

Lecture 2: Monday, January 28, 2008

The articles and excerpts can be found on the class web site
<http://www.physics.rutgers.edu/~karin/140>

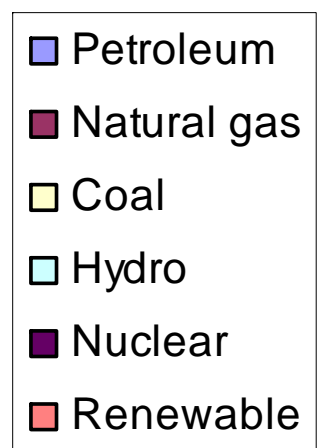
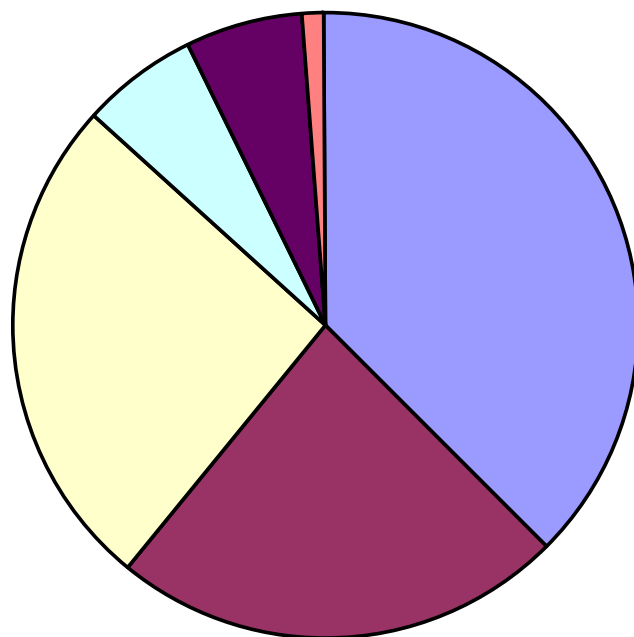
Readings for upcoming lectures will be added up to the day of the lecture; the lecture notes will be added in the afternoon after the lecture

Homework #1 will be posted by 6:30 PM Tuesday, due Wednesday February 6; time for questions next Monday.

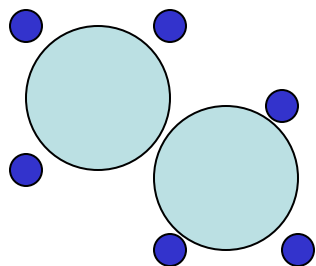
Special permission?

