E85 as a Vehicle Fuel
Module 1

Introduction to E85

E85
85% Ethanol
What is E85?

- A mix of 85% ethanol and just 15% petroleum, E85 is a leading gasoline alternative in the U.S. and in other countries. Nearly 4 million E85-capable vehicles will be on U.S. roads in 2004, and E85 may be found at about 250 stations nationally. When E85 is not available, “flexible” fuel vehicles operate on any blend of ethanol or gasoline.

Courtesy NEVC
Approximately 30% of all U.S. gasoline will be ethanol-blended in 2004. The ethanol molecule contains oxygen, and allows for more complete combustion, resulting in fewer emissions. Ethanol-blended gasoline is used in engines that require gasoline. Approval for ethanol is found in the owners' manual under references to fueling or gasoline.

Courtesy NEVC
Why E85?

- Domestically produced
- Renewable, most U.S. ethanol is made from the starch of corn
- E85 is an EPAct Alternative Fuel
- More OEMs available than any other alternative fuel
Why E85? - 2

- 10% ethanol blends reduce carbon monoxide by as much as 25%.
- Ethanol-blended fuel shows a 35-46% reduction in greenhouse gas emissions and a 50-60% reduction in fossil energy use.
- Ethanol contains 35% oxygen by weight, allowing ethanol-blended fuels to burn more completely than conventional gasoline.
Why E85? - 3

- E85 contains ~80% fewer gum-forming compounds than conventional gasoline.
- E85 contains ~80% less sulfur than typical gasoline, which helps protect a vehicle’s catalytic converter - allowing it to function properly.
- Ethanol is highly biodegradable, making it less of a risk in to the environment.
E85 Economics

- Fleet fuel costs may be slightly higher than unleaded gasoline.
- Fueling station costs comparable or virtually the same as gasoline.
- No or minimal vehicle price premium.
- A range of light duty “flexible fuel vehicles” are produced.
E85 Economics – 2

- Total operating costs approximately 13% higher
- Fuel:
  - E85 may cost 6%-18% higher per GGE than regular gasoline
Oil

- DaimlerChrysler
  - Special motor oil still recommended when using E85 100% of the time

- GM, Ford & Others
  - Standard motor oil
  - Normal oil change frequency
E85 Performance

- Fuel economy up to 75%-85% of gasoline’s MPGs based on fuel volume
- Range: Typically 80% to 85% of gasoline

2004 Chevy Silverado/GMC Sierra
E85 Performance

- Power, acceleration, payload and cruise speed comparable to gasoline
- Fueling time: same as gasoline
- Pure, 100% ethanol has an octane rating of 113.
- Adding 10% ethanol to unleaded gasoline raises the octane by 2 - 3 points.
- Ethanol is used in racing because of these high-performance characteristics.
Module 2

Properties and Characteristics of E85

85% Ethanol
Module 2
Learning Objectives

❖ Understand E85 and how it compares to other fuels
❖ Be familiar with E85 characteristics
Ethanol is a renewable fuel produced from corn, other grains or ‘starchy’ wastes.

- Fermentation into grain alcohol.
- Denatured with addition of gasoline or ‘drip gas’ (product of natural gas refining).
Production - 2

Photosynthesis

Carbon Dioxide

Plants → Ethanol Plant → Ethanol → 85% Ethanol Fuel → Flexible Fuel Vehicle

source: NEVC
Chemical Composition

- Ethyl alcohol or EtOH
- E85 refers to 85% ethanol/15% gasoline
- Petroleum added to:
  - Improve cold-start
  - Increase flame luminosity
  - Denature or ‘poison’ ethanol (grain alcohol)
Make no mistake . . . E85 is poisonous!

