

Your Life, Your Planet , Your Choice

Dr. Barry L. Butler
SDUMC Peak Oil Seminar-
Pre Panel Summary
May 15, 2005

Distinguished Presenters

- Overall Seminar- Mr. Jim Fassett
- Coal- Dr. John A. Eldon
- Solar- Dr. Barry L. Butler
- Hydrogen- Dr. Robert Ginaven
- Fusion- Dr. Max Fenstermacher
- Fission- Dr. Al Tschaeche

“Space Ship Earth Must Be Sustainable”

Where are we going to live if we are not separated from the consequences of our own actions ????

Love Your Maker as Yourself



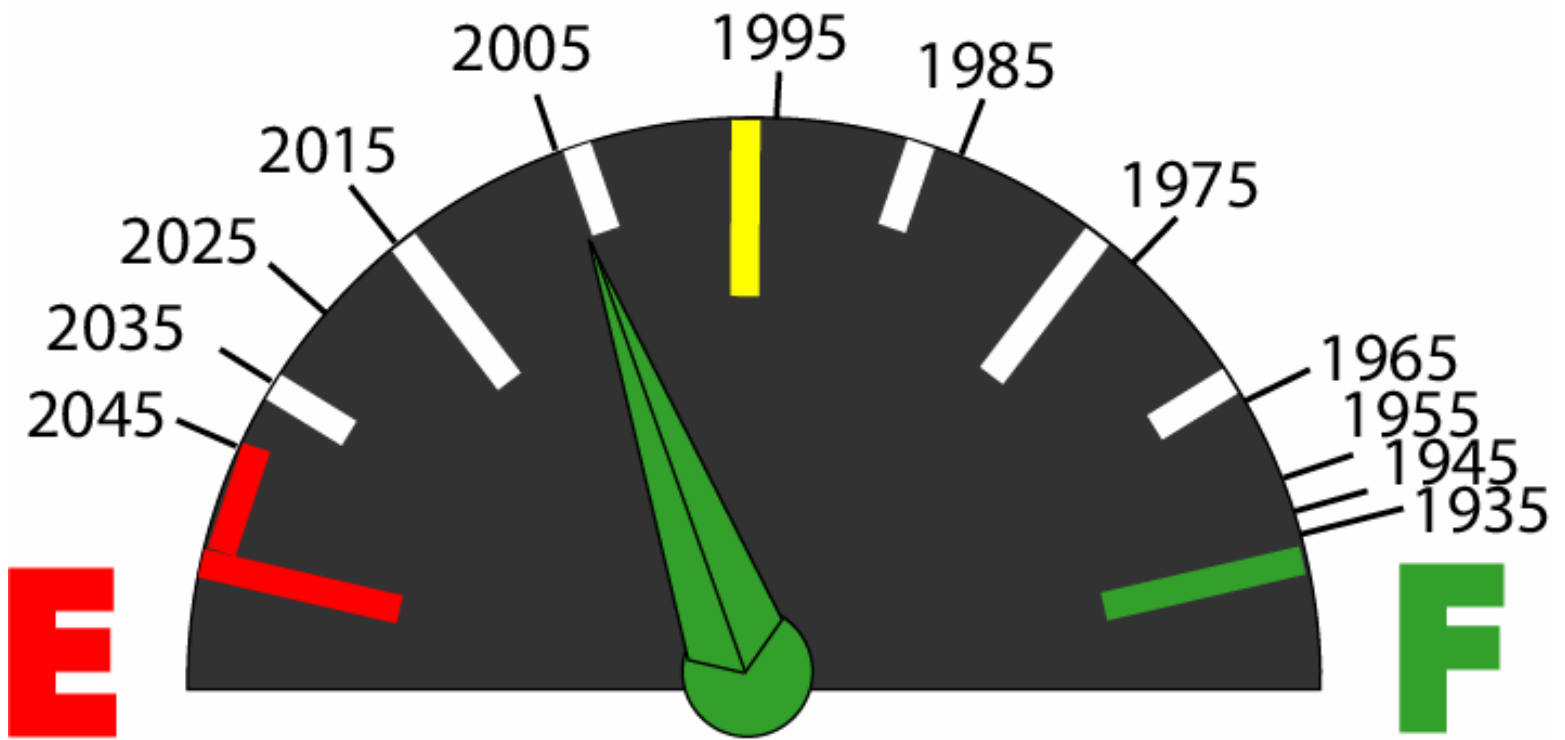
Today 2005

Love What You Have



Tomorrow 2030 ??

Martians will not want to come here, but we will want to go there.