Email Ms. Julia Sotory jsotory@physics.rutgers.edu

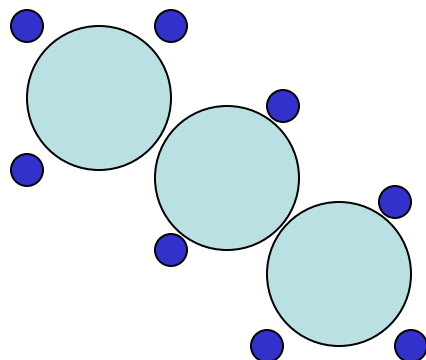
World energy consumption 2004



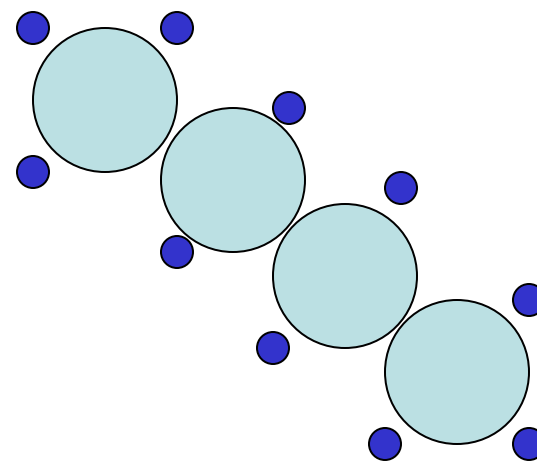
More hydrocarbons



2 Carbon Atoms
ETHANE



3 Carbon Atoms
PROPANE



4 Carbon Atoms
BUTANE

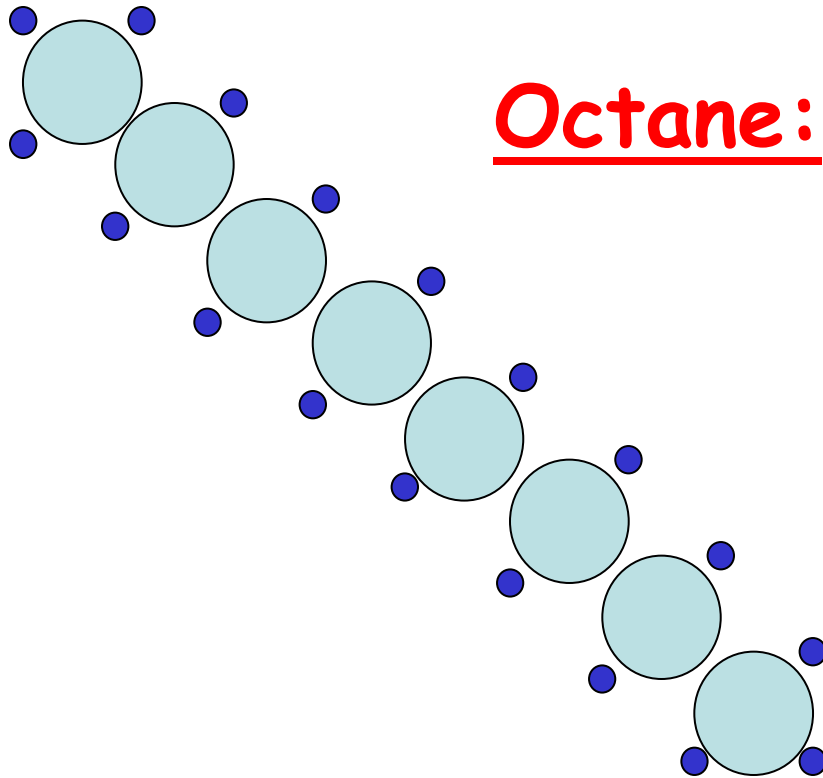
And so on.

Five Carbon Atoms give you PENTANE.

Six Carbon Atoms give you HEXANE.

Seven give you HEPTANE.

The World's Favorite Hydrocarbon



Octane: Eight Carbons.
The main ingredient in
gasoline.

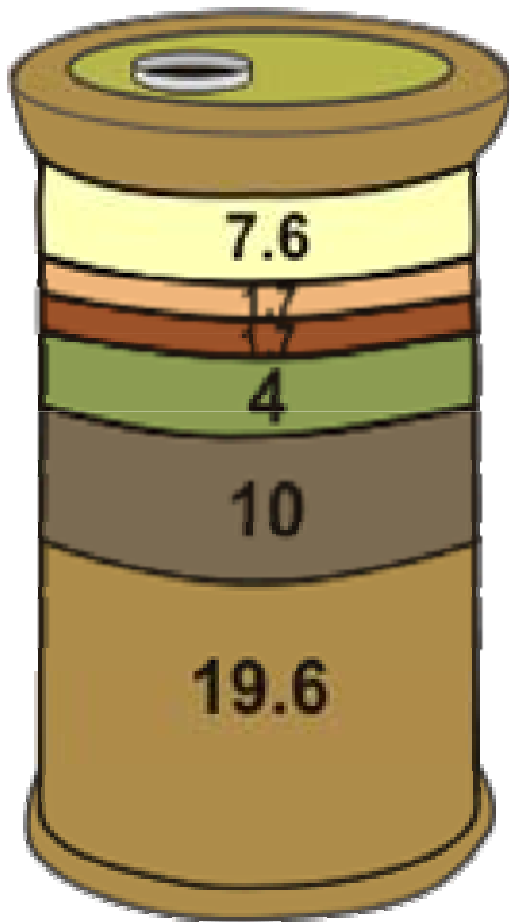
Bigger is Better

The bigger the hydrocarbons get:

- The more energy per molecule you get from burning.
- The easier it is to *Liquefy* them.

