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LESSON 9

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WHY DO OIL RESERVES  
KEEP INCREASING?

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# LESSON 9

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## WHY DO OIL RESERVES KEEP INCREASING?

### LESSON DESCRIPTION

The students view a visual regarding oil reserves and consumption. They calculate how many years it will take us to run out of oil at a given rate of consumption. The teacher then explains that the numbers on the visual were from 1970 and that in the meanwhile we have not run out of oil. How can this be? The students learn the meaning of *provable reserves of petroleum* and use economic reasoning to explain why we have not run out of oil.

### BACKGROUND

The physical quantity of petroleum in the world is fixed. It was created by changes that took place in the environment millions of years ago. From this fixed quantity we pump millions of barrels every day to be refined and sold worldwide so that people can drive cars, use electricity, fertilize their food and wear wrinkle-proof clothing.

Many environmentalists are concerned about the use of fossil fuels. Using fossil fuels pollutes the land and air; it may also make us dependent on a source of energy that will be unsustainable in the future.

The underlying question is whether we are in danger of running out of fossil fuels. In 1970 it seemed that perhaps we were. Environmental groups and government officials then expressed concern upon learning that provable oil reserves were 531 billion barrels and we were consuming 16.5 billion barrels annually. At that rate, we would run out of oil in about 30 years. Today, however, world reserves of crude oil are estimated at over 1 trillion barrels.

### ECOMYSTERY

How could world reserves of oil (a nonrenewable resource) have increased over the past 35 years when greater amounts of oil are being burned every day?

### ECONOMIC REASONING

The core misunderstandings here are two: first, that we know how much oil is available under the earth's crust; and second, that the *physical supply* and the *economic supply* of oil are the same thing.

Oil supplies are measured as *provable reserves at current prices and technology levels*. As prices rise or the costs of extraction go down, suppliers are given greater incentives to find more oil and list it as provable reserves (EcoDetection principle 4). Rising prices also encourage suppliers to extract oil that was previously known to exist but considered too difficult to obtain.

We have no idea what the physical amount of petroleum concealed by the earth's crust might be. But we do know something about the physical amount of petroleum that people now have an incentive to find. The amount that people are willing to find will change as incentives change.

### ECONOMIC CONCEPTS

- Incentive
- Price
- Supply

### OBJECTIVES

Students will:

1. Define the concept of *provable reserves of petroleum*.
2. Explain the relationship of incentives to the amount of petroleum available to the public.
3. Explain how a nonrenewable resource such as petroleum can increase in availability while huge amounts of it are being consumed.

### CONTENT STANDARDS

- People respond predictably to positive and negative incentives. (NCEE Content Standard 4.)
- Markets exist when buyers and sellers interact. This interaction determines market prices and thereby allocates scarce goods and services. (NCEE Content Standard 7.)
- Prices send signals and provide incentives to buyers and sellers. When supply or demand changes, market prices adjust, affecting incentives. (NCEE Content Standard 8.)

### TIME

45 minutes

## MATERIALS

- A transparency of Visual 9.1, 9.2, 9.3, 9.4 and 9.5

## PROCEDURE

- A. Explain that the purpose of this lesson is to explore a mystery related to oil. People everywhere use more oil every year, yet we don't seem to be running out of oil. In fact, what is called the provable reserve supply of oil has increased over the past 35 years. How can this be?
- B. **Display Visual 9.1** and pose the question to the class. Invite the students to calculate how many years it will take for the world to run out of crude oil. Tell the students they may use calculators if they wish. The students should estimate that it will take the world about 30 years to run out of oil at this rate of consumption.
- C. **Display Visual 9.2.** Tell the students that the situation described in Visual 9.1 was based on oil reserves and consumption rates as of 1970. According to the calculations suggested at that time, we should have run out of oil by now. But we haven't run out. Today, provable reserves have grown to over a trillion barrels of oil — nearly double the reserves estimated in 1970 — and we are consuming more oil now than we did then.
- D. Explain that in order to understand the change in oil reserves, we need to know what the *provable reserve supply* of oil is. **Display Visual 9.3.** Explain that provable reserves are determined by how much fossil fuel has been discovered and how much can be extracted with today's technology. Ask: What does knowing the amount of provable reserves tell us about how much of a natural resource still remains?
- Not much. Provable reserves can change, for example, if technological improvements make new levels of extraction possible.*
- E. **Display Visual 9.4.** Discuss the pattern of large increases in oil reserves compared to modest increases in consumption.
- F. Explain that the answer to the mystery lies in understanding how incentives affect the supply of provable reserves. **Display Visual 9.5** and discuss the incentives for producers and consumers. Ask:

- How do prices create incentives for producers of natural resources like petroleum?