FUEL GAUGE, GLOBAL OIL

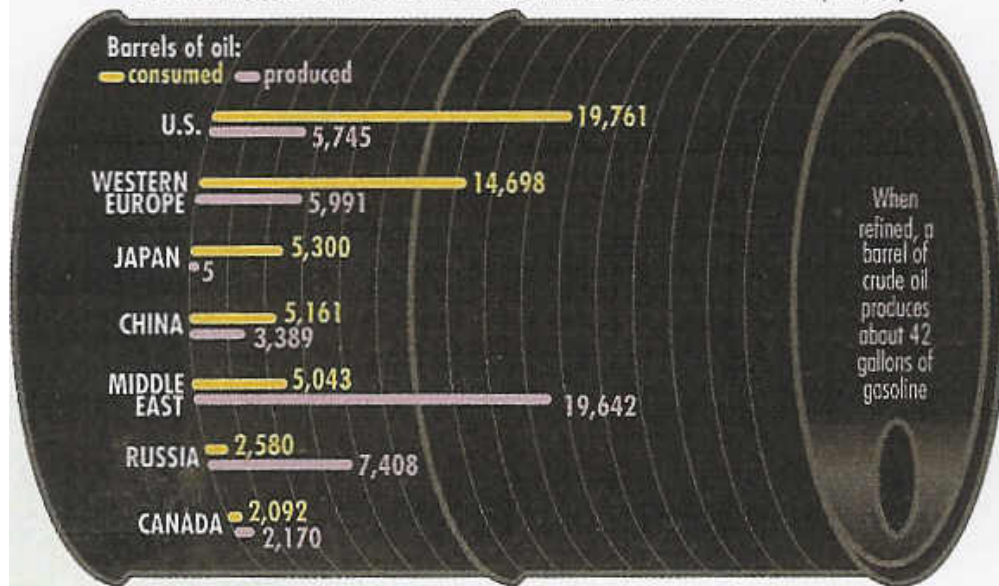
DRIVING

UNITED STATE OF THE CAR

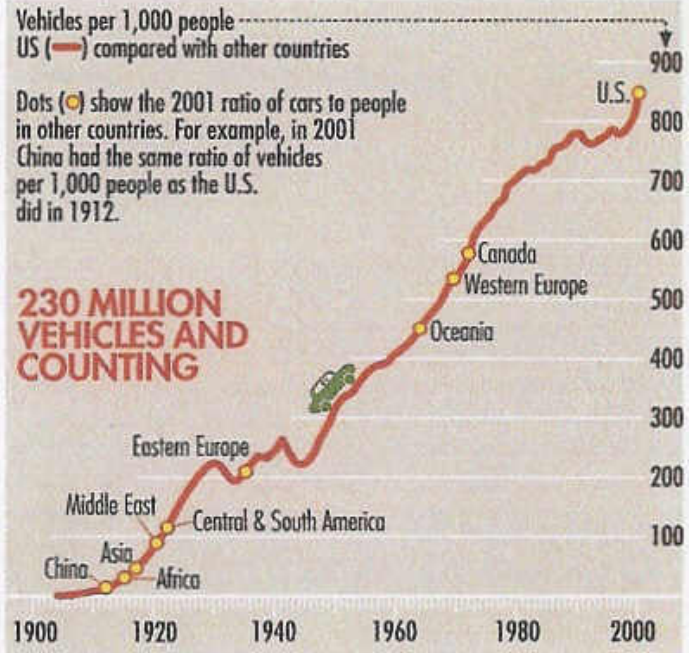
Wealth, geography and manufacturing ability have led to our obsession with cars: There's about one for every man, woman and child in the U.S. Unsurprisingly, we also consume the most oil, aided in part by our relatively low gas taxes.

THE FLOW OF GLOBAL OIL

The balance of oil around the world, in thousands of barrels per day



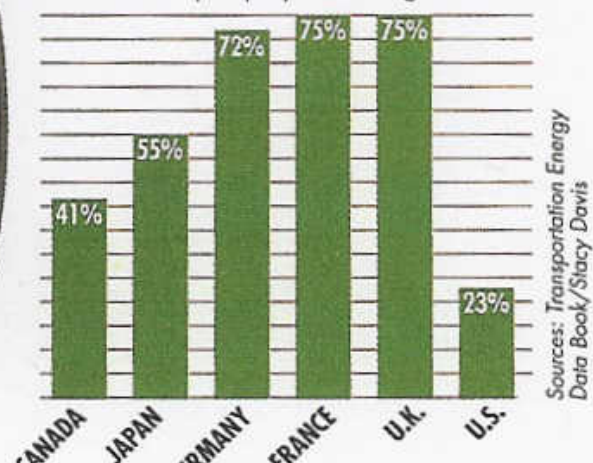
Source: Energy Information Administration



Source: Transportation Energy Data Book/Stacy Davis

GAS TAX

Percent at the pump siphoned to government

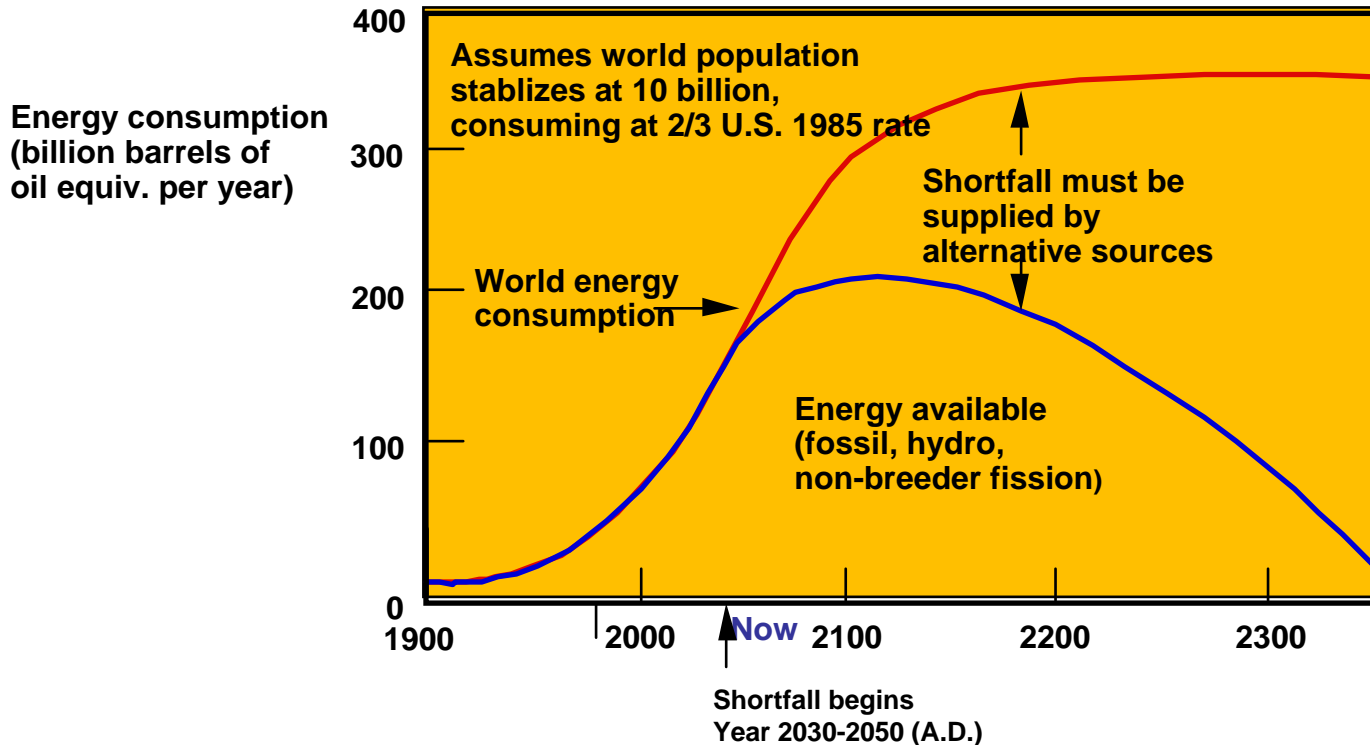


The Coming Era of Fusion Energy

The fossil fuel era is almost over. If we continue to burn fossil fuels for energy, they will last only another few hundred years. At our present rate of use, experts predict a shortfall in less than fifty years.

