

## Electric School Buses for Rural Schools

Students investigate under which conditions an electric school bus is an effective solution for rural schools. For grades 6-8.

### INTRODUCTION

Culminating Activity:

*You are a fleet manager for a rural school in a small town. The community is somewhat resistant to change in the “green” direction. You are attempting to persuade members of the community that the transition of using electric school buses during normal school hours will be the most beneficial. Create a Venn diagram to compare the various drawbacks and benefits associated with diesel and electric school buses to present to parents and members of the community at the next board meeting.*

#### Objectives (Students Will Be Able To...)

- Students will evaluate the suitability of electric school buses for rural school districts.
- Students will create a Venn diagram.

### ACTIVITIES IN THIS LESSON

#### Frontloading

##### Lecture

##### Activity

Using rehearsal and elaboration cognitive strategies, the instructor develops vocabulary focusing on the words *emission*, *maintenance*, and *diesel*.

The instructor will define what is meant by the term *zero emission*, noting that this term refers only to the bus, and not the power source for the charging station.

Using rehearsal and elaboration cognitive strategies, the instructor then discusses physics terms students will encounter in their readings, focusing on understanding that:

- Power is measured in watts and kilowatts in the metric system.
- Power is measured in horsepower in the English system.

- That there are 1000 watts in a kilowatt.
- Energy consumption is measured in kilowatt-hours.
- Energy consumption is measured in BTUs in the English system.
- BTU stands British thermal unit.
- Online unit converters can convert one unit to another.

## Video Discussion

### *Group Work*

### Activity

This activity begins with a video to introduce electric school buses to the students.

The students will then be prompted with questions that pertain to zero emissions, pollution, smog, and maintenance. These questions should illicit informal discussion among students.

The students will then be provided the following resources to research the parameters surrounding the electric and diesel buses.

- <https://www.trackschoolbus.com> (This link details various monetary advantages associated with converting to electric school buses. Parameters students may not have been aware of are brought to light in this article.)
- <https://blue-bird.com/electric> (This link details the nuances associated with traditional buses that electric buses are devoid of. In addition this article presents information in an informal compare and contrast manner which students can integrate into their own diagrams.)
- <https://www.trackschoolbus.com> (This link reveals the numerous companies that manufacture various school buses from diesel to completely electric. In addition, the site highlights when these businesses were established and how each company has incorporated modern technology in the manufacturing of their buses.)
- <https://www.dieselforum.org/ab> (This link briefly explains the evolution of diesel fuel over the years.)

Students can research the articles independently or with a partner; the Venn diagram will be completed in pairs, but if a student researches better alone, it is fine to do so. At this time, students should take their own independent notes.

## Checking for Understanding and Questioning for Engagement

### *Check Understanding*

#### **Activity**

The questions/tasks that will be discussed in this activity will be printed on a handout so to allow students time to digest questions and formulate quality responses.

Checking for understanding and questions for engagement will be asked aloud in a classroom discussion manner after the brief research period.

If it is apparent that the content is not adequately understood, the teacher can opt to present the appropriate articles and guide students with further questioning.

Students are encouraged to take notes of opinions presented in the discussion as this will make filling in the Venn diagram easier.

### **Checking for Understanding & Engagement**

- What are some of the notable differences between traditional and electric buses?
- What are some of the main financial advantages of electric buses?
- Do you think more and more vehicles will be electric in the future?

## Venn Diagram Development

### *Group Work*

#### **Activity**

The instructor will write down some of the responses on the board as they come. After the questions have been asked, the instructor can begin filling in the Venn diagram to get the students going.

The students should break off into pairs to complete the Venn diagram. Notes during research, discussion, and ideas during pair sharing should all be incorporated. All questions on the handout should have adequate responses.

## SUMMATIVE ASSESSMENT

### **Assessment Type:** Writing Samples

The instructor will check each student's Venn diagram and ask the student to explain its contents. Students will be graded according to the teacher's own rubric.

## Notes:

- Development of this lesson plan funded by The Fresno State Transportation Institute (FSTI).
- This lesson plan developed using the approach described in *The Art and Science of Lesson Design* by J. Walkup and S. Squire.

## Lesson Times

**Frontloading:** 10 minutes

**Video Discussion:** 15 minutes

**Checking for Understanding and Questioning for Engagement:** 10 minutes

**Venn Diagram Development:** 15 minutes

## Industries / Subjects / Grades

## Industries / Pathways

- Transportation
- Operations

## Standards and Objectives

**Standards**

## California's 2013 CTE Standards

- **CTE.T.A.7.3** Define fueling infrastructure needed to move vehicles, equipment, goods, and services from one location to another
- **CTE.T.C.3.4** Describe the applications of alternative power sources

## California English Common Core Standards

- **W.6.4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

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