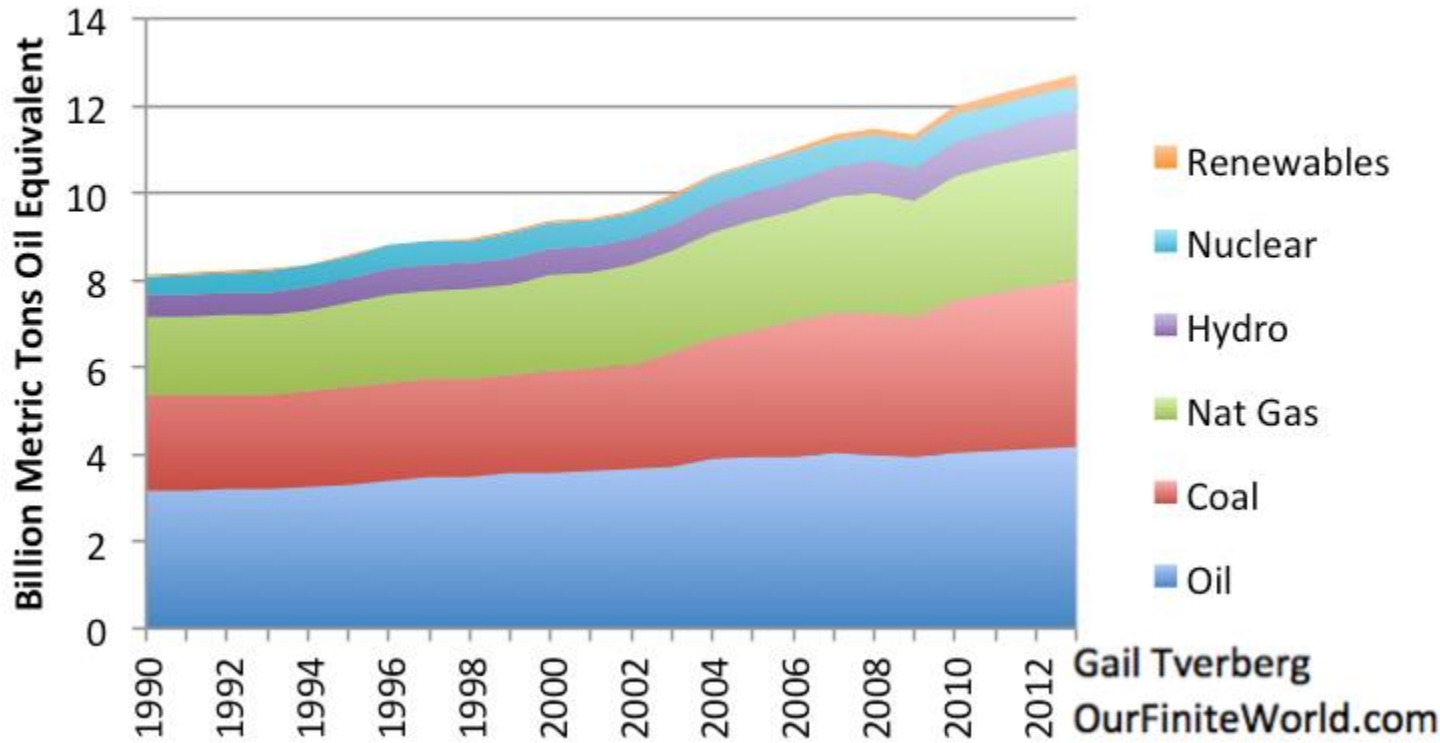


# Chapter 8

Energy and Civilization:  
Patterns of Consumption

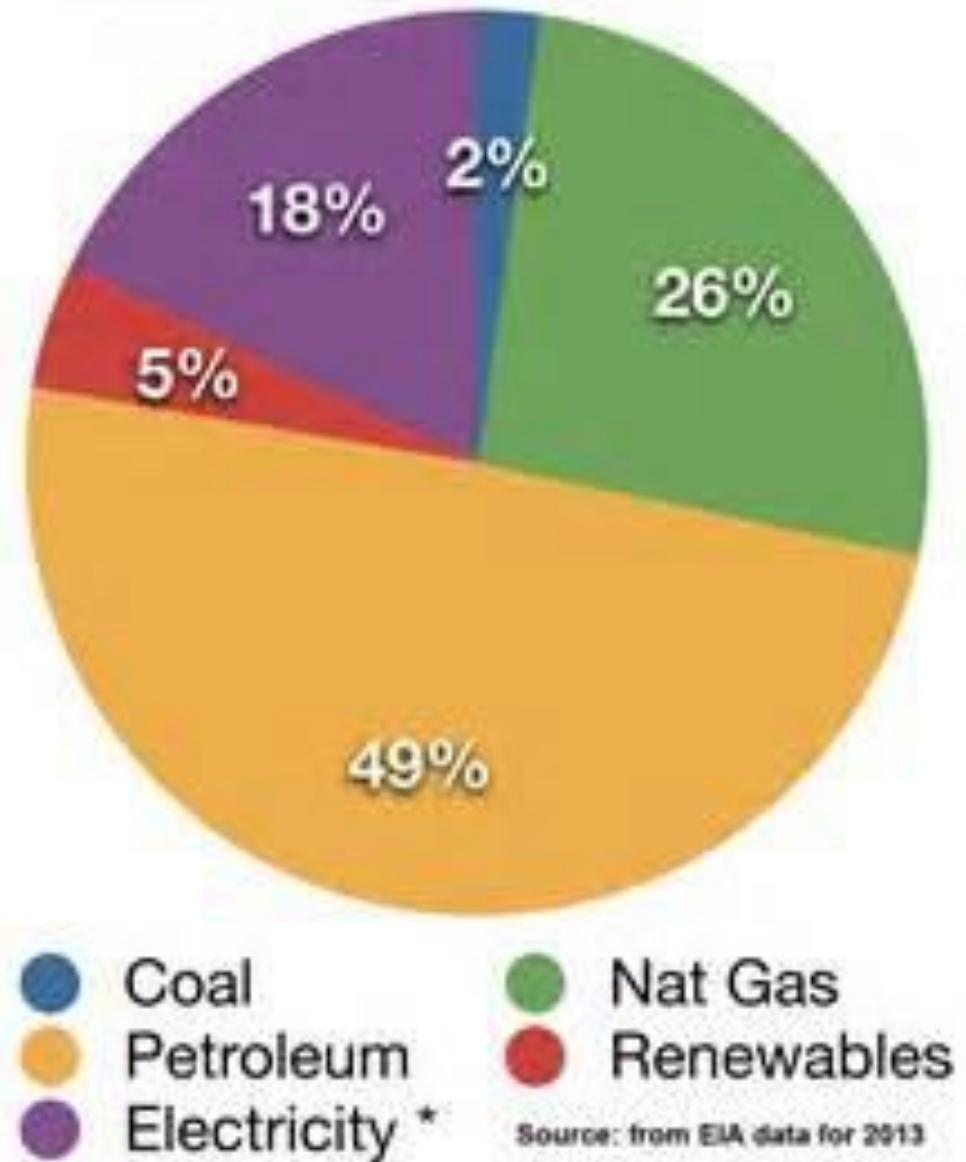
# World Energy Use:

## World Energy Consumption - BP



## Energy Consumption by fuel

Trillion Btu



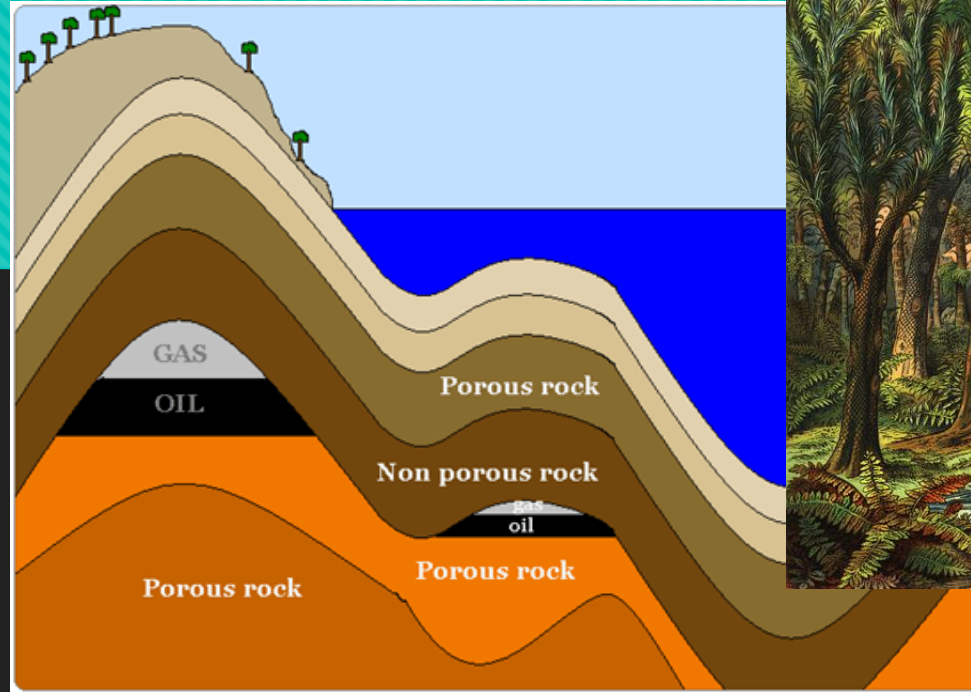
# History of Energy Consumption



- History of Energy Consumption: Hunter-Gatherers (Food is energy) => Development of cities (Energy from muscle and burning biomass) => High use of wood (importation) => Coal burning.

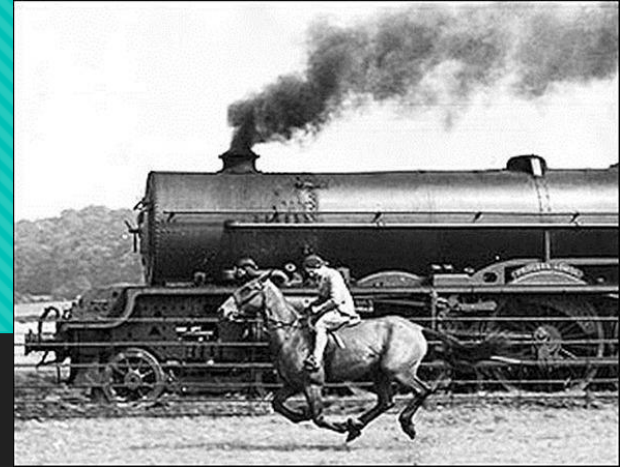


# Fossil Fuels



- Modified remains of plants, animals, and microorganisms that lived millions of years ago.
  - Coal was formed during the Carboniferous period (299-358 mya) when earth was warm and humid.

# Industrial Revolution (18<sup>th</sup> century)



- Coal was first fossil fuel extensively used
- First in England => to all of Europe and then North America
- Machines invented to manufacture and transport goods
- Steam engine => large scale mining

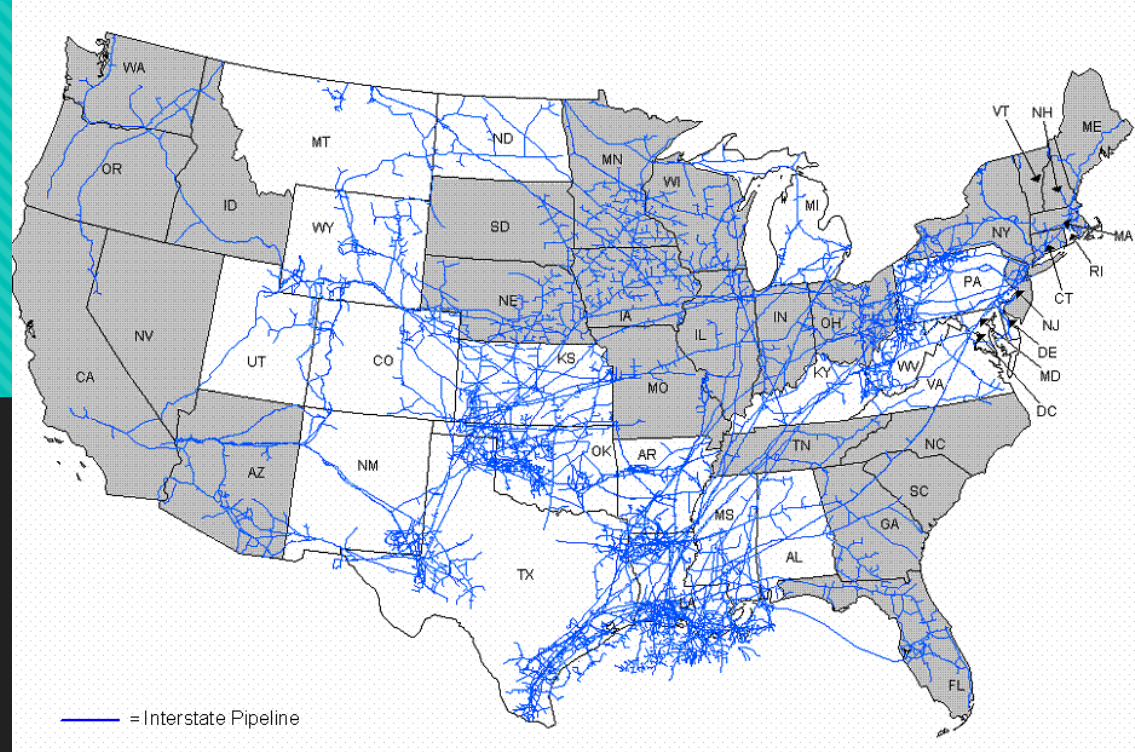
# The Role of the Automobile



- First oil was to make kerosene for lamps – gasoline was waste product
- Invention of the automobile and internal combustion engine increased demand for oil
- Autos lead to road construction, requiring energy.
- Lead to lifestyle changes – vacation, live in suburbs and buy energy-consuming products.



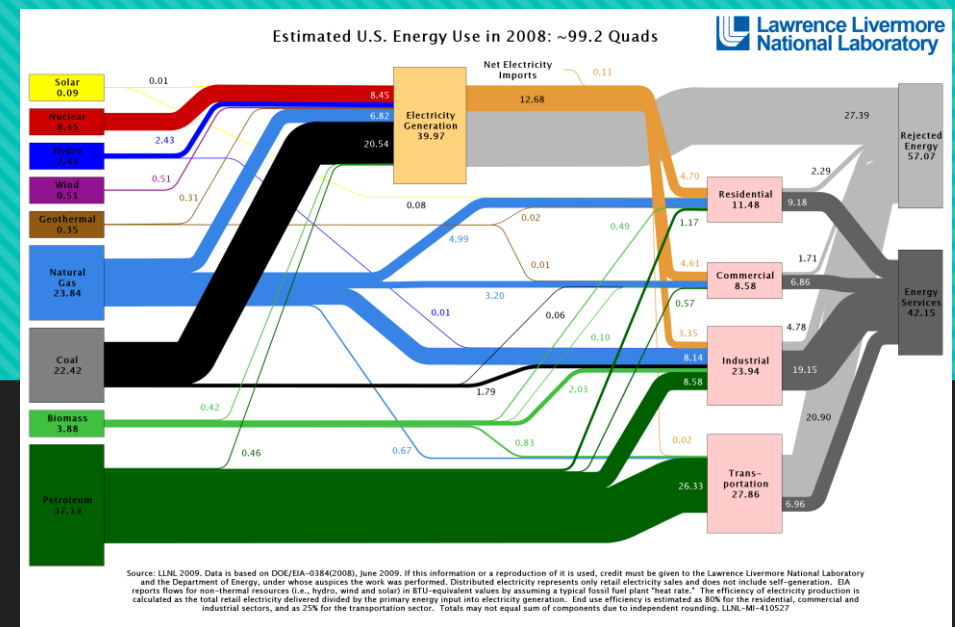
# Natural Gas



- Originally a waste product of oil production, used once transport was possible.



# Energy use

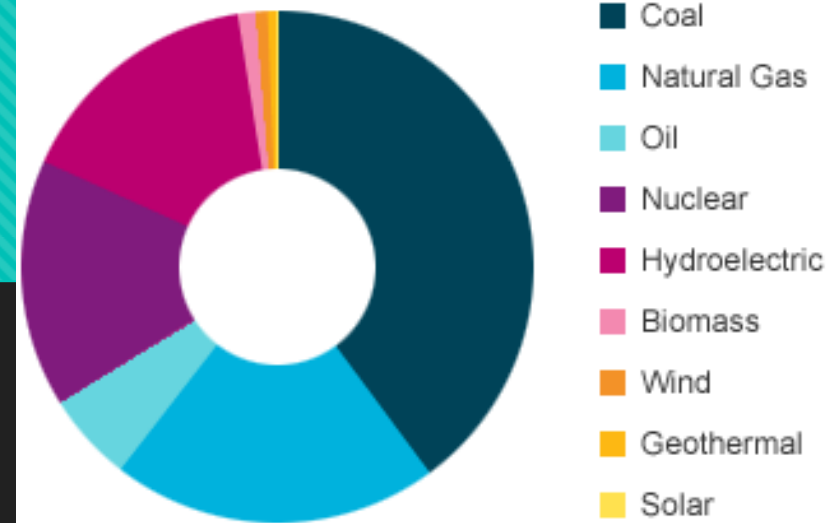


Developing countries	Transitioning countries	Developed countries
Residential (cooking and heating)	To develop industrial base	Residential and commercial
		Industrial
		transportation



# Electrical Energy

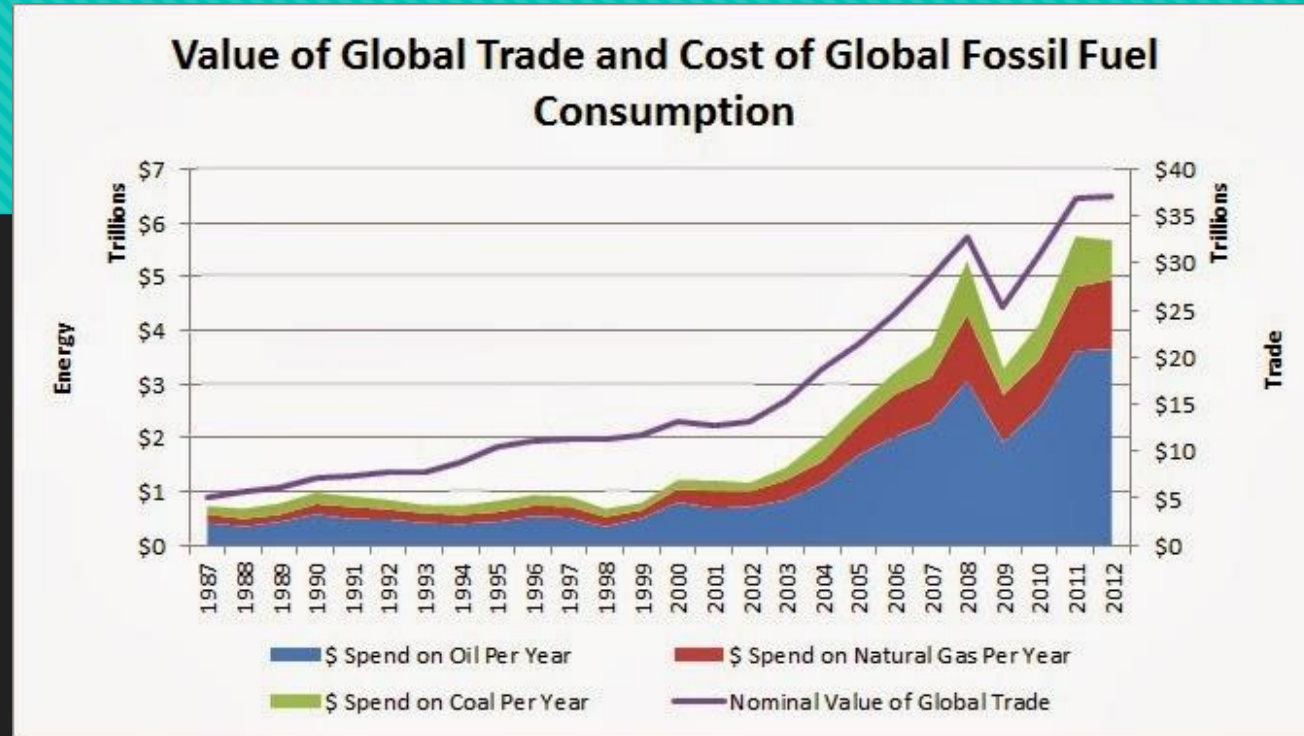
Global electricity generation by source



Source: EIA 2007; IEA World Energy Outlook 2008

- Production methods: burning fossil fuels, nuclear power plants, hydroelectric plants, and some renewable (geothermal, wind, tidal, solar).
- The methods in each country depends on the available resources and the government.

# Economics and Politics of Energy Use



- Economic Growth and the availability of inexpensive energy are linked.
- Energy and Productivity linked
- Many countries subsidize energy

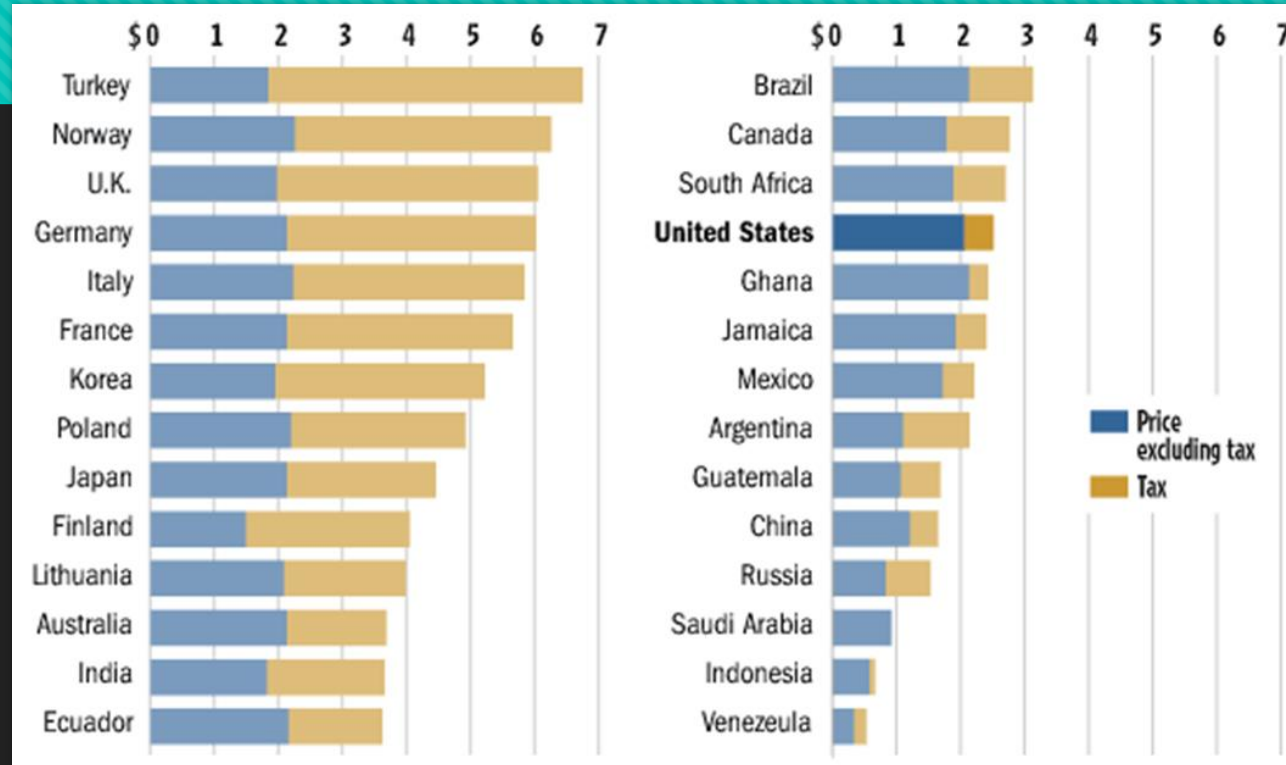
# Fuel taxes



- Many European countries generate money from taxes that covers all road repairs, the US only covers 50% from taxes.
- European countries tax carbon emission on cars and the US doesn't (Didn't sign the Kyoto Treaty).

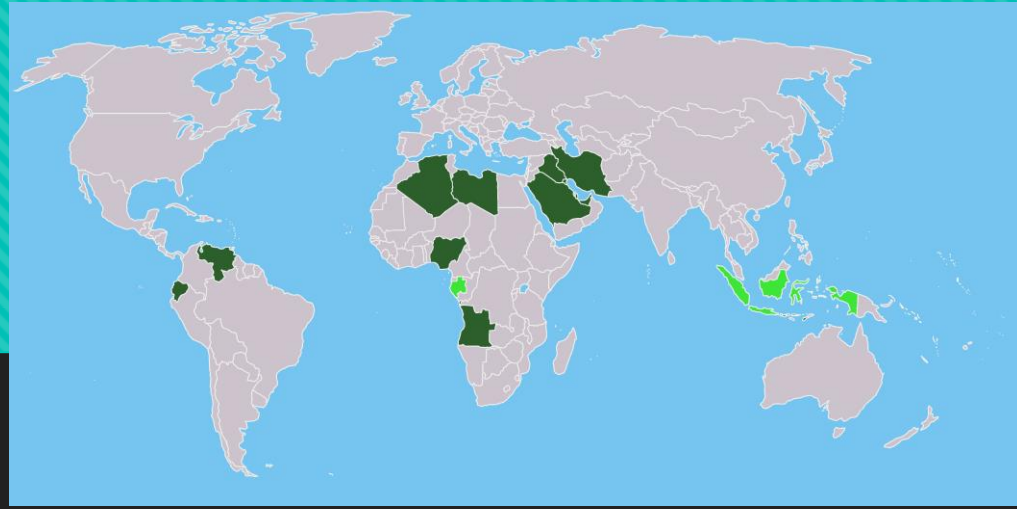


# Fuel Economy and Government Policy



The cost of gas is determined by the cost of purchasing and processing crude oil and taxes.

# OPEC



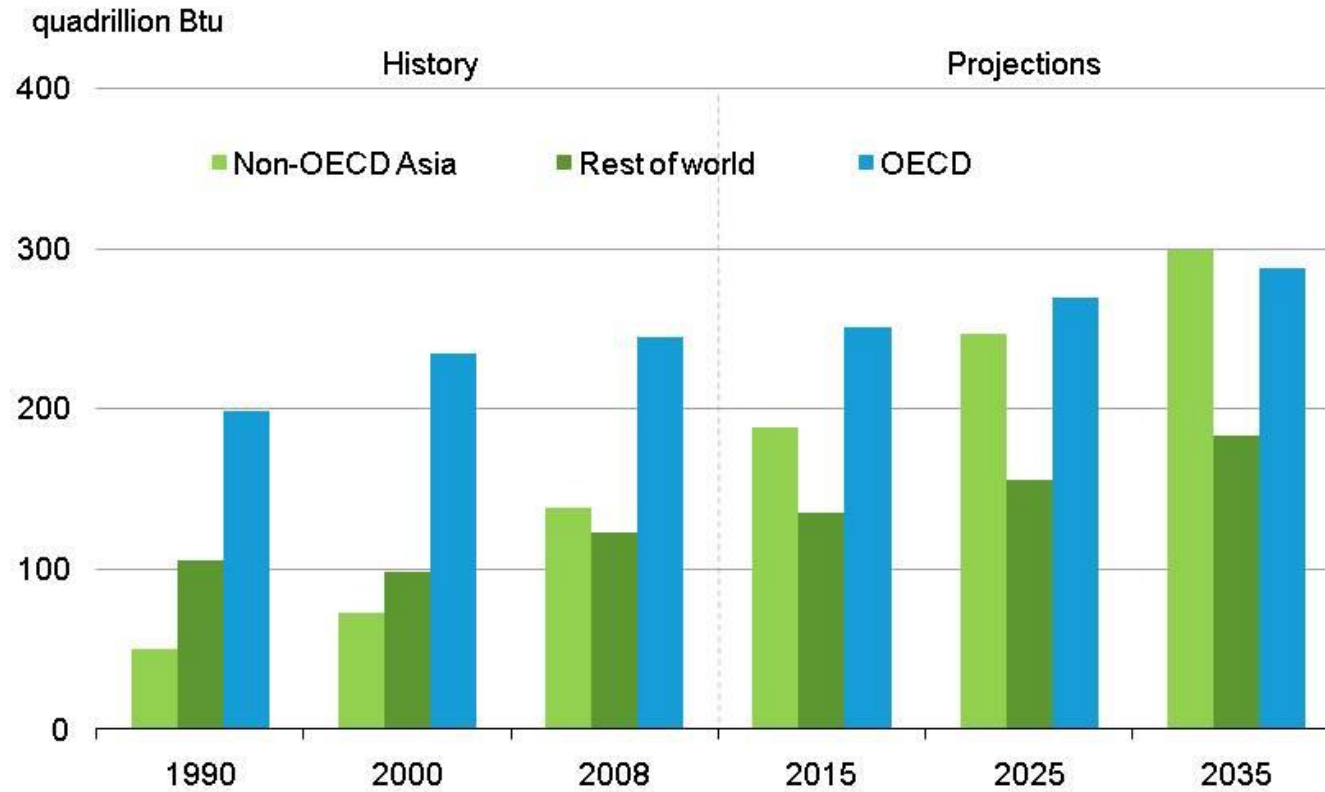
- Organization of Petroleum Exporting Countries (OPEC) – Cartel
- Saudi Arabia, Iraq, Kuwait, Venezuela and Iran = original 5 leaders of oil export
- Currently 13 countries in OPEC (Saudi Arabia, Kuwait, Libya, Algeria, Iraq, Qatar, United Arab Emirates, Iran, Indonesia, Nigeria, Ecuador, Angola, and Venezuela).
- Control 72% of oil reserves and oil prices.

# Energy Consumption Trends



- Nearly half of world energy consumption is by the 25 countries that are members of the Organization for Economic Cooperation and Development (OECD): Australia, New Zealand, Japan, Canada, Mexico, US, and European countries = Developed nations.

Figure 1. China and India account for about half of the world increase in energy use



Source: EIA, International Energy Outlook 2011

# Government Action and Energy Policy

- Governments use economic tools to encourage desired behaviors
  - Carbon tax: artificially raise the price of energy to get people to use less.
  - Gas taxes: Encourage consumers to change driving habits or car types.
  - Oil company subsidies: Encourage oil exploration or alternative energies.
  - Tax credits for energy efficiency in homes
  - Fuel economy standards for vehicles by given dates or get fined.



# Energy Conservation

## HOME

- Adjust thermostat to reduce use of heat and air conditioning
- Conserve water
- Use energy-efficient appliances
- Use conservation landscaping

## LARGE SCALE

- Improve fuel economy
- Use BEVs (Battery Electric Vehicles) and hybrids
- Use public transportation
- Use green building design features

# Bozeman Wrap-up

