Maximizing Your Fuel Mileage: Getting More per Gallon

Goal of Module

To discuss techniques to maximize fuel economy and minimize total fuel costs.

- The module is to be used in the classroom portion of novice driver education as a supplement to discussions on safe and fuel-efficient driving techniques.
- This section is not designed to be a comprehensive module on all aspects of safe driving, nor is it a discussion of fuel types or motor types (hybrids, electric, etc.).

Integration with Driver Education Programs/Curriculums

If you are using:	This module might best fit in:
How To Drive, 14th Edition	Chapter 16: Consumer's Guide to Economical and Trouble-Free Driving
How To Drive, 13th Edition	Chapter 13: Consumer's Guide to Trouble Free and Economical Driving
Responsible Driving	Chapter 12: Vehicle Movement- Natural Laws and the Movement of Your Vehicle
Licensed To Learn	Unit 3, Session 3.4.1: Managing Speed I: Normal Driving

Instructor Preparation

Have on hand:

- Current price of fuel (per gallon)
- Optional:
  - Handout: *Driving Techniques: Fuel Mileage & Cost Comparison Worksheet*
  - Whiteboard & markers (or chalkboard & chalk)
  - Simulated steering wheel

Additional resources at www.AAA.biz

- Text Messaging Mini-Module- free for instructors
- Sign up for ***The Accelerator***, AAA's free quarterly newsletter for instructors

Module Start

Introduction

Let's take a look at how to use less fuel while driving. Specifically, we'll be discussing:

- How you drive affects how much fuel you use
- What you gain by driving efficiently
- Fuel-efficient driving techniques you can use every time you drive

Background

- We have lots of vehicles in the U.S.
  - 160 million on the road
  - Burn 126 billion gallons of fuel each year
  - Fuel use rises approximately 3% per year
- The amount of fuel used by drivers in the U.S. has an impact on:
  - Family finances- fuel costs money
  - The environment

ASK: What types of fuels are used to power vehicles today?

- Some common types include:
  - Gasoline
  - Diesel
  - Bio-fuel
  - Electricity
  - Hybrids (generally a combination of gasoline and electricity)
  - Compressed Natural Gas
  - And others

ASK: How does fuel come to result in forward motion?

- The engine converts fuel to energy, which propels the vehicle
- The rule: Speed costs- period. It requires fuel, and fuel costs money.

- Vehicle efficiency
  - Combustion engines are not actually very efficient, in terms of converting energy into forward motion
  - More than 80% of the energy in a vehicle's gas tank is wasted in various thermal, frictional and standby losses and the exhaust system
  - This leaves less than 20% of potential energy being converted to vehicle motion

ASK: How is fuel use measured in the U.S.?

- Miles per gallon, abbreviated "mpg"
- It describes how many miles you can drive on one gallon of fuel

ASK: What are some of the main factors that can affect your mileage?

- Vehicle factors
- How you drive

ASK: What are some of the benefits you could gain by driving as efficiently as possible?

- Saves on fuel costs
- Reduces wear and tear on the vehicle
- Reduces negative impact on environment
- Safety! (It turns out that fuel-efficient driving techniques can also be safe)

Driving Techniques

Let's take a look at some driving techniques that can be used to consume less fuel.

ASK: To start, what are the major inputs drivers can perform with any vehicle?

- Accelerate, and selection of cruising speed
- Steer
- Decelerate, or brake

We'll take a look at each of these. But first, we have to remember that safety takes priority, no matter what. It does you no good to save fuel if you so do at the expense of safety.

A. Acceleration and Cruising Speed

Accelerating

ASK: What is the relationship between how quickly you accelerate and how much fuel you use?

- The faster you accelerate, the more fuel is used
- If you accelerate gently, you use less fuel
- If you accelerate quickly or aggressively, you use much more fuel

ASK: Next, say you are parked. How much fuel does it take to get a vehicle moving from a stopped position?

- It actually requires quite a lot of fuel
- Accelerating from a stop is not very efficient- it takes lots of energy to get a 3,000+ pound vehicle moving from zero miles per hour (mph)

ASK: When might a driver need to accelerate from a stop (from zero mph)?

- When a signal light turns green
- When moving forward in stop-and-go traffic
- After backing up, in order to move forward
- When leaving a parking space

Let's take a closer look at that last one- leaving a parking space. Drivers often park in spaces that require them to back out before moving forward.