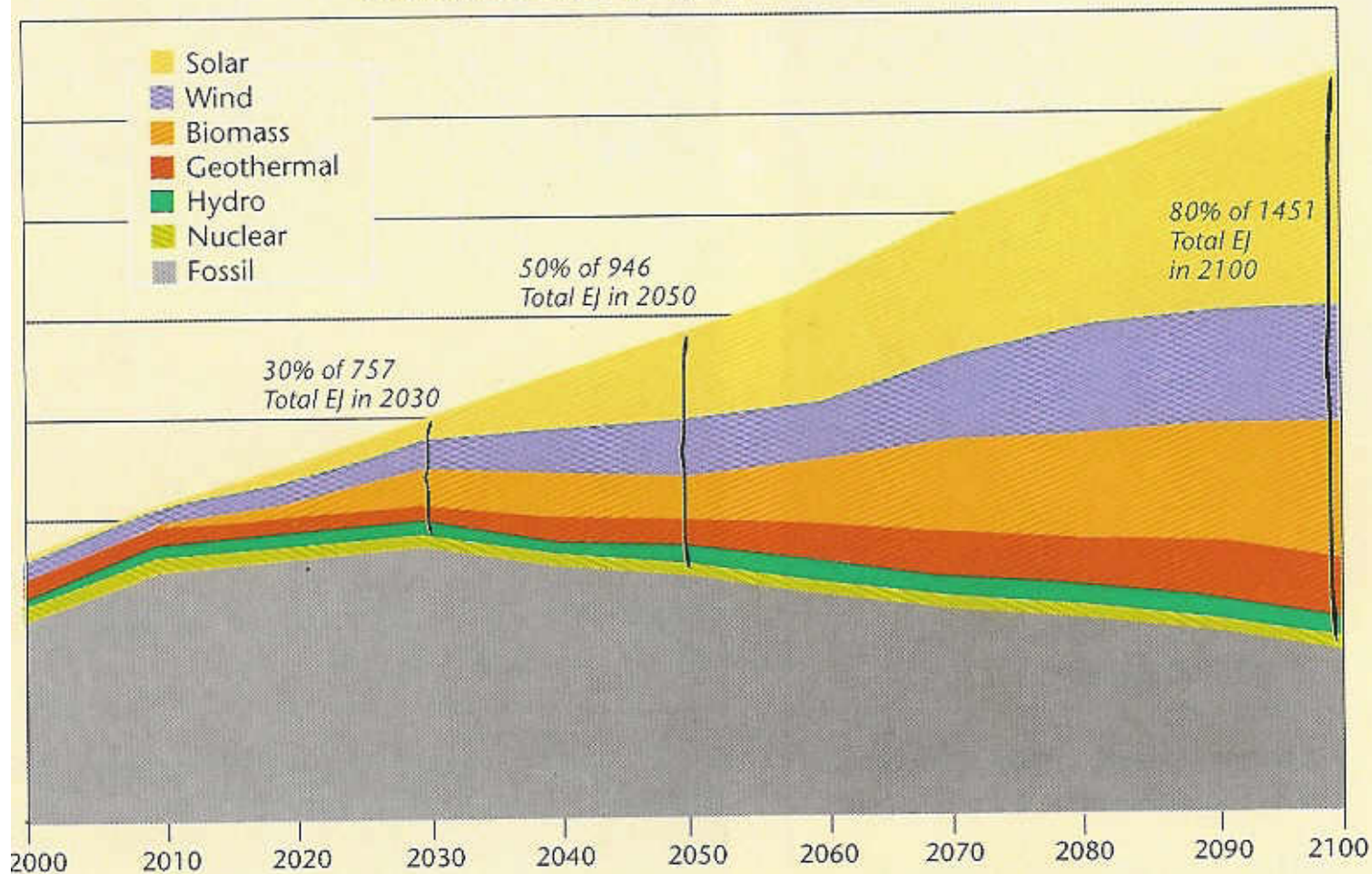
Predicted Fossil Fuel Supply

- Coal 200 years
- Oil 35 years
- Natural Gas 60 years



Filling the Carbon-Neutral Gap to Approach 550 ppm CO₂: The 10/20/50% Usage Pattern

