

# Automotive Technology 5<sup>th</sup> Edition

## Chapter 67 ALTERNATIVE FUELS

### Opening Your Class

KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	This course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
<b>Motivate Learners</b>	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.
<b>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.</b>	Explain learning objectives to students as listed below: <ol style="list-style-type: none"> <li>1. List alternatives to gasoline.</li> <li>2. Discuss how alternative fuels affect driveability.</li> <li>3. Explain how alternative fuels can reduce CO exhaust emissions.</li> <li>4. Discuss safety precautions when working with alternative fuels.</li> </ol>
<b>Establish the Mood or Climate</b>	Provide a <b>WELCOME</b> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	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 the 5<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 67: [ATE5 Chapter Images](#)**

## ICONS



DEMO

## Chapter 67 Alternative Fuels

1. SLIDE 1 Chapter 67 ALTERNATIVE FUELS
2. SLIDE 2 EXPLAIN Figure 67-1 ethanol molecule showing 2 carbon atoms, 6 hydrogen atoms, & 1 O<sub>2</sub> atom

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

### Videos

**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?

**SAFETY** Review the meaning of denatured. Remind the students that when fuel becomes denatured, it is unfit for human consumption.

**DISCUSSION:** Have the students talk about cellulose biomass? How are the greenhouse effects of combustion of biomass offset?

3. SLIDE 3 EXPLAIN Figure 67-2 Some retail stations offer a variety of fuel choices, such as this station in Ohio where E10 and E85 are available.

**DISCUSSION:** Have students talk about E85 and its effects on fuel economy. Is it worth using E85 since you have to purchase more E85 than regular gas for the same mileage? What is price difference between regular gas & E85? **FIGURE 67-2**

4. SLIDE 5 EXPLAIN Figure 67-3 location of sensor can vary, depending on make & model of vehicle, but it is always in fuel line between tank & injectors.
5. SLIDE 5 EXPLAIN Figure 67-4 cutaway view of a typical variable fuel sensor.

**DEMONSTRATION:** Show students location of variable fuel sensor. Review its function with the students: **FIGURES 67-3 & 4**

## ICONS

## Chapter 67 Alternative Fuels



**DISCUSSION:** discuss fuel compensation.

Compare use of fuel compensation sensor and oxygen sensor for a flex-fuel system. Why should a technician avoid resetting fuel compensation?

6. **SLIDE 6 EXPLAIN** Figure 67-5 pump for E85 (85% ethanol and 15% gasoline). E85 is available in more locations every year.

**DISCUSSION:** Have the students discuss E85 fuel system requirements. What additional hardware is on E85 vehicles? **FIGURE 67-5**

7. **SLIDE 7 EXPLAIN** Figure 67-6 flex-fuel vehicle often has a yellow gas cap, which is labeled E85/gasoline.











**DISCUSSION:** Have the students talk about enhanced fuel system components & materials used for flex-fuel vehicles. Can ethanol damage common fuel pumps? What will happen to O-rings that are not alcohol-resistant?

**DEMONSTRATION:** Use a Flex-Fuel Vehicle to show students identifiers that place it in E85 class. Talk about emissions produced by ethanol fueled vehicles.

**DISCUSSION:** Have students talk about vehicles listed on Page 770. Has there been an increase in E85 vehicles? Has there been an increase in different styles of E85 vehicles? Why or why not?

**HANDS-ON TASK:** Have students locate VECI on Flex-Fuel Vehicles you have in your shop. Have students share locations & information found: **FIGURE 67-6 OR** students select one vehicle from flexible fuel vehicles on page 770. Have students identify special features on E85 vehicle & explain why vehicle is identified as flex-fuel.

8. **SLIDE 8 EXPLAIN** Figure 67-7 A vehicle emission control information (VECI) sticker on a flexible fuel vehicle indicating that it can use ethanol from 0 to 85%.

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	<p><b>HANDS-ON TASK:</b> Have students diagnose a vehicle with an O<sub>2</sub> code present. Help them use a <b>SCAN TOOL, DMM, &amp; 5-Gas analyzer</b>, as needed, for their diagnoses.</p>
	<p>9. <b>SLIDE 9 EXPLAIN</b> Figure 67-8 The molecular structure of methanol showing the one carbon atom, four hydrogen atoms, and one oxygen atom.</p>
	<p>10. <b>SLIDE 10 EXPLAIN</b> Figure 67-9 Sign on methanol pump shows that methyl alcohol is a poison and can cause skin irritation and other personal injury. Methanol is used in industry as well as being a fuel</p>
	<p><b>SAFETY</b> Review with students <b>PPE</b> that should be used when handling <b>methanol</b>. Talk about ventilation procedures when working with methanol vehicles, including where exhaust fans should be placed, opening bay doors, monitoring running vehicles in shop, etc. <b>FIGURE 67-9</b></p>
	<p><b>DISCUSSION:</b> Have the students talk about <b>methanol</b> and its production. What is biggest source of methanol in United States? What is <b>M85</b>?</p>
	<p>11. <b>SLIDE 11 EXPLAIN</b> Figure 67-10 Propane fuel storage tank in trunk of Ford taxi.</p>
	<p><b>DISCUSSION:</b> Have the students talk about <b>propane</b>. How does propane's use compare to that of other fuels? Why is propane less economical to use than other fuels? <b>FIGURE 67-10</b></p>
	<p>12. <b>SLIDE 12 EXPLAIN</b> Figure 67-11 The blue sticker on the rear of this vehicle indicates that it is designed to use compressed natural gas.</p>
	<p>13. <b>SLIDE 13 EXPLAIN</b> Figure 67-12 A 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.</p>
	<p><b>DISCUSSION:</b> Have students talk about compressed natural gas. Why is natural gas odorized during production? <b>FIGURE 67-11 &amp; 12</b></p>

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**14. SLIDE 14 EXPLAIN Figure 67-13** 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.

**DISCUSSION:** Have the students discuss differences between using gasoline and **CNG** in vehicles. What design differences are required for a CNG engine? **FIGURE 67-13**

**15. SLIDE 15 EXPLAIN Figure 67-14** This CNG pump is capable of supplying compressed natural gas at either 3,000 PSI or 3,600 PSI. The price per gallon is higher for the higher pressure.

**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:** Have students use **Chart 67-2** to review the advantages & disadvantages of alternative fuels. Which have fossil fuel sources?

**16. SLIDE 16 EXPLAIN Figure 67-15** A Fischer-Tropsch processing plant is able to produce a variety of fuels from coal.

**DISCUSSION:** discuss **Fischer-Tropsch method**. What is biggest drawback to Fischer-Tropsch fuels? **FIGURE 67-15**

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     	<p><b><u>DISCUSSION:</u></b> Have the students discuss future of <u>synthetic fuels</u>. How is rising cost of crude oil affecting the cost effectiveness of alternative methods of producing fuels?</p> <p><b><u>SAFETY</u></b> When working on fuel systems, equipment that can create a spark/flame should be removed from area. Students review their shop area &amp; address which items should be removed for working on fuel systems.</p> <p><a href="#">Fuel Mileage, Electric (View) (Download)</a>  <a href="#">Fuel Mileage, EREV (View) (Download)</a></p> <p><b><u>ON-VEHICLE NATEF TASK Alternative Fuel Meets NATEF Task: Not specified by NATEF <a href="#">Page 222</a></u></b></p> <p><a href="#">Crossword Puzzle (Microsoft Word) (PDF)</a>  <a href="#">Word Search Puzzle (Microsoft Word) (PDF)</a></p>