

# Reinventing the Wheel

## Objective

Students will examine the financial and environmental impacts that electric buses could have on their community.

## Curriculum Focus

Science  
Math

## Materials

- Access to research materials: internet, books, magazines
- Copies of “Student Sheet: Electric and Diesel Comparison”

## Key Vocabulary

Greenhouse gas emissions  
Miles per gallon equivalent (MPGe)

## Next Generation Science Correlations

MS-ESS3 - 3  
HS-ESS3 - 4



## Introduction

Each year, over half of America’s public school students ride nearly half a million diesel fueled buses that release of greenhouse gas emissions into our environment. Greenhouse gases, most commonly carbon dioxide, methane and nitrous oxide, in high amounts can trap heat in our atmosphere and warm the planet. These emissions can also cause health problems. While electric buses have a higher upfront purchase price, they are known to have reduced maintenance and fuel costs, improved performance and energy security, as well as added environmental benefits.

Like other electric vehicles (EVs), electric buses do not have a traditional engine or fuel tank. Their electric motor is powered by high-voltage batteries that convert chemical energy into electrical energy. Electric bus batteries can last for up to 15 years and have a charging time of up to 8 hours, depending on battery capacity and charger type. They have similar capacity to traditional school buses. Electric buses can reach top speeds of 60 mph via a 250 kW battery, which is the equivalent of a 335 horsepower engine. Most major school bus manufacturers offer an electrified version of a school bus. According to the U.S. Department of Energy, a diesel powered school bus averages 6.2 mpg. The National Renewable Energy Laboratory reports that electric buses get 13.3 miles per gallon equivalent (MPGe). These buses are also useful in our communities as they can be charged at night during off-peak hours when energy consumption is low. They can also store additional energy that can be sent back to utility companies in case of an emergency.

In this activity, students will examine the impact electric buses can have on the community and environment. Give students the worksheet below which they will use to calculate the impact and cost savings savings associated with electric buses before envisioning what those savings could provide for their school.

(Source: [nrel.gov](http://nrel.gov), [epa.gov](http://epa.gov) and [afdc.energy.gov](http://afdc.energy.gov), [thelionelectric.com](http://thelionelectric.com), accessed November 2022)



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## Procedure

1. Show students this video from PBS to introduce them to electric buses and their potential impact: “Inside California Education: Charged – America’s Largest Electric School Bus Fleet” at [youtu.be/Tj1yPvK9yaQ](https://youtu.be/Tj1yPvK9yaQ). Then discuss what stood out to them most about electric buses from the video. How do they think going electric would affect their daily commutes?
2. Review the facts from this lesson’s introduction, then distribute the student activity sheet below for each student to complete.
3. Once section 1 is completed, have students move to section 2 on the student sheet and research the price of three resources they would enjoy having in the classroom. Then students will calculate how many resources they could purchase with their annual electric bus cost savings.



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## Discussion

- Discuss students’ findings from this activity along with how the cost savings and emission reductions would affect them over time. How would students want the school to spend these hypothetical savings?



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## To Know and Do More

- Students can personalize this activity by researching the current kWh and gasoline prices locally and building that into their calculations.
- Students can also research how many diesel buses are used by their school district and calculate the fuel savings for the entire school district if they went electric.

# Student Sheet: Electric and Diesel Comparison

## Section 1

Calculate the amount of pollution for 10 miles and 50 miles in the chart below.

	Electric Bus	Diesel Bus	Difference
<b>Air Pollution</b>			
1 mile pollution	0	15.303	Diesel pollutes 15.303 grams more than electric per mile.
10 miles pollution			_____ pollutes _____ more than _____ in 10 miles.
50 miles pollution			_____ pollutes _____ more than _____ in 50 miles.
<b>Cost (per 12,000 miles/year)</b>			
1 charge/tank	120 miles = \$15.78	510 miles = \$211.80	
1 year	\$ _____ per year (12,000/120x15.78)	\$ _____ per year (12,000/510x211.80)	_____ costs _____ more than _____ annually.
5 years	\$ _____ per 5 years	\$ _____ per 5 years	_____ costs _____ more than _____ every 5 years.
10 years	\$ _____ per 10 years	\$ _____ per 10 years	_____ costs _____ more than _____ every 10 years.

\* costs based on national average of \$.1315 electricity rate and national average diesel gas price of \$3.53 and 60 gallon clean-diesel bus tank capacity

## Section 2

Calculate the number of items you could purchase with the savings from one year of using an electric bus from the chart above.

Item (average price)	Annual Savings Applied
High school math textbook (\$66.26)	= _____ more text books
12 pack dry erase markers (\$9.69)	= _____ more 12 packs of markers
_____	= _____ more _____
_____	= _____ more _____
_____	= _____ more _____