*Increased prices for a resource send signals about the potential for increased rewards. The potential for increased rewards encourages producers to find more of the resource and to develop new technology for extracting the resource.*

- Why do producers develop new technology for extracting resources?

*Producers want to earn profits. One way to increase profits is to reduce costs. Technology often enables producers to reduce costs.*

- What incentives do consumers face when prices for petroleum-related products, such as gasoline, begin to increase?

*When prices for petroleum-related products increase, consumers have an incentive to conserve. When gasoline prices go up steeply, consumers drive less, use mass transportation more, form car pools and begin to purchase more fuel-efficient cars.*

- G. **Display Visual 9.1** again and review the mystery. Ask the students to use the principles of EcoDetection to explain how the amount of oil (a nonrenewable resource) can increase when huge amounts of it are burned every day.

*Oil companies' choices are influenced by incentives. As oil companies explore for oil, they know that estimates of provable reserves refer only to oil that can be recovered today. As prices and technology change, these reserve estimates increase or decrease. Reserve estimates do not reveal how much oil remains beneath the earth's crust. No one knows how much oil there is in that sense, but the amount is much greater than the reserve estimates indicate.*

## CLOSURE

Summarize the key points of the lesson. Estimates of provable reserves are not accurate estimates of the physical quantity of fossil fuel beneath the earth's crust. People's choices are influenced by incentives. Estimates of fossil fuel reserves change when the incentives to produce change. These incentives are affected by changing prices and technology.

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## ASSESSMENT

### Multiple-Choice Questions

1. Which of the following statements is false?
  - a. Petroleum is a fossil fuel.
  - b. Provable reserves of petroleum have increased from 1948 to 1995.
  - c. People around the world are using more petroleum.
  - d. The available amount of petroleum is decreasing.**
2. Which of the following answers describes an incentive to produce oil?
  - a. Consumers decide to use less oil.
  - b. Businesses decide to use less oil.
  - c. Governments decide to use less oil.
  - d. Higher prices are paid for oil.**

### Essay Questions

1. Read the following statement. Tell whether you think it is accurate. Explain your answer.

“Oil is a nonrenewable resource. In 10 years we will not have any oil left to use for gas in our automobiles.”

*Petroleum is a nonrenewable resource as we presently produce it. It comes from fossil remains in the earth’s crust. But we have several decades of provable reserves remaining. Provable reserves have increased since 1948, and they are likely to increase more. Also, we have not found all the reserves that exist in the earth’s crust.*

2. Read the following statement. Write a reply, using the concepts of *provable reserves* and *incentives* to help the writer understand this problem better.

“I can’t believe statistics these days. Provable reserves of petroleum are greater now than 1948. But petroleum is limited. We have been using it heavily since 1948. How can it keep increasing when we use so much of it?”

*The writer doesn’t understand what “provable reserves” means. “Provable reserves” refers to the amount of petroleum available at today’s prices and by means of today’s technology. Provable reserves can increase if incentives such as higher prices or lower costs encourage producers to find and extract more petroleum. The numbers are not influenced by how much petroleum we have already used.*

### VISUAL 9.1

#### HOW LONG WILL THE WORLD'S OIL LAST?

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Imagine this situation:

- Provable oil reserves stand at 531 billion barrels.
- The world is consuming 16.5 billion barrels each year.

How many years will it take for us out run out of oil?

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### VISUAL 9.2

#### HOW LONG WILL THE WORLD'S OIL LAST? LONGER THAN YOU THINK!

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- In 1970, provable oil reserves were 531 billion barrels.
- At 1970 rates of consumption, many people thought that we would run out of oil by the year 2000.
- Today we consume over 26 billion barrels of oil per year.
- Oil reserves today are over 1 trillion barrels.
- Almost certainly, we will never pump the last barrel of oil out of the earth.
- How can this be?

## VISUAL 9.3

### DEFINITION OF PROVABLE RESERVES

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*Provable reserves* of fossil fuels such as coal, gas and oil, include only those amounts that have already been discovered and amounts can be extracted by means of present technology at current prices.

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## VISUAL 9.4

### WORLD OIL RESERVES AND CONSUMPTION

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#### Reserves

Year	Barrels (in billions)
1980	645
1990	1,002
2002	1,032

#### Average Consumption

Year	Thousand barrels per day
1980	63,067
1990	66,083
2002	77,659

*Source: Energy Information Administration*

## VISUAL 9.5

### SOLVING THE MYSTERY: PEOPLE'S CHOICES ARE INFLUENCED BY INCENTIVES

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Producers:

- How do prices create incentives for producers of natural resources like petroleum?
- Why do producers develop new technology for extracting resources?

Consumers:

- What incentives do consumers face when prices for petroleum-related products, such as gasoline, begin to increase?

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