

Alternative Energy And Fuels

by Eric Coffin P.E.



Thank You

- **John Ellington**
- **Nicole Seifert**
- **Bob Andrews**
- **Francine Neuman**



Thank You

Florida Institute of Phosphate Research

- Gary Albarelli**
- Karen Stewart**
- Malysavanh Birdy**



Thank You

- **Terry Tarte**
- **George Mcquien**
- **Mark Thompson**



Thank You

- **Paul Waters**
- **Elton Curran**
- **Bruce Wiggins**
- **Deana Cochran**



Alternative Energy And **Fuels**



"There is no single silver bullet
for our energy situation,
however, there are 100 brass
bullets and we just need to find
the right match."

-Prof Sam Shelton, Georgia Tech



No Single Silver Bullet

- Georgia
- California
- Florida
- Wisconsin







No Single Silver Bullet

Electricity – from

Coal - 51%

Nuclear - 21%

Natural gas - 17%

Renewable (Hydro) - 9%

Domestic & Foreign Oil - 1%



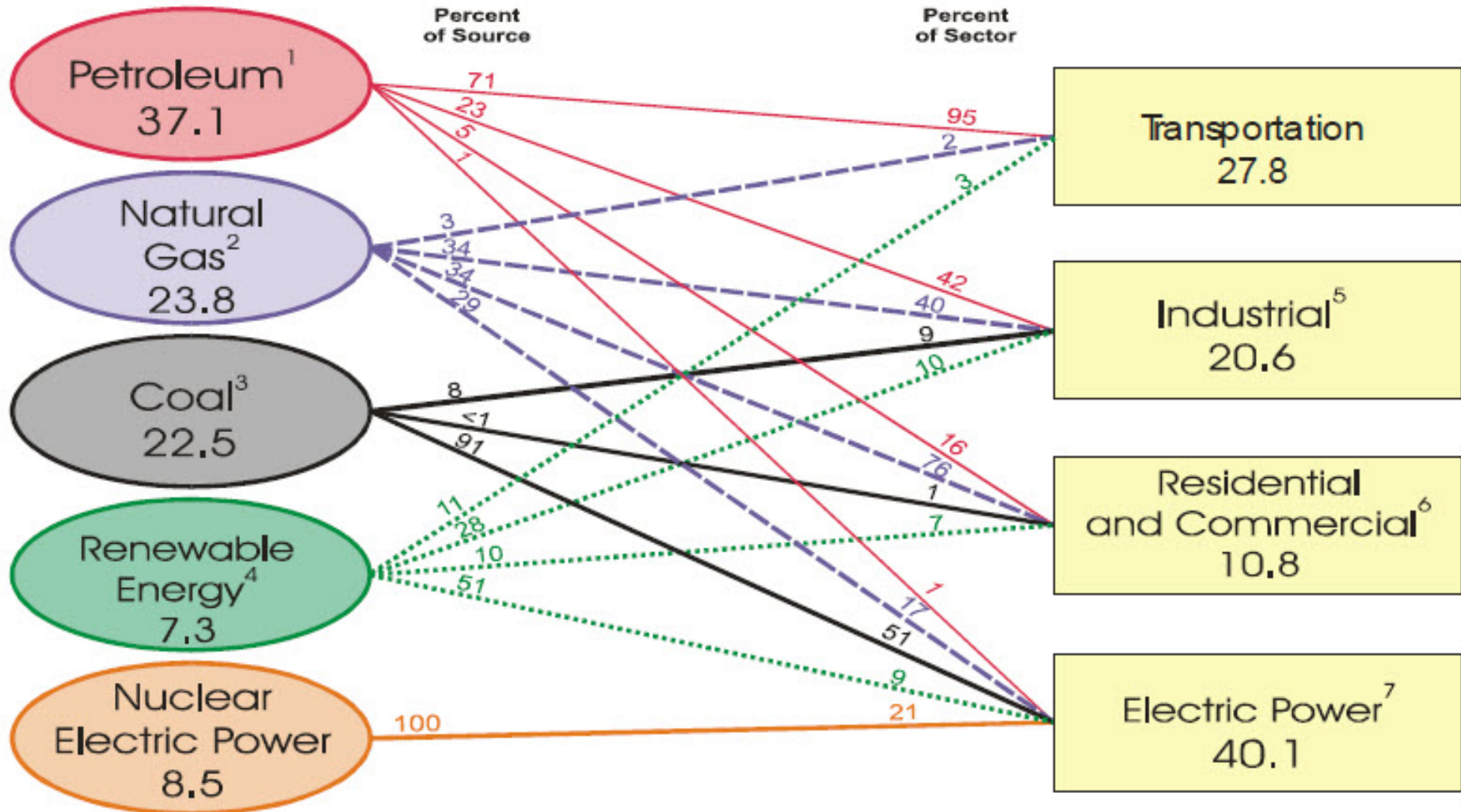