ASK: What would be a fuel-saving alternative to parking in a space from which you have to back out?

- Park in a space from which you can pull <u>forward</u> when you leave
- For example, many parking lots feature perpendicular parking that features two adjacent spaces, front-to-back
    - When it's safe and when the space on the far side is clear, you can pull through the first space into the second and park
    - This allows you to pull <u>straight out</u> when you leave, and accelerate from zero mph only <u>once</u>, instead of twice
      (Once to back up, then Once to move forward)

ASK: How about when you are in heavy, slow traffic? What can you do to minimize the number of times you stop?

- Look ahead, even <u>through</u> the car ahead, to judge space and time
    - Look for brake lights ahead
    - Try to lift off the accelerator well before braking is needed
- This can help you keep rolling
- Rolling forward even at a low speed can help you minimize the number of times you have to stop, if done safely

Cruising at Speed

ASK: How about once you get up to speed? How can you drive to save fuel?

- One of the easiest ways is to drive at the speed limit (or below, depending on conditions- traffic, weather, etc.)
- Government estimates indicate that each 5 mph over 60 mph is like paying an extra 25 cents per gallon of fuel- it uses that much more fuel

ASK: What else can you do to save fuel once you're up to speed?

- Try to maintain a constant speed
- Each time you slow down or speed up, you use more fuel
- The engine will run most efficiently at a constant speed

ASK: What system do many vehicles have that helps drivers maintain a constant speed?

- Cruise control (Speed control)
- When used properly, it can help drivers use up to 14% less fuel
- If you have cruise/speed control, read your owner's manual to learn how to use it- it can really make a difference

B. Steering and Turning

The fact that how fast you accelerate and how fast you drive at speed affects how much fuel you use is probably not that surprising.

How Much You Steer

ASK: But how about steering? How could how your steering technique affect how much fuel you use?

- Tires provide traction by gripping the road surface- this grip, or "traction," occurs due to friction: surface resistance to relative motion.
- The friction between the tires and the road surface also plays a role when steering
    - Each degree that the steering wheel is turned causes the vehicle to slow
    - The tires resist the turning motion, and as a result the vehicle slows a little
        - This can add up!
    - Each degree that the tires are turned from straight ahead equals applying the brakes to about 1.5% of their stopping ability
        - That is, if you turn the steering wheel just one degree, the car will slow down as if the brakes were applied by 1.5% of their ability
        - Example- turning the tires 20 degrees equals about 30% brake application (20 degrees X 1.5% = 30% braking)

DEMONSTRATION: Use a simulated steering wheel to show slight steering to emphasize that it doesn't take much steering input to start slowing the vehicle noticeably.

- Bottom line- turn the steering wheel only as much as needed
    - Be sure to turn enough- too little can be unsafe
    - If you turn too much, you have to then unwind the steering, all the while scrubbing off speed that you have to regain through acceleration

Left Turns Across Oncoming Traffic

ASK: How about one specific type of steering- left turns across oncoming traffic? Why might such a turn cause a driver to use extra fuel?

- Because of the oncoming traffic, these turns generally require a driver to wait for a sufficient gap in traffic before turning safely
    - At zero miles per hour, you get zero miles per gallon- you're wasting fuel keeping the engine running while at a standstill
    - Having to wait for a large enough gap can use up a lot of fuel
- One large delivery service company does not allow its drivers to make left turns across oncoming traffic
    - The company recognizes significant fuel savings and safety benefit
    - It sounds strange, but a little thought about which route options you have can help you use less fuel
    - Consider avoiding such turns- it's safer, and it can save you fuel

C. Decelerating and Braking

Just like the accelerating, when and how you slow down can be a very effective tool to maximize fuel mileage. It largely comes down to timing.

