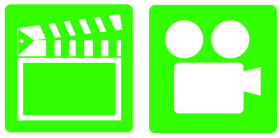
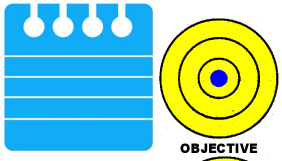
A8 Engine Performance 4th Edition

Chapter 6 Alternative Fuels

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Automotive Engine Performance.** 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.	Explain the chapter learning objectives to the students. 1. Describe how alternative fuels affect engine performance. 2. List alternatives to gasoline. 3. Discuss how alternative fuels affect driveability. 4. Explain how alternative fuels can reduce CO exhaust emissions. 5. Discuss safety precautions when working with alternative fuels.
Establish the Mood or Climate	Provide a *WELCOME,* 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.

ICONS	Ch06 ALTERNATIVE FUELS
	**1. SLIDE 1 CH6 ALTERNATIVE FUELS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE REGULARLY UPDATED**
	**POWER POINTS DONE BY INDIVIDUAL LEARNING OBJECTIVES, SO THERE IS POWER POINT FILE FOR EACH LEARNING OBJECTIVE**
	**2. SLIDE 2 EXPLAIN OBJECTIVE CH6 AEP_LO1** **3. SLIDES 3-4 EXPLAIN** Propane
	**5. SLIDE 5 EXPLAIN Figure 6-10** Propane fuel storage tank in trunk of Ford taxi.
	**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?**
	**6. SLIDE 6 EXPLAIN Figure 6-11** The blue sticker on the rear of this vehicle indicates that it is designed to use compressed natural gas. **7. SLIDE 7 EXPLAIN Figure 6-12** 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.
	**DISCUSSION: HAVE STUDENTS TALK ABOUT COMPRESSED NATURAL GAS. WHY IS NATURAL GAS ODORIZED DURING PRODUCTION? FIGURE 6-11 & 12**
	**8. SLIDE 8 EXPLAIN** Compressed Natural Gas

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	9. **SLIDE 9 EXPLAIN Figure 6-13** 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? FIG 6-13**
	10. **SLIDE 10 EXPLAIN Figure 6-14** CNG pump is capable of supplying compressed natural gas at either 3,000 PSI or 3,600 PSI. 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?**
	11. **SLIDES 11-12 EXPLAIN** Liquefied Natural Gas
	**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?**
	13. **SLIDES 13-15 EXPLAIN** P-Series Fuels
	**DISCUSSION: HAVE STUDENTS USE CHART 6–2 TO REVIEW THE ADVANTAGES & DISADVANTAGES OF ALTERNATIVE FUELS. WHICH HAVE FOSSIL FUEL SOURCES?**

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	16. SLIDES 16-17 EXPLAIN Synthetic Fuels 18. SLIDE 18 EXPLAIN Figure 6-15 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 6-15**
	**DISCUSSION: HAVE THE STUDENTS DISCUSS FUTURE OF SYNTHETIC FUELS. HOW IS RISING COST OF CRUDE OIL AFFECTING THE COST EFFECTIVENESS OF ALTERNATIVE METHODS OF PRODUCING FUELS?**
	**SAFETY WHEN WORKING ON FUEL SYSTEMS, EQUIPMENT THAT CAN CREATE A SPARK/FLAME SHOULD BE REMOVED FROM AREA. STUDENTS REVIEW THEIR SHOP AREA & ADDRESS WHICH ITEMS SHOULD BE REMOVED FOR WORKING ON FUEL SYSTEMS.**
	2. SLIDE 2 EXPLAIN **OBJECTIVE CH6 AEP_LO2** 3. SLIDE 3 EXPLAIN Alternative Fuel Vehicles
	4. SLIDE 4 EXPLAIN **Figure 6-3** 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 6-4** cutaway view of a typical variable fuel sensor.
	**DEMONSTRATION: SHOW STUDENTS LOCATION OF VARIABLE FUEL SENSOR. REVIEW ITS FUNCTION WITH THE STUDENTS: FIGURES 6-3 & 4**
	**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 Alternative Fuel Vehicles

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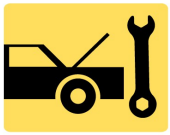
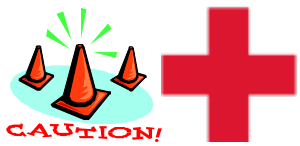
	7. **SLIDE 7 EXPLAIN Figure 6-5** pump for E85 (85% ethanol and 15% gasoline). E85 is available in more locations every year.
	**DISCUSSION: HAVE THE STUDENTS DISCUSS E85 FUEL SYSTEM REQUIREMENTS. WHAT ADDITIONAL HARDWARE IS ON E85 VEHICLES? FIGURE 6-5**
	8. **SLIDE 8 EXPLAIN Figure 6-6** flex-fuel vehicle 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.**
	**HANDS-ON TASK: HAVE STUDENTS LOCATE VECI ON FLEX-FUEL VEHICLES YOU HAVE IN YOUR SHOP. HAVE STUDENTS SHARE LOCATIONS & INFORMATION FOUND: FIGURE 6-6 OR STUDENTS SELECT ICLE FROM FLEXIBLE FUEL VEHICLES. HAVE STUDENTS IDENTIFY SPECIAL FEATURES ON E85 VEHICLE & EXPLAIN WHY VEHICLE IS IDENTIFIED AS FLEX-FUEL.**
	**DISCUSSION: 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.**

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	**DISCUSSION: HAVE THE STUDENTS TALK ABOUT CELLULOSE BIOMASS? HOW ARE THE GREENHOUSE EFFECTS OF COMBUSTION OF BIOMASS OFFSET?**
	9. **SLIDE 9 EXPLAIN Figure 6-7** vehicle emission control information (VECI) sticker on a flexible fuel vehicle indicating that it can use ethanol from 0 to 85%. 10. **SLIDE 10 EXPLAIN FIGURE 6–8** molecular structure of methanol showing the one carbon atom, four hydrogen atoms, and one oxygen atom. 11. **SLIDE 11 EXPLAIN FIGURE 6–9** 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.
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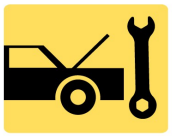	**HANDS-ON TASK: HAVE STUDENTS DIAGNOSE A VEHICLE WITH AN O_2 CODE PRESENT. HELP THEM USE SCAN TOOL, DMM, & 5-GAS ANALYZER, AS NEEDED, FOR THEIR DIAGNOSES.**
	**SAFETY REVIEW WITH STUDENTS PPE THAT SHOULD BE USED WHEN HANDLING METHANOL. TALK ABOUT VENTILATION PROCEDURES WHEN WORKING WITH METHANOL VEHICLES, INCLUDING WHERE EXHAUST FANS SHOULD BE PLACED, OPENING BAY DOORS, MONITORING RUNNING VEHICLES IN SHOP, ETC. FIGURE 6-9**
	**DISCUSSION: HAVE THE STUDENTS TALK ABOUT METHANOL AND ITS PRODUCTION. WHAT IS BIGGEST SOURCE OF METHANOL IN UNITED STATES? WHAT IS M85?**
	12. **SLIDES 12-13 EXPLAIN PROPANE** 14. **SLIDE 14 EXPLAIN Figure 6-10** Propane fuel storage tank in trunk of Ford taxi. 15. **SLIDE 15 EXPLAIN Figure 6-11** The blue sticker on the rear of this vehicle indicates that it is designed to use compressed natural gas. 16. **SLIDE 16 EXPLAIN Figure 6-12** A CNG storage tank from a Honda Civic GX shown with the fixture used to

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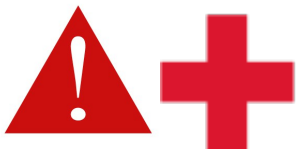
	**20. SLIDES 20-21 EXPLAIN** Liquefied Natural Gas
	**22. SLIDES 22-24 EXPLAIN** P-Series Fuels
	**25. SLIDES 25-26 EXPLAIN** Synthetic Fuels **27. SLIDE 27 EXPLAIN Figure 6-15** Fischer-Tropsch processing plant is able to produce a variety of fuels from coal
	**SAFETY WHEN WORKING ON FUEL SYSTEMS, EQUIPMENT THAT CAN CREATE A SPARK/FLAME SHOULD BE REMOVED FROM AREA. STUDENTS REVIEW THEIR SHOP AREA & ADDRESS WHICH ITEMS SHOULD BE REMOVED FOR WORKING ON FUEL SYSTEMS.**
 	**2. SLIDE 2 EXPLAIN OBJECTIVE CH6 AEP_LO3 REPEAT FROM AEP_LO2 SLIDES 4-27**
	**33. SLIDES 33-35 EXPLAIN Safety Procedures When Working with Alternative Fuels**

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	2. SLIDE 2 EXPLAIN **OBJECTIVE CH6 AEP_LO4** 3. SLIDES 3-5 EXPLAIN Safety Procedures When Working with Alternative Fuels