Understanding Earth's Energy Sources

Grades: 9-12


Owner: ACTS

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“Understanding Earth’s Energy Sources”
Part 1. Nonrenewable Energy

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July 28, 2006
Energy from finite resources that eventually will dwindle, becoming too expensive or too environmentally damaging to retrieve.

Energy from sources that do not use up natural resources or harm the environment;
Source of energy can be replaced in a short period of time.
Energy Sources

✓ ✓ Nonrenewable Energy

✓ Nuclear Power
Energy Sources

Renewable Energy

- Solar
- Hydrogen
- Bioenergy
- Hydroelectric
- Geothermal
- Wind
Fossil Fuels

Nonrenewable carbon based fuels made from the remains of plants and other organisms that were buried in the earth’s crust and altered by heat and pressure over millions of years.
COAL

✓ The most abundant fossil fuel
✓ 4 main grades: peat, lignite, bituminous and anthracite
Coal Deposits in the U.S.
In the US, 90% of electricity comes from coal.
World Population Growth 1750-2100

EIA projects 60% energy consumption increase by 2020

Source: Population Reference Bureau
Global Warming:
An increase in the average temperature of the earth's atmosphere (especially a sustained increase that causes climatic changes).
Changes in Atmospheric Concentration
CO₂, CH₄, and N₂O – A Thousand Year History

CO₂ and Global Climate Change

Temperature over Antarctica

Atmospheric carbon dioxide concentration

Atmospheric methane concentration

Carbon dioxide concentration (ppmv)

Methane concentration (ppbv)

Thousands of years before present (Ky BP)

Temperature relative to present climate (°C)

380 ppm

Primary Power [TW]

ISS2a

WRE 550

WRE 750

WRE 850

WRE 950

WRE 1000

WRE 450

WRE 500

WRE 600

WRE 700

WRE 800

WRE 900

WRE 1000

WRE 1100

WRE 1200

WRE 1300

WRE 1400

WRE 1500

WRE 1600

WRE 1700

WRE 1800

WRE 1900

WRE 2000

WRE 2100

1980

2000

2020

2040

2060

2080

2100

Renewable

Nuclear

Coal

Oil

Gas
Carbon Sequestration

Capturing carbon dioxide from a power plant and storing it someplace so that it cannot get into the atmosphere.
Renewable Energy vs. Sequestration
Broad Perspective – J. Turner view

✓ To modify or build a new energy infrastructure requires money and energy - that energy must come from existing resources.
✓ Sequestration is only a temporary fix.
✓ Sequestration increases the rate at which we consume our finite resources.
What’s New in China?

• 1 new coal power plant coming into service every 6 DAYS.

• 5000 humans died in China’s coal mines in 2005.
CLIMATE CRISIS!
THE PRO-GROWTH, PRO-TECH FIGHT TO STOP GLOBAL WARMING

AL GORE & THE RISE OF NEO-GREENS
8 PEOPLE & TRENDS TO WATCH
12 D.I.Y. WAYS TO GO GREEN

ROBBED BLIND
Smartcards & the New RFID Hackers

SPEED DEMON
Can You Survive the Fastest Boat on Earth?
The Experts Say….

• Worldwide, leading scientists say it’s too late to stop the effect of increased CO$_2$ levels on Earth’s climate.

• We need to be flexible and ADAPT to the changes.
Sea Level Rise of 17 Feet (5.2 m)

Western Antarctic Ice Sheet Melts

http://www.pbs.org/wgbh/warming/waterworld/
**COAL**

**BENEFITS**
- Many coal burning power plants are already in place.
- Costs are relatively low.
- World reserves should last for about 200 years.

**CONCERNS**
- Burning coal causes **air pollution** and is a serious contributor to **global warming**.
- Pollution controls are expensive.
- Many countries are gearing up to use more coal, thus depleting world supplies quicker than expected.
- A 200 year supply is not a long time!
Facts

- Oil can be a viscous thick or thin black liquid formed from the buried remains of marine organisms.
- Natural gas forms under similar conditions, but as a gas.
- Geologic faults and folds in the earth help to trap oil and gas under anticline cap rocks.
Well. Well. Well.
Oil Refineries
The Price of “Crude” Impacts Our Daily Lives
The gain from processing is about 5%.
Oil → Gasoline
Oil price climbs to $54 neighborhood

Gas prices rise to record average $2.368 per gallon

By James R. Healey
USA TODAY

Prices of gasoline and crude oil soared Monday, as soaring energy prices and concerns about potential terrorist attacks in oil giant Saudi Arabia raised fears of a disruption of U.S. oil supplies. The current price of $2.368 per gallon is the highest average price for gasoline since 1981.