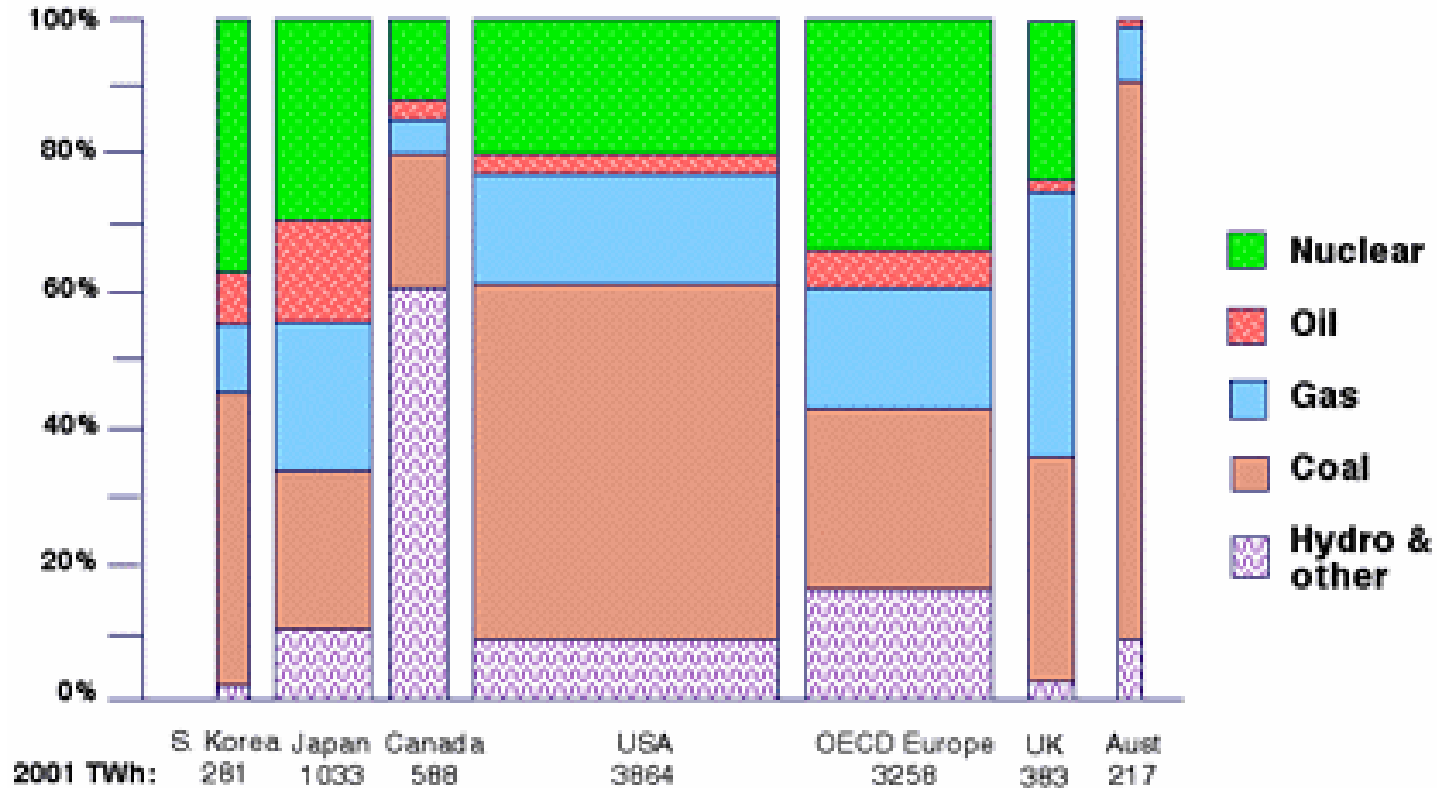
Projection of the 10/20/50% Scenario*



* From a study by Dr. Stanley Bull and Lynn Billman, National Renewable Energy Laboratory. Straight lines here and in Figure 2 are approximate averages over time, not revealing, for example, the dominance of wind power in the early years.

WORLD USE OF NUCLEAR POWER

Fuel for electricity generation (percent)



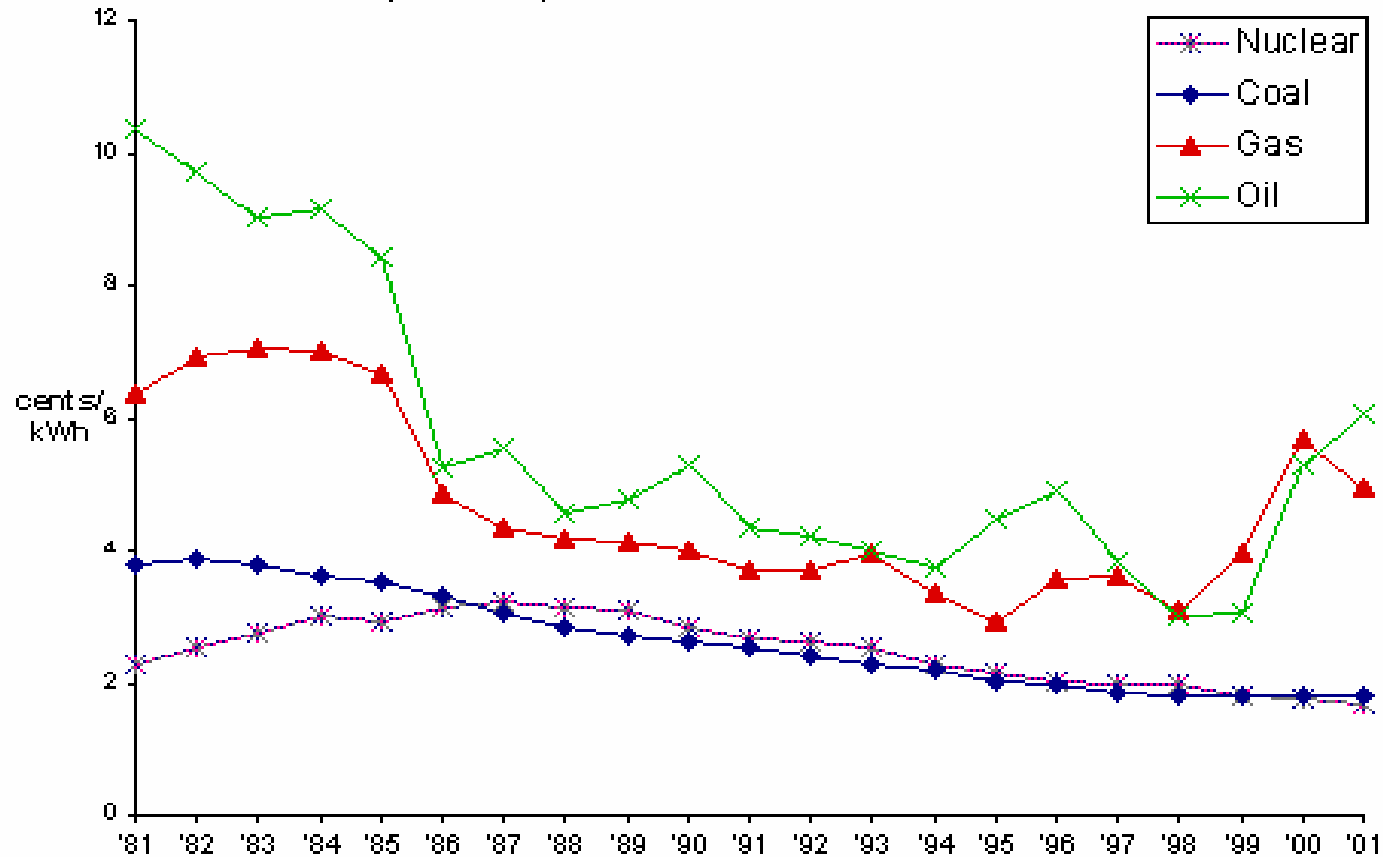
Width of each bar is indicative of power generated (gross production)

Source: OECD/IEA 2003, Energy Balances of OECD Countries 2001.