*More in small volume
Easier to transport!*

Methane is very difficult to liquefy.
Propane will liquefy at 40 below zero.
Butane will liquefy on a cold winter day.



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

Estimated oil reserves (billions of barrels)

1 Saudi Arabia	264.2
2 Iran	137.5
3 Iraq	115
4 Kuwait	101.5
5 UAR	97.8
6 Venezuela	79.7
7 Russia	74.4
8 Kazakhstan	39.6
9 Libya	39.1
10 Nigeria	35.9
11 US	29.9
12 Canada	16.5
13 China	16

Oil well



Oil refinery



World consumption: 80 million barrels per day

US consumption: 20 million barrels per day

US imports: 12 million barrels per day

February 2006: price was about \$52/barrel (recently above \$70)

Oil well



Oil refinery



The New York Times
nytimes.com

January 3, 2008

TODAY IN BUSINESS

OIL REACHES \$100 A BARREL Oil prices began the year with a volatile surge, briefly reaching \$100 a barrel on the New York Mercantile Exchange, left, before settling at \$99.62. Said one analyst: "It's the same usual suspects: the bad, bad world out there, a cold winter and declining oil inventories."

January 4, 2008

NEWS ANALYSIS

Economy and Geopolitics Decide Where Oil Goes Next

By [CLIFFORD KRAUSS](#)

NOW that the price of crude oil has crossed the \$100-a-barrel threshold, and then retreated slightly, what direction will it take now?

Many experts say it will go up, then down, and then maybe up again. That, anyway, has been the pattern of the last several years of volatile prices.



TENNESSEE VALLEY AUTHORITY

[TVA Home](#) [About TVA](#) [Power System](#) [Environmental Stewardship](#) [River System](#) [Economic Development](#) [Investor Resources](#) [News & Media](#)

Methane Gas Energy

Energy from methane gas is provided by the City of Memphis wastewater treatment facility, which produces a methane by-product that is co-fired with coal at TVA's Allen Fossil Plant. The project provides eight megawatts of power production.

Methane is produced when organic wastes decay. The wastewater plant's lagoon was covered to capture the methane, which otherwise would have to be burned, or flared, in order to reduce the hazard arising from gas buildup.





Solid Waste Division

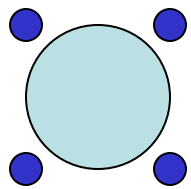
Landfill Gas-to-Energy Project

Resulting from a strategic alliance between the Authority and the National Energy Resource Corporation (NERC), the Landfill Gas-to-Energy project integrates the MCUA's principle objectives of sound waste management, cost efficiency and environmental preservation and protection. The Landfill Gas-to-Energy project beneficially utilizes methane, a greenhouse gas naturally occurring from decomposing waste. Methane is collected from a consortium of inactive landfills within Middlesex County - the Edison Landfill, which is owned by Edison Township, ILR, a privately owned landfill, and the Middlesex County Landfill. The gas is then transported via a network of pipelines to the Electric Power Generating Facility in Sayreville, where the gas is converted into 16-megawatts of electrical energy. The recycled energy is used to power the MCUA's operations in Sayreville.

The Landfill Gas-to-Energy project characterizes the future of the waste management industry by introducing sound ingenuity to maximize efficiency in resource management and energy consumption and minimizes the environmental impact of waste disposal. The project is currently producing cost-savings for the MCUA operation and, ultimately, for Middlesex County residents.

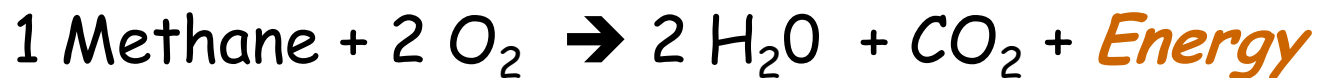
NERC is a private contractor in charge of the construction, management, operation, and maintenance of the Landfill Gas-to-Energy project, which is part of a regional approach to air quality improvement.

How Do Fossil Fuels Work?



Methane, the simplest Hydrocarbon, burns (well, all hydrocarbons burn):

Burning is a process of combining with oxygen.



Hydrocarbons burn fast.

Hydrocarbon burning releases water and CO_2