

Energy Costs and Conservation

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Why were the prices so high for Gasoline in 2005



- World demand is nearly exceeding supply.
- Hurricanes took out 25% of U.S. crude production and 10-15% of U.S. refinery capacity. After Hurricane Katrina, Saudi Arabia offered to increase capacity by 500,000 barrels a day. U.S. refineries rejected their oil because they can't handle "sour" crude oil.
- Seasonal demand – Summer is usually 5% higher than the rest of the year.
- The result - Price of a barrel oil (\$80.42)

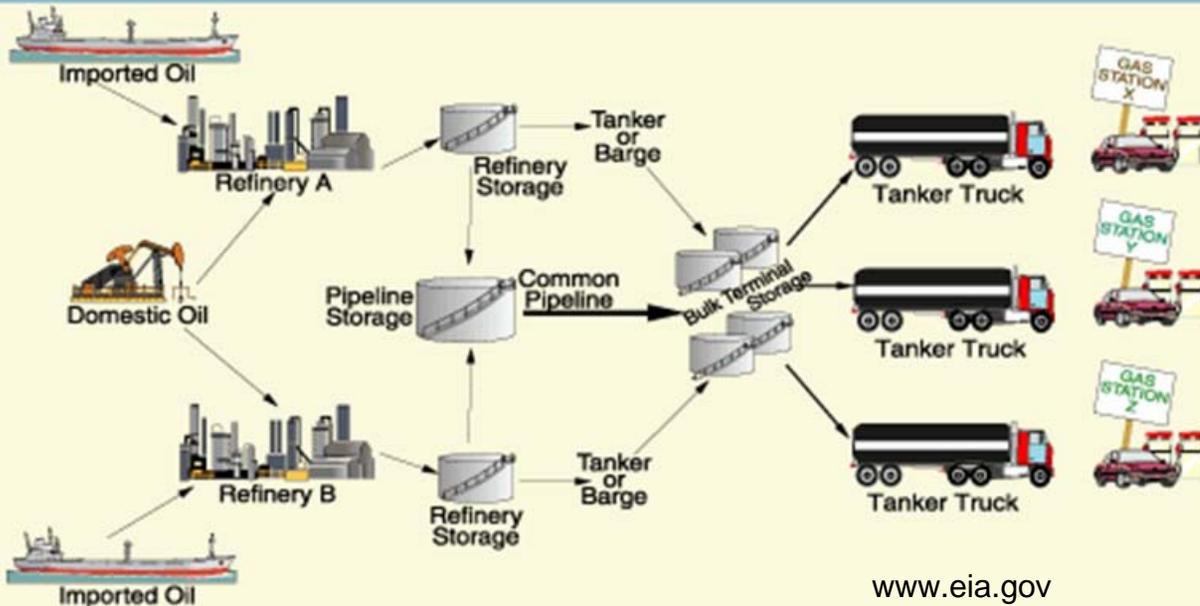
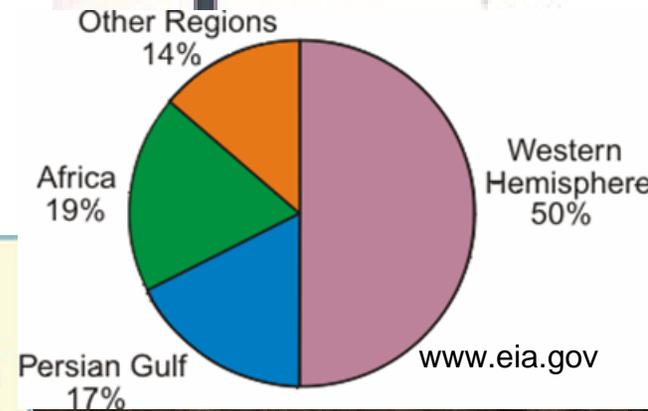
Top World Oil Producers



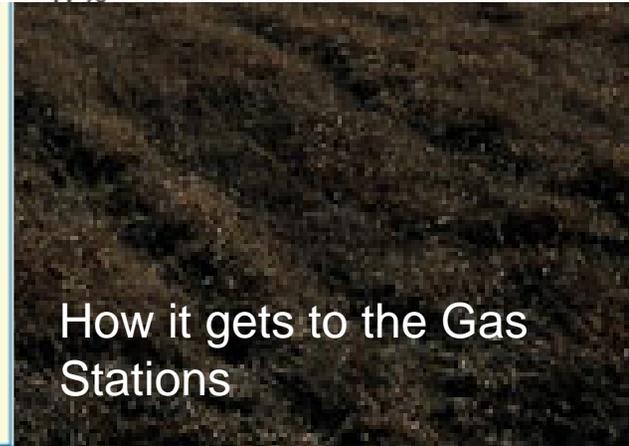
<http://www.nevtahoilsands.com>



Where the U.S. Oil Comes From



How it gets to the Gas Stations



The Prices of Crude Oil

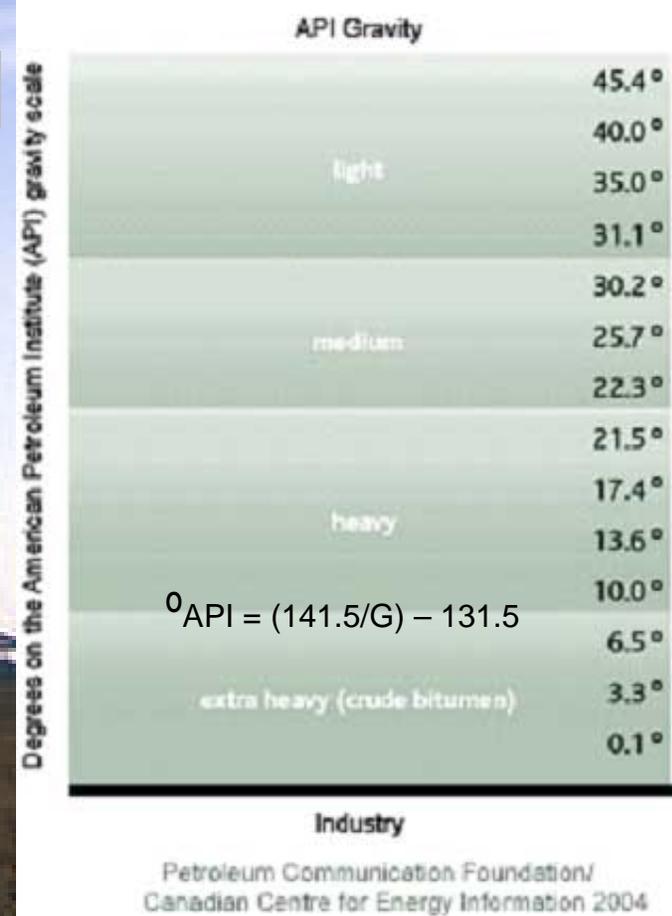
There are 161 different internationally traded crude oils. They vary in terms of characteristics, quality, and market penetration.

West Texas Intermediate (WTI) API 39.6°, 0.24% Sulfur - Very high quality, generally priced at about a **\$5-6/barrel** premium to the OPEC Basket and about **\$1-2/barrel** premium to Brent

Brent API 38.3°, 0.38% Sulfur - Brent Blend is a combination of crude oil from 15 different oil fields located in the North Sea. Brent blend is generally priced at about a **\$4/barrel** to the OPEC Basket or about a **\$1-2/barrel** discount to WTI.

OPEC collects pricing data on a "basket" of 7 crude oils - Algeria's Saharan Blend, Indonesia's Minas, Nigeria's Bonny Light, Saudi Arabia's Arab Light, Dubai's Fateh, Venezuela's Tia Juana Light, and Mexico's Isthmus (a non-OPEC crude oil).

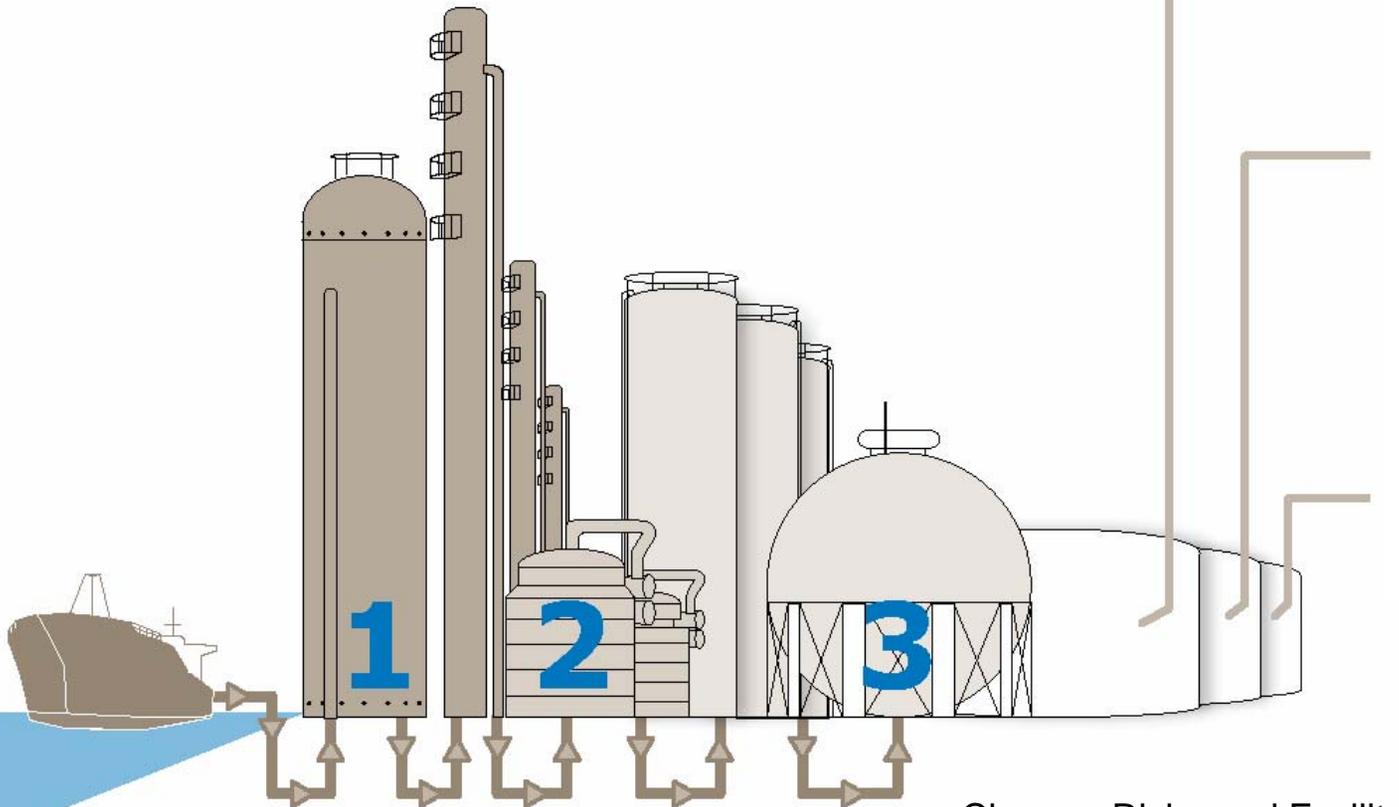
Lansing-Kansas City API 33° (aver.)
Morrowan Ave API 31° (aver.)
Mississippian Ave. API 34° (aver.)



