallons
Trip Incomplete Regenerations	0	
Trip Peak Soot Fill Monitor Status	Normal	
Trip Peak Soot Filter Delta Pressure	0	psi

Technical Accomplishments and Progress

ECM Data Report:

Performance data is now
downloaded from each bus via
the Electronic Control Module



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Collaboration and Partnerships:

- **Kentucky Department of Education**
- **Local school districts**
(Sub-recipients)
- **Kentucky Department of Energy Development & Independence**
(Insight and Planning)
- **Kentucky Finance & Administration Cabinet**
(Master Agreements)
- **Kentucky Department for Air Quality**
(Insight and Planning)
- **Kentucky Clean Fuels Coalition**
(Outreach and Data Collection)
- **KY National Energy Education Development program**
(Insight and Planning)
- **Hybrid electric school bus manufacturers (Thomas – Cummins ISB, Freightliner; IC Corp – MaxForce 7, International)**



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Collaborations and Partnerships:

Kentucky Department of Education Commissioner, Terry Holliday, and Corbin Independent School Superintendent, Ed McNeel, are all smiles.



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Collaborations and Partnerships

Hybrid Education:

Teachers and students see first hand how the hybrid system operates on “their” bus.



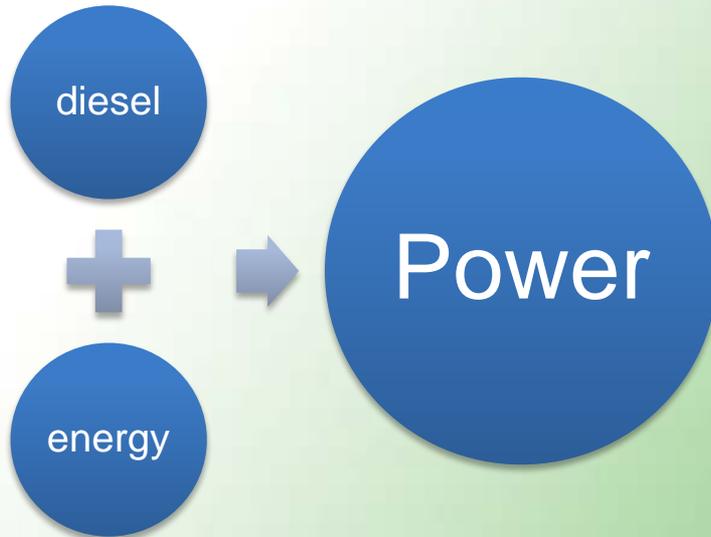
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Future Work:

- Additional procurements
- Bus delivery and press events
- Complete vehicle ordering
 - Target completion September 2012.
- Data collection
 - Will continue through the end of the grant.



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Future Work

Curriculum Building:

Hybrid technology will be the focus of energy & science curriculum piece in 2011.

Eaton Corporation, National Energy Education Development Program (NEED) and the Kentucky Clean Fuels Coalition will team to develop, produce and present across the state.



Kentucky Hybrid Electric School Bus Program

	Allen County					Breathitt County	
<u>Month</u>	<u>mpg hybrid</u>	<u>mpg diesel</u>	<u>miles driven</u>	<u>avg speed</u>	<u>brake actuations</u>	<u>mpg hybrid</u>	<u>mpg diesel</u>
January							
February	8.3	6.1	601.4	16 mph	2035	8.99	
March							
April							
May							
June							
July							
August							
September							
October							
November							
December							

Future Work

2011 Program Data Gathering Sample:

Program reports will be compiled monthly and can reflect comparisons.

	Allen County		Breathitt County	
	<u>mpg hybrid</u>	<u>mpg diesel</u>	<u>mpg hybrid</u>	<u>mpg diesel</u>
Quarter 1 Avg:	2.77	2.03	3.00	0.00
Quarter 2 Avg:	0.00	0.00	0.00	0.00
Quarter 3 Avg:	0.00	0.00	0.00	0.00
Quarter 4 Avg:	0.00	0.00	0.00	0.00

	Allen County		Breathitt County	
	<u>mpg hybrid</u>	<u>mpg diesel</u>	<u>mpg hybrid</u>	<u>mpg diesel</u>
Yearly Average	0.69	0.51	0.75	0.00



Kentucky Hybrid Electric School Bus Program

- **Summary:**

- The Kentucky Department of Education (KDE) met every task planned for the first and second cycles of school bus procurement, including completing the NEPA process and actions necessary to enable vehicle purchases.
- Two RFA's were posted, and 101 out of 213 hybrid electric school buses have been ordered.
- Upon award to school districts, the Kentucky Clean Fuels Coalition implemented project outreach/marketing plans and began executing the plans, meeting with all Superintendents, local Boards of Education, as well as Transportation Directors.
- Program is well-positioned for work planned next fiscal year: Additional procurements, outreach/marketing, training and data collection.