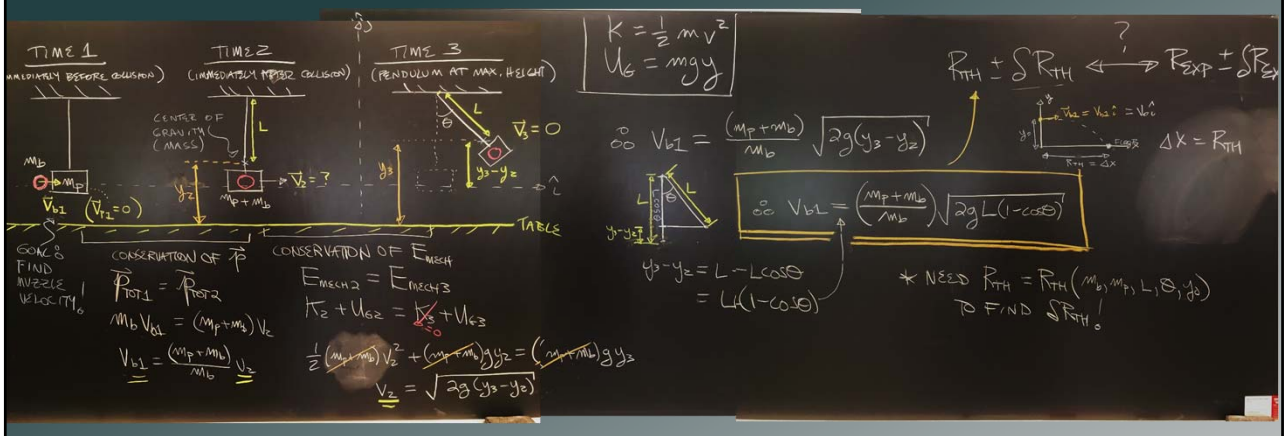
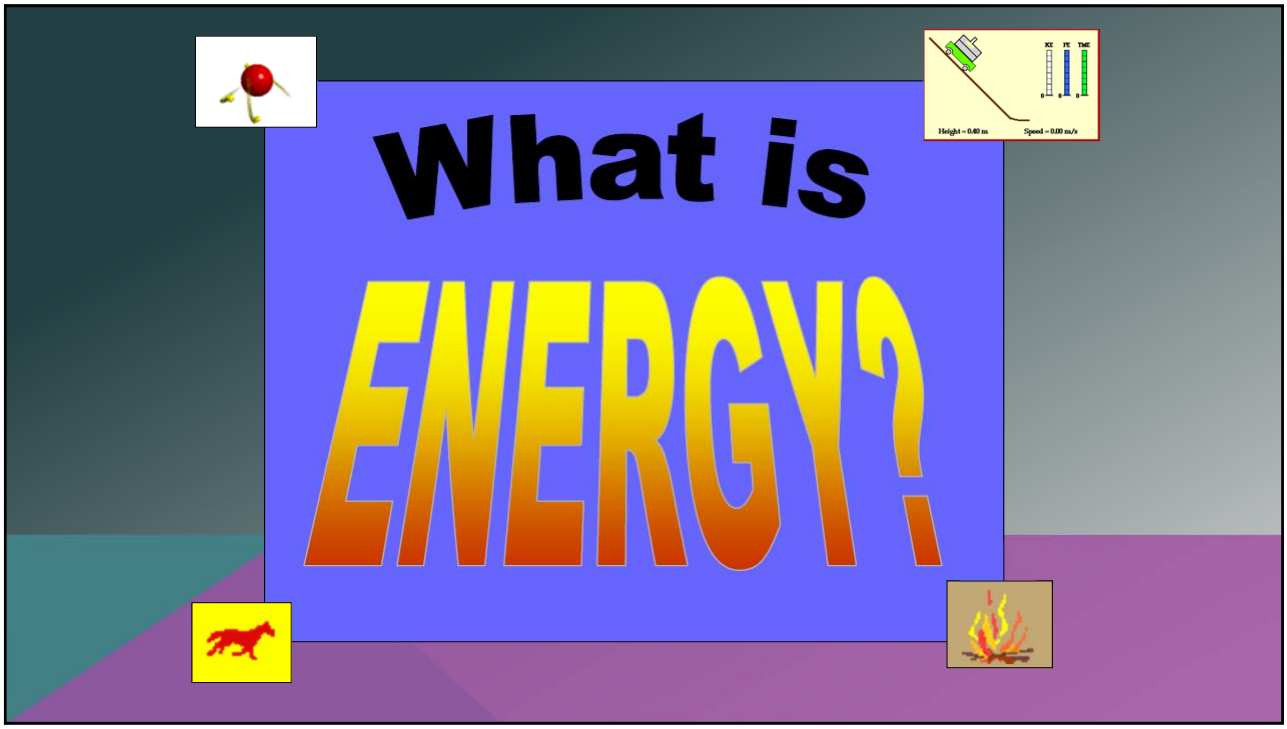