ECONOMICS OF NUCLEAR POWER

US Electricity Production Costs

(O&M+fuel) in constant 2001 cents/kWh



Source: US Utility Data Inst. (pre 1995), Resource Data International (1995-)

Note: the above data refer to fuel plus operation and maintenance costs only, they exclude capital, since this varies greatly among utilities and states, as well as with the age of the plant. On the basis of the OECD projections opposite, capital costs in USA are 55% of total for nuclear, 45% of total for coal and 16% of total for gas. Grossing these up on this basis for 2001 gives 3.73 c/kWh for nuclear, 3.27 c/kWh for coal and 5.87 c/kWh for gas.

Energy Prices to Electricity Generators by Source
(1996 Dollars per Million Btu)

| | | | | | | | | | |
|---------------------|------|------|------|------|------|------|------|------|------|
| Fossil Fuel Average | 1.54 | 1.46 | 1.49 | 1.44 | 1.51 | 1.49 | 1.60 | 1.51 | 1.71 |
| Petroleum Products | 3.27 | 3.61 | 3.57 | 3.76 | 3.46 | 4.13 | 4.00 | 4.27 | 3.77 |
| Distillate Fuel | 4.90 | 5.17 | 5.16 | 5.15 | 5.14 | 5.45 | 5.47 | 5.42 | 5.40 |
| Residual Fuel | 3.07 | 3.23 | 3.20 | 3.34 | 3.09 | 3.67 | 3.60 | 3.79 | 3.36 |
| Natural Gas | 2.64 | 2.58 | 2.63 | 2.56 | 2.72 | 2.80 | 2.98 | 2.85 | 3.32 |
| Steam Coal | 1.29 | 1.14 | 1.14 | 1.11 | 1.13 | 1.01 | 1.03 | 0.97 | 0.97 |

Source: Energy Information Administration, Office of Integrated Analysis and Forecasting, National Energy Modeling System runs ncomp.d010698a, aeo98b.d100197a, complo3.d031298b, and comphiD3.d031398b.

THE REAL COST OF GASOLINE

What U.S. drivers pay to fill the tank varies slightly by location and reflects the costs of turning crude into the gasoline that is sold at more than 130,000 outlets. External costs are harder to nail down; estimates vary widely

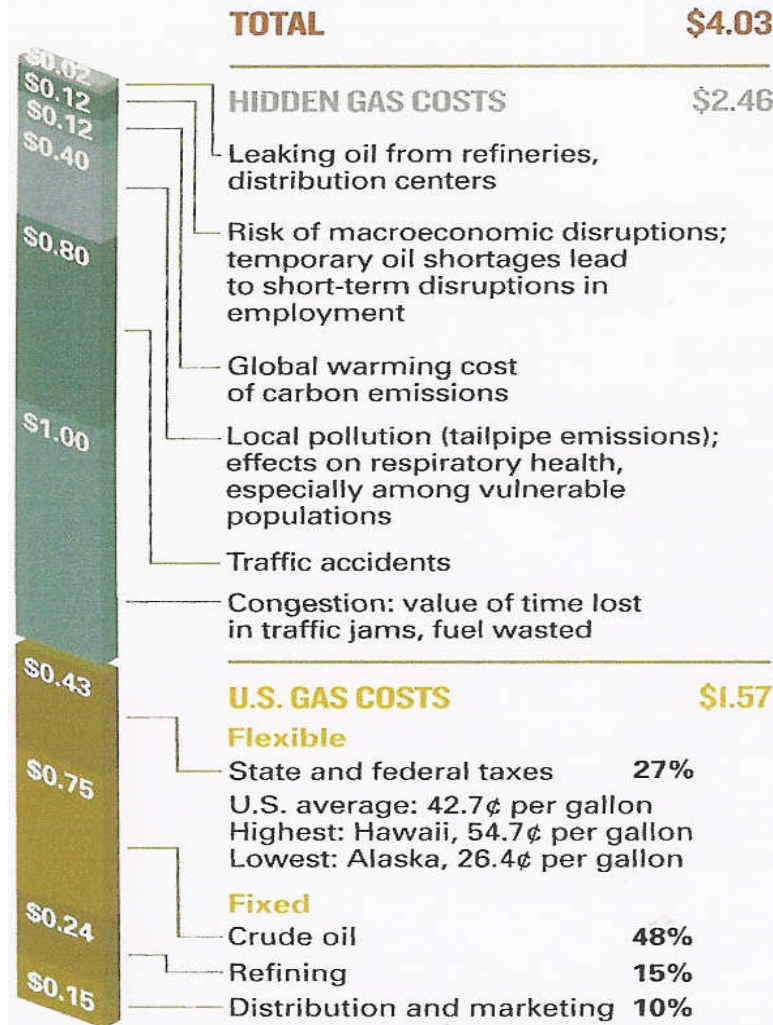


CHART BY 5W INFOGRAPHICS. JANUARY 2004 AVERAGES. SOURCES: ENERGY INFORMATION ADMINISTRATION AND AMERICAN PETROLEUM INSTITUTE (U.S. GAS COSTS); IAN PARRY (HIDDEN GAS COSTS)

Worst source of industrial air pollution =Electric power plants

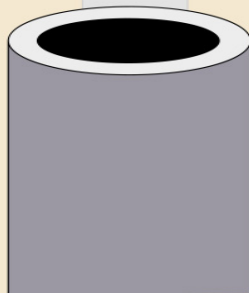
- More than 159 million Americans live in communities with unhealthy air. Air pollution from power plants alone contributes to an estimated 30,000 premature deaths, hundreds of thousands of asthma attacks, and tens of thousands of hospitalizations for respiratory and cardiovascular illnesses each year.
- Dilution has been the Solution, Air is getting dirty
 - 67% of SO₂
 - 25% of No_x
 - 40% of CO₂
 - 33% of Hg
 - US, 1998