No Single Silver Bullet

- Electricity
- Gasoline
- Diesel Fuel
- Kerosene
- Natural Gas
- Wood



Supply Sources

Demand Sectors



Tampa Electric Company

Revenue From
Electric Operations

\$2,163,200,000

\$947,400,000

44%





Big Bend Unit 4

1985

400 MW

\$575,000,000

\$1,400 per kW



Heat Rate 10,000 BTU/kWh

Availability of 85%

Load Factor 60%

Coal at \$2.00 per MM BTU

\$36,000,000



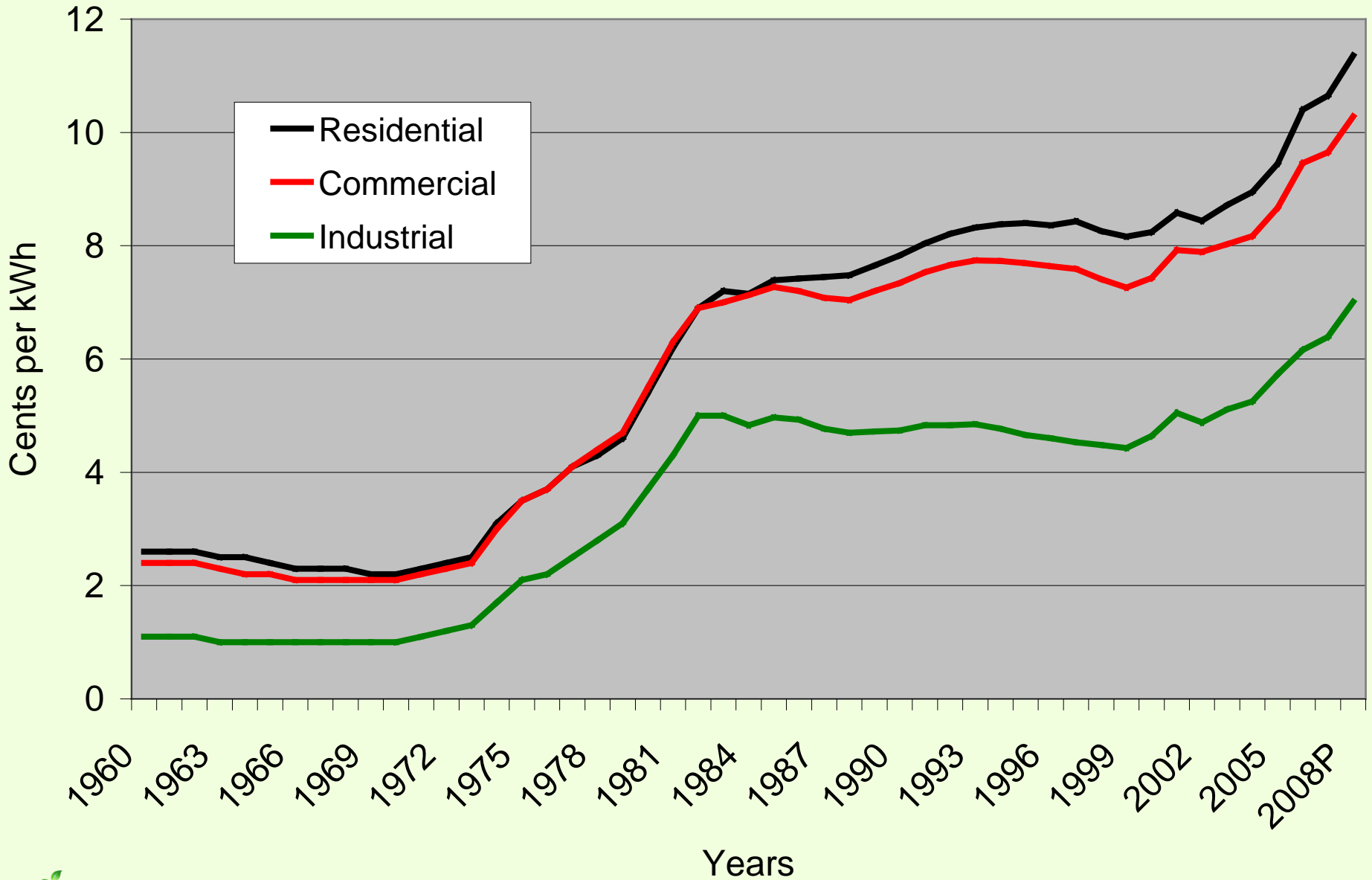