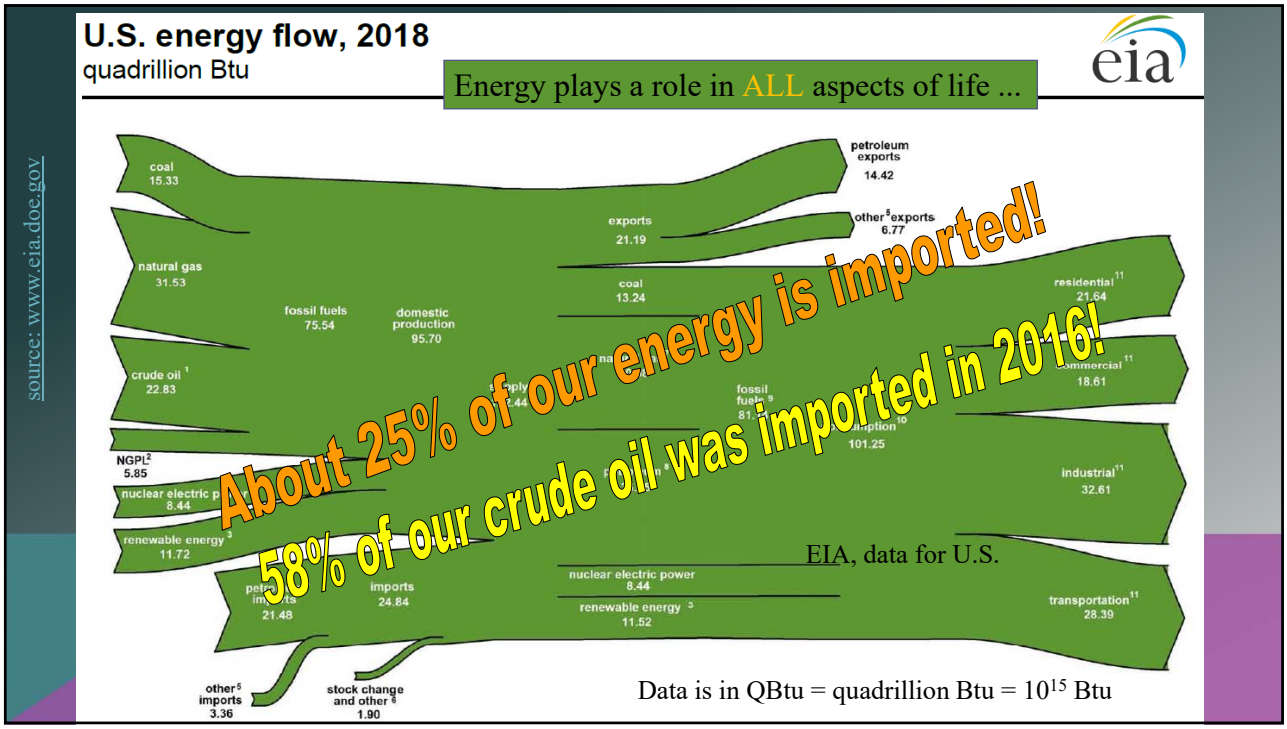
PHYS 210 - General Physics I

