

Hybrids & Alternative Fuel Vehicles 4/E

Chapter 6 Propane, CNG, LNG, & Synthetic Fuel

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of Hybrid and Alternative Fueled Vehicles . It correlates material to task lists specified by ASE and NATEF.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	<p>Explain the chapter learning objectives to the students.</p> <ol style="list-style-type: none"> 1. Describe the vapor and liquid methods of propane use in a vehicle. 2. Discuss the advantages and disadvantages of propane as a vehicle fuel. 3. Discuss the advantages and disadvantages of CNG as a vehicle fuel. 4. Explain where LNG vehicles are used. 5. List the compounds used in P-series fuels. 6. List the safety precautions that need to be adhered to when working with alternative fuels.
Establish the Mood or Climate	Provide a <i>WELCOME</i> , Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

NOTE: This lesson plan is based on Hybrids 4th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 6:

ICONS



Ch6 Propane, CNG, LNG, & Synthetic Fuel

1. SLIDE 1 CH6 Propane, CNG, LNG, & Synthetic Fuel

Check for **ADDITIONAL VIDEOS & ANIMATIONS**
@ <http://www.jameshalderman.com/>
WEB SITE REGULARLY UPDATED

At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them

Crossword Puzzle (Microsoft Word) (PDF)

Word Search Puzzle (Microsoft Word) (PDF)

2. **SLIDE 2 EXPLAIN FIGURE 6-1** ethanol molecule showing 2 carbon atoms, 6 hydrogen atoms, & one oxygen atom

DISCUSSION: HAVE THE STUDENTS DISCUSS ETHANOL AND HOW IT IS PRODUCED. SINCE ETHANOL PRODUCED FOR FUEL IS THE SAME AS THAT FOUND IN ALCOHOLIC DRINKS, CAN DRINK MANUFACTURERS PRODUCE FUEL FOR VEHICLES? DISCUSSION: HAVE THE STUDENTS TALK ABOUT CELLULOSE BIOMASS? HOW ARE THE GREENHOUSE EFFECTS OF COMBUSTION OF BIOMASS OFFSET?

2. **SLIDE 2 EXPLAIN Figure 6-1** molecule of propane includes three carbon atoms and eight hydrogen atoms. Propane has a high octane rating but produces less heat energy than gasoline

3. **SLIDE 3 EXPLAIN Figure 6-2** Propane fuel storage tank in trunk of Ford taxi.

ICONS**Ch6 Propane, CNG, LNG, & Synthetic Fuel**

DISCUSSION: HAVE THE STUDENTS TALK ABOUT PROPANE. HOW DOES PROPANE'S USE COMPARE TO THAT OF OTHER FUELS? WHY IS PROPANE LESS ECONOMICAL TO USE THAN OTHER FUELS? FIGURE 6-26

4. **SLIDE 4 EXPLAIN Figure 6-3** Ford medium duty truck that has been converted to use propane.
 5. **SLIDE 5 EXPLAIN Figure 6-4** sticker on this converted truck states to use HD-5 propane only
- DISCUSS FREQUENTLY ASKED QUESTION**

6. **SLIDE 6 EXPLAIN Figure 6-5** storage tank under a Ford truck that was converted to operate on propane.
7. **SLIDE 7 EXPLAIN Figure 6-6** The blue sticker on the rear of this vehicle indicates that it is designed to use compressed natural gas.
8. **SLIDE 8 EXPLAIN Figure 6-7** CNG storage tank from a Honda Civic GX shown with the fixture used to support it while it is being removed or installed in the vehicle. Honda specifies that three technicians be used to remove or install the tank through the rear door of the vehicle due to the size and weight of the tank.

DISCUSSION: HAVE STUDENTS TALK ABOUT COMPRESSED NATURAL GAS. WHY IS NATURAL GAS ODORIZED DURING PRODUCTION?

9. **SLIDE 9 EXPLAIN Figure 6-8** fuel injectors used on this Honda Civic GX CNG engine are designed to flow gaseous fuel instead of liquid fuel and cannot be interchanged with any other type of injector.
10. **SLIDE 10 EXPLAIN Figure 6-9** typical CNG station which shows the compressors, and all of the equipment needed are behind a secured area.
11. **SLIDE 11 EXPLAIN Figure 6-10** fill handle on a CNG station

DISCUSSION: HAVE THE STUDENTS DISCUSS DIFFERENCES BETWEEN USING GASOLINE AND CNG IN VEHICLES. WHAT DESIGN DIFFERENCES ARE REQUIRED FOR A CNG ENGINE?

ICONS**Ch6 Propane, CNG, LNG, & Synthetic Fuel**

DISCUSSION: HAVE THE STUDENTS DISCUSS CNG FUEL SYSTEMS. WHAT IS IMPORTANCE OF HAVING LOCK-OFF VALVES IN CNG VEHICLES?

DISCUSSION: DISCUSS REFUELING OF CNG VEHICLES. WHY IS IT IMPORTANT TO FILL A CNG VEHICLE'S TANK SLOWLY?

DISCUSSION: HAVE THE STUDENTS TALK ABOUT LIQUEFIED NATURAL GAS. WHAT ARE PRACTICALITIES OF USING LNG IN VEHICLES?

DISCUSSION: HAVE THE STUDENTS TALK ABOUT TRI-FUEL VEHICLES. WHICH FUELS ARE TRI-FUEL VEHICLES CAPABLE OF USING?

DISCUSSION: USE CHART 6-3 TO REVIEW THE ADVANTAGES & DISADVANTAGES OF ALTERNATIVE FUELS. WHICH HAVE FOSSIL FUEL SOURCES?

12. SLIDE 12 EXPLAIN Figure 6-11 Fischer-Tropsch processing plant able to produce a variety of fuels from coal

DISCUSSION: DISCUSS FISCHER-TROPSCH METHOD. WHAT IS BIGGEST DRAWBACK TO FISCHER-TROPSCH FUELS? FIGURE 6-11

EXPLAIN WARNING

DISCUSSION: DISCUSS FUTURE OF SYNTHETIC FUELS. HOW IS RISING COST OF CRUDE OIL AFFECTING THE COST EFFECTIVENESS OF ALTERNATIVE METHODS OF PRODUCING FUELS?