$$\$36\text{M}/575\text{M} = 6\%$$

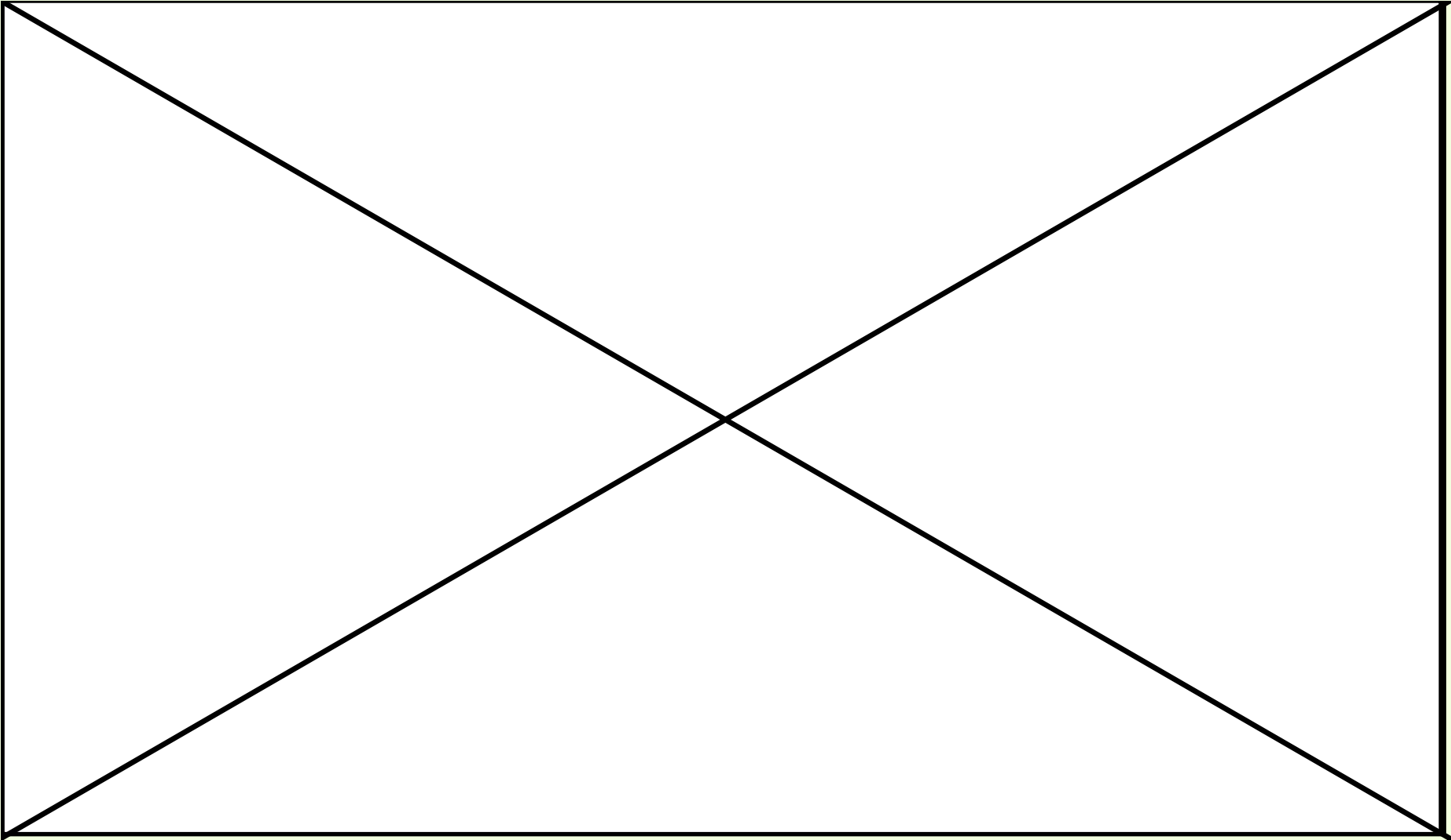
Depreciation over 40 years

$$\$36\text{M}/\$14\text{M} = 248\%$$

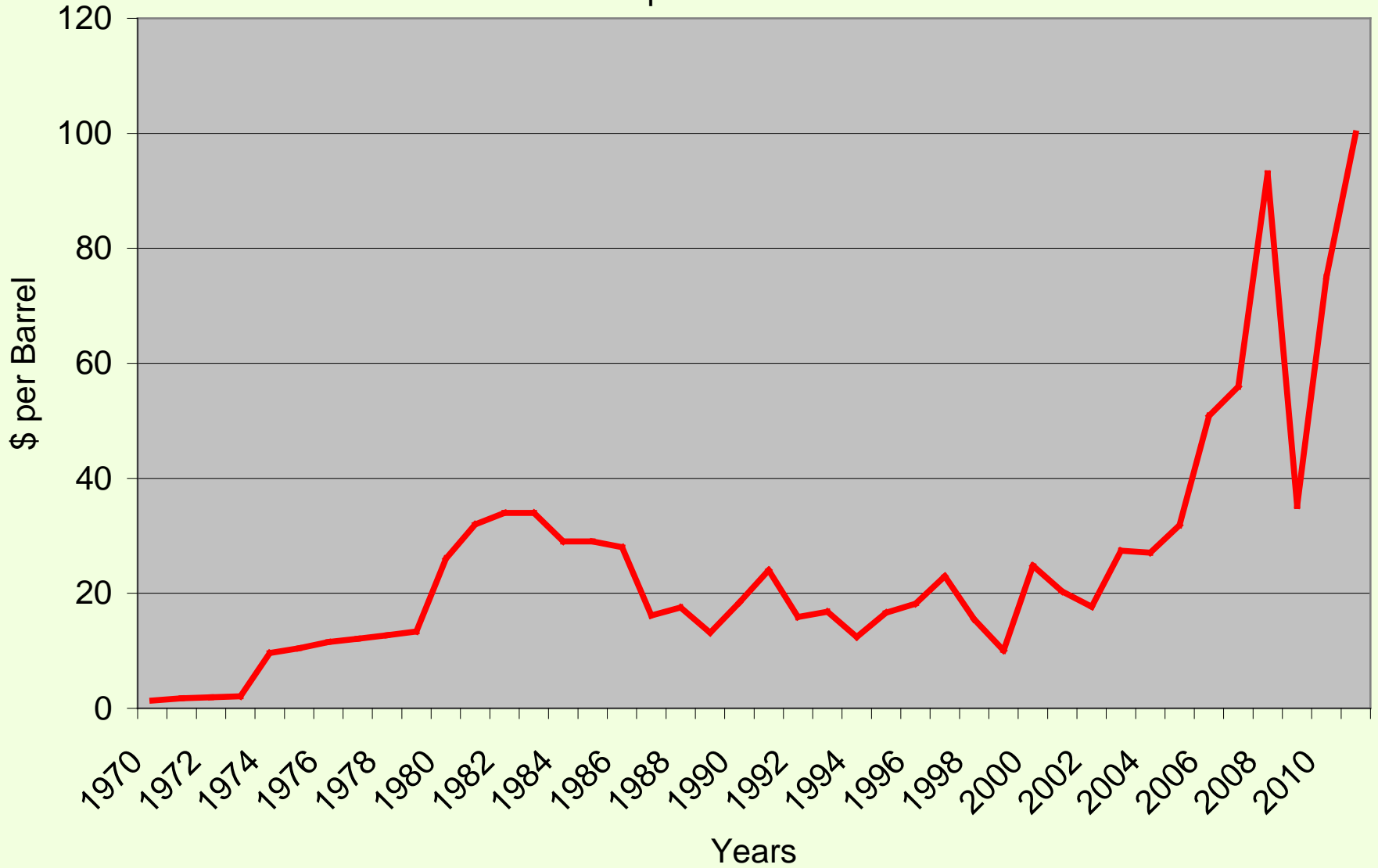


Electricity Prices over Time in Cents per kWh

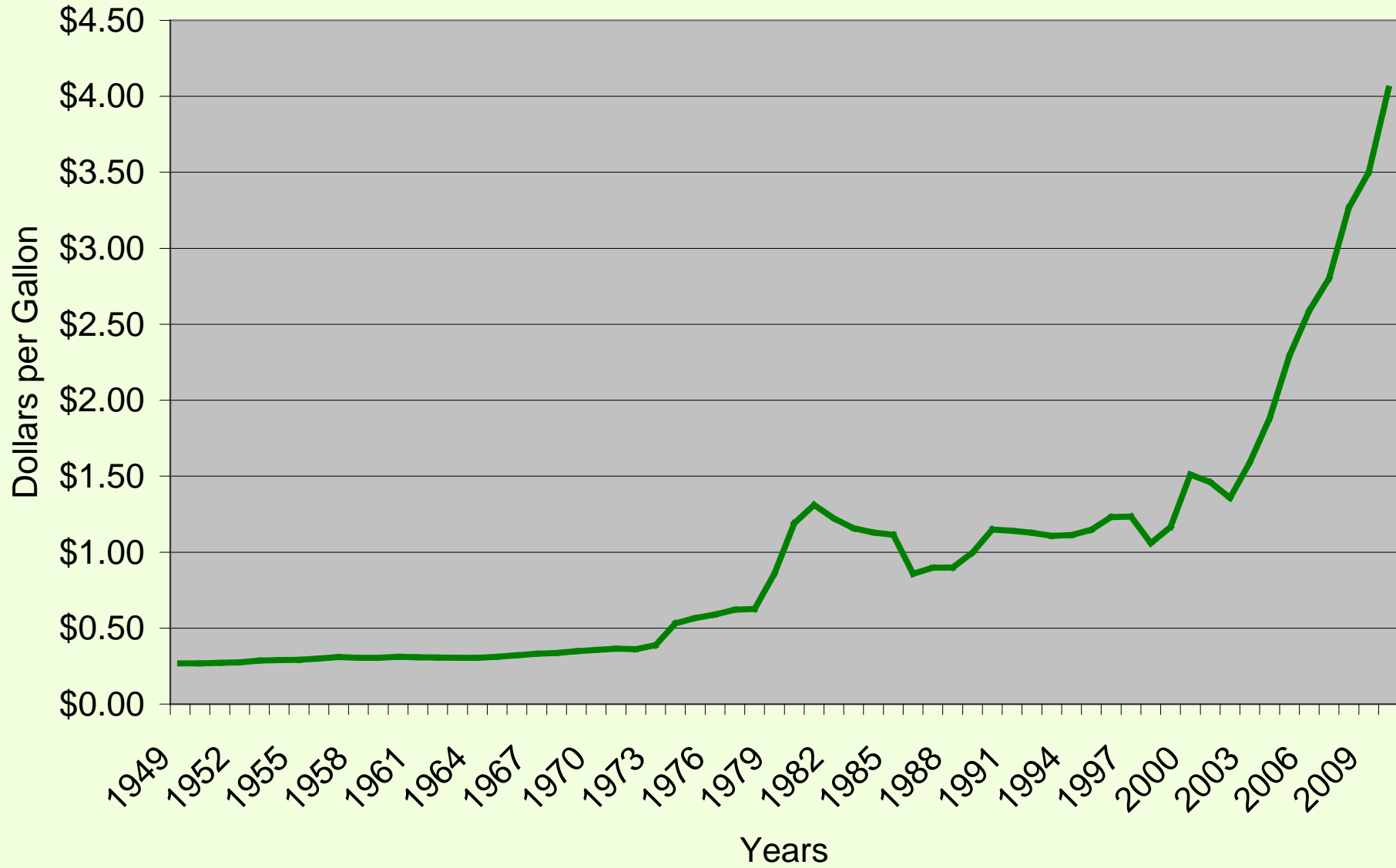




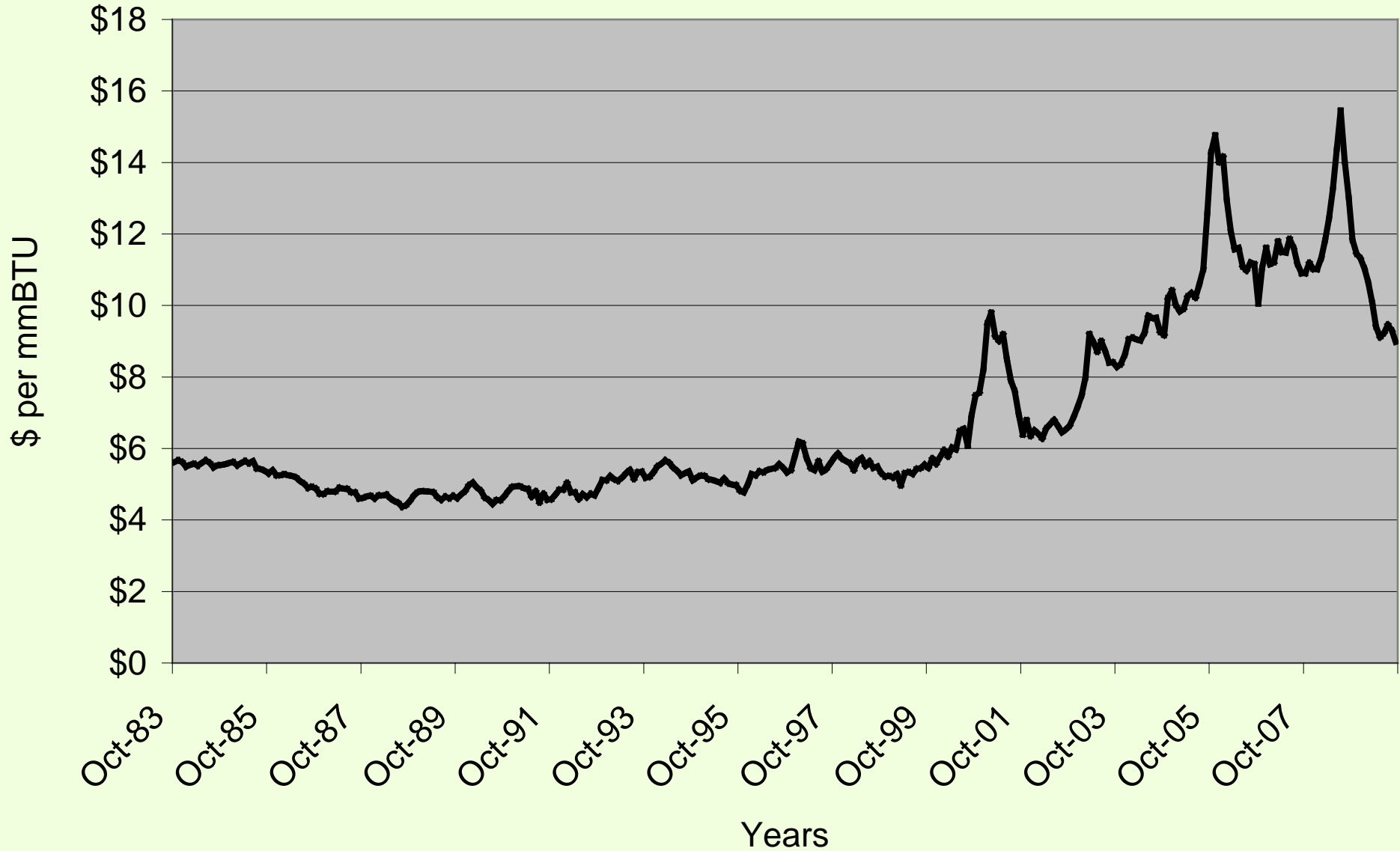
Crude Oil Price per Barrel over Time



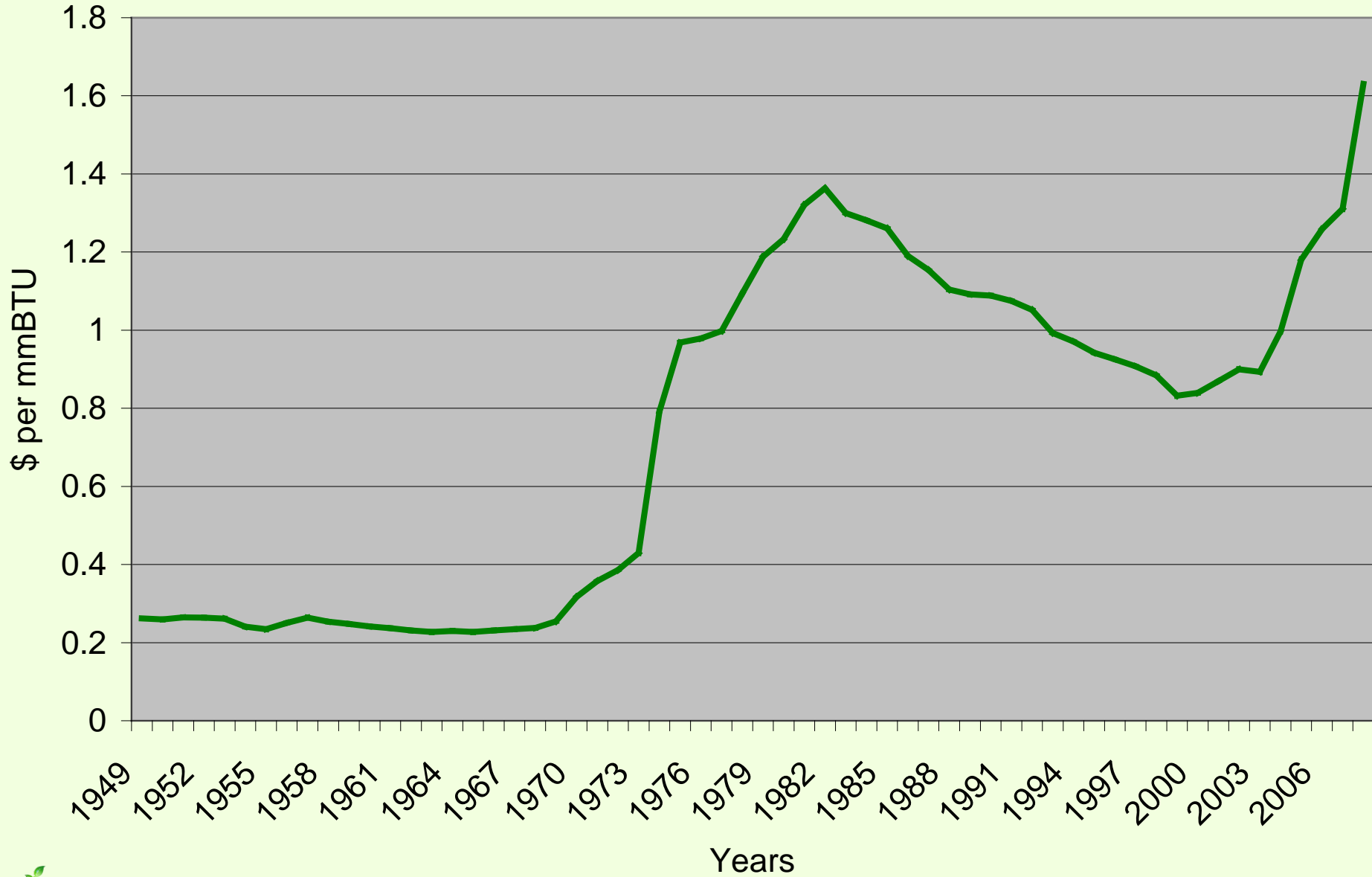
Gasoline Price over Time

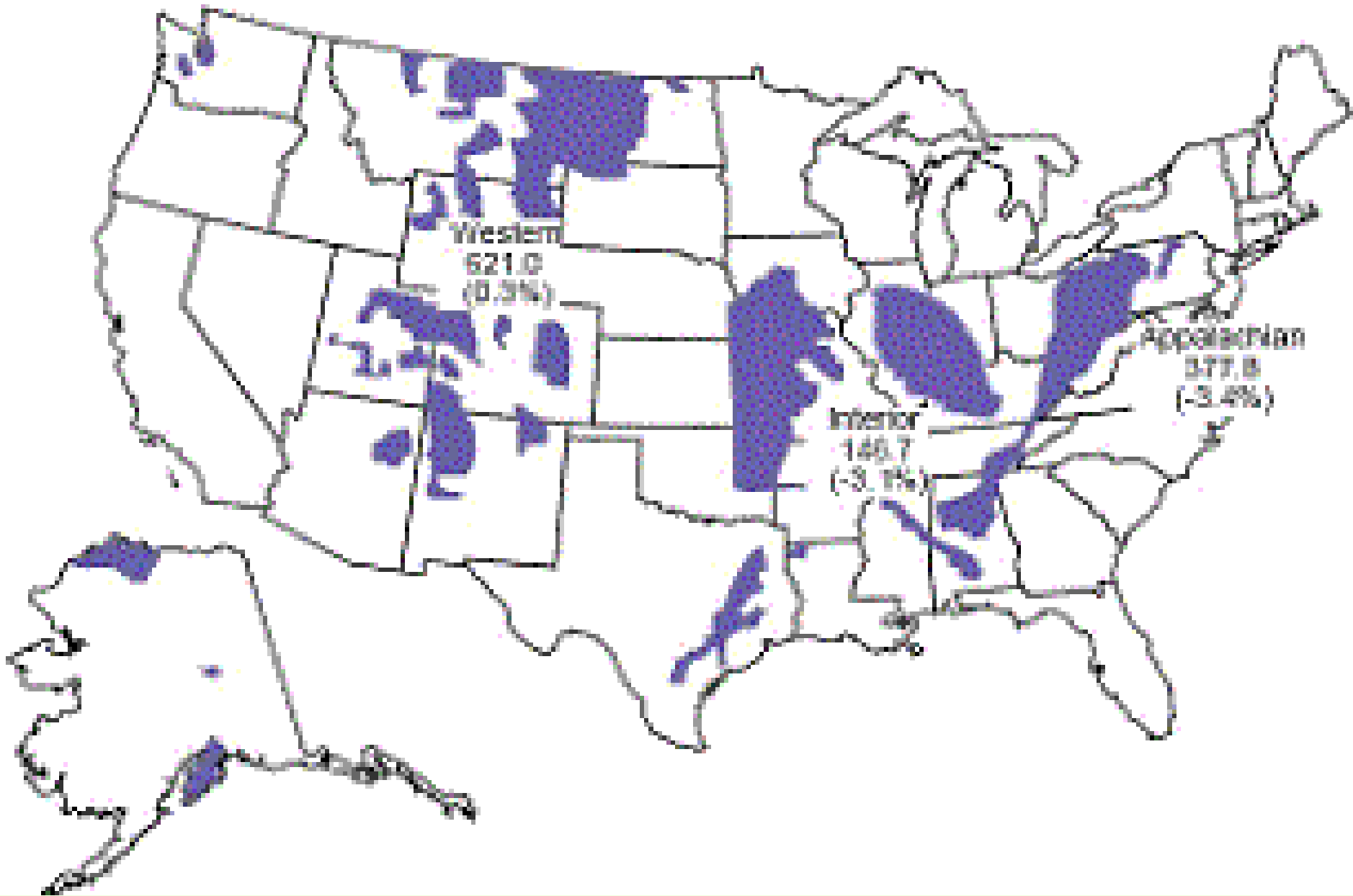