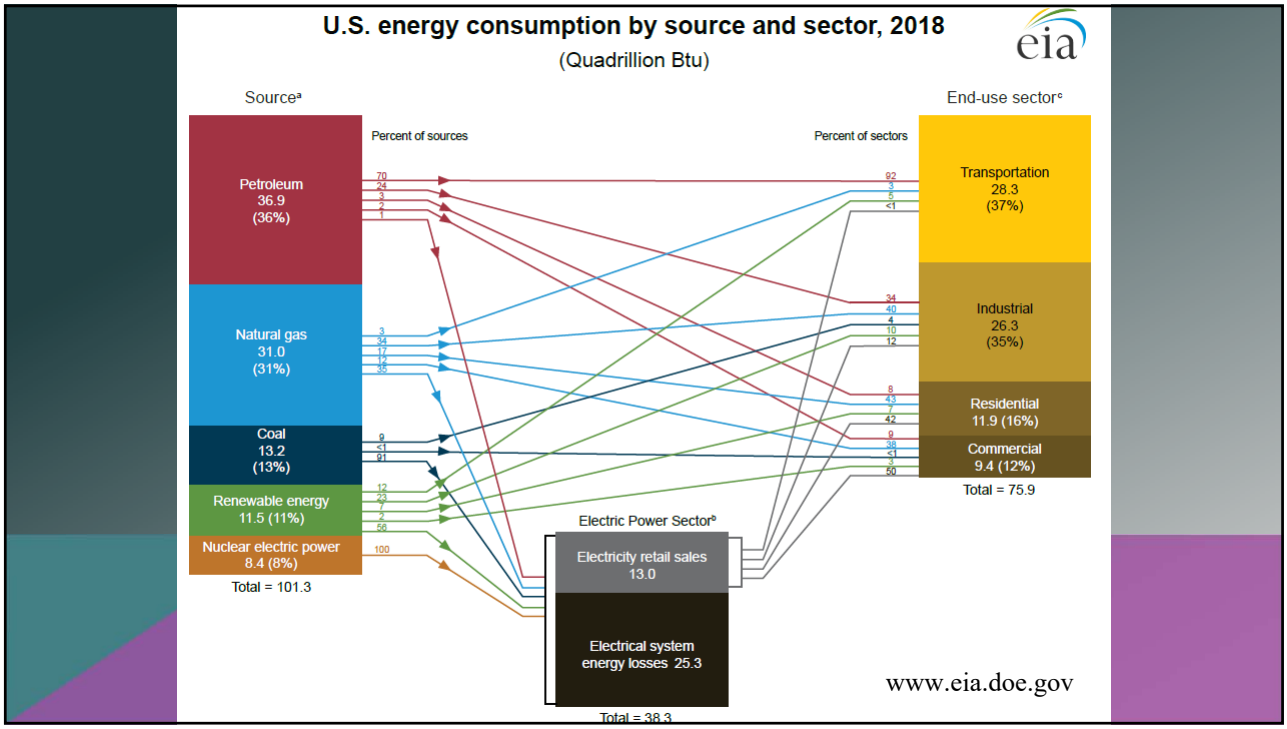
- From lab …
- Energy!
- Conservation of Mechanical Energy

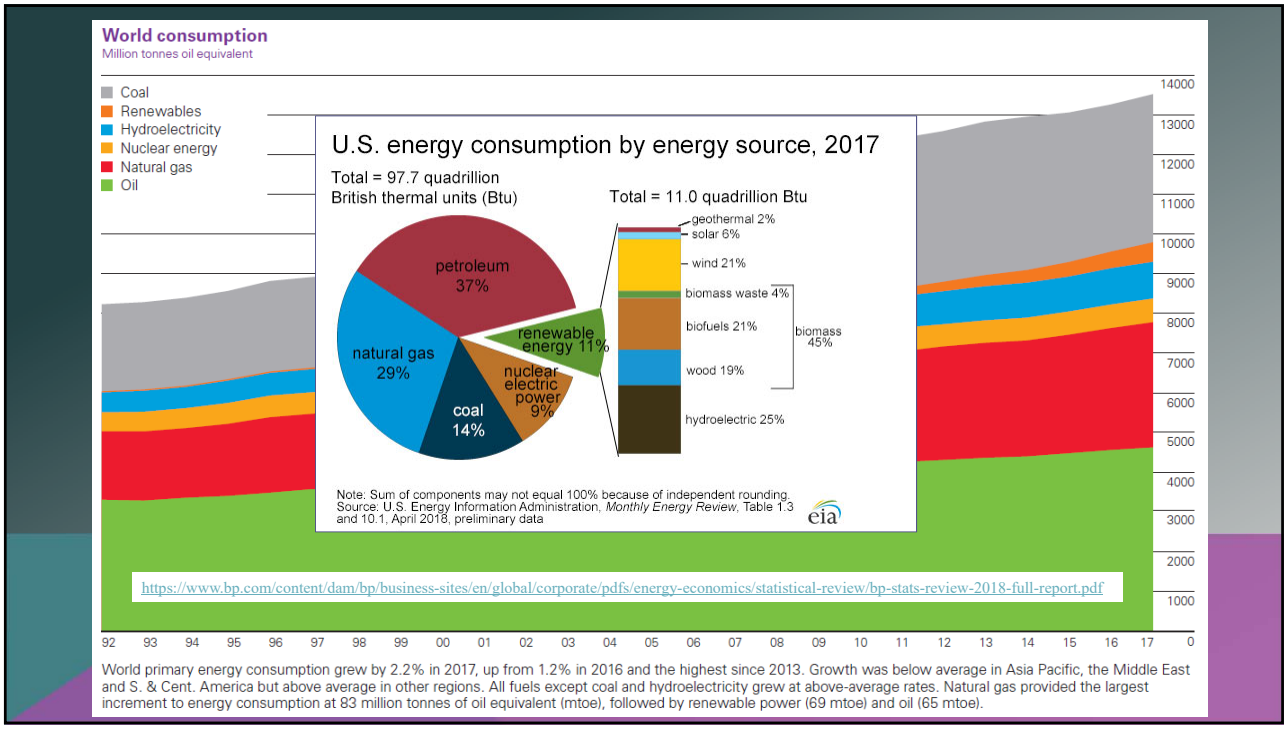
FROM LAB …



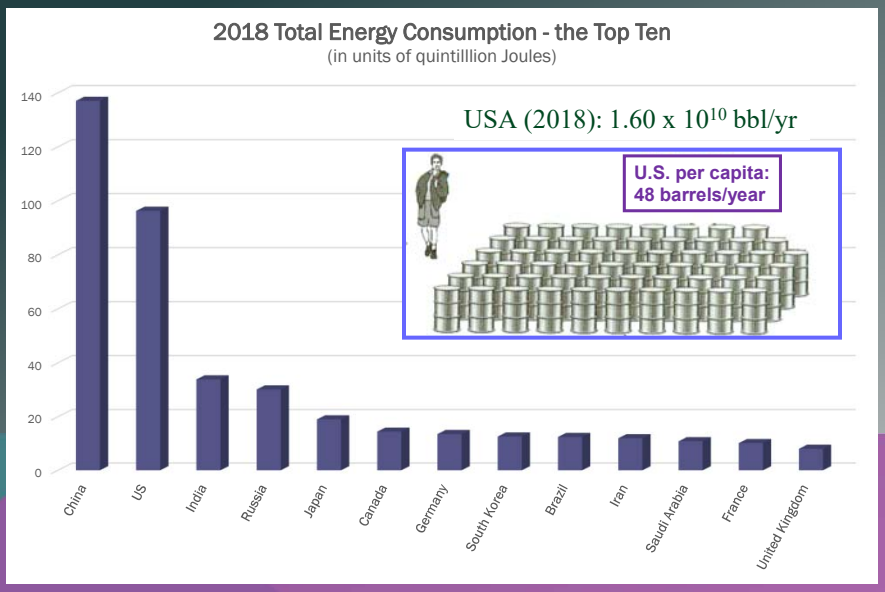

What is
ENERGY?


U.S. energy flow, 2018
quadrillion Btu
Energy plays a role in ALL aspects of life ...
eia
source: www.eia.doe.gov
coal 15.33
natural gas 31.53
fossil fuels 75.54
domestic production 95.70
crude oil 22.83
NGPL 5.85
renewable energy 11.72
petroleum exports 14.42
exports 21.19
other exports 6.77
coal 13.24
fossil fuels 81
imports 24.84
nuclear electric power 8.44
renewable energy 11.52
other imports 3.36
stock change and other 1.90
residential 21.64
industrial 32.61
transportation 28.39
About 25% of our energy is imported!
58% of our crude oil was imported in 2016!
EIA, data for U.S.
Data is in QBtu = quadrillion Btu = 10^15 Btu


U.S. energy consumption by source and sector, 2018
(Quadrillion Btu)
eia
Source[a]
End-use sector[c]
Percent of sources
Percent of sectors
Petroleum 36.9 (36%)
Natural gas 31.0 (31%)
Coal 13.2 (13%)
Renewable energy 11.5 (11%)
Nuclear electric power 8.4 (8%)
Total = 101.3
Transportation 28.3 (37%)
Industrial 26.3 (35%)
Residential 11.9 (16%)
Commercial 9.4 (12%)
Total = 75.9
Electric Power Sector[b]
Electricity retail sales 13.0
Electrical system energy losses 25.3
Total = 38.3
www.eia.doe.gov


World consumption
Million tonnes oil equivalent
Coal
Renewables
Hydroelectricity
Nuclear energy
Natural gas
Oil
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17
U.S. energy consumption by energy source, 2017
Total = 97.7 quadrillion British thermal units (Btu)
petroleum 37%
natural gas 29%
coal 14%
nuclear electric power 9%
renewable energy 11%
Total = 11.0 quadrillion Btu
geothermal 2%
solar 6%
wind 21%
biomass waste 4%
biofuels 21%
wood 19%
hydroelectric 25%
biomass 45%
Note: Sum of components may not equal 100% because of independent rounding.
Source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3 and 10.1, April 2018, preliminary data
eia
https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf
World primary energy consumption grew by 2.2% in 2017, up from 1.2% in 2016 and the highest since 2013. Growth was below average in Asia Pacific, the Middle East and S. & Cent. America but above average in other regions. All fuels except coal and hydroelectricity grew at above-average rates. Natural gas provided the largest increment to energy consumption at 83 million tonnes of oil equivalent (mtoe), followed by renewable power (69 mtoe) and oil (65 mtoe).

WHO USES ENERGY? THE TOP TEN:

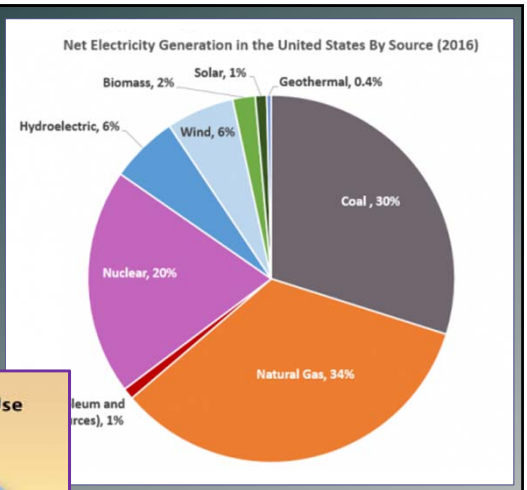


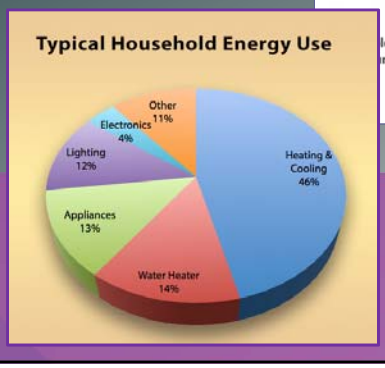
ELECTRICITY: U.S.

~40% of our energy use goes into electricity production

~70% of this is from fossil fuels

Electricity production is likely to increase dramatically as we move beyond fossil fuel resources





ENERGY

Loosely, energy is "what makes it go!"

Energy is an abstract, mathematical concept that reflects the condition of an object or system.

- It can be changed when the object/system interacts with something
- It comes in many different *forms*
- All energies are scalars

First, consider the energies associated with motion and position:

Kinetic Energy $K = \frac{1}{2}mv^2$

Gravitational Potential Energy $U_g = mgy$

Happy Wednesday!