

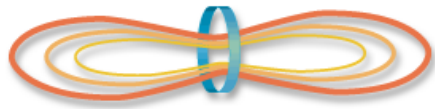
**Hydrogen**



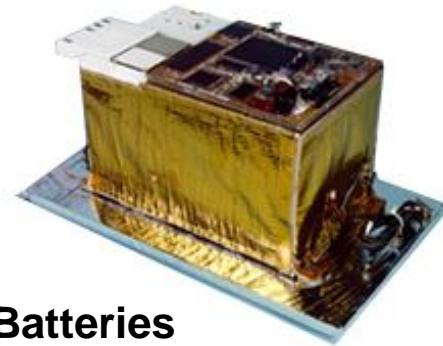
**Oil and Gas**



? ? ?



**Fusion**



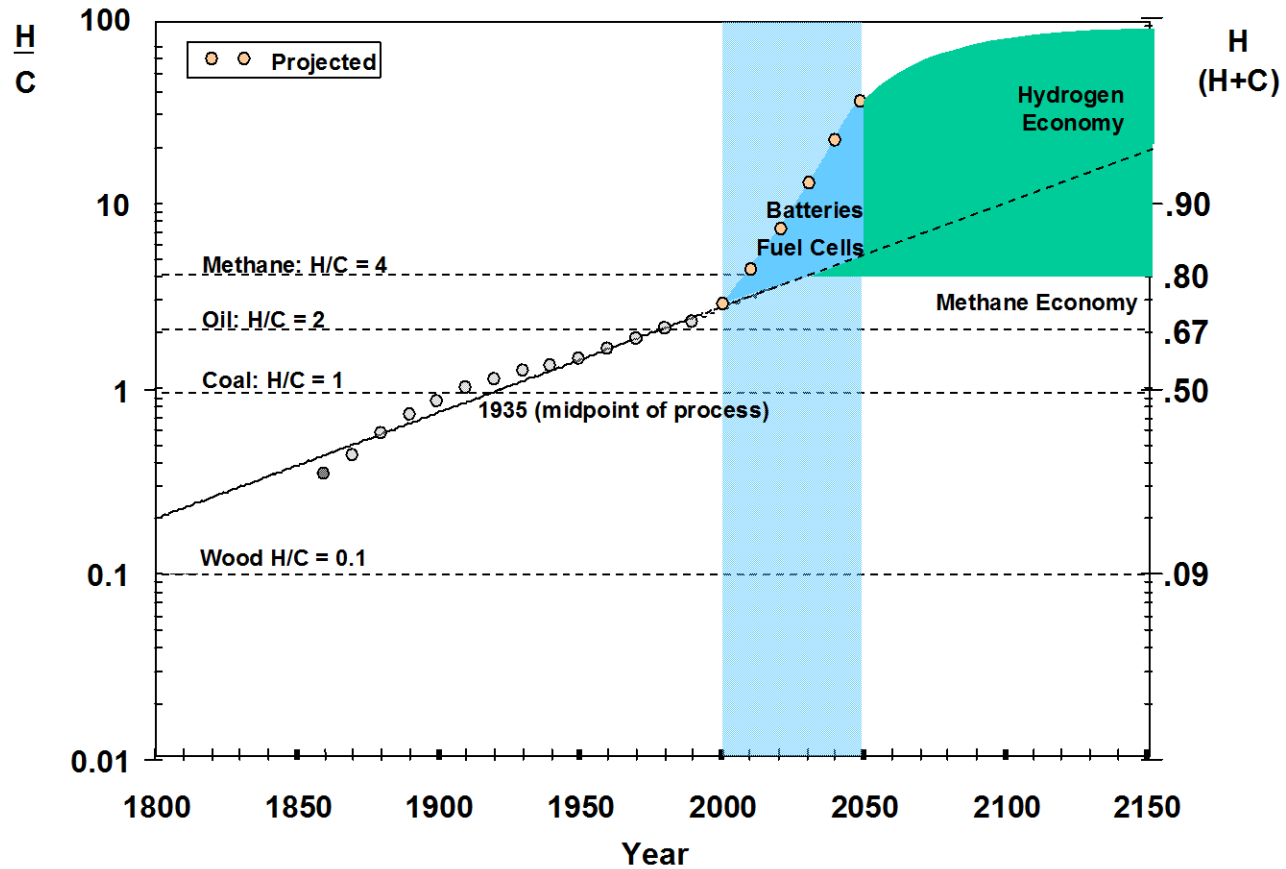
**Batteries**



**Solar**

# History of Energy

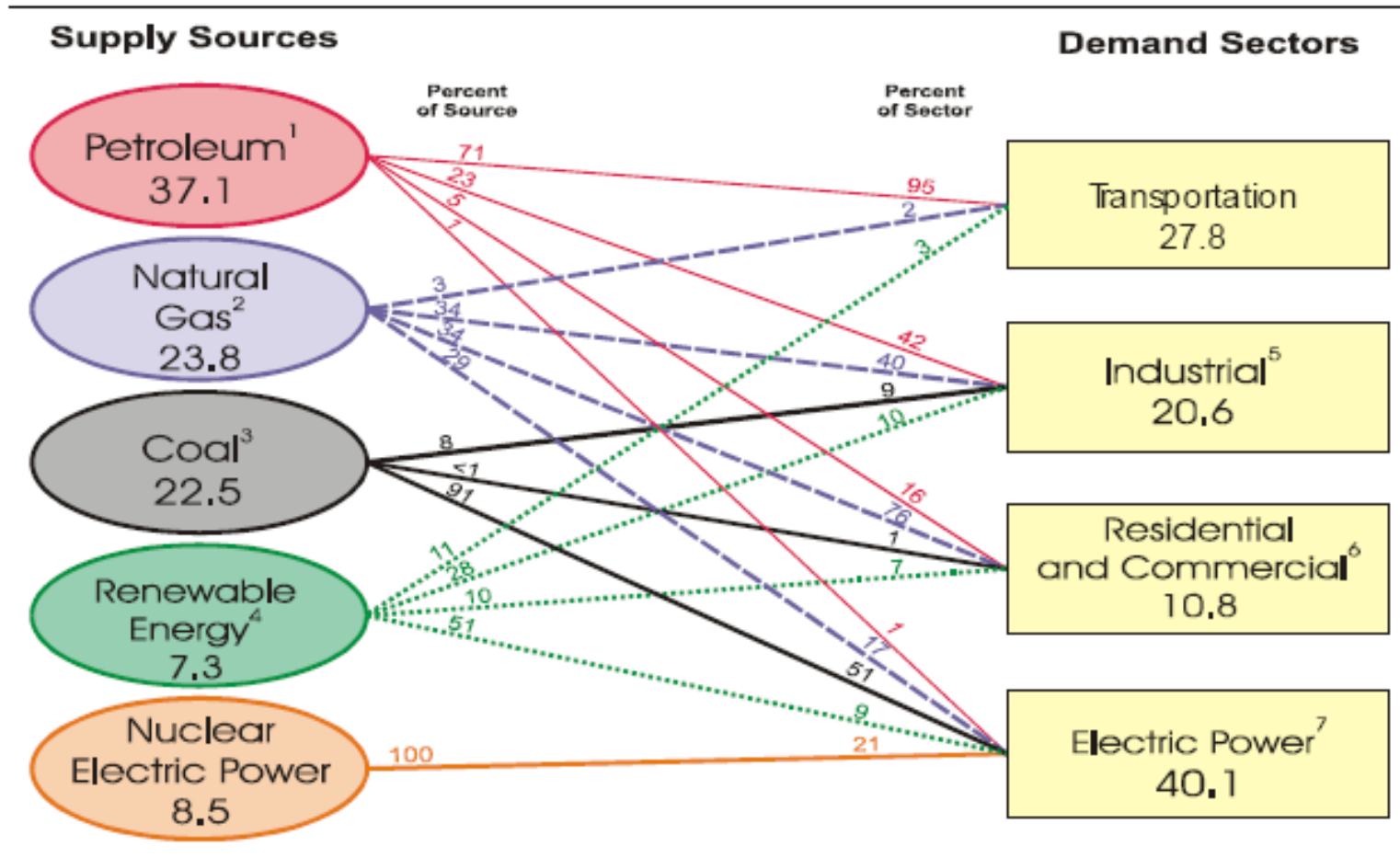
## Decarbonization



Source: Ausubel, *American Scientist*, March-April 1996

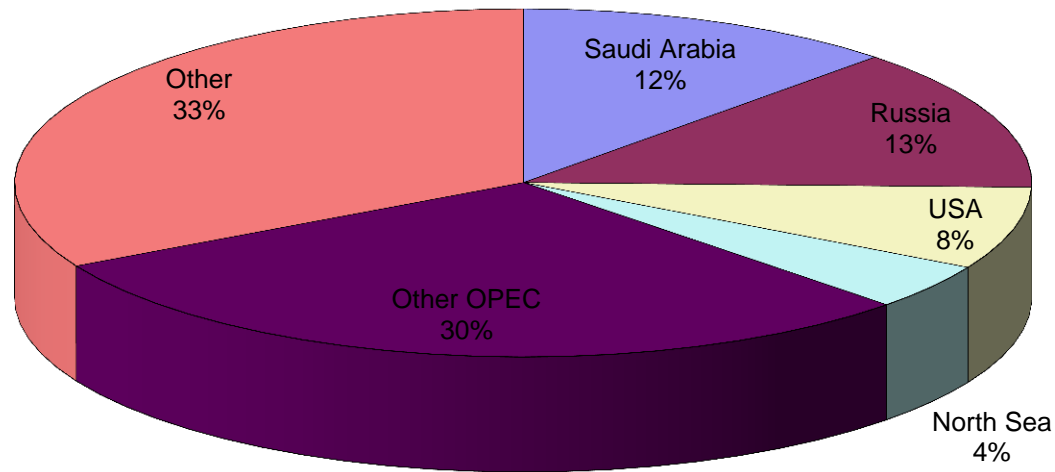
# Primary Energy Consumption by Source and Sector, 2009

(Quadrillion btu)



# Petroleum Facts

World wide oil production (as of March 2011)  
= 73.5 million bbl/day



# Petroleum Facts

## Top oil producing states:

2011 rank	Top oil producing states	mmbo/month (Apr 2011)	2010 rank
1	Texas	38.8	1
2	Alaska	18.2	2
3	California	16.2	3
4	North Dakota	10.5	5
5	Oklahoma	5.9	6
6	New Mexico	5.6	7
7	Louisiana	5.6	4
8	Wyoming	4.0	8

Federal Offshore 46.4  
 State offshore 3.6

2010 rank	Top Oil reserve states	mmbo (1/1/2010)	2009 rank
1	Texas	5006	1
2	Alaska	3566	2
3	California	2835	3
4	North Dakota	1046	6
5	New Mexico	700	4
6	Oklahoma	622	5
7	Wyoming	583	7
8	Louisiana	370	8

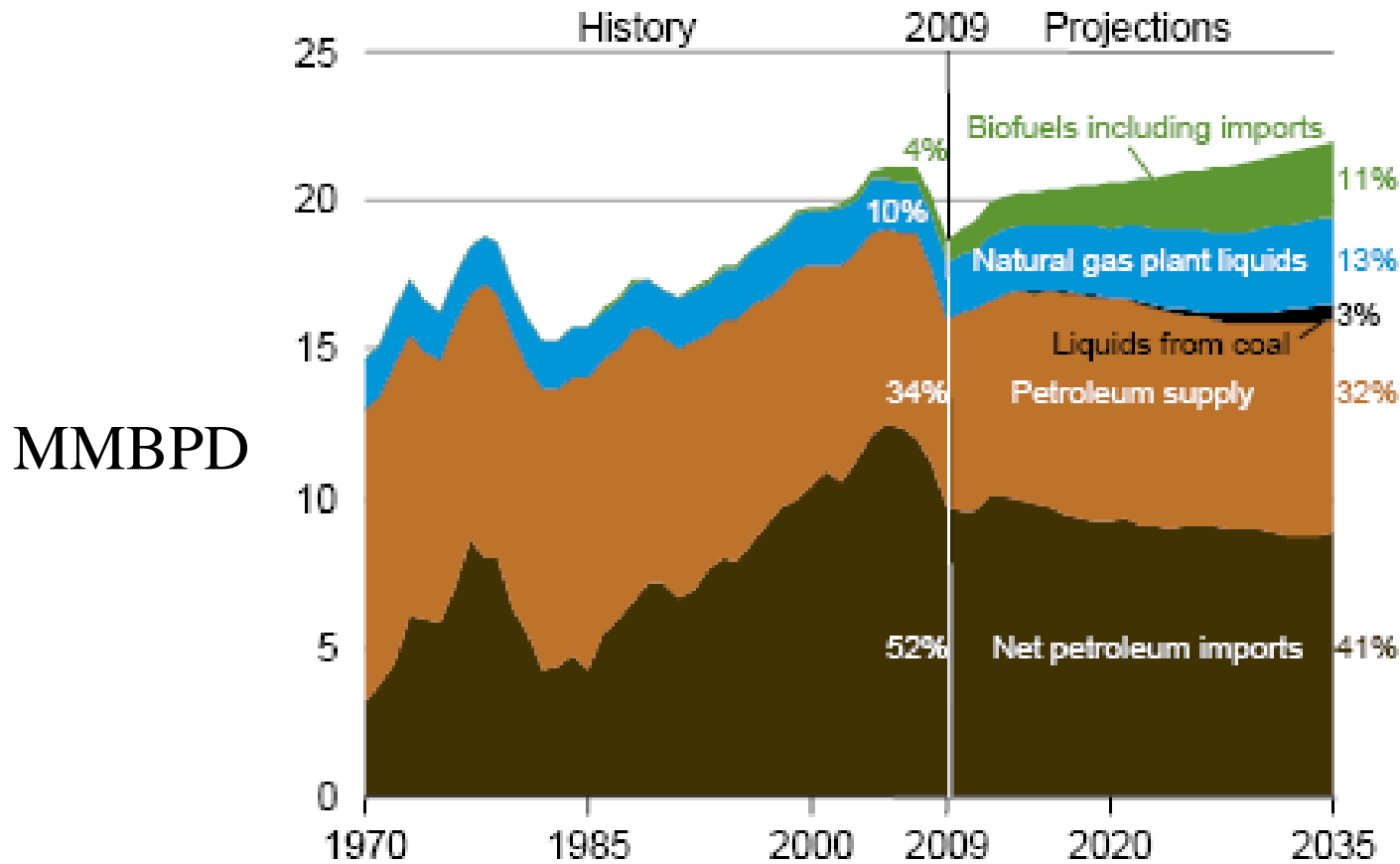
Federal offshore 4129

(Source: EIA)

## *Petroleum Facts (2010 averages)*

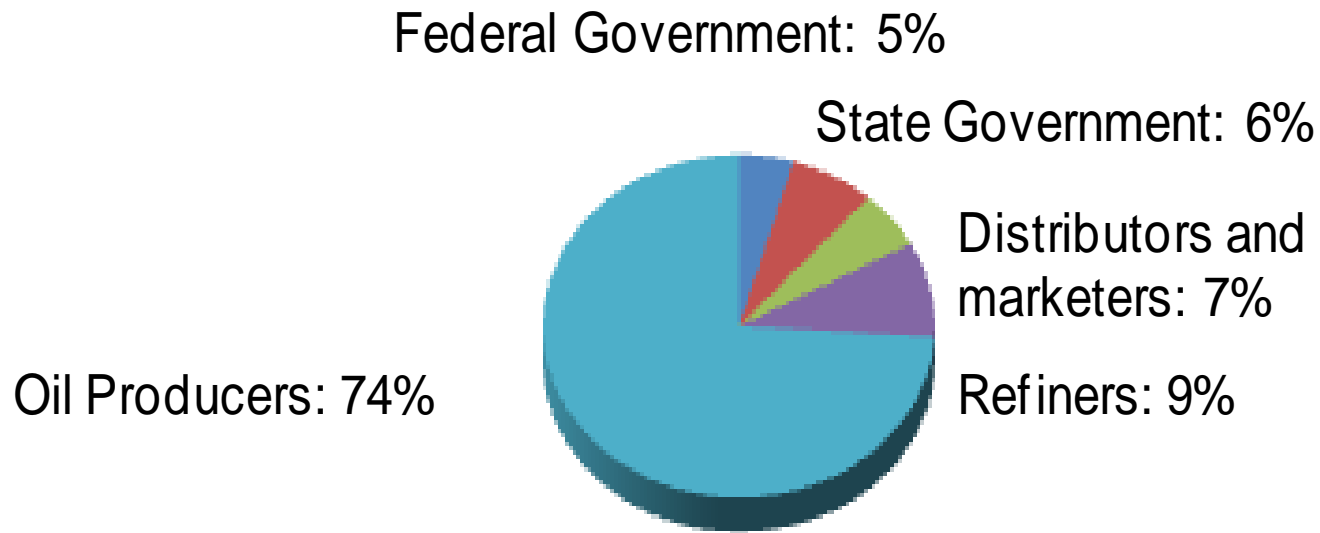
- U.S. demand is ~ 19.2 million bpd (26% of world supply)
- Gasoline is ~ 9 million bpd (47% of demand)
- Oil imports are ~ 11.8 million bpd (61 % of demand)
- Ethanol is ~ 867,000 bpd (10% of the gasoline demand)

# US liquids fuel consumption, 1970-2035



Source: EIA, AEO 2011

## *Price of a gasoline dollar*



*Source: U.S. D.O.E.*

## *Price*

*Comparative costs of a gallon of gasoline to other items*

\_\_\_\_\_ Gasoline (1 gal.)

\_\_\_\_\_ Perrier Bottled water(750 ml)

\_\_\_\_\_ Pompei (Extra Virgin)\_Olive oil (32 oz)

\_\_\_\_\_ Milk (1 gal.)

\_\_\_\_\_ Coca cola (2 liter)

\_\_\_\_\_ Visine Eye Drops (1 oz)

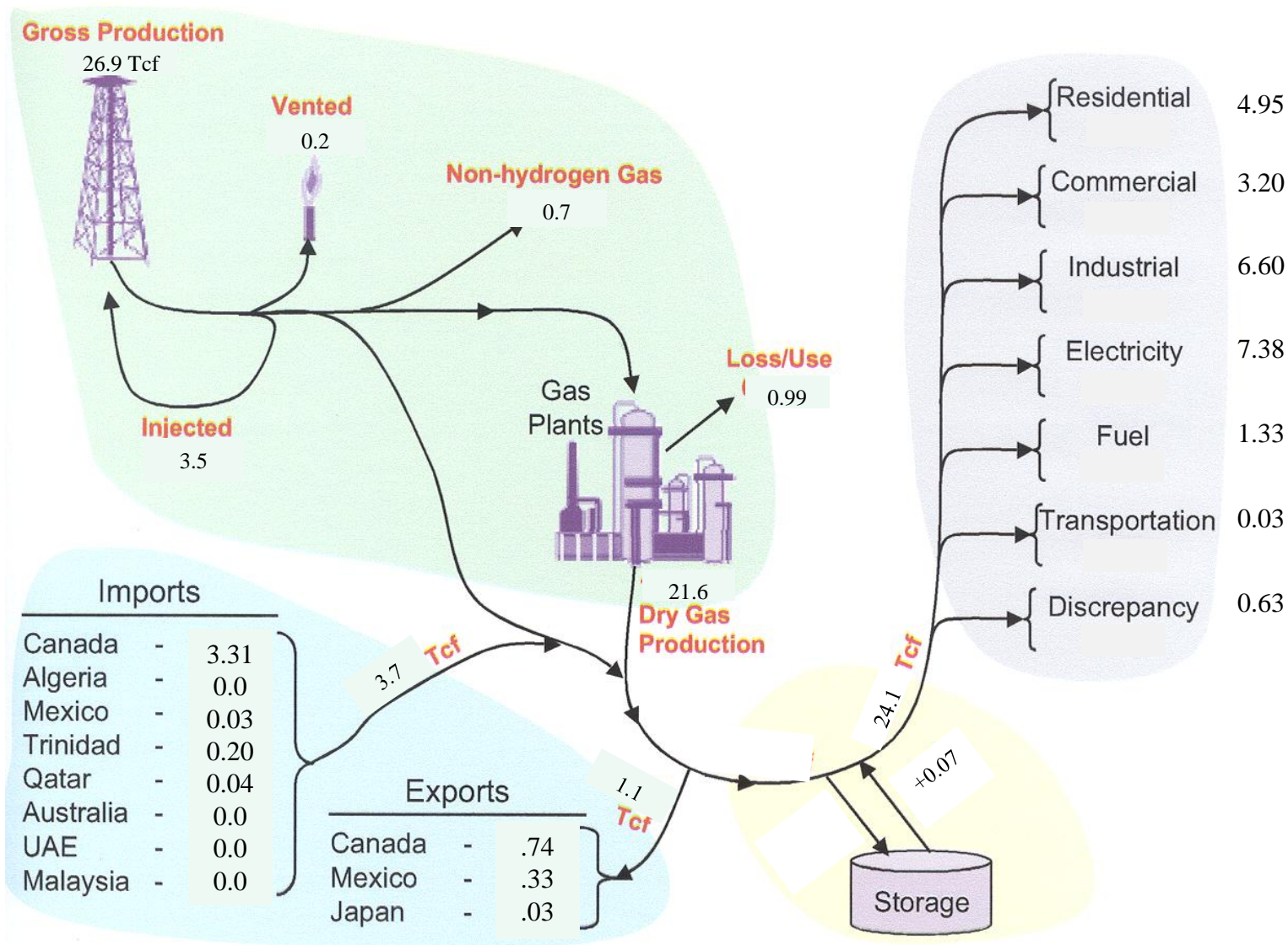
\_\_\_\_\_ Budweiser beer (12 pack-12 oz)

\_\_\_\_\_ Jack Daniels (750 ml)

\_\_\_\_\_ Listerine (1.5 liters)

\_\_\_\_\_ Afrin (0.5 oz)

# Natural Gas (2010)



Source: EIA

# Top gas producing states?

2009 rank	Top gas producing states	Bscf/month 2009 ave	2008 rank
1	Texas	638	1
2	Wyoming	211	2
3	Oklahoma	155	3
4	Louisiana	130	5
5	Colorado	126	6
6	New Mexico	119	4

Federal Offshore

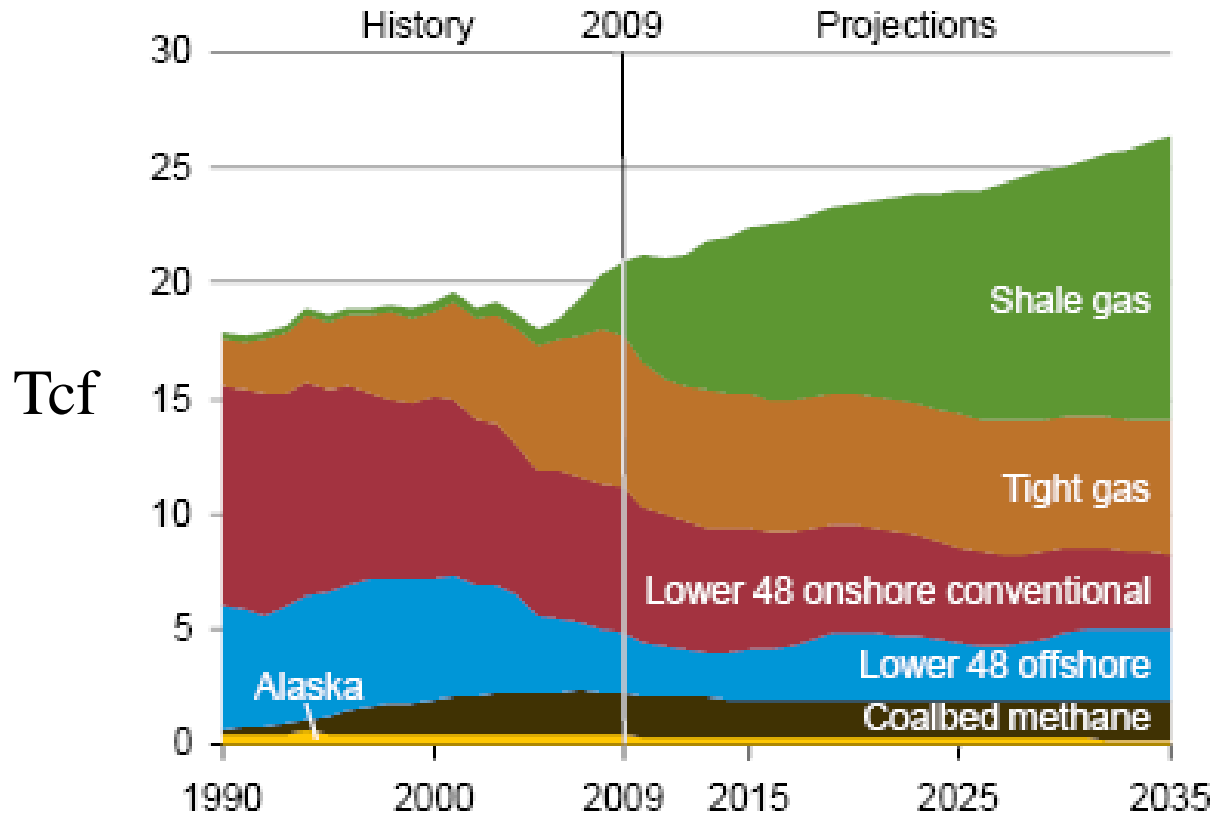
207

2009 rank	Top gas reserve states	Tscf 1/1/2010	2008 rank
1	Texas	278.7	1
2	Wyoming	111.1	2
3	Colorado	78.6	3
4	Oklahoma	77.9	4
5	Louisiana	71.9	6
6	New Mexico	52.6	5

Federal offshore

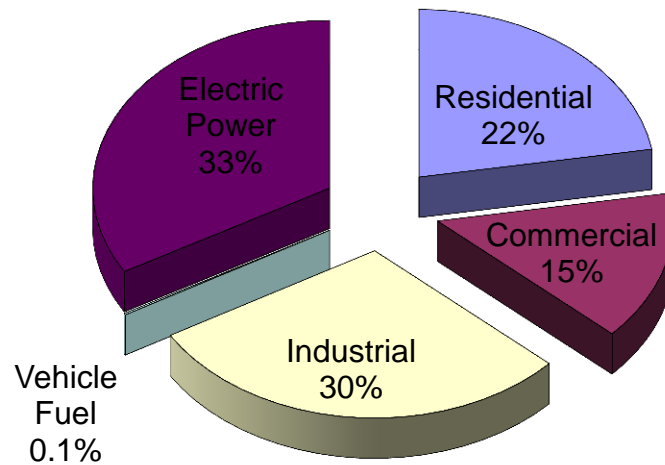
38.3

# US Natural Gas Production by source, 1990-2035



Source: EIA, AEO 2011

# Annual Natural Gas Consumption



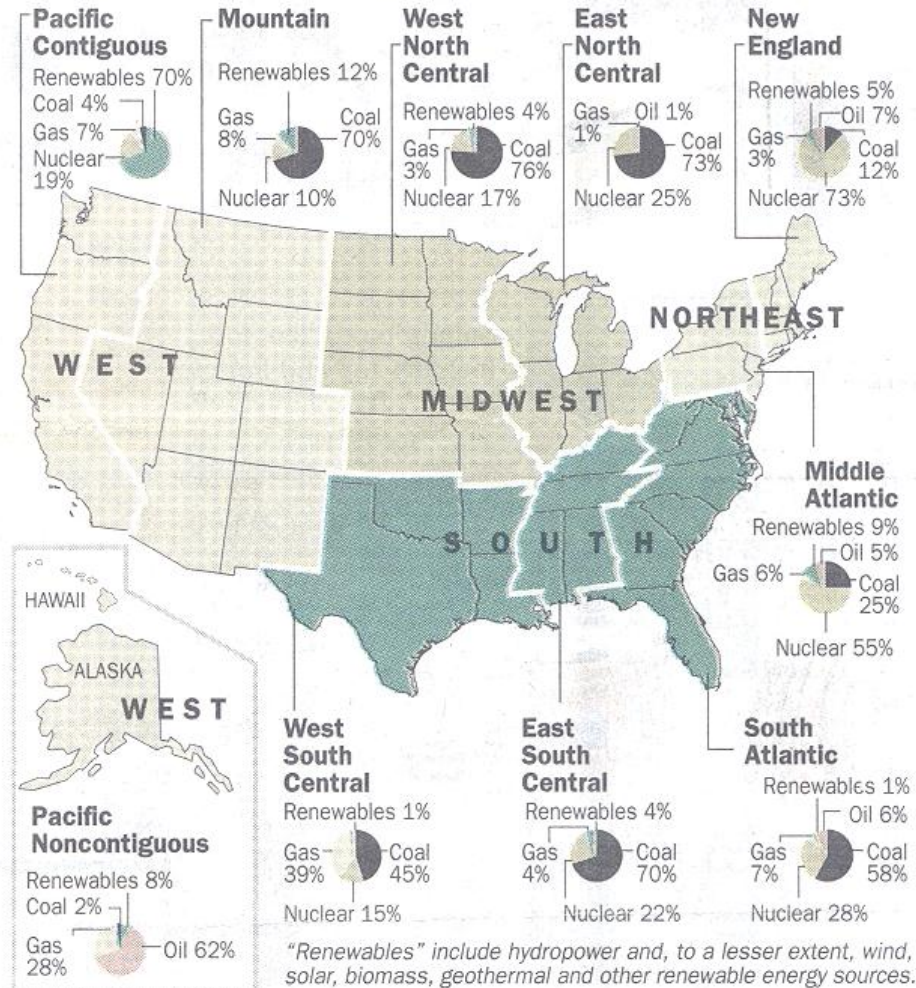
***Year 2010 – 22 Tcf***

# Energy Needs

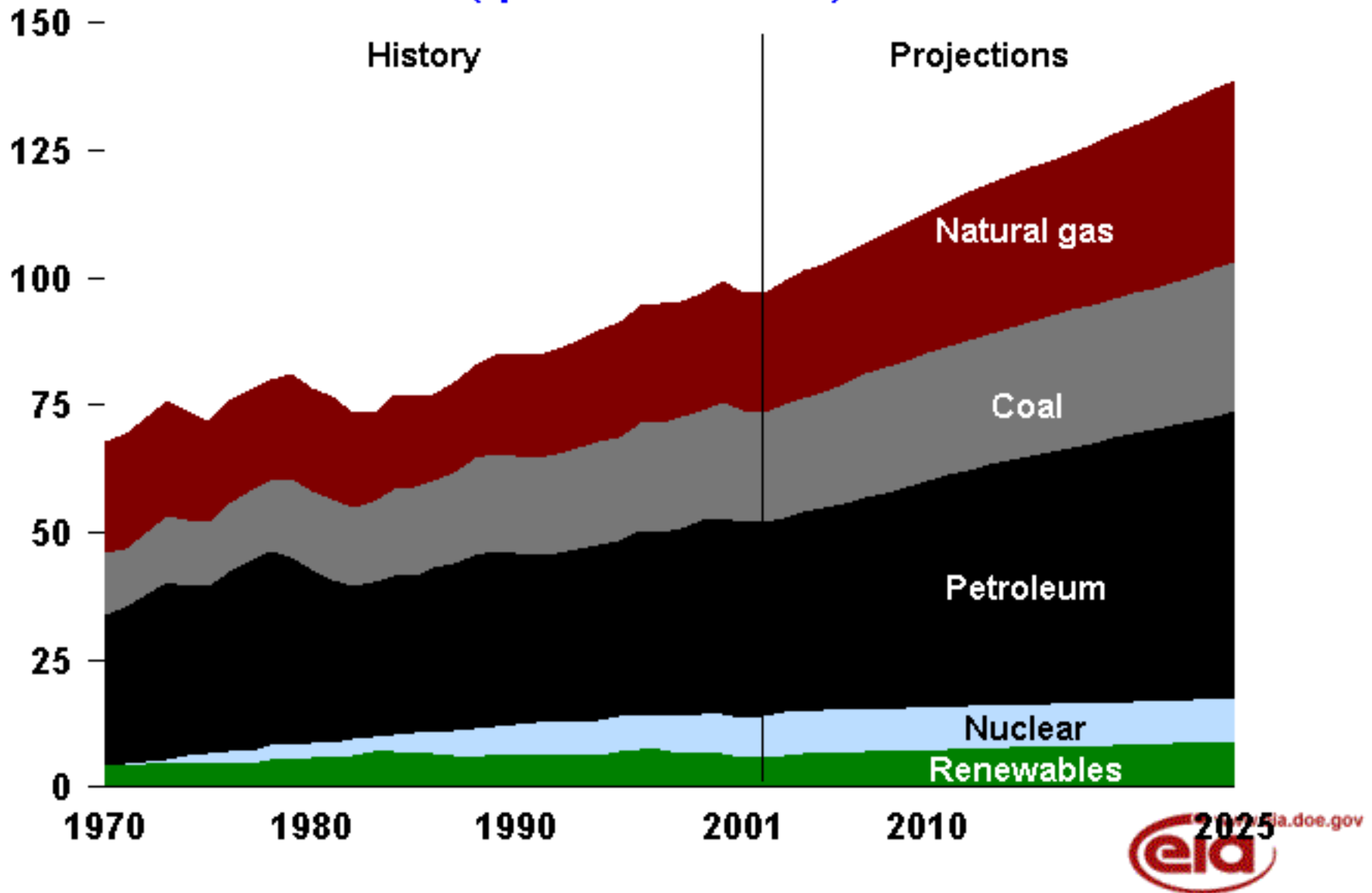
## REGIONAL RECIPES FOR ELECTRICITY GENERATION

Using a diversity of fuels, such as coal, nuclear and wind, to generate electricity may be the solution to keeping the cost of electricity down in the event of a price spike in one type of fuel.

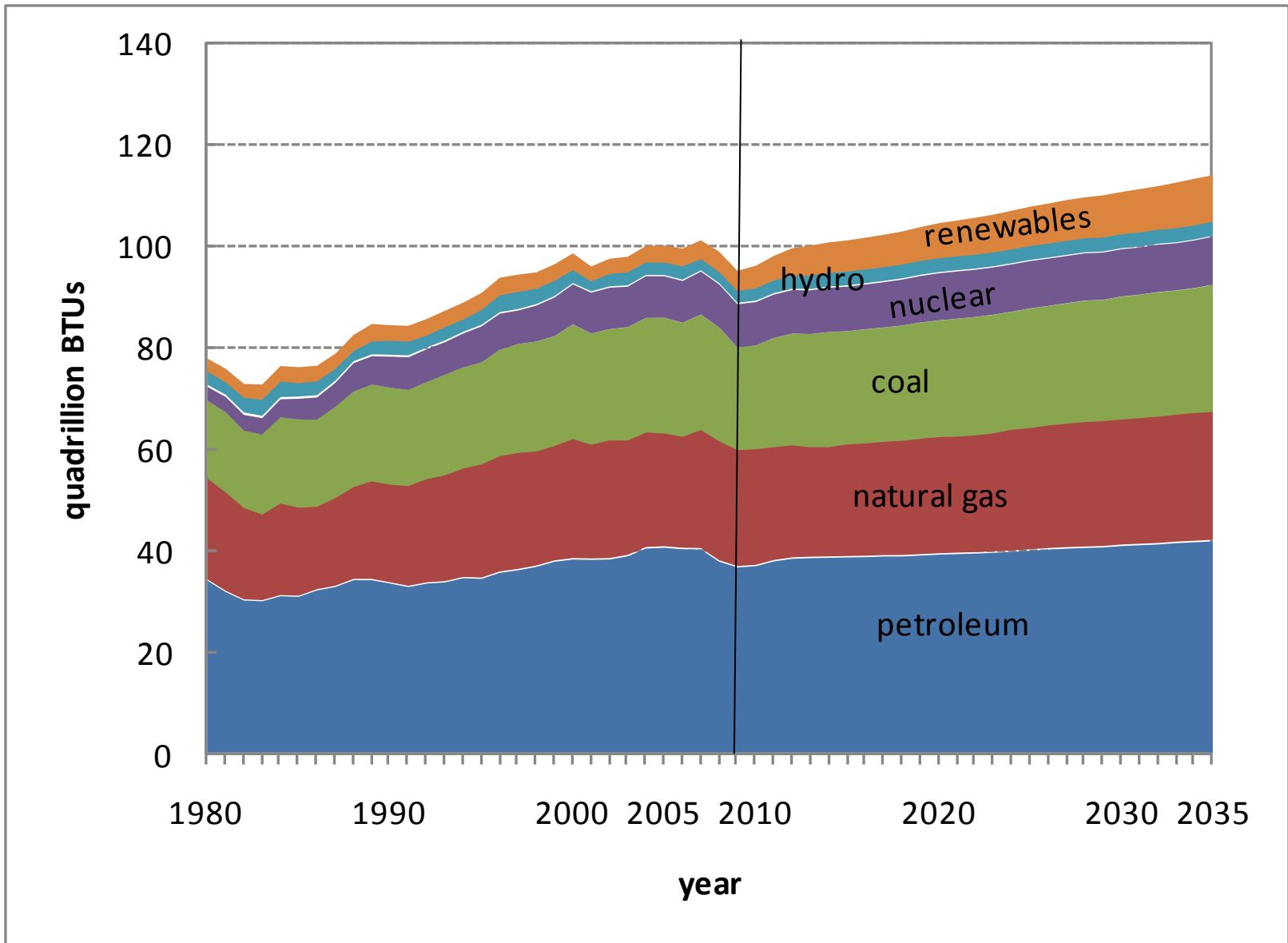
### Current combinations, by region



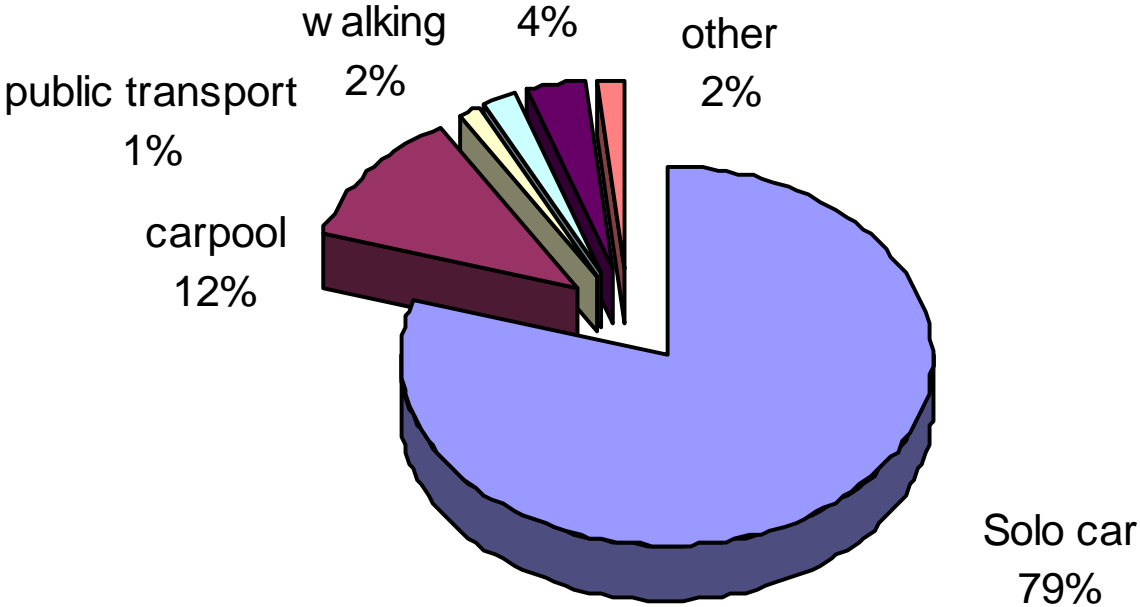
# U.S. Energy Consumption by Fuel, 1970-2025 (quadrillion Btu)



# U.S. Energy Consumption by Fuel (1980 – 2035)



# Conservation & Efficiency



Drivers not changing habits

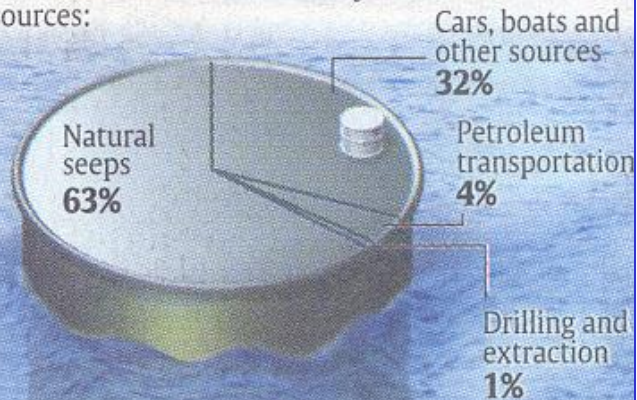
ABQ J 6/24/08

Data from Census Bureau

# Environmental Concerns

## Slippery seas

Despite industry reforms after the Exxon Valdez oil spill in 1989, 29 million gallons of petroleum wash into North American waters each year. The sources:



Source:  
National  
Academy  
of Sciences



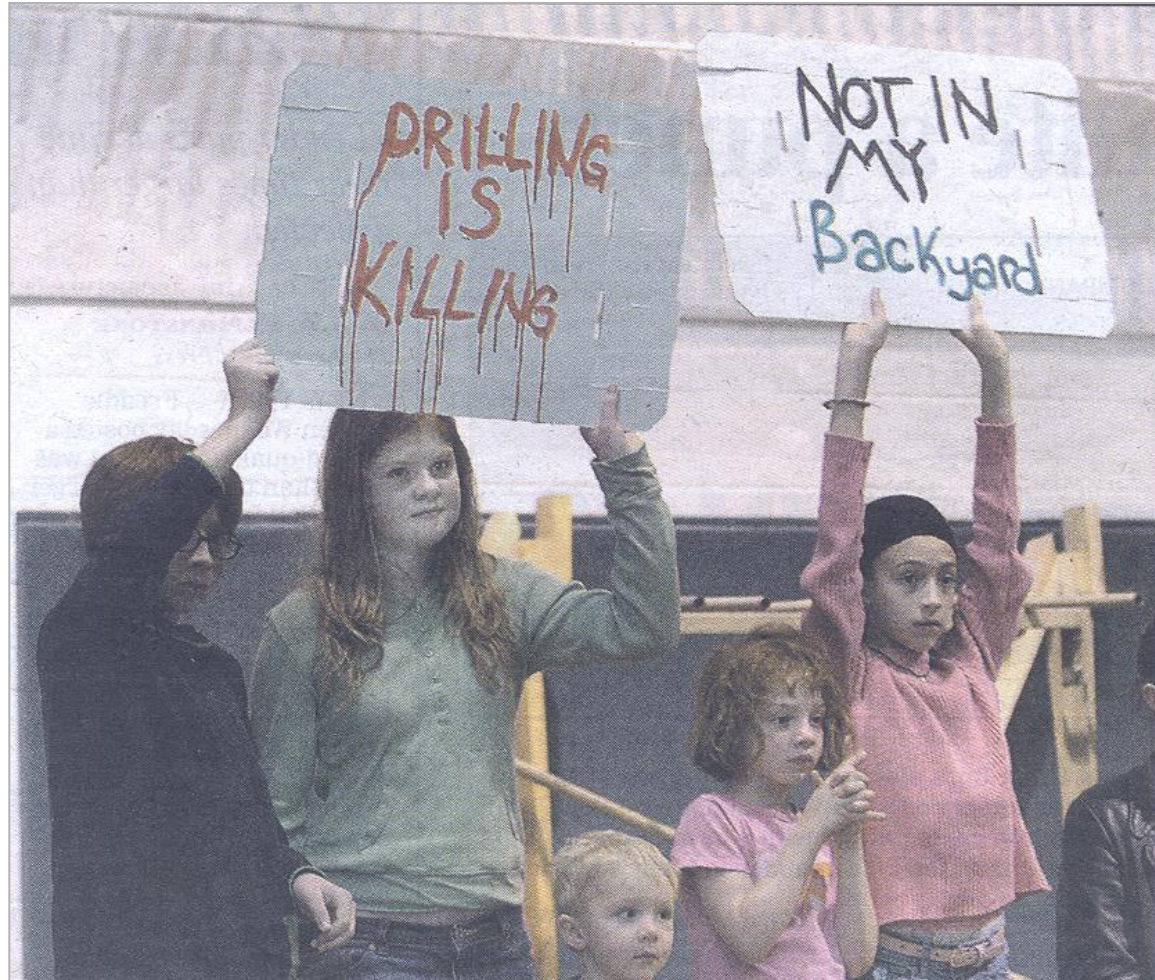
**Oil stains the earth with its dark substance Monday on County Road 5030 north of Bloomfield.** — Donovan Quintero/The San Juan Sun

## Public perception

# BIG OIL

Who is BIG OIL?

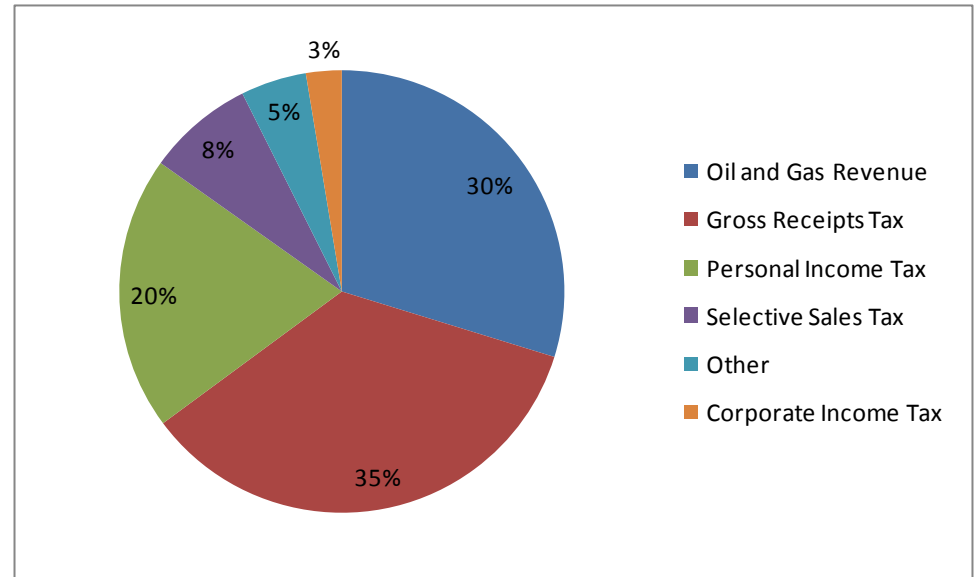
# Public perception



(Business Outlook, ABQ journal, 8/7/2008)

# What this industry means to the State of New Mexico

State Revenue General Fund Source, FY 2010*		
Source	\$ billion	Percent
Oil and Gas Revenue	1.428	30%
Gross Receipts Tax	1.685	35%
Personal Income Tax	0.957	20%
Selective Sales Tax	0.373	8%
Other	0.230	5%
Corporate Income Tax	0.125	3%
<b>Total NM General Fund</b>	<b>4.798</b>	



\* estimates, from NMLFC

Plus...

# What this industry means to the State of New Mexico

## Land Grant Permanent Fund

- \$9.55 billion balance as of Sept 2010
- Paid out \$566 million to 21 public entities
- Oil and natural gas make up 95% of the revenue into this fund

## Severance Tax Permanent Fund

- \$3.6 billion balance as of Sept 2010
- Paid out \$322 million for state construction projects
- Oil and natural gas makes up 99%...

Plus...

# What this industry means to the State of New Mexico

- Industry provides more than 13,000 **direct** jobs  
with salaries almost **twice** the state average.

# Renewable Energy

- wind
- solar
- water
- biomass

## BIZFACTS

### Energy Trends

Annual rate of growth worldwide for different types of energy, 1990-98:

Wind power

22%

Solar

16%

Geothermal

4%

Hydroelectric

2%

Oil

2%

Natural gas

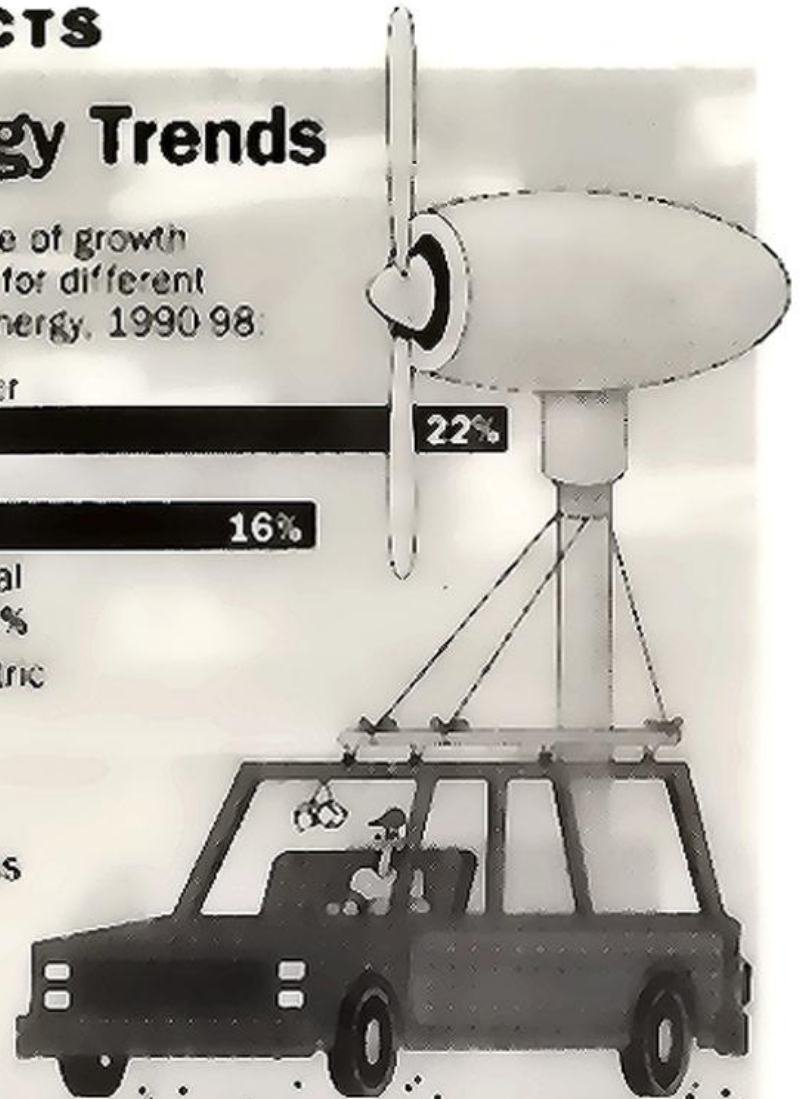
2%

Nuclear

1%

Coal

0%



SOURCE: Worldwatch Institute

Research: CAT CARB, Graphic: PAUL TRAP/WJET

# *What is the future of petroleum engineering?*

- *"When 2100 rolls around....oil and gas will play a major role in the energy demands of the world."*
- Predictions based on:
  - ecologically driven future
  - advanced technological improvements
  - economic growth
- Percent of energy needs contributed by oil and gas,

1990	53%
2050	41 to 51 %
- Amount of oil and gas to meet energy needs,

1990	4.7 Gtoe
2050	6.0 to 12.5 Gtoe

## *What is needed?*

### Technological advances in:

- renewable energy sources
- hydrogen fuel cells
- oil and natural gas development

## *What can we do?*

To maintain this supply of oil and natural gas requires the following:

- Improving efficiency.
- Reducing uncertainty.
- Environmental responsibility.
- Participating in global technological advances

Advances in technology and creativity will continue this trend of success. My objective is to meet these needs by providing creative, bright petroleum engineers to apply or develop advanced technology in the oil and gas industry.