The spike in oil prices was caused by concerns about potential terrorist attacks in Saudi Arabia, which is the world's largest oil producer. Analysts believe that a disruption of oil supplies could lead to higher prices and decreased availability of gasoline.

Energy experts say that if the current trend continues, gasoline prices could rise to $3.00 per gallon by the end of the year. This would be the highest price since 2008, when the average price was $3.40 per gallon.

Experts say that the current situation is a reminder of how vulnerable the U.S. is to events in other countries. They say that the country needs to focus on diversifying its energy sources and reducing its reliance on foreign oil.

Oil companies have already started raising their prices in response to the increase in energy prices. Some have announced plans to raise prices by as much as 10% in the coming weeks.

The current price of $2.368 per gallon is up from $2.19 last month, and it is expected to rise further in the coming weeks. The high price is also due to the weak dollar, which has made imported oil more expensive.
World wide 4 million cars are made each month.
NO NEED TO WORRY ABOUT PETROLEUM RESERVES... OUR LATEST SPORT UTILITY VEHICLE IS EQUIPPED WITH ITS OWN DRILLING RIG!
"Daddy, why is the sky brown?"
## U.S. Dependancy on Foreign Oil

### Have Oil
- Saudi Arabia: 26%
- Iraq: 11%
- Kuwait: 10%
- Iran: 9%
- UAE: 8%
- Venezuela: 6%
- Russia: 5%
- Mexico: 3%
- Libya: 3%
- China: 3%
- Nigeria: 2%
- U.S.: 2%

### Use Oil
- U.S.: 26%
- China: 9%
- Japan: 6%
- Germany: 4%
- Russia: 3%
- S. Korea: 3%
- France: 3%
- Italy: 3%
- Mexico: 3%
- Brazil: 3%
- Canada: 3%
- India: 3%

The U.S. uses more than the next 5 highest consuming nations combined.

Geopolitical Concerns
Geopolitical Concerns...not just the Middle East

Venezuelan President Hugo Chavez Frias
Environmental Concerns
Environmental Concerns
Environmental Concerns

The government of Spain puts the estimated cost of cleaning up the *Prestige* oil tanker spill at more than $1 billion.
Environmental Concerns
Environmental Concerns
At What Cost Do We Drill?

The debate about ANWR

Oil Field or Sanctuary?

Prospecting for more crude
Oil companies are looking offshore, and want to open public lands like part of the Arctic National Wildlife Refuge.
You make the call:

Oil or Plastic?
Crude Reality
In millions of barrels per day

*Includes oil imports as well as U.S. crude and natural gas liquids.
Source: National Geographic, August 2001 “Oil Field or Sanctuary?”
# Oil

## BENEFITS
- Relatively low cost
- Infrastructure in place (wells, refineries, gas stations, automobiles)

## CONCERNS
- Increases global warming
- Makes the air polluted
- Oil spills can kill many species and ruin habitats.
- Not renewable, limited supplies.
- Geopolitical concerns
Natural Gas

Facts

✓ Colorless, odorless fuel that burns cleaner than other fossil fuels
✓ Made up of hydrocarbon gases, primarily methane
✓ Removed from underground with the same equipment that is used with crude oil
How Do We Use Natural Gas?

![Pie chart showing the percentage of natural gas usage by different sectors. Residential 21%, Commercial 15%, Industrial 50%, and Electric Utilities 14%. Source: U.S. Energy Information Administration.]

Source: U.S. Energy Information Administration
Natural Gas Uses

- Heating
- Cooling
- Production of electricity
Natural Gas

**BENEFITS**

- Relatively low cost
- Infrastructure in place (wells, refineries, pipelines, power plants, appliances)
- Cleanest burning fossil fuel

**CONCERNS**

- Increases global warming
- Prices on rise
- 40 year supply
Outlook for Fossil Fuel Resources

Estimated Lifetimes of Fossil Fuel Resources

(Based on Projected Annual Growth Rates: 1% for Petroleum, 2.8% for Natural Gas, and 2% for Coal)

- Worldwide Petroleum*
- Worldwide Natural Gas**
- U.S. Natural Gas**
- U.S. Coal

*Estimated peak in world petroleum supply
** Based on estimated natural gas resources

Review
Part 1. Nonrenewable Energy Sources

- Define nonrenewable energy.
- How are fossil fuels formed?
- Compare and contrast the three main types of fossil fuels.
- Interpret the consequences of the rise in human population and the supply of fossil fuels.
- What will driving be like in 10 years? 50 years?
- What can you do about global warming?
Acknowledgements

- NREL Office of Education
- Dr. John Turner, Hydrogen Wizard, NREL
- Ken Sheinkopf, President of the Florida Solar Energy Society
- Google Images