On average, crude oils are made of
Carbon - 84%
Hydrogen - 14%
Sulfur - 0.1 to 3%
 Less than .05% - 'Sweet'
 Greater than .05% - 'Sour' (max 1.99%)
Nitrogen - less than 1%
Oxygen - less than 1%
Metals - less than 1%
Salts - less than 1%

Refining Crude Oil

1. Fractional Distillation – separates the components
2. Conversion – chemically converts gas oil into fuels
3. Treatment and Blending – remove impurities



Gasoline of various grades, with or without additives

Lubricating oils of various weights and grades

Kerosene of various grades

Jet fuel

Diesel fuel

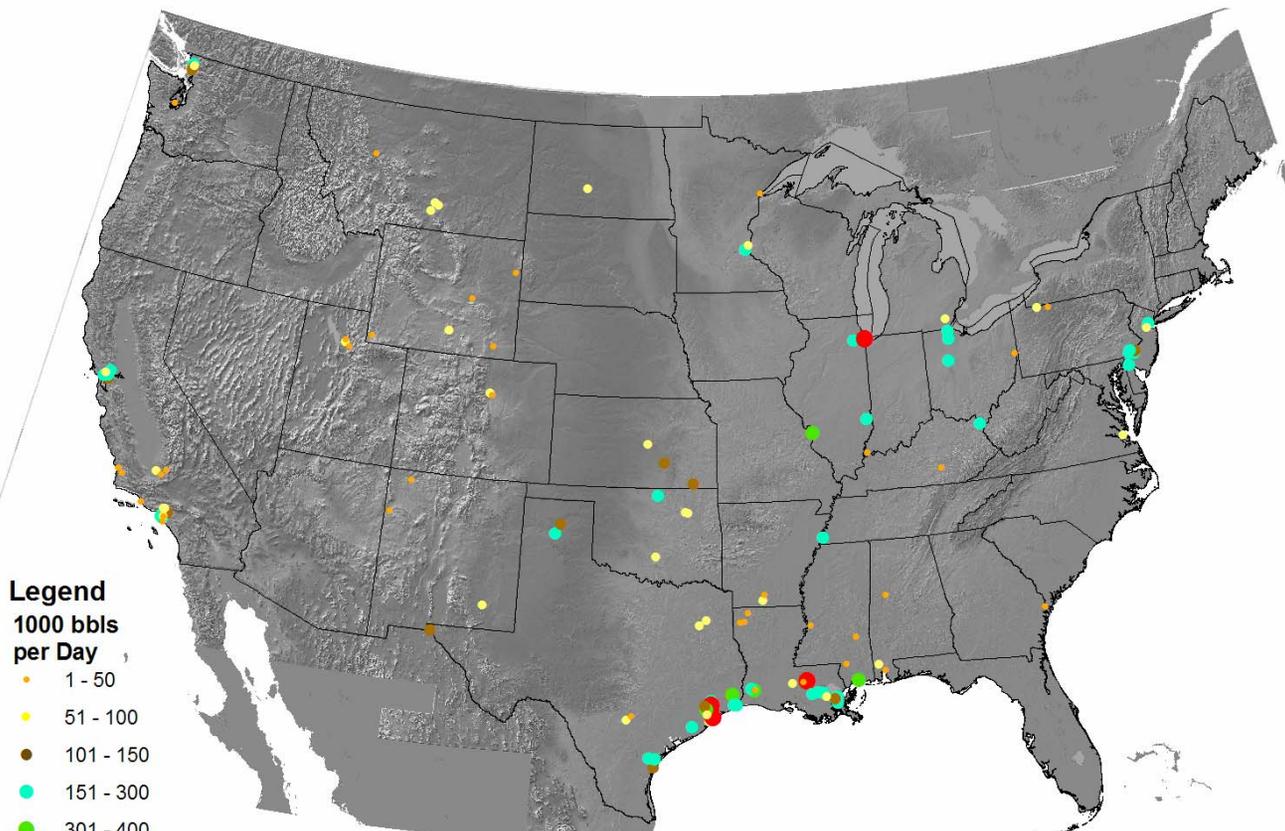
Heating oil

Chemicals of various grades for making plastics and other polymers

Chevron Richmond Facility

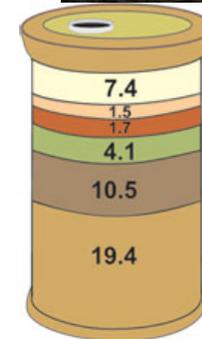
U.S. Refineries

The number of refineries in the U.S. has decreased in the last 20 years. Total production capacity is **17.4 million barrels/day**. Because of reduced capacity and increasing demand, U.S. refineries are operating at **91%** capacity. 1.3 million barrels/day of gasoline is imported.



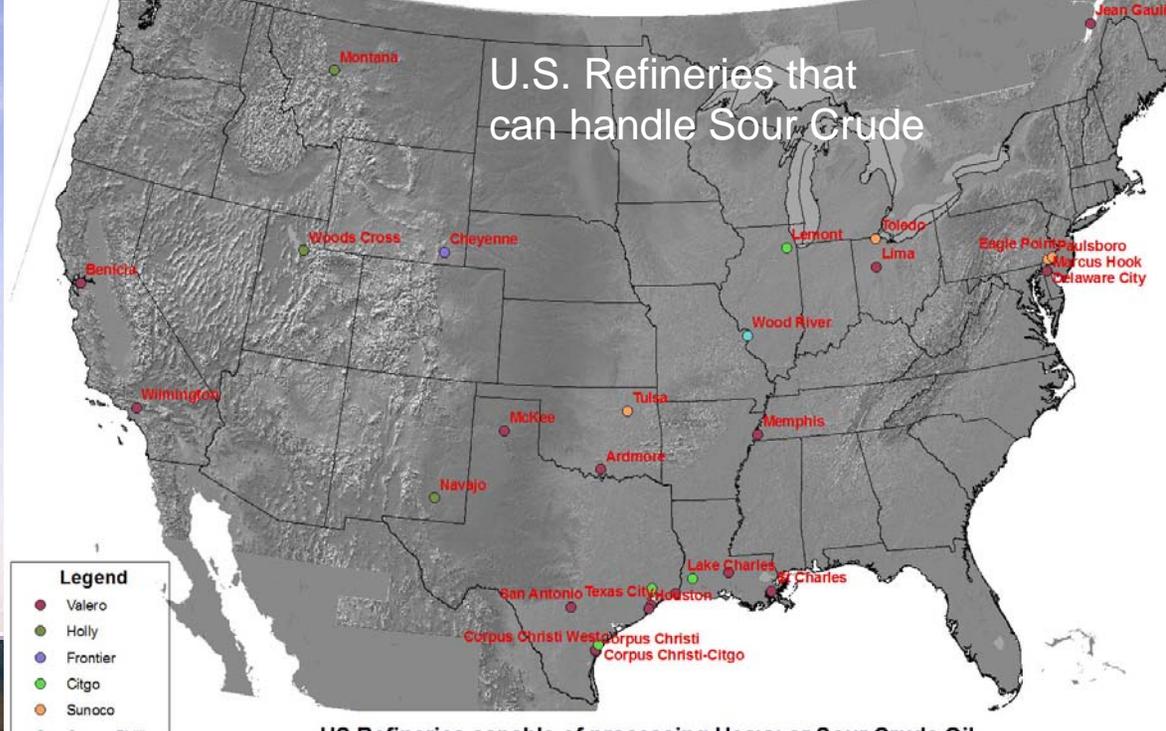
- Legend**
1000 bbbls
per Day
- 1 - 50
 - 51 - 100
 - 101 - 150
 - 151 - 300
 - 301 - 400
 - 400 - 600

Top U.S. Refineries (2005)



- Other Products
- Liquefied Petroleum Gas (LPG)
- Heavy Fuel Oil
- Jet Fuel
- Diesel Fuel & Heating Oil
- Gasoline

What's Left



- 40% of the world's current crude output is "Sweet".(sulfur content of <math><0.5\%</math>)
- 75%+ of proven crude oil reserves in the ground is "Sour".(higher sulfur content)
- Refineries could be upgraded to handle sour crude oil – for a price.
- Sour Crude varies from \$4-\$16/barrel less than Sweet.
- Heavy oil makes up about 15% of the world's remaining oil reserves.

