



### **Acquisition cost**

Q: How much does the hybrid system add to the price of a school bus?

A: The charge-sustaining system, which uses lead acid batteries, adds around \$90,000 to the price of a bus. The charge-depleting system, using lithium-ion battery technology, adds approximately \$150,000.

Q: Will the prices come down in the future?

A: While we cannot commit to any future pricing direction today, the trend with this technology is that prices decline as volume increases.

### **Application**

Q: Is there any advantage to using this hybrid technology on a rural route as opposed to an urban route?

A: The frequent stops and starts of typical urban and suburban routes get the most out of the hybrid system. Routes with extended distances between stops won't see as much improvement in fuel economy but would still realize benefits in reduced maintenance from the regenerative braking.

Q: Does the diesel shut off when stopped?

A: No. The diesel engine stays on during operation of the bus, even if the hybrid system is engaged. This is required to drive the accessories such as power steering, air compressors, vehicle alternator, etc.

### **Battery life**

Q: What is the expected life of the batteries?

A: The lead acid batteries in the charge-sustaining system should last between 3 and 5 years. The lithium-ion batteries in the charge-depleting system are expected to last 5 to 7 years.

Q: Do the batteries have a "memory" in them? In other words, do they have to be discharged to a certain level before being recharged in order for the batteries to maintain a certain level of usefulness, or can they be recharged at any level of discharge and still maintain the maximum amount of use?

A: No, the batteries do not have a memory. The system controller maintains the correct state of charge.

Q: What is the cost of a replacement battery pack?

A: The batteries are some of the most expensive components to this system. Worldwide battery technology is rapidly evolving, so we expect that any systems we build today will receive the latest batteries available when it comes time to replace them.



### **Biodiesel**

Q: Is the use of biodiesel acceptable with the hybrid system?

A: Yes, up to B5 or B20 depending upon your operation. The hybrid system we offer is completely "post transmission," meaning that all of the components are mounted in the driveline after the transmission output. Thus, the biodiesel rules for our MaxxForce engines apply to hybrid and non-hybrid alike.

### **Charging costs**

Q: How much does the electric cost to charge these units versus the savings in diesel fuel?

A: The equivalent cost of charging the batteries from an outlet is roughly \$0.60/ gallon compared to approximately \$3.00/ gallon for diesel.

### **Cold weather**

Q: Will the hybrid system work in cold climates?

A: Yes, cold weather operation should be unaffected by the addition of the hybrid system.

Q: We have concerns about heating the bus in the winter. Will this provide adequate BTU's?

A: The primary heat source will remain the diesel engine. If you are in an area with prolonged cold weather, supplemental heating systems are available like on our non-hybrid buses.

### **Cost efficiency**

Q: Is there a payback during expected life of the vehicle? What is the life of the vehicle?

A: The life of the HEV bus is designed to be the same as the life of a non-hybrid school bus, which average around 12 years. Any payback analysis is dependent upon the amount of supplemental funding used to assist in buying down the cost of the system.

### **Emissions**

Q: The estimates of reduction in emissions of particulate matter and NOx you cite are from the tailpipe. Have you done an analysis of emissions that includes the power production for plug-ins?

A: The Advanced Energy consortium has conducted a study including the effects of electrical power plants. For details, please click the link below.

[www.hybridschoolbus.org/pdfs/HESB%20Technical%20Feasibility%20Study.pdf](http://www.hybridschoolbus.org/pdfs/HESB%20Technical%20Feasibility%20Study.pdf)



### **Funding**

Q: What types of funding exist for hybrid buses?

A: Various funding sources exist. Existing formal programs would include the Clean School Bus program as well as the hybrid tax credit. Informal programs are found in the way of local demonstration projects by any interested constituency that has funding capability. This can include state EPA organizations, power companies, or others.

### **High altitude**

Q: Will the hybrid system provide sufficient power and torque in high altitude applications?

A: Our hybrid system provides a boost to the diesel engine output, so if anything a hybrid bus will have more power available.

### **Maintenance**

Q: What kind of precautions do we have to take servicing these units due to the high voltage, etc?

A: The system encompasses overlapping safety systems. The system utilizes normally open switches as well as high voltage fusing and on/off switches. All high voltage cables are marked in orange sheathing.

### **Miscellaneous**

Q: How much weight does this system add?

A: The system adds a total of around 2,000 lbs.

### **Warranty**

Q: What is the warranty on the hybrid system?

A: The hybrid system is warranted for 1 year.