Pollutant Emission Factors for Electrical Generation (g/kWh): The Total Fuel Cycle*

| Energy Source | CO ₂ | NO _x | SO _x |
|---------------|------------------|-----------------|-----------------|
| Coal | 322.8 | 1.8 | 3.400 |
| Oil | 258.5 | 0.88 | 1.700 |
| Natural Gas | 178.0 | 0.9 | 0.001 |
| Nuclear | 7.8 | 0.03 | 0.030 |
| Photovoltaics | 5.3 | 0.007 | 0.020 |
| Biomass | 0.0 ¹ | 0.6 | 0.140 |
| Geothermal | 51.5 | TR | TR |
| Wind | 6.7 | TR | TR |
| Solar Thermal | 3.3 | TR | TR |
| Hydropower | 5.9 | TR | TR |

TR = trace

¹ with biomass
fuel regrowth
program

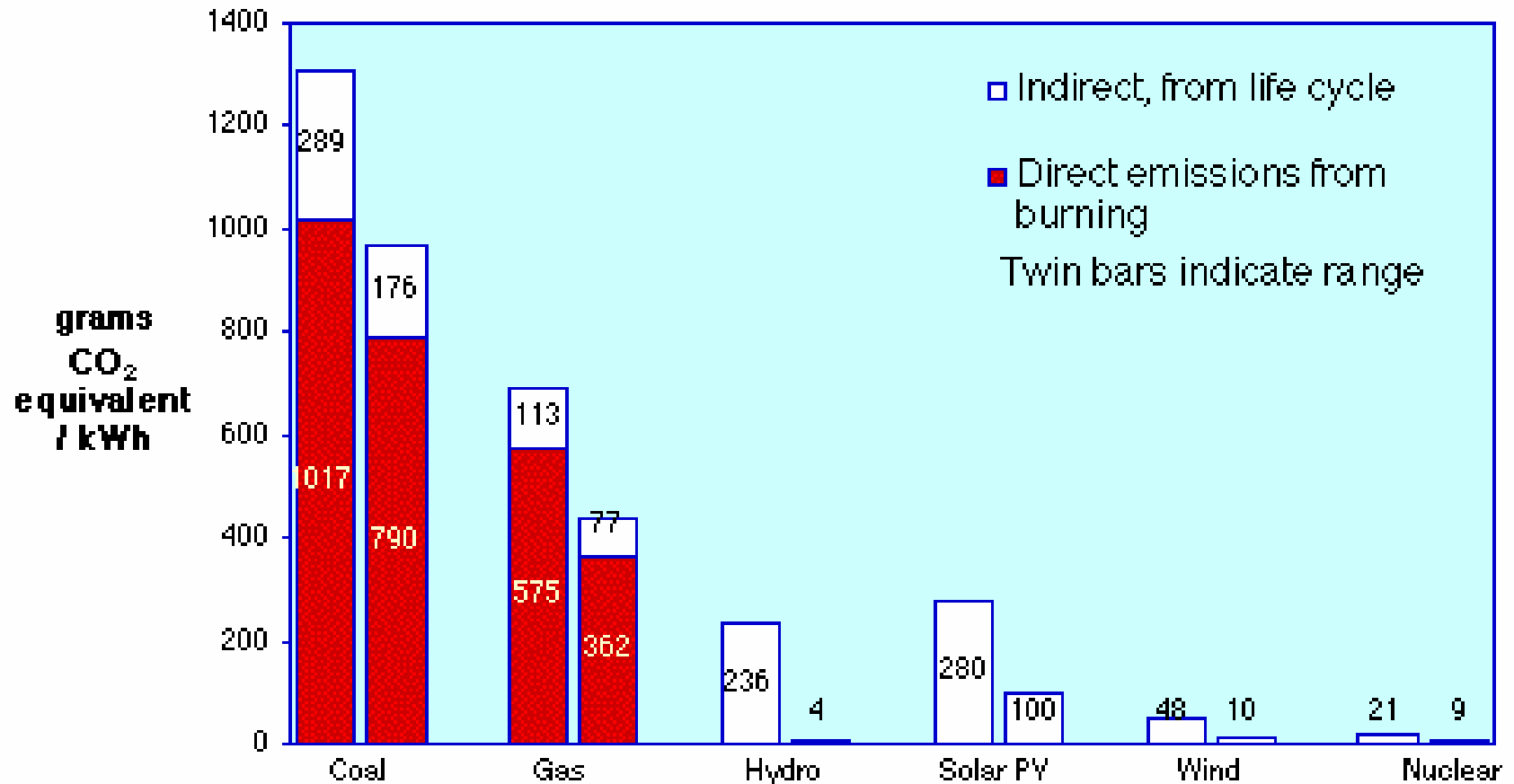


* Fossil fuel emission factors provided by the American Gas Association; nuclear and renewable energy sources from the Council for Renewable Energy Education.

Source: Solar Energy Industries Association:
Solar Thermal Water Heating: The U.S. Industry

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Greenhouse Gas Emissions from Electricity Production