Oil Sand

- Oil sands are a combination of clay, sand, water, and **bitumen**. Oil sands can be mined and processed to extract the oil-rich bitumen, which is then refined into oil.
- Oil sands are found in about 70 countries.
- Alberta, Canada has the only large-scale mining operation.
(production costs:\$10/barrel 3x more than regular production costs)

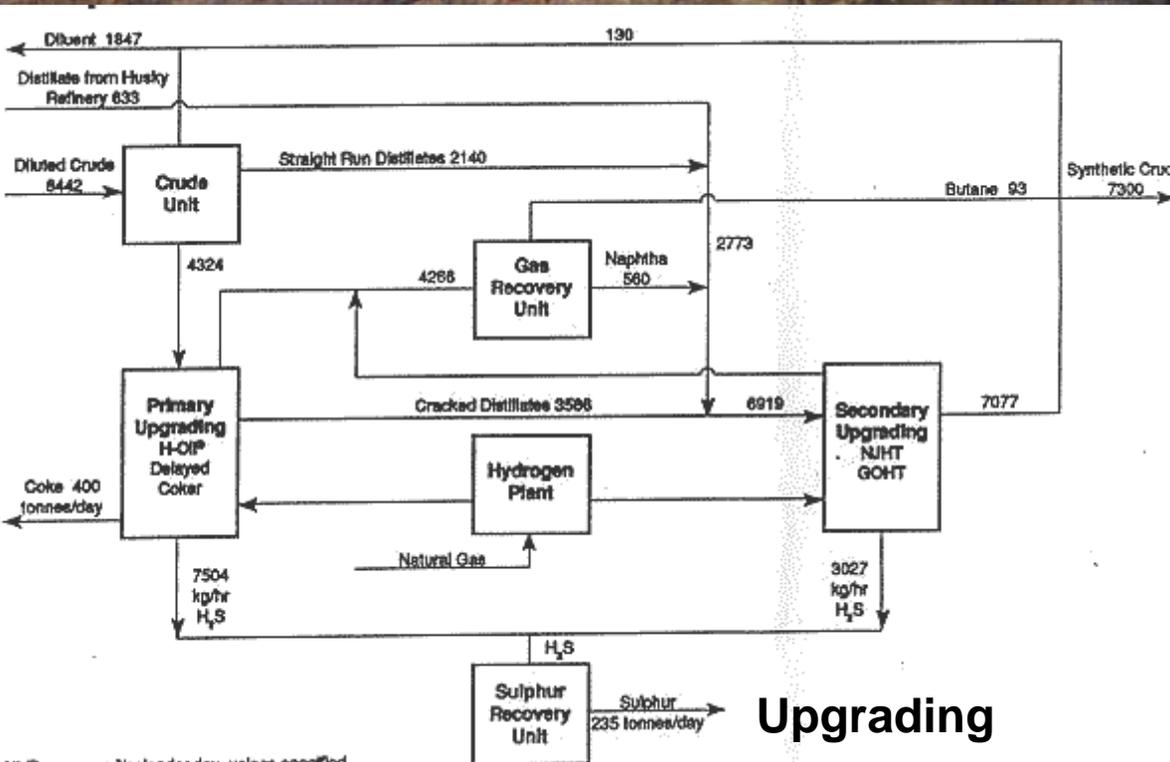
Composition of oilsands



- Water layer
- Sand particle
- Bitumen film

Each grain of sand is surrounded by a layer of water and a film of bitumen

Source of Image: ©Petroleum Communication Foundation/
Canadian Centre for Energy Information 2004



Oil Shale

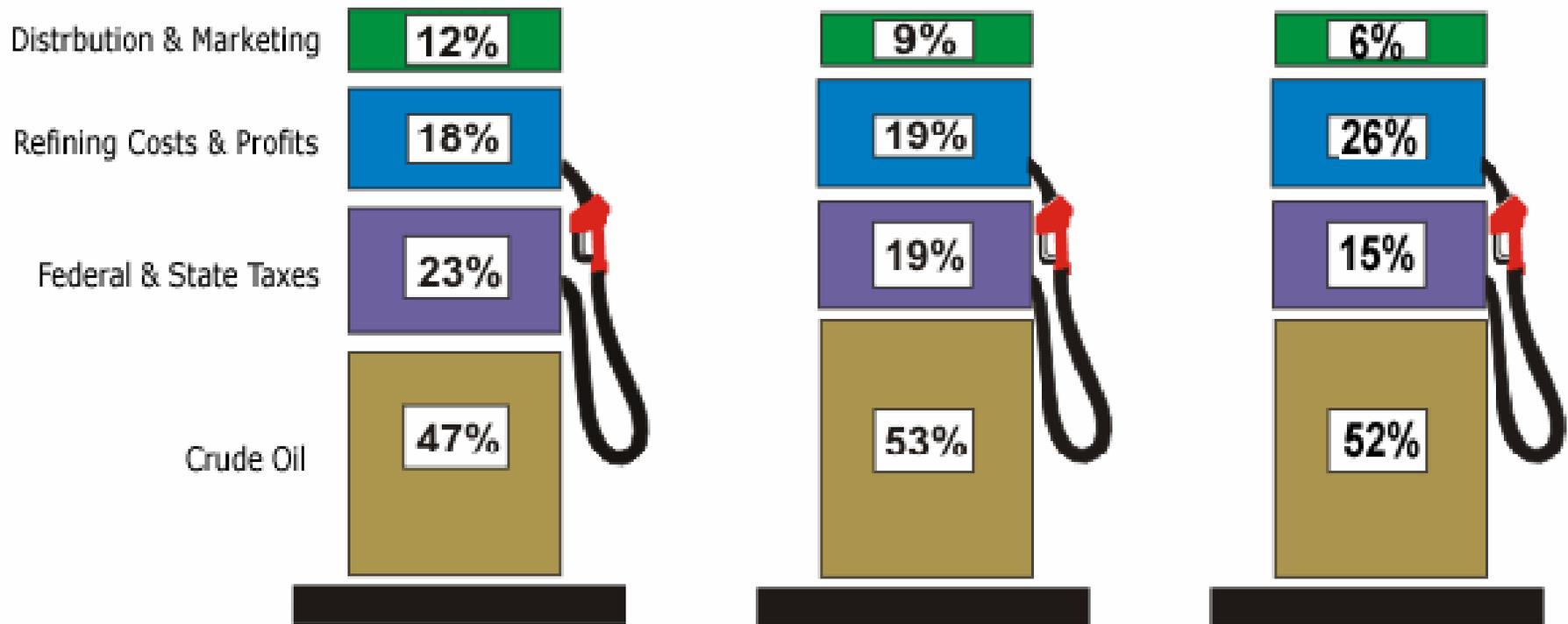
Although the U.S. has the largest potential reserves, only Brazil, Estonia and Australia has recovered oil (1999)

The cost of a gallon of Unleaded Gasoline

2004 Average
Retail Price: \$1.85/gallon

2005 Average
Retail Price: \$2.27/gallon

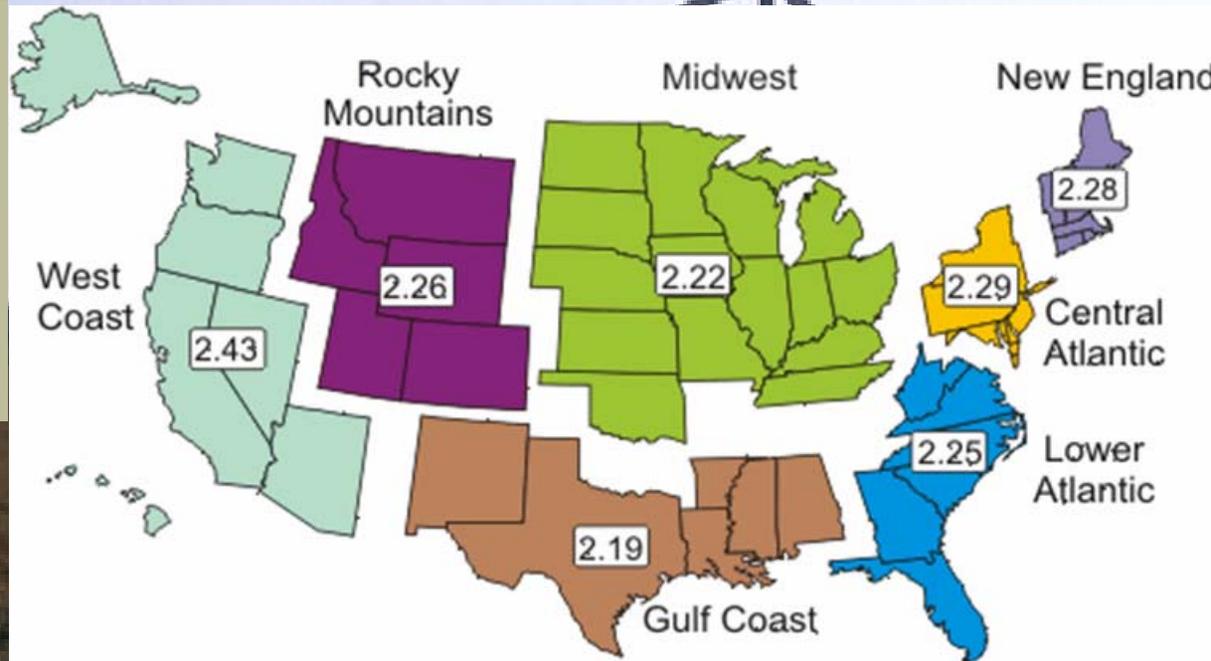
2006 Average (July)
Retail Price \$2.98



Source: Energy Information Administration, Washington, DC

Why do Gasoline prices differ from state to state

1. Proximity of supply
2. Supply disruptions
3. Competition
4. Environmental programs
5. State and local taxes



Source: Energy Information Administration, Average Monthly Data, 2005.

MOTOR GASOLINE TAXES AS OF APRIL 2006

Source: American Petroleum Institute

New York 67.9	Georgia 43.5
California 60.6	Delaware 41.4
Connecticut 59.6	North Dakota 41.4
Illinois 55.7	Colorado 40.4
Michigan 52.9	Minnesota 40.4
Wisconsin 51.3	Arkansas 40.2
Nevada 50.9	Iowa 40.1
Pennsylvania 50.7	Tennessee 39.8
Florida 50.3	New Hampshire 39.0
Hawaii 50.2	Alabama 38.7
Rhode Island 49.4	Dist. of Col. 38.4
Washington 49.4	Louisiana 38.4
Indiana 49.0	Texas 38.4
North Carolina 48.6	Vermont 38.4
Ohio 46.4	Virginia 38.0
Montana 46.2	Arizona 37.4
Maine 45.8	Mississippi 37.2
West Virginia 45.4	Kentucky 36.9
Nebraska 45.4	New Mexico 36.4
Idaho 43.4	Missouri 36.0
Kansas 43.4	Oklahoma 35.4
Oregon 43.3	South Carolina 35.2
Utah 42.9	New Jersey 32.9
South Dakota 42.4	Wyoming 32.4
Maryland 41.9	Alaska 26.4
Massachusetts 41.9	

What can you do about it?