Ethanol is less of a risk to ground water or soil

Ethanol used as

- E85 (85% E85/15% gasoline blend)
- E70 during winter months is important
  - Raises the vapor pressure
  - Improves starting in cold temperatures
Appearance and Smell

- Colorless to slight tint
- Odor – pleasant smell
E85 Properties

- **Fuel value**
  - Octane
    - E85: 100-plus octane (as high as 105 or more)
    - Typical Gasoline: 86-94
  - Lower heating value (~27% less energy)
    - E85: 87,250 BTU/gal
    - Gasoline: 114,000 BTU/gal
Module 3
Learning Objectives

- Understand similarity to normal gasoline fueling
- Be familiar with safety practices
Fueling

- No high pressure fueling as in CNG or H2
- E85 fueling practices are identical to gasoline fueling
Fueling Station Components

- E85 storage
Fueling Station Components

- Dispenser(s)
- Station Controls
- Emergency shutdown system
Fueling Station

- Aluminum parts should be replaced with stainless steel:
  - Especially the nozzle.
- Teflon hose
- 1- or 2-micron dispenser filter
- ~$2,500 to convert typical gasoline system for dispensing E85
Facility Layout Plan

- May exist for private stations
- Designates important information such as:
  - Fuel storage tank locations
  - Emergency equipment switches
  - Fire extinguishers
  - Pre-planned evacuation routes
  - Designated assembly areas
  - Street address of facility
Module 4
Learning Objectives

- Know basic safety practices
- Understand purpose and content of Emergency Action Plan
- Be familiar with signage and emergency equipment
- Understand emergency actions
Safety Practices

- Same as gasoline

- Emergency telephone numbers
  - Fire department
  - Emergency medical help
  - Police
  - Maintenance
  - Adjoining facilities

- Safety Signs
Safety Practices – 2

Equipment condition and inspection

- Before using, inspect
  - Hoses, joints, break-away valves, etc.
  - Fueling nozzle and receptacle
- Do not use defective or equipment incompatible with high-blend alcohol
- Report defective equipment
Safety Practices – 3

- Turn off/do not use cell phone or other distractions while fueling
- Do not re-enter vehicle during fueling
- Keep ignition sources away from E85
- Do not light matches or smoke cigarettes
Purpose of Emergency Action Plan

- Identification of emergencies
- Action items
- Notification procedures
- Evacuation procedures
- Safety systems
- Emergency event action items
If There’s a Fire Involving E85

- Do not attempt to disconnect nozzle from vehicle
- Evacuate immediate area of fire
- Trigger ESD button
- Contact fire department
Module 5

What Makes an FFV Different?
Module 5
Learning Objectives

- Understand Flex Fuel Vehicle (FFV) Basics
Flex Fuel Vehicles (FFVs)

- Run on any ethanol blend up to 85%
- Any mix of gasoline or E85 from 100% gasoline to all E85 – interchangeably.
- On E85 10% to 25% mileage reduction vs. gasoline. In practical terms, this may be:

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<th>Gasoline Range</th>
<th>E85 Range</th>
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<tr>
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<td>340</td>
<td>250</td>
</tr>
<tr>
<td>Model B</td>
<td>470</td>
<td>340</td>
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</tbody>
</table>
How FFVs Work - 1

- Engine Control Module (computer) determines fuel blend
- FFVs may fuel with any E85 or gasoline combination
- Uses same fuel gauge
- Uses same fuel filler entry point
How FFVs Work - 2

- Computer adjusts fuel injection and timing for different fuel mixtures
  - No switches, no mixing or blending required
  - All fueling in same fuel system
  - No special training needed
- No additional fuel tanks needed
How FFVs Work - 3

- Anti-Siphon Device Installed
- Fuel Filler Pipe Assembly
- Higher Capacity Fuel Tank
  18 Gallons (68 liters)

- 3.0L V-6 FF Engine
- Dielectric Sensor
- Fuel Delivery Module
- 4-Liter Carbon Canisters
Module 6

E85 in Review

E85 85% Ethanol
E85

- Fewer tailpipe & evaporative emissions
- Renewable-based, domestic fuel
- Little or no incremental cost on FFVs
- 85% ethanol/15% gasoline
- Safety practices similar to gasoline
- ESD is key safety device