Natural Gas Price



Coal Price over Time in Dollars per million BTUs







1975 Chevrolet Corvette

\$15,000

5 year

12,000 miles per year

Gasoline \$0.40

\$192 or

4% of annual operation



1975 Chevrolet Corvette

\$15,000

5 year

12,000 miles per year

Gasoline \$4.00

\$1,920 or

27% of annual operation



<u>Country</u>	<u>Price in US \$/Gal</u>
Norway	9.25
Liverpool, United Kingdom	8.42
Israel	8.00
Nairobi, Kenya	6.16
Canada	5.25
Colombia	4.21
United States	4.00
Nigeria	1.85
Iran	0.33
Venezuela	0.12



















- Animal Waste
- Biomass
- Landfill Methane Gas
- Petroleum Coke
- Waste Wood



- Wood
- Solar Thermal
- Synthetic Gas
- Coal
- Natural Gas



- #6 Oil
- #4 Oil
- Crude Oil
- Sulfur
- #2 Oil



- Kerosene
- Gasoline
- Electricity
- Solar Photovoltaic
- Algae Biodiesel



- \$ per Gallon
- \$ per Ton
- \$ per Therm
- \$ per mm BTU



Fuel

Dollars per mmBTU

Animal Waste	\$0.11
Biomass	\$1.00
Landfill Methane Gas	\$1.00
Petroleum Coke	\$1.10
Waste Wood	\$1.11
Wood	\$1.25



Fuel

Dollars per mmBTU

Solar Thermal	\$2.00
Synthetic Gas	\$2.50
Coal	\$3.08
Natural Gas	\$8.50
#6 Oil	\$11.88
#4 Oil	\$13.84
Crude Oil	\$15.03



Fuel

Dollars per mmBTU

Sulfur	\$20.10
#2 Oil	\$24.31
Kerosene	\$25.93
Gasoline	\$29.79
Electricity	\$46.88
Solar Photovoltaic	\$79.11
Algae Biodiesel	\$102.57