Trade for a more
efficient car

1. Honda Insight Hybrid -- 60/66
2. Toyota Prius Hybrid -- 60/51
3. Honda Civic Hybrid 49/51
4. Volkswagen New Beetle & Volkswagen Golf TDI -- 37/44
5. Volkswagen Jetta TDI -- 36/41
6. Ford Escape Hybrid FWD -- 36/31
7. Toyota Corolla – 32/41
8. Scion xA – 32/37
9. Hyundai Accent 32/35
10. Honda Civic 30/40

You say Hybrids are nice but...?

1. Say you have a 1999 Ford Explorer with 79,000 miles. You can expect to get about \$3,700 in trade-in. (a 2003 Ford Expedition would get you \$8,500)
2. That Toyota Prius is going to cost you about \$25,000. (sticker plus).
3. For that difference in cost, you could get about 7,100 gallons of gas(@\$3/gal) and at 15 mpg you could go about 106,500 miles.

Of course if you want to trade in you 8 mpg Ferrari for a hybrid, then....

If not a hybrid, then what about...

- **Fuel Cell cars** — Where's that Hydrogen Fueling Station in Kansas again?
- **Biodiesel** — A good alternative, assuming the price for used cooking oil remains low.
- **E85, E70** — Fine if you want to pay more for less mpg and you'll probably need to buy a new car as well. And if you can find a gas station that carries it. (E70 is required in winter months)
- **Electric Cars** — If you can build it, go ahead, the car makers won't help you.
- **Walking, Biking, Mass Transit, Horse...**

Gas Saving Tips

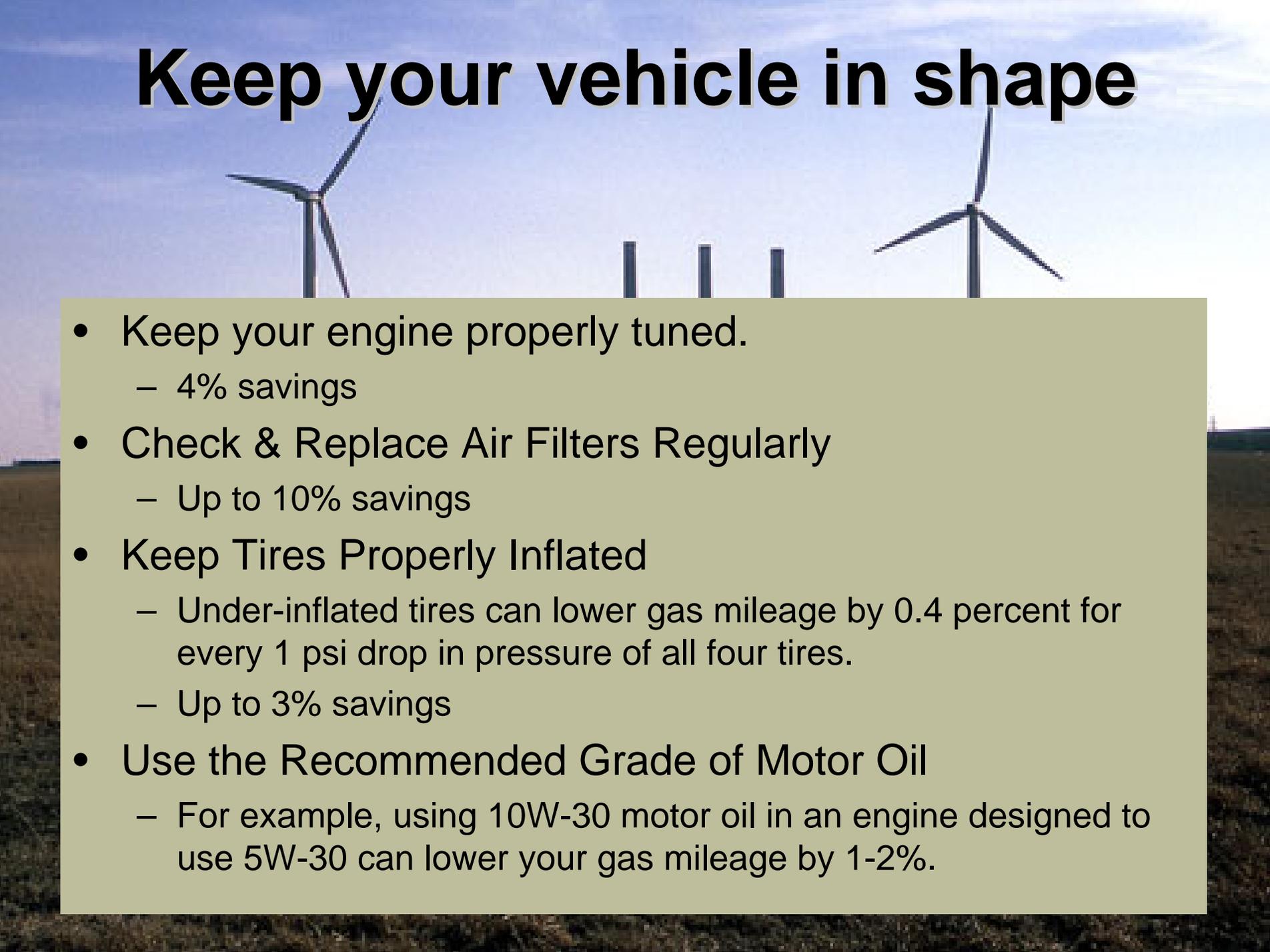
- Drive Sensibly - Aggressive driving (speeding, rapid acceleration and braking) wastes gas.
- Observe the Speed Limit
 - gas mileage decreases rapidly at speeds above 60 mph.
 - As a rule of thumb, you can assume that each 5 mph you drive over 60 mph is like paying an additional \$0.20 per gallon for gas
(based on \$2.91/gal)



More tips

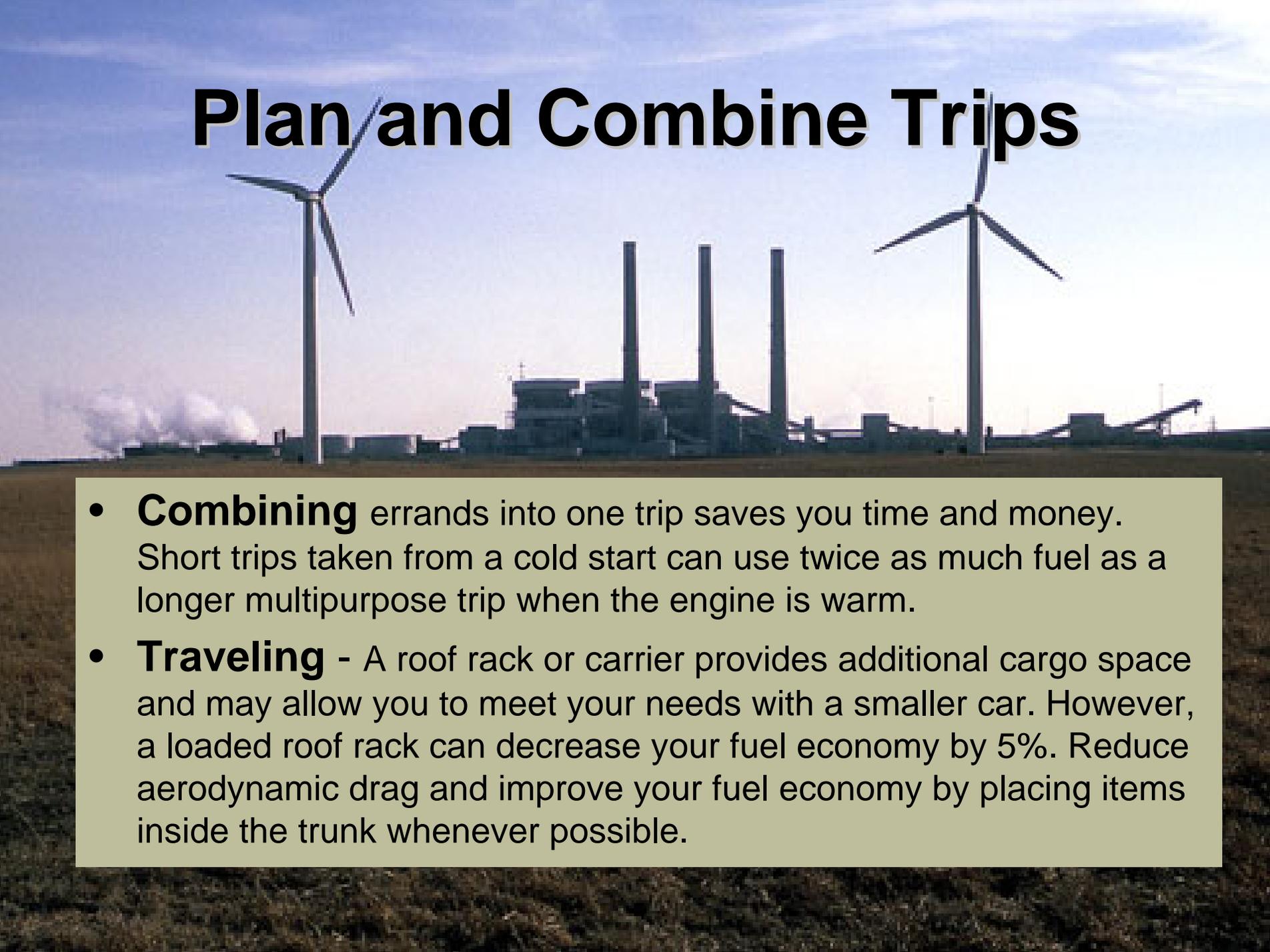
- **Remove Excess Weight**
 - An extra 100 pounds in your vehicle could reduce your MPG by up to 2%.
- **Avoid Excessive Idling**
 - Idling gets 0 miles per gallon.
 - However, don't turn off your engine at stoplights. This will consume more fuel than you would be saving
- **Use Cruise Control at proper times**
 - Using cruise control on the highway helps you maintain a constant speed and, in most cases, will save gas.
 - If you're in hilly terrain cruise control can use more gas.
- **Use Overdrive Gears**
 - When you use overdrive gearing, your car's engine speed goes down. This saves gas and reduces engine wear.