- Try this: When you determine that you will have to come to a stop (stop sign, signal light), lift off the accelerator as early as reasonably and safely possible
    - Avoid continuing at full speed and having to use the brakes hard as you near the stopping area
    - Instead of braking hard, you'll be coasting more smoothly toward your intended stopping point
    - If you lift early, you increase the chance that the intersection will be open to you by the time you reach it, eliminating your need to stop the vehicle
        - Remember the earlier recommendation to keep rolling?
        - When you do, even when slowing down, you could save fuel
        - This requires looking and thinking ahead

- Also avoid slowing down more than you need to
  - Each time you slow down more than necessary, it takes even more acceleration to get you back up to your cruising speed
  - Don't decrease your safety, but when possible, look ahead far enough to ensure you don't slow down more than necessary

How Fuel-efficient Driving Techniques Can Pay Off- Literally

► Exercise: **Fuel Mileage & Cost Comparison Worksheet**

What: A worksheet example (attached) to demonstrate how much money could be saved in a year by driving to maximize fuel efficiency.

How long: Approximately 4 minutes

How: Two choices

A. Hand out the worksheet for each student to complete separately

B. The instructor can lead the exercise on the board for the entire class

Answers: See table below.

	25 mpg	**30 mpg**
Miles per month	1,000	1,000
Gallons per month	40	33
Fuel cost per month	$110	$91
Fuel cost per year	$1,320	$1,092
Difference	**$228!**	

ASK: What can $228 buy you each year?

- A new cell phone
- A lot of music
- A portion of car insurance
- Others???

Optional Content

Some Additional Fuel-Saving Tips

• Combine trips together to minimize the total number of miles driven over a few days.

• Remove excess weight from the vehicle (school books, sports equipment, etc.). The heavier the vehicle, the more fuel it uses.

• Remove roof racks when not in use. These can create aerodynamic drag, requiring more fuel.

• Purchase a "toll tag" if you drive on toll roads frequently- this can help you avoid having to slow down as much, or to stop to pay tolls by hand.

ASK: What other fuel-efficient driving techniques can you think of that are both safe and effective?

Knowledge Review

A. List at least two techniques related to acceleration and cruising speed that can help reduce fuel use.

- Accelerate slowly
- Drive at the speed limit
- Minimize changes in speed

B. List two techniques related to steering and turning that can help reduce fuel use.

- Turn only as much as needed
- Avoid left turns across oncoming traffic

C. List two techniques related to deceleration and braking that can help reduce fuel use.

- Lift off the accelerator as early as reasonably and safely possible
- Do not slow more than necessary

Summary

- Regardless what type of fuel, or energy source, is used (gasoline, diesel, electricity), there are always techniques you can apply to use less fuel
- We know that driving efficiently can save you money
    - And that doing so has less effect on the environment
- Never trade off safety for fuel efficiency
    - Safety needs to remain your first priority
    - Fuel efficiency at the expense of safety yields no benefit
- Overall
    - Be smooth- Drive as if you had a mug filled to the top with water on the dash, and you didn't want to spill a drop
    - A big key to doing this well is to use your eyes well, especially for maintaining a constant speed, and determining when and how much to slow down
- Here's the challenge to you: Work on these techniques every time you drive.
    - Over time they will become habits- you won't even have to think about it any more
    - Also over time, you can save a bundle of money and significantly reduce your impact on the environment

Supplementary Information

Resources

AAA Driver Training Programs (www.aaa.biz)
AAA Public Affairs (www.aaapublicaffairs.com)
AAA Foundation for Traffic Safety (aaafoundation.org)
Fueleconomy.gov (www.fueleconomy.gov)
Governors Highway Safety Association (www.ghsa.org)
National Highway Traffic Safety Administration (NHTSA; www.nhtsa.dot.gov)

References

The EcoDriver's Manual. EcoDrivingUSA.
How To Drive, 14th Edition. AAA.
Responsible Driving. AAA.

Driving Techniques:
Fuel Mileage & Cost Comparison Worksheet

Scenario: A single driver safely operates the same vehicle two different ways:

A. Driving aggressively, and with no concern for efficiency

B. Driving efficiently, focusing on minimizing fuel use

Directions: Compute the values in the empty cells to determine any difference in results between the two driving styles. Use the Assumptions provided below.

Assumptions	
Miles driven per year	12,000
Cost of fuel per gallon	$2.75

	Vehicle driven aggressively, achieving 25 mpg	Vehicle driven efficiently, achieving 30 mpg*
Number of miles driven per month		
Number of gallons of fuel needed to drive that distance per month		
Total fuel cost per month		
Total fuel cost per year		
Difference		

* A 20% improvement over driving aggressively.