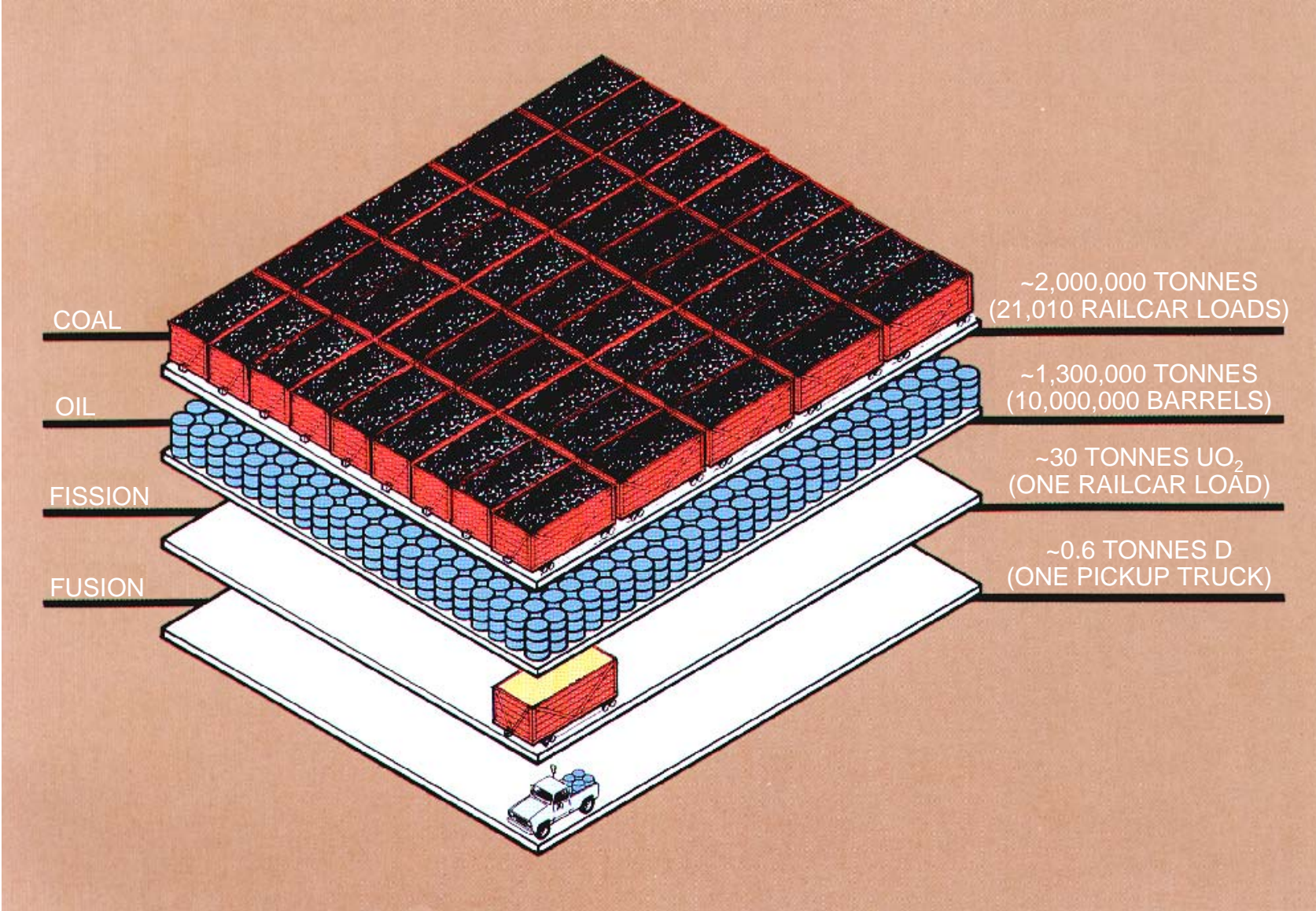


Source: IAEA 2000

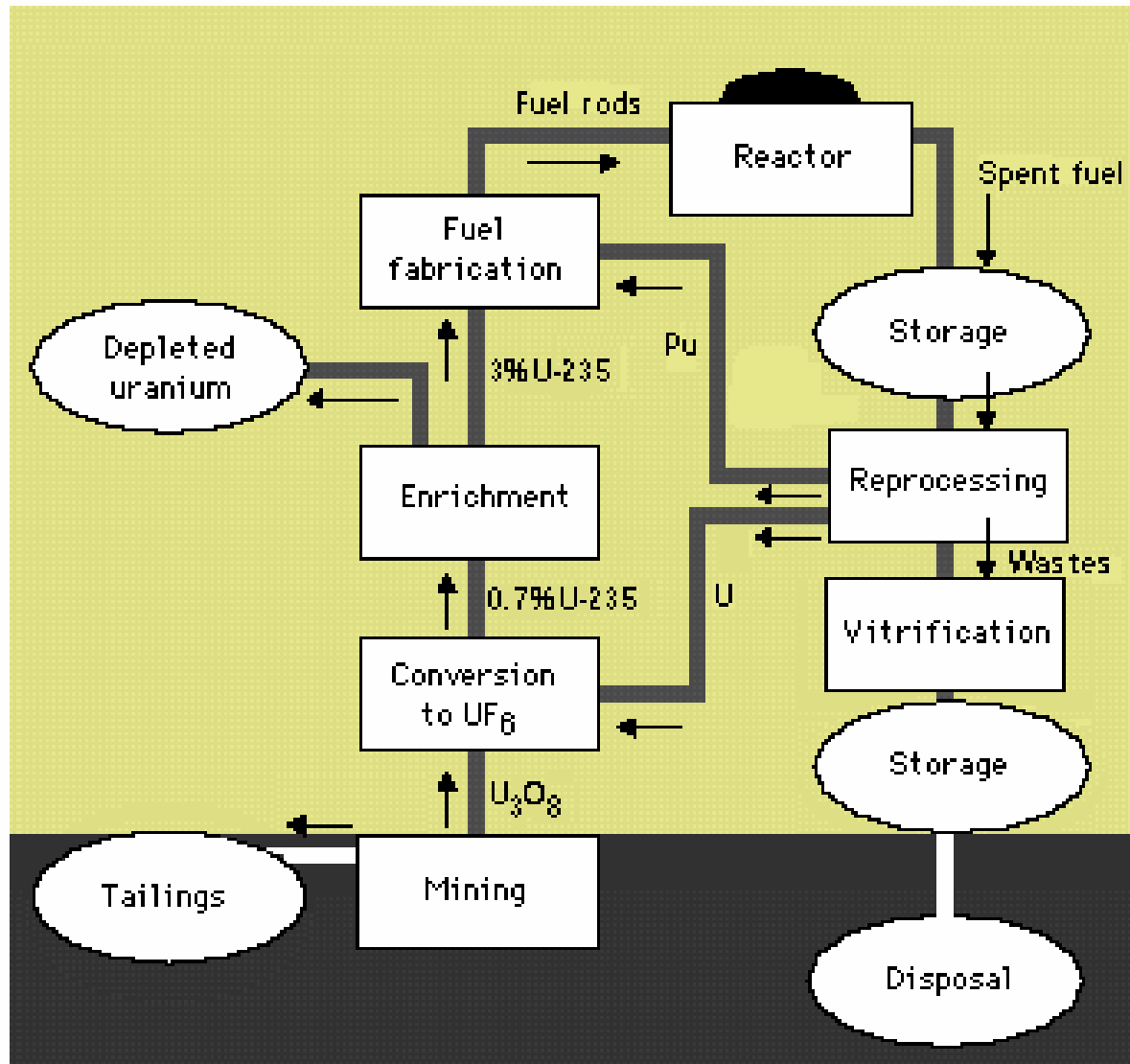
Non-fossil Energy Source Advantages and Disadvantages

| Energy Sources | Advantages | Disadvantages |
|---|---|--|
| Fission (Nuclear Power) (45 Years) (2700 Years-Breeder) | <ul style="list-style-type: none">• Clean, no CO₂• Does not produce immediate pollution | <ul style="list-style-type: none">• Waste disposal is difficult• Safety concerns |
| Hydroelectric (mostly utilized) | <ul style="list-style-type: none">• Clean, no CO₂ | <ul style="list-style-type: none">• Dam construction destroys habitats• Geographically limited |
| Wind (low utilization) | <ul style="list-style-type: none">• Clean, no CO₂ | <ul style="list-style-type: none">• Huge numbers of windmills required for adequate power generation• Geographically limited |
| Geothermal (low utilization) | <ul style="list-style-type: none">• Clean, no CO₂ | <ul style="list-style-type: none">• Geographically limited |
| Solar (under utilized) | <ul style="list-style-type: none">• Clean, no CO₂ | <ul style="list-style-type: none">• Huge number of solar cells required for adequate power generation• Geographically limited |

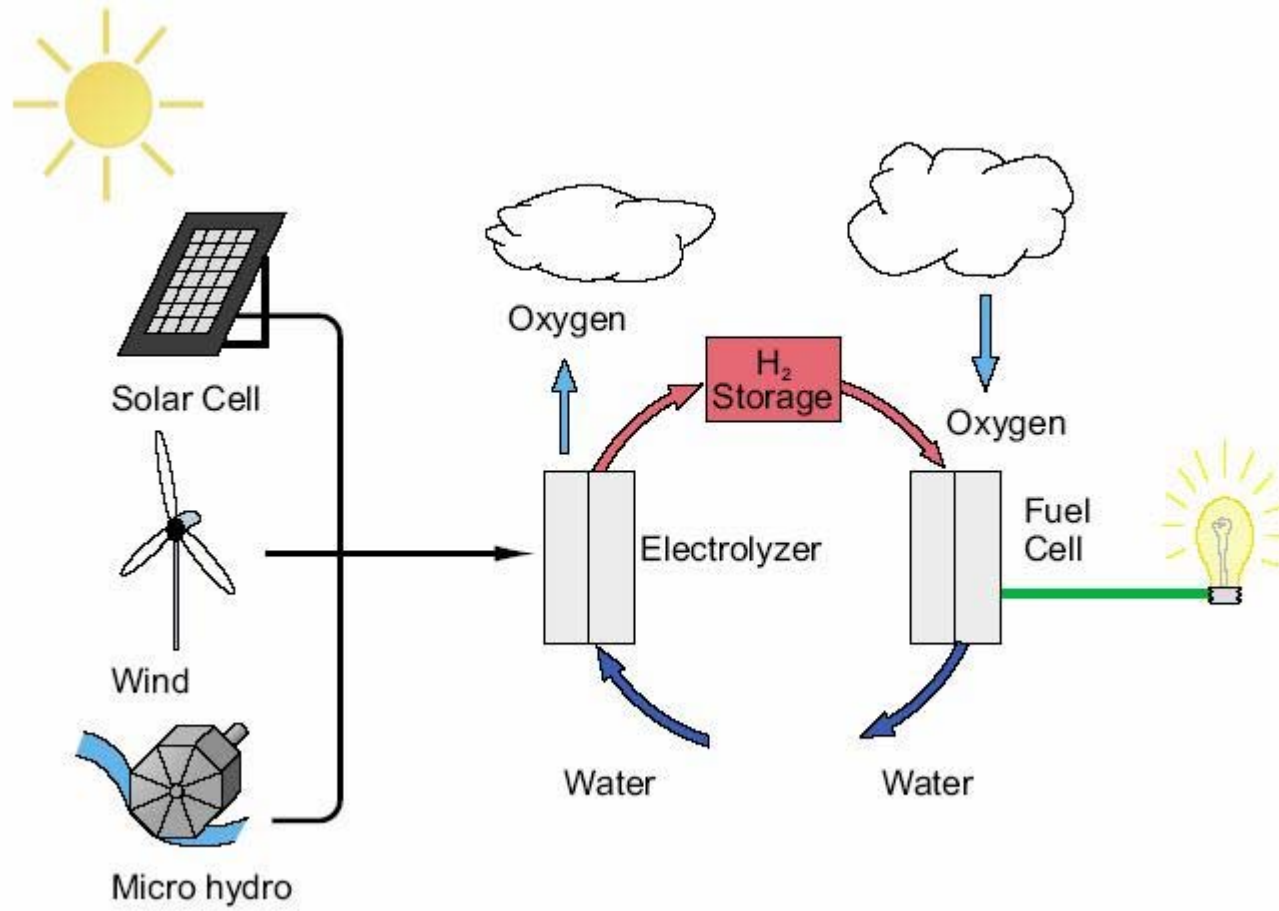
FUEL NEEDED FOR ONE YEAR OF POWER PLANT OPERATIONS (1000 MWe)



NUCLEAR FUEL CYCLE



Solar Hydrogen Cycle



Alternative Fuels (non-petroleum based)

| | | |
|--------------------|--|---|
| Biodiesel | B20 | Recycled cooking oil, soybean oil, animal fats, rapeseed oil |
| Ethanol | E10,E85 | Corn, grain, agricultural waste |
| Methanol | M85 | Natural gas, coal, biomass |
| Natural Gas | CNG/LNG | wells |
| Propane | LPG | Byproduct of petroleum refining or natural gas processing |
| Hydrogen | Compressed gas cryogenic liquid metal hydride | Natural gas, methanol, Water + electricity |