Keep your vehicle in shape



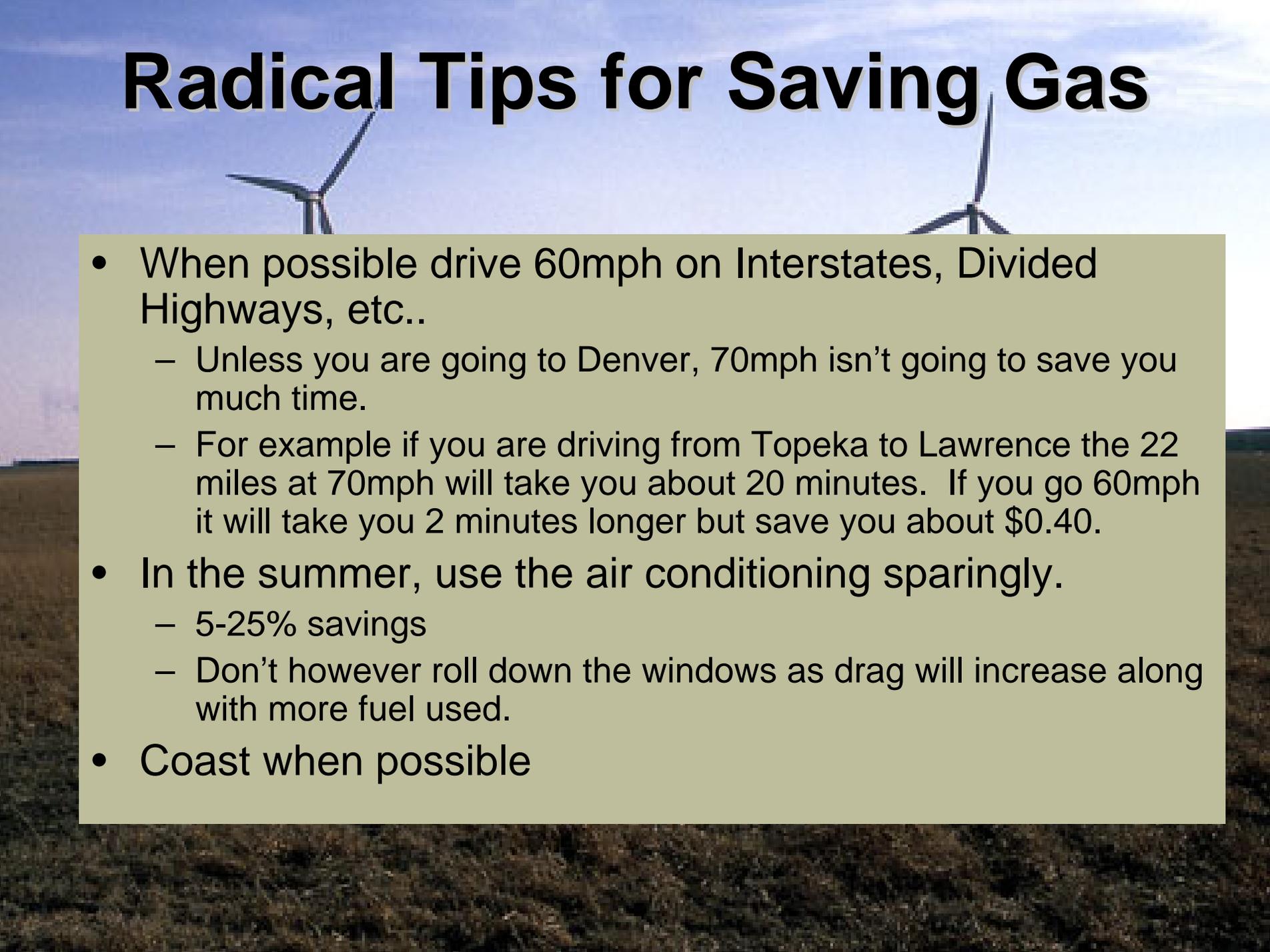
- Keep your engine properly tuned.
 - 4% savings
- Check & Replace Air Filters Regularly
 - Up to 10% savings
- Keep Tires Properly Inflated
 - Under-inflated tires can lower gas mileage by 0.4 percent for every 1 psi drop in pressure of all four tires.
 - Up to 3% savings
- Use the Recommended Grade of Motor Oil
 - For example, using 10W-30 motor oil in an engine designed to use 5W-30 can lower your gas mileage by 1-2%.

Plan and Combine Trips



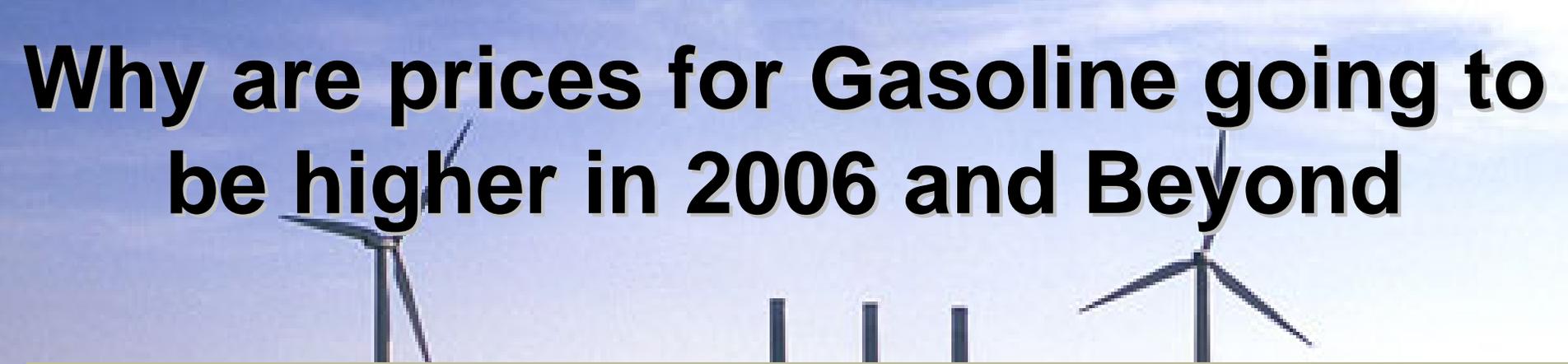
- **Combining** errands into one trip saves you time and money. Short trips taken from a cold start can use twice as much fuel as a longer multipurpose trip when the engine is warm.
- **Traveling** - A roof rack or carrier provides additional cargo space and may allow you to meet your needs with a smaller car. However, a loaded roof rack can decrease your fuel economy by 5%. Reduce aerodynamic drag and improve your fuel economy by placing items inside the trunk whenever possible.

Radical Tips for Saving Gas



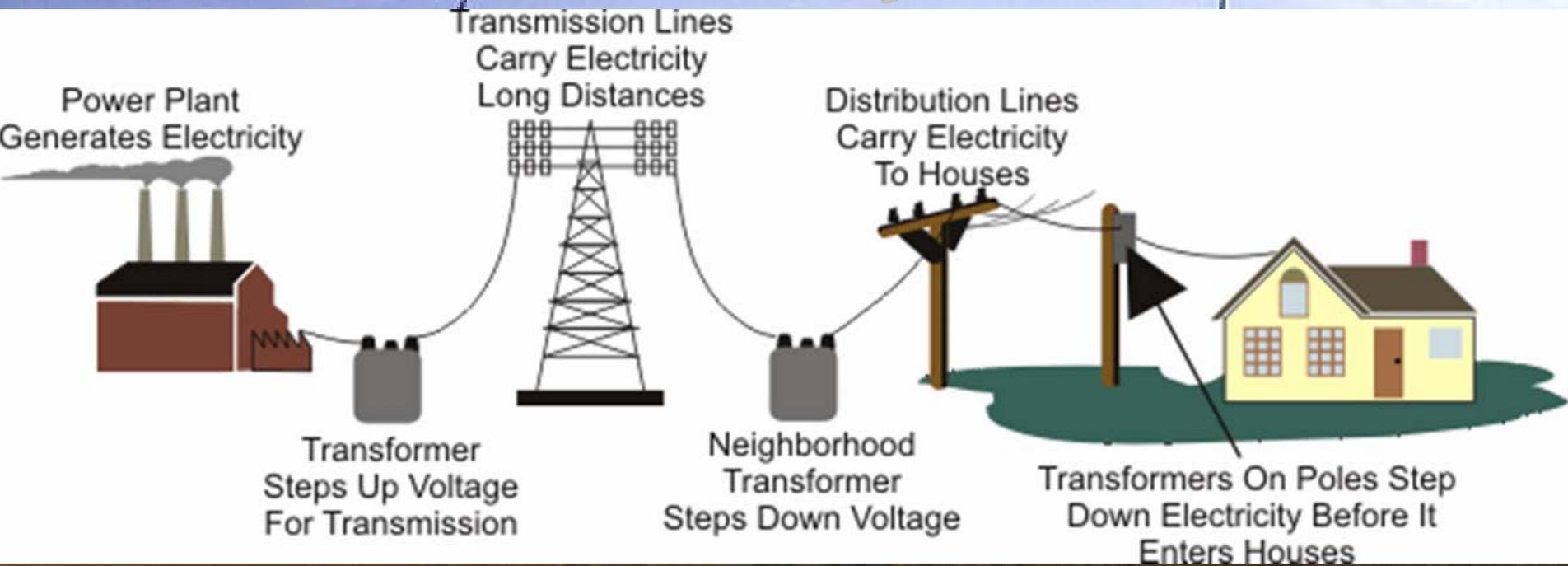
- When possible drive 60mph on Interstates, Divided Highways, etc..
 - Unless you are going to Denver, 70mph isn't going to save you much time.
 - For example if you are driving from Topeka to Lawrence the 22 miles at 70mph will take you about 20 minutes. If you go 60mph it will take you 2 minutes longer but save you about \$0.40.
- In the summer, use the air conditioning sparingly.
 - 5-25% savings
 - Don't however roll down the windows as drag will increase along with more fuel used.
- Coast when possible

Why are prices for Gasoline going to be higher in 2006 and Beyond

The background of the slide features a light blue sky with several wind turbines. In the center, there is a simple bar chart with three vertical bars of varying heights.

