

Renewable Fuels



Renewable Fuels Foundation



Renewable Fuels Association



Non-Automotive Use of Ethanol

Unit 3 Lesson 3

Precepts

- J. Mental Growth
- J2. Think creatively.

National Standards

- NL-ENG.K-12.4. Communication Skills.
- NT.K-12.4. Technology Communications Tools.

Student Learning Objectives

- As a result of this lesson, the student will ...
- Identify non-automobile uses of Ethanol.

Time

Instruction time for this lesson: 60 minutes.

Resources

- <http://www.youtube.com/watch?v=BSm2WeJ4ZRE>
- http://www.gm.com/experience/education/teachers/power_of_com.jsp

Tools, Equipment, Supplies

- Writing surface
- Projector
- Computer/Internet/LCD projector
- <http://www.youtube.com/watch?v=BSm2WeJ4ZRE>
- Small equipment owner's manuals (mowers, chainsaws, blowers, string trimmers, etc) - one per four students.
- AS.A- one per student
- TM.A
- Blank paper
- Crayons, markers, colored pencils, or paint and paint brushes

INTEREST APPROACH

Begin the class by showing the YouTube video The Power of Corn. This video summarizes ethanol production and describes how ethanol can be made into fuels for automobiles. After the video, share that ethanol is not just used for automobile engines. It can be used for other engines as a fuel option.

After the discussion, have students examine owner's manuals of common equipment that can use ethanol-based fuels (mowers, chainsaws, blowers, string trimmers, etc) and determine if the equipment can run on ethanol or is incompatible by manufacturer standards.



Thanks for being here today! I certainly appreciate the amount of effort each of you have put into really examining the benefits associated with ethanol production. To begin today's class; let's take a look at this video that further illustrates the ethanol production process. As you are watching the video, think about how the information you are seeing relates to what we have discussed previously.

Show the You Tube video, The Power of Corn. This video is approximately 18 minutes long. After the video have the students discuss how the video relates to what they have previously learned about ethanol production.



After seeing the video, how does the information relate to what we have previously learned about ethanol production? *Elicit student responses.* Nice work! It sounds like we have really grasped the concept and the importance of ethanol. But is it only useful for automotive engines? Can we use ethanol-based fuels in other engines? Let's take a look.

Place the students in groups of three or four and give each group a manual. Have the students locate in the manual where it talks about maintenance and fuel options and determine if the equipment can be ran on ethanol fuels or is incompatible by manufacturer standards.



In just a minute, each group will receive an owner's manual for a small piece of equipment. When I say "search," in our groups we will have four minutes to use the manual to determine if ethanol based fuels can be used in the equipment? Questions? Search!

While students are working on this task be sure to monitor their progress and help them locate the correct information. When time is up or all students are finished, discuss their findings.



Time is up! What did we find? Which group's equipment is able to use ethanol-based fuels? *Elicit student responses.* How did you determine this? *Elicit student responses.*



It looks like we had some equipment that specifically said that ethanol-based fuels could be used, and we had a few that were incompatible. It's important to remember that ethanol-based fuels are not just used in the automotive industry, but they can be used in other equipment as well.

Today, we are going to examine a few non-automotive uses of ethanol. I invite you to be curious learners as we explore this concept.

OBJECTIVE 1. Identify non-automobile uses of ethanol.

Provide each student a copy of AS.A which lists some common engine manufacturers that can use ethanol blends. The manufacturers' names are scrambled, and it is the student's task to unscramble them.



First, let's think about some common manufacturers that make engines that use ethanol blend fuels. In just a minute, each of you will be receiving a handout that lists some of those manufacturers, but there's a catch! The letters are scrambled, and it is our task to unscramble the letters. We'll have three minutes to complete the task? Questions? Begin!

As students are working on the activity sheet, be sure to monitor their progress and assist them as needed. When time is up or students are finished, give them the correct answers.



Let's hear your guesses. Who will share with us the answer to the first scrambled word? Next? *Continue this process until you have revealed the answers to each scrambled word.*



We have just identified several manufacturers that make engines that can use ethanol fuel blends. Let's take a closer look at this idea.

Write the following on the writing surface or show T.M.A.

I. Ethanol can be used in a variety of engine types.

A. Engine manufacturers have long permitted the use of ethanol fuels. The same blends of fuels used in automobiles should also run small engines, watercrafts and ATVs.

1. Consumers and technicians should focus on the recommendations by the equipment manufacturers when it comes to fuel usage. They are the most familiar with the characteristics of their products and whether or not they will operate satisfactorily on specific fuels.
2. Many of the non-automotive applications are for seasonal use; the "life" of gasoline in storage being limited to 90 days requires special attention. Draining fuel systems and refilling them with fresh fuel or using a gas stabilizer is recommended.
3. The use of ethanol-blended fuel is required in some recreation and wilderness areas due to rising concerns about emissions from snowmobiles to protect air quality.
4. Tests completed on lawnmowers, chainsaws, weed trimmers and blower vacs with ethanol fuels showed no engine failures, no unscheduled maintenance and good performance.

B. A variety of motors can use E10 blend of fuel.

1. Motorcycles

Non-Automotive Use of Ethanol

Unit 3 Lesson 3

2. Lawn mowers
3. Small engines.
4. Watercrafts
5. ATV

REVIEW/SUMMARY

Use the Picasso Moment to review the lesson. To complete the Picasso Moment, follow these steps.

1. *Teach the content. Ensure that students have a solid understanding of the information you have presented. The Picasso Moment, because of its more global viewpoint, is best used after a unit of study or series of lessons connected to the same topic.*
2. *Paint it. Ask students, “If you were an artist painting a picture, how could you pictorially represent the information we covered today about non-automotive uses of ethanol? What would be included in the picture? Is the picture that of a landscape, a portrait, a still life, or an action?” On a blank sheet of unlined paper, have students “paint” their understanding of the information using colored markers, pencils, paint, and/or crayons. Note: The size of paper is determined by the amount of information represented. Paper sizes of 8½" × 11" up to 18" × 36" are recommended.*
3. *Gallery Walk. After a specified amount of time, have students stand and walk about looking in silence at their classmates’ creations.*
4. *Explain it. Students then pair up and explain how their “painting” represents the content.*



Consider these questions for a moment...if you were an artist painting a picture, how could you represent the non-automotive uses of ethanol? What would be included in your picture?

When I say “artist,” we will each receive a sheet of paper. We will have eight minutes to “paint” your understanding of the information we covered in class today. When everyone has finished, we will post your paintings for everyone to see. Questions? Artist!

As students are working, monitor their progress and give them suggestions as needed. It might be very helpful to have an example for them to see. When students are finished, have them explain their painting to a partner and then ask two or three to share with the entire class.



We have been very creative in our pictures and I can see that we have a very thorough understanding of the non-automotive uses of ethanol. Great work!

APPLICATION

Extended classroom activity: *Encourage students to explore other alternative energy sources being used, tested or researched. Have groups prepare presentations of their findings, including advantages and disadvantages of the fuel source. Organize a ‘Renewable Energy Fair’ at your school to share the results.*

FFA activity: *Ask students to think about and research other uses for ethanol. One possible use is for hydrogen to be extracted from ethanol for fueling hydrogen-powered fuel cells. Fuel cells can power vehicles, homes, factories and anything that runs on batteries - the only emission is water vapor. Encourage them to share their results by writing a speech to present in the Public Speaking Career Development Event.*

SAE activity: *Have students create a report on other non-automotive uses of ethanol and present their report at a meeting. Students will be able to count the hours and the presentation as Exploratory SAE hours.*

EVALUATION

Answers to AS.A.

1. Arctic Cat*
2. Bombardier
3. Honda
4. Kawasaki
5. Polaris
6. Suzuki
7. Yamaha
8. Indmar Marine
9. Mercury Marine
10. Nissan
11. Pleasurecraft
12. Suzuki

TM.A

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2. Lawn mowers
3. Small engines.
4. Watercrafts
5. ATV

AS.A

Unscramble the letters to create the engine manufacturer that can use ethanol blends.

1. _____ acctir atc
2. _____ bardreiom
3. _____ noHda
4. _____ wasKaaki
5. _____ Parolis
6. _____ uzukSi
7. _____ amYaah
8. _____ dInram arMine
9. _____ cuMeryr rienMa
10. _____ siNsan
11. _____ ealPeruaftr
12. _____ zuSuik