Fuel	Commonly Quoted Price	Commonly Used Units of Sale	Dollars per mmBTU
Animal Waste	\$1.00	\$ per Ton	\$0.11
Biomass	\$8.00	\$ per Ton	\$1.00
Landfill Methane Gas	\$0.10	\$ per Therm	\$1.00
Petroleum Coke	\$1.10	\$ per mmBTU	\$1.10
Waste Wood	\$10.00	\$ per Ton	\$1.11
Wood	\$12.50	\$ per Ton	\$1.25
Solar Thermal	\$2.00	\$ per mmBTU	\$2.00
Synthetic Gas	\$0.25	\$ per Therm	\$2.50
Coal	\$80.00	\$ per Ton	\$3.08
Natural Gas	\$0.85	\$ per Therm	\$8.50
#6 Oil	\$1.75	\$ per Gallon	\$11.88
#4 Oil	\$2.00	\$ per Gallon	\$13.84
Crude Oil	\$100.00	\$ per Barrel	\$15.03
Sulfur	\$160.00	\$ per Ton	\$20.10
#2 Oil	\$3.20	\$ per Gallon	\$24.31
Kerosene	\$3.50	\$ per Gallon	\$25.93
Gasoline	\$4.00	\$ per Gallon	\$29.79
Electricity	\$0.16	\$ per kWh	\$46.88
Solar Photovoltaic	\$0.27	\$ per kWh	\$79.11
Algae Biodiesel	\$13.50	\$ per Gallon	\$102.57

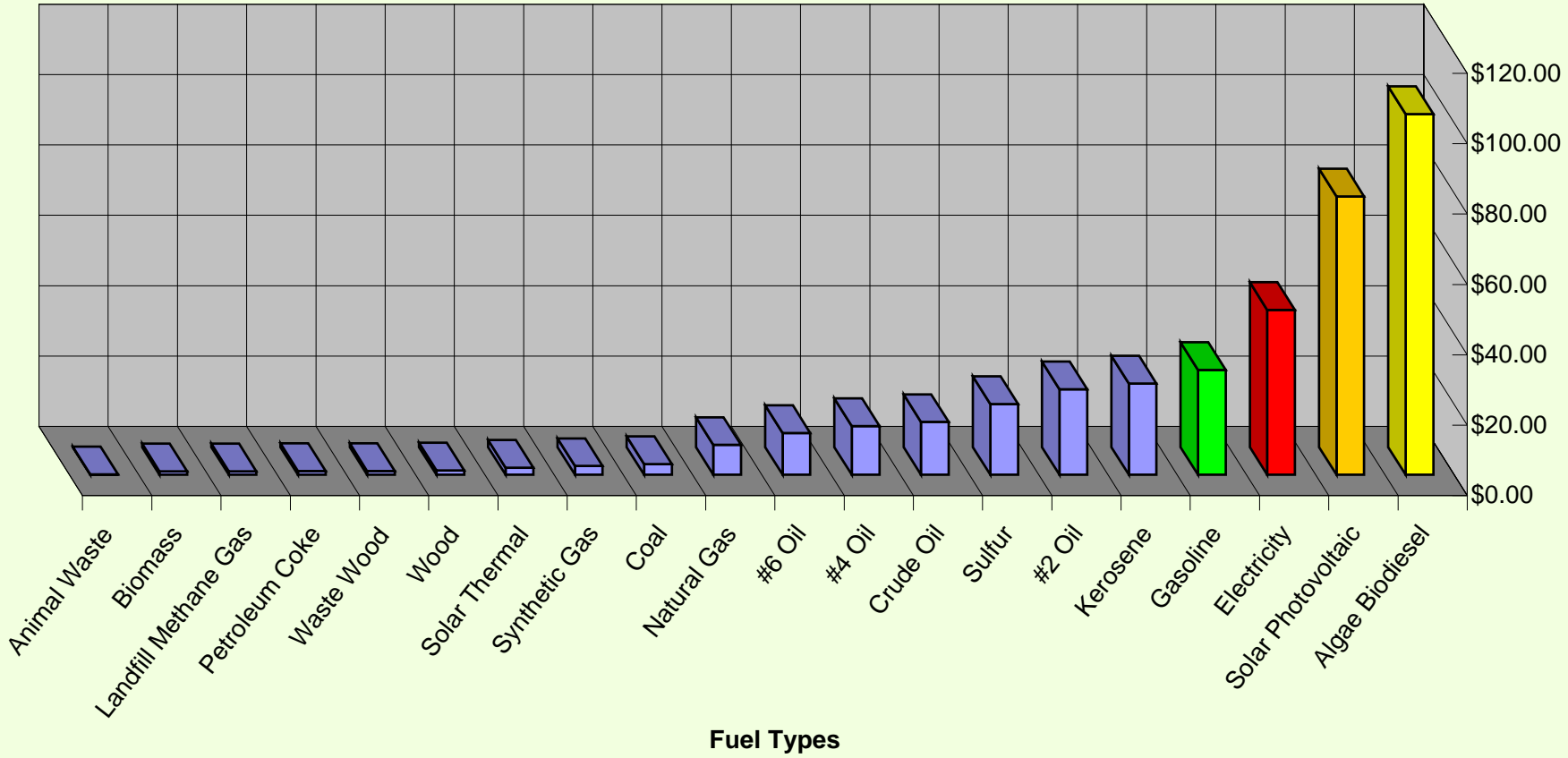




Blinders...



Dollars per mmBTU



**Brass Bullet
Central Florida
Phosphate**

**Mine – Trees
Local MSW
Cattle**



Thank You!

- **Questions?**



**For more information
Please contact
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