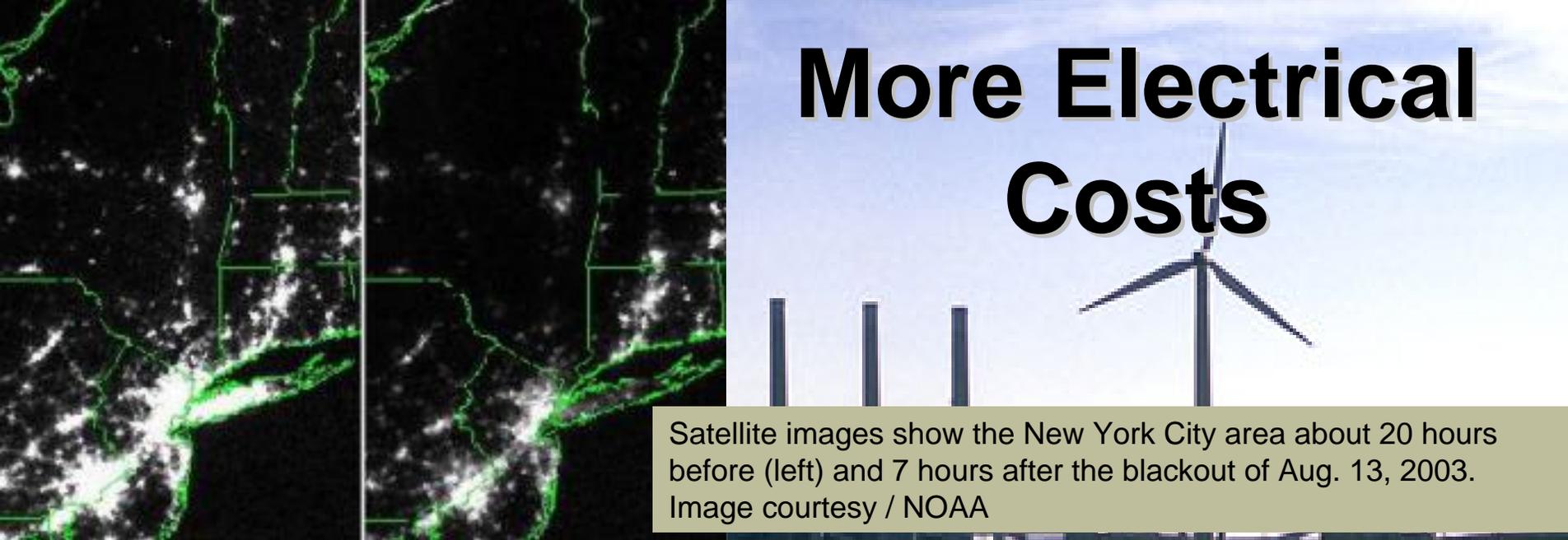
1. World demand is nearly exceeding supply.
2. Oil industry still hasn't fully recovered from Hurricane Katrina (12% oil and 9% natural gas production still off line).
3. Hurricane season can threaten U.S. crude production and refineries.
4. Tensions around the world (Iraq, Iran, Middle East, North Korea, Nigeria, etc.)
5. Oil Infrastructure –pipelines, refineries, etc.
6. Seasonal demand
7. Price of a barrel oil (currently - \$72.63 08/29/2006)

Electricity Costs



- **Capital Costs** – Financing/Interest on Loans, Land Acquisition, Design, Construction, Interconnection to Grid
- **Fuel** – Price, Availability
- **Operation and maintenance** – Personnel, Reliability, Environmental monitoring, Unit lifetime.

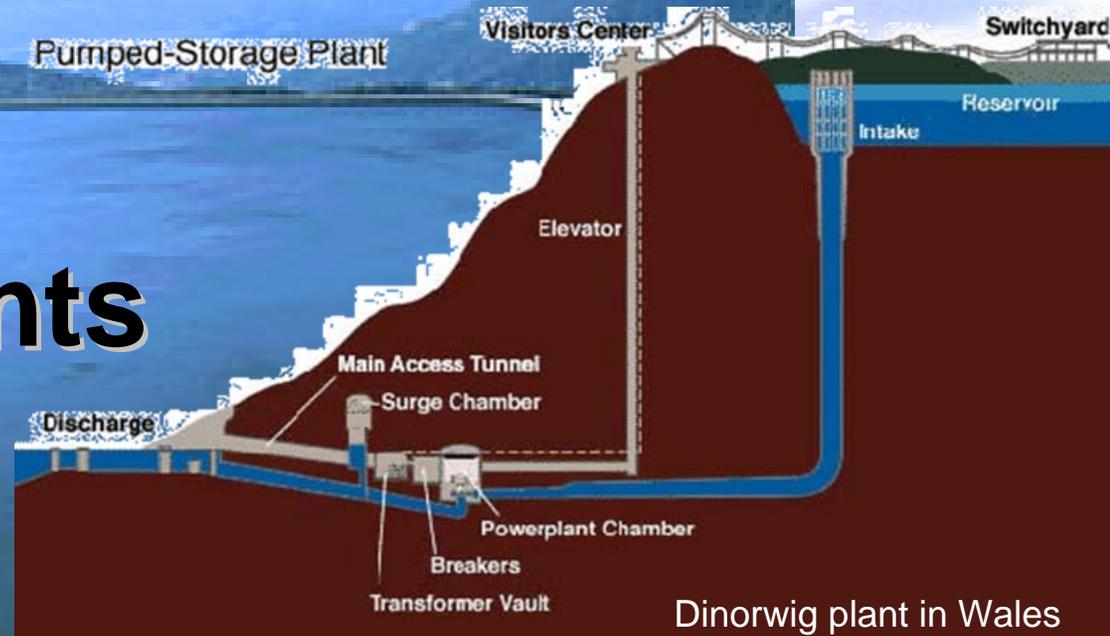
More Electrical Costs

The background of the slide features a composite image. On the left, two satellite images of the New York City area are shown side-by-side, with the left one being 20 hours before and the right one 7 hours after a blackout on August 13, 2003. The images show a dense network of green lines representing power lines and bright white spots representing city lights. To the right of the images, there is a stylized illustration of a wind turbine with three blades. Below the turbine, there are three vertical bars of varying heights, suggesting a bar chart or data visualization.

Satellite images show the New York City area about 20 hours before (left) and 7 hours after the blackout of Aug. 13, 2003. Image courtesy / NOAA

- Demand is usually highest in the afternoon and early evening (on-peak).
- Summer has highest usage.
- Baseload Power plants are most efficient generating electricity at an even, consistent level.
- Peaking plants are expensive to operate, high fuel cost, (Hydroelectric power plants can operate in base and/or peaking mode).

Pumped Storage Plants



- A relatively small amount of electricity is generated.
- They pump water from a river or reservoir up into reservoirs located above hydroelectric turbines.

Taum Sauk Reservoir Proffitt Mt, SE Missouri

1. Water is pumped up at night
2. Water is released during peak times to pass through the generator

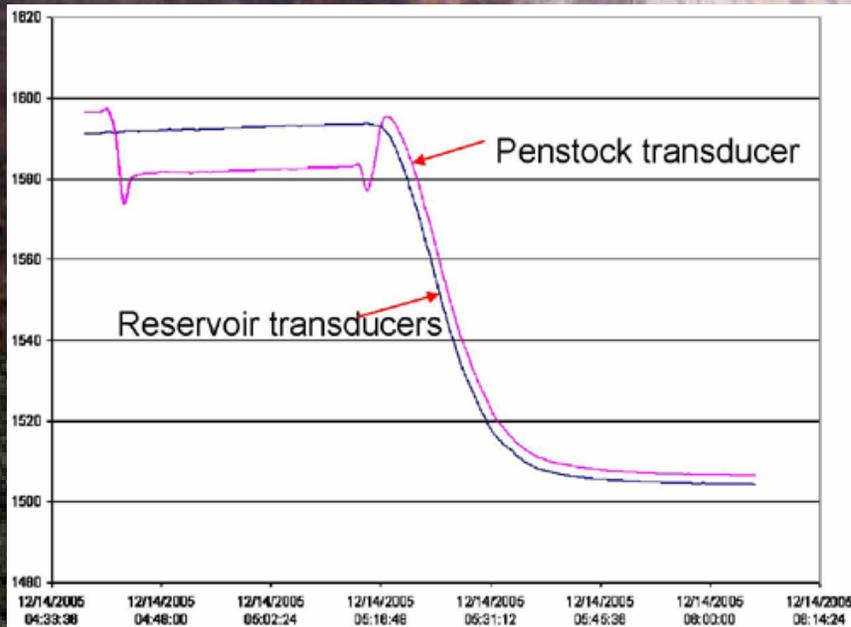


The Upper Reservoir has a capacity of 4,350 acre-feet. The upper reservoir is 800 feet above the hydroelectric plant. The two are connected by a 7,000 ft tunnel through the mountain. The first filling of the Upper Reservoir was in July 1963.



On December 14, 2005

The reservoir's berm was overtopped when one of two pumps failed to shutdown due to pressure transducers became detached from their supports. The breach allowed a 20' wall of water to flow down the Black River.



Dec. 14th breach.



View of breach and scoured surface

Flow Path

View looking towards the reservoir breach



View from top of breach

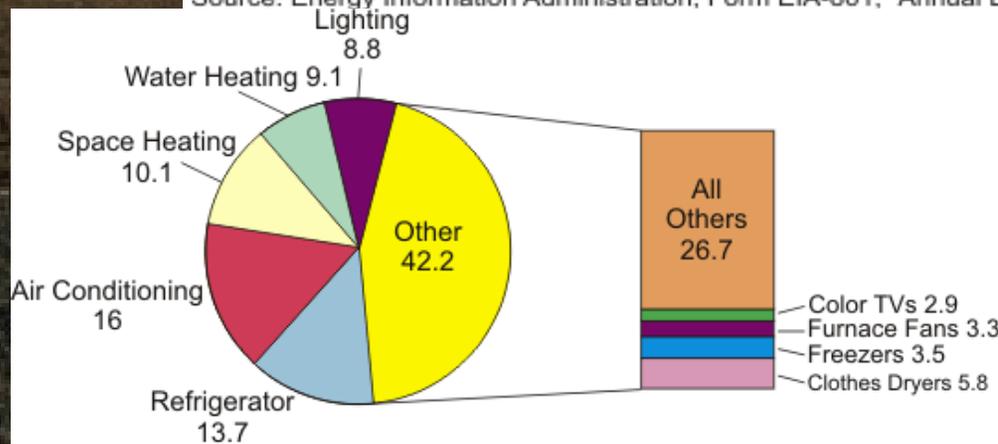
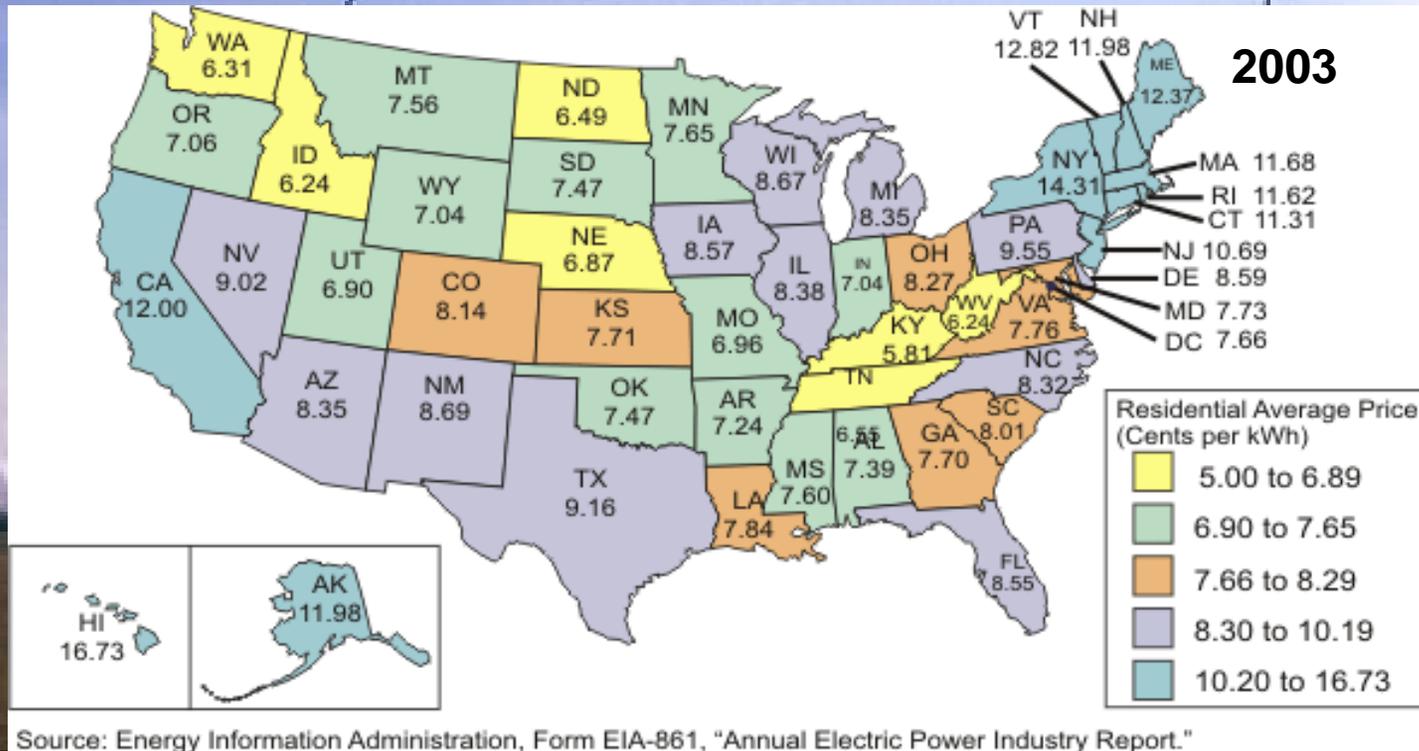


Secondary cause of the breach was the marginally stable dumped “dirty” rockfill embankment and associated parapet wall that could not tolerate additional pore pressures and erosive effects of the overtopping water flowing down the 1.3:1 slope.

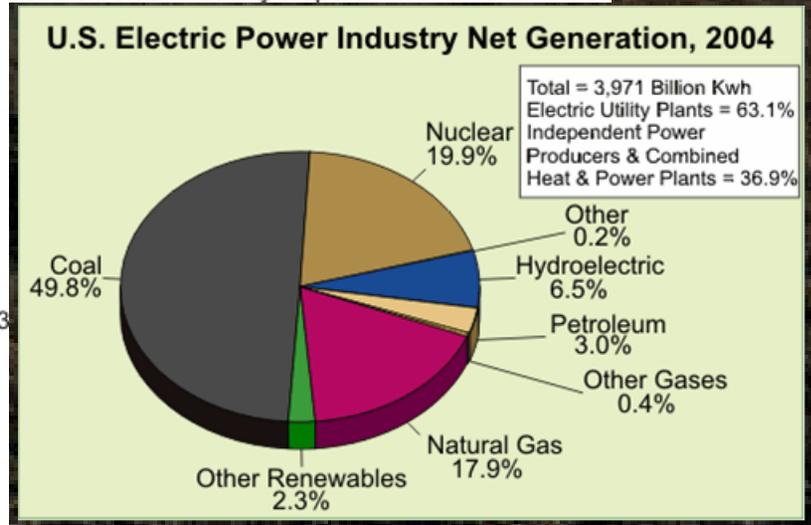
“Dirty” rockfill (20% fines, 45% sand sizes and smaller).



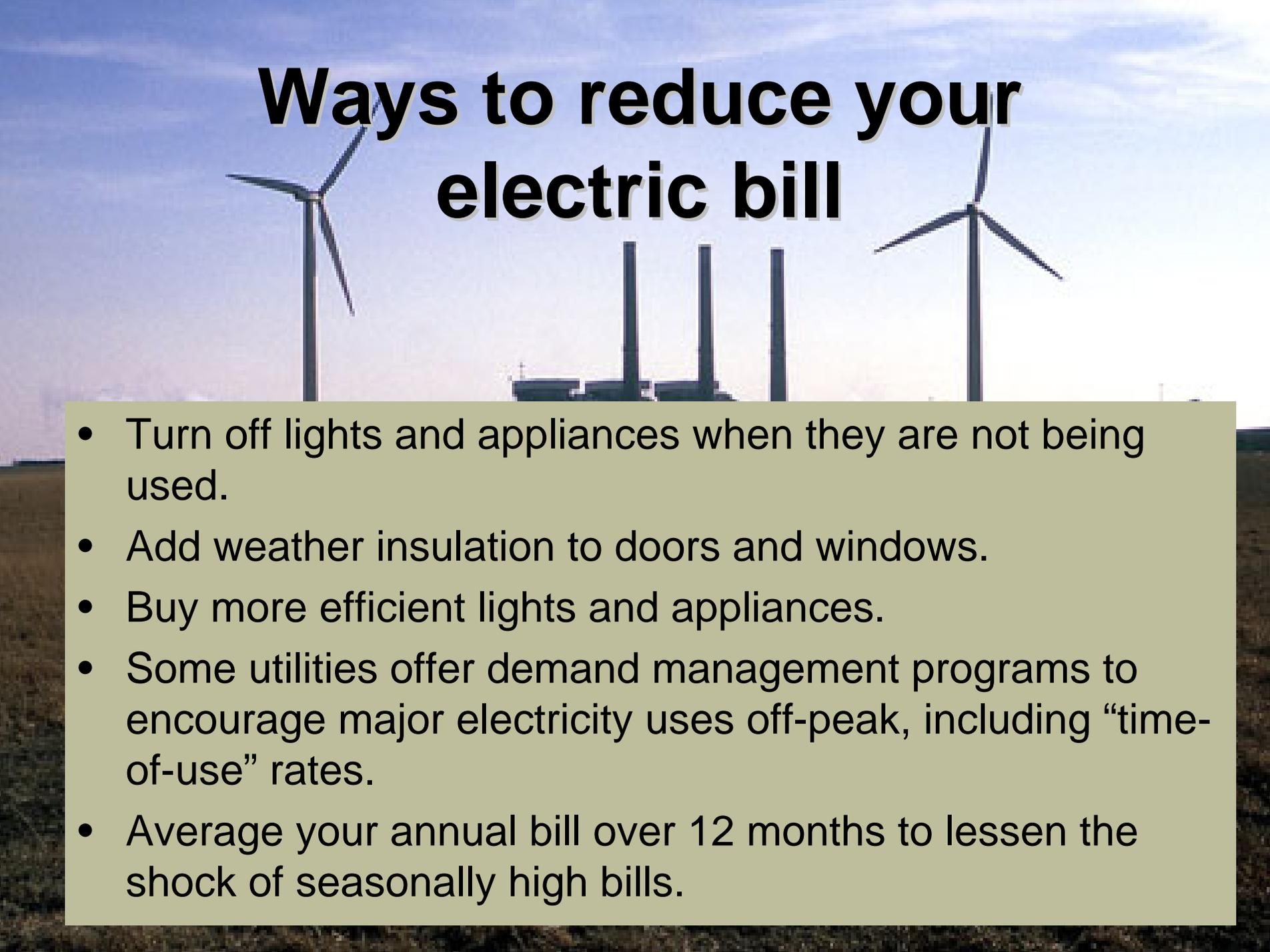
Back to Electricity Costs



Source: Energy Information Administration, Form EIA-457A, B, C, E, and H of the 2001 Residential Energy Consumption Survey.

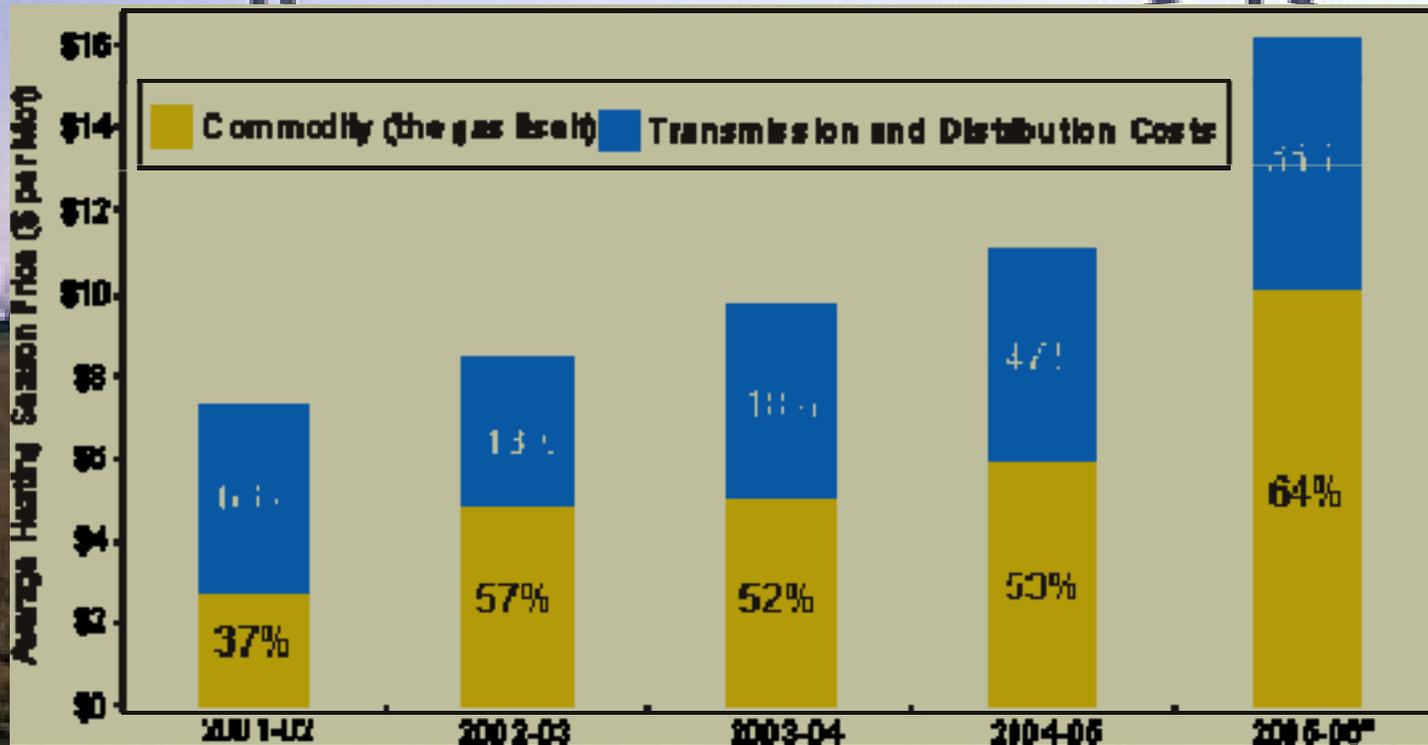


Ways to reduce your electric bill

The background of the slide features a landscape with two large wind turbines on the left and right sides. In the center, there are three tall, dark industrial smokestacks. The sky is a clear, light blue, and the ground in the foreground is a dark, flat expanse, possibly a field or plain.

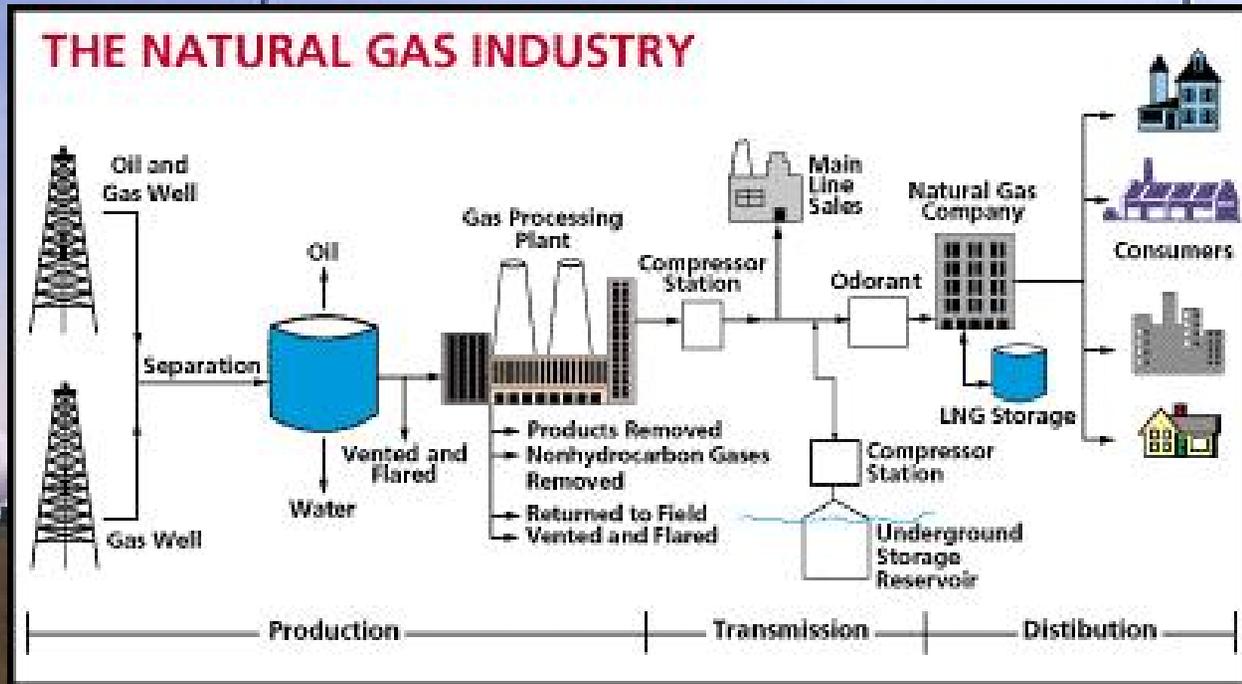
- Turn off lights and appliances when they are not being used.
- Add weather insulation to doors and windows.
- Buy more efficient lights and appliances.
- Some utilities offer demand management programs to encourage major electricity uses off-peak, including “time-of-use” rates.
- Average your annual bill over 12 months to lessen the shock of seasonally high bills.

Heating Costs using Natural Gas



Breakdown of natural gas price paid by residential customers during the heating season

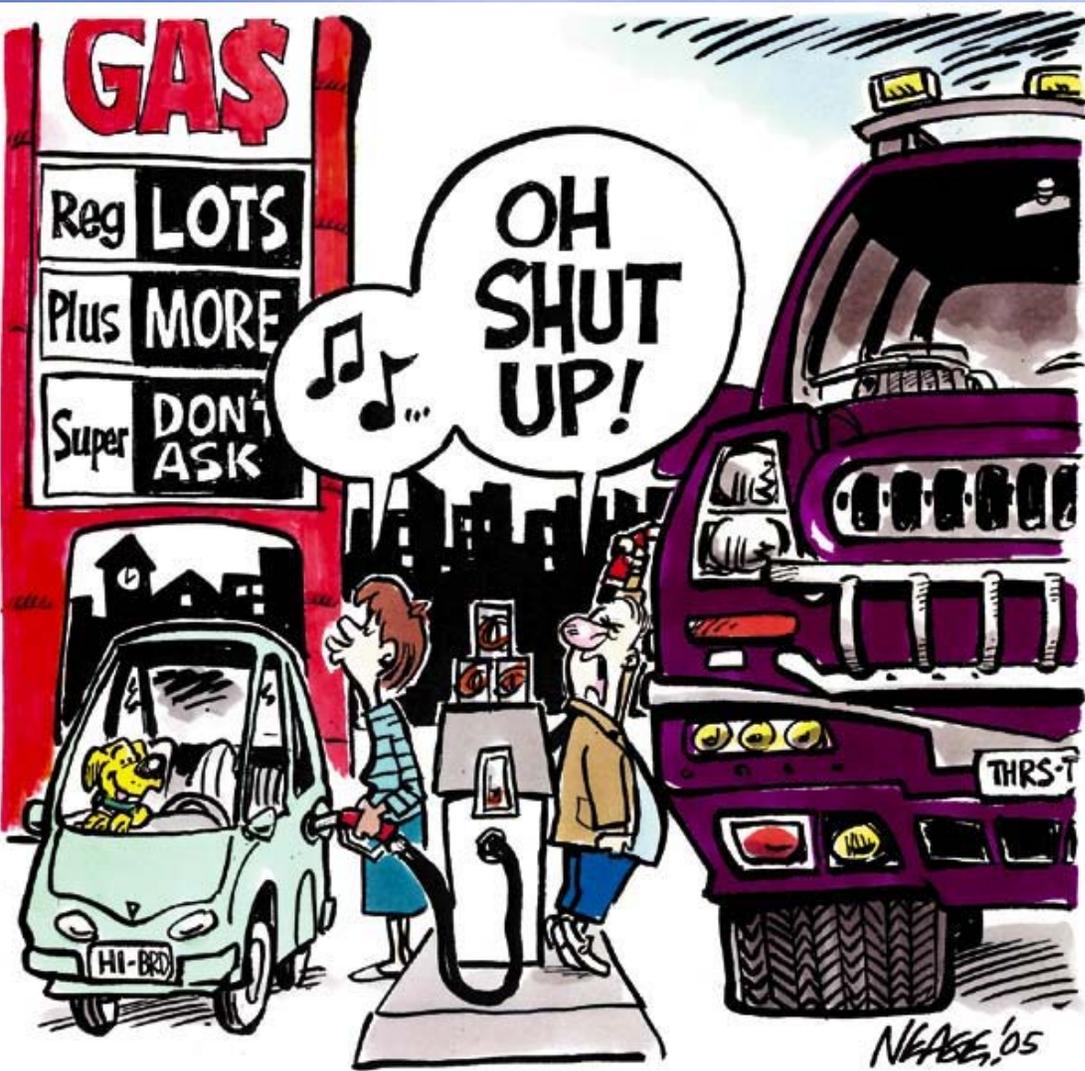
Factors That Affect Prices



- **Weak production** –decreased by 0.6 percent in 2004, reaching the lowest production level since 1999.
- **Rising net imports** – Net imports increased by almost 3 percent in 2004.
- **High Demand** – blame the strong economy. Also, Additionally, high temperatures last summer have increased the need for home cooling, which adds to natural gas demand used by electric power generators.
- **Hurricane Activity** – major service disruptions and production, resulting in record high prices of natural gas.

Heating Costs Savings

- Reduce thermostat settings, change furnace filter monthly, have furnace cleaned and tuned annually.
- Obtain a home energy audit to identify ways to conserve energy
- Participate in a yearly budget plan to spread gas costs evenly throughout the year
- Check and replace weather stripping on doors and windows, close storm windows and doors
- Operate kitchen and bath vents minimally
- Lower the thermostat set point on your water heater to about 120 degrees, install a water heater blanket, reduce hot water use
- New Furnace? 20 year old furnaces waste 40% heating.



Mike Keefe THE DENVER POST

