# Hybrids & Alternative Fuel Vehicles 4/E

## Chapter 16 GM Hybrid Vehicles

## 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.** | Explain the chapter learning objectives to the students.<br>1. Identify General Motors hybrid electric and extended range electric vehicles.<br>2. Describe how the parallel hybrid truck system works.<br>3. Describe the features and operating characteristics of the Saturn, Chevrolet, and Buick mild hybrids, and two-mode hybrid vehicles.<br>4. Describe how the Chevrolet VOLT works.<br>5. Explain the precautions necessary when working on General Motors hybrid vehicles.<br>6. Explain the service procedures for General Motors hybrid vehicles. |
| **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 | Ch15 GM Hybrid Vehicles |
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|  | **Ch15 GM Hybrid Vehicles** |
| | **1. SLIDE 1 CH15 GM Hybrid Vehicles** |
| | **2. SLIDE 2 EXPLAIN** Chevrolet/GMC Parallel Hybrid Truck |
|  | **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** |
| | **WEB SITE IS CONSTANTLY UPDATED** |
|  | **3. SLIDE 3 EXPLAIN FIGURE 15-1** Stator assembly used on the General Motors parallel hybrid truck. |
| | **4. SLIDE 4 EXPLAIN FIGURE 15-2** flywheel alternator starter assembly. |
| | **5. SLIDE 5 EXPLAIN Chevrolet/GMC Parallel Hybrid Truck** |
|  | **3. SLIDE 3 EXPLAIN FIGURE 15-1** Stator assembly used on the General Motors parallel hybrid truck. |
| | **4. SLIDE 4 EXPLAIN FIGURE 15-2** flywheel alternator starter assembly. |
| | **5. SLIDE 5 EXPLAIN Chevrolet/GMC Parallel Hybrid Truck** |
|  | **8. SLIDE 8 EXPLAIN FREQUENTLY ASKED QUESTION** |
|  | **9. SLIDE 9 EXPLAIN FIGURE 15-5** double outlets in the bed of the truck are covered with a spring-loaded rubber-sealed cover to keep out water and dirt. |
| | **10. SLIDE 10 EXPLAIN** Chevrolet/GMC Parallel Hybrid Truck |
|  | **11. SLIDE 11 EXPLAIN TECH TIP** |
|  | **12. SLIDE 12 EXPLAIN FIGURE 15-6A** laptop computer or other similar device can be plugged into the 120-volt AC outlet in the interior of the Chevrolet hybrid truck. |
| | **13. SLIDE 13 EXPLAIN FIGURE 15-6B** laptop cord can be left plugged into the outlet, making it easy to use. |
|  | **15. SLIDE 15 EXPLAIN Ground-Fault Detection (GFD)** |
| | **16. SLIDE 16 EXPLAIN Electrohydraulic Steering** |
| | **17. SLIDE 17 EXPLAIN FIGURE 15-7** electrohydraulic power steering assembly on Chevrolet hybrid P/U |

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|  | 18. **SLIDE 18 EXPLAIN Parallel Hybrid Truck Systems**<br>19. **SLIDE 19 EXPLAIN Driving GM Parallel Hybrid**<br>20. **SLIDE 20 EXPLAIN CAUTION** |
|  | 21. **SLIDE 21 EXPLAIN General Motors Mild (ASSIST) Hybrids**<br>22. **SLIDE 22 EXPLAIN FIGURE 15-8** overall view of components and their locations in Saturn VUE HEV<br>23. **SLIDE 23 EXPLAIN FIGURE 15-9** motor/generator assembly used in Saturn VUE & Chevrolet Malibu HEV<br>24. **SLIDE 24 EXPLAIN FIGURE 15-10** Saturn VUE engine showing location of accessories and motor/generator. Dual-tensioner assembly that controls the motoring (help to power vehicle) & generating loads |
|  | **HANDS-ON TASK: : IF YOU CAN OBTAIN EITHER A BAS OR MICRO-HYBRID CONVERSION KIT, HAVE YOUR CLASS CONVERT A COMMON ICE VEHICLE INTO A MILD HYBRID BY ADDING A BAS OR MICRO-HYBRID SYSTEM. THIS IS ALSO AN OPPORTUNITY FOR STUDENTS TO REVIEW SAFETY PROCEDURES & ELECTRICAL PRINCIPLES TO DEVELOP A BETTER UNDERSTANDING OF HYBRID VEHICLES.** |
|  | **DISCUSSION: HAVE STUDENTS TALK ABOUT BELT ALTERNATOR STARTER SYSTEMS. WHAT ARE ADVANTAGES OF BAS SYSTEMS?** |
|  | 66. **SLIDE 66 EXPLAIN Figure 89-9** components of a typical belt alternator-starter (BAS) system. |
|  | **HANDS-ON TASK: IF YOU HAVE ACCESS TO A VEHICLE WITH A BAS SYSTEM, HAVE STUDENTS IDENTIFY THE COMPONENTS OF SYSTEM** |
|  | **DISCUSSION: DISCUSS BENEFITS & DRAWBACKS OF BAS SYSTEM. SHOULD VEHICLE WITH BAS SYSTEM BE CONSIDERED HYBRID VEHICLE? CAN BAS SYSTEM BE ADDED TO A** |

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|  | **CONVERTED DIESEL VEHICLE TO HELP IT BE CONSIDERED A FULL HYBRID VEHICLE?**<br>25. **SLIDE 25 EXPLAIN General Motors Two-Mode Hybrid**<br>26. **SLIDE 26 EXPLAIN FIGURE 15-11** Cadillac Escalade, like many hybrids built by GM have many emblems showing that it is hybrid electric vehicle.<br>27. **SLIDE 27 EXPLAIN FIGURE 15-12** graph showing the operation of the two-mode hybrid vehicle. At lower speeds, vehicle is capable of being propelled using electrical power alone and assist at higher speeds. |
|  | 28. **SLIDE 28 EXPLAIN FIGURE 15-13** two modes of the GM two-mode hybrid vehicle.<br>29. **SLIDE 29 EXPLAIN FIGURE 15-14** two-mode General Motors hybrid encloses both electric motor-generators inside transmission case.<br>30. **SLIDE 30 EXPLAIN FIGURE 15-15** two-mode General Motors vehicle is a full (strong) hybrid capable of propelling the vehicle using battery power alone.<br>31. **SLIDE 31 EXPLAIN FIGURE 15-16** Cutaway view of two-mode GM transmission.<br>32. **SLIDE 32 EXPLAIN FIGURE 15-17** high voltage NiMH battery pack is located underneath rear seat in GM two-mode hybrid vehicle. The high voltage disconnect plug is located on the passenger side of the battery pack. |
|  | 33. **SLIDE 33 EXPLAIN General Motors Two-Mode Hybrid**<br>34. **SLIDE 34 EXPLAIN FIGURE 15-18** gasoline engine can power motor A to charge the batteries and help propel the vehicle.<br>35. **SLIDE 35 EXPLAIN FIGURE 15-19** high-voltage battery current can be fed to both electric motors to propel the vehicle.<br>36. **SLIDE 36 EXPLAIN FIGURE 15-20** electric motors can be used to assist the gasoline engine to provide additional torque for rapid acceleration.<br>37. **SLIDE 37 EXPLAIN FIGURE 15-21** gasoline engine alone can power vehicle. |
|  | 38. **SLIDE 38 EXPLAIN TECH TIP** |

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|  | **39. SLIDES 39-40 EXPLAIN Chevrolet Volt**<br>**41. SLIDE 41 EXPLAIN FIGURE 15-22** two-mode hybrid also operates on electric power alone during deceleration (regenerative braking).<br>**42. SLIDE 42 EXPLAIN FIGURE 15-23** Chevrolet Volt is a small four door vehicle that is based on the Chevrolet Cruze platform.<br>**43. SLIDE 43 EXPLAIN FIGURE 15-24** high-voltage battery pack is housed between seat under center console and under rear seat. Orange high-voltage disconnect plug is shown in this cutaway model and is located under console package tray. |
|  | **44. SLIDE 44 EXPLAIN FIGURE 15-25** engine cooling system uses a 20 PSI pressure cap and the cooling systems for the battery and electronic use 5 PSI caps.<br>**45. SLIDE 45 EXPLAIN FIGURE 15-26** smart phone can be used to link On-Star in Chevrolet Volt, which can send state-of-charge and estimated range information.<br>**46. SLIDE 46 EXPLAIN FIGURE 15-27** After Volt has been charged it uses electrical power stored in high-voltage battery to propel vehicle and provide heating and cooling for 25 to 50 miles (40 to 80 km). Then gasoline engine starts and maintains SOC between 25% and 35%. Gasoline engine cannot fully charge high-voltage batteries but rather vehicle has to be plugged in to provide a higher SOC level.<br>**47. SLIDE 47 EXPLAIN FIGURE 15-28a** Chevrolet Volt is charged using a standard SAE 1772 connector using either 110 or 220 volts.<br>**48. SLIDE 48 EXPLAIN FIGURE 15-28b** After connecting charging plug, a light on top of dash turns green and dash display shows estimated time when high-voltage battery will be fully charged and the estimated current range using battery power alone. |
|  **HOMEWORK** | **HAVE STUDENTS SEARCH INTERNET TO RESEARCH HEVS FOR SALE IN US. WHAT IS COST OF THESE VEHICLES? WHAT NEW FEATURES ARE AVAILABLE AND IS THERE ANY NEWER BATTERY TECHNOLOGY AVAILABLE? HAVE STUDENTS REPORT THEIR FINDINGS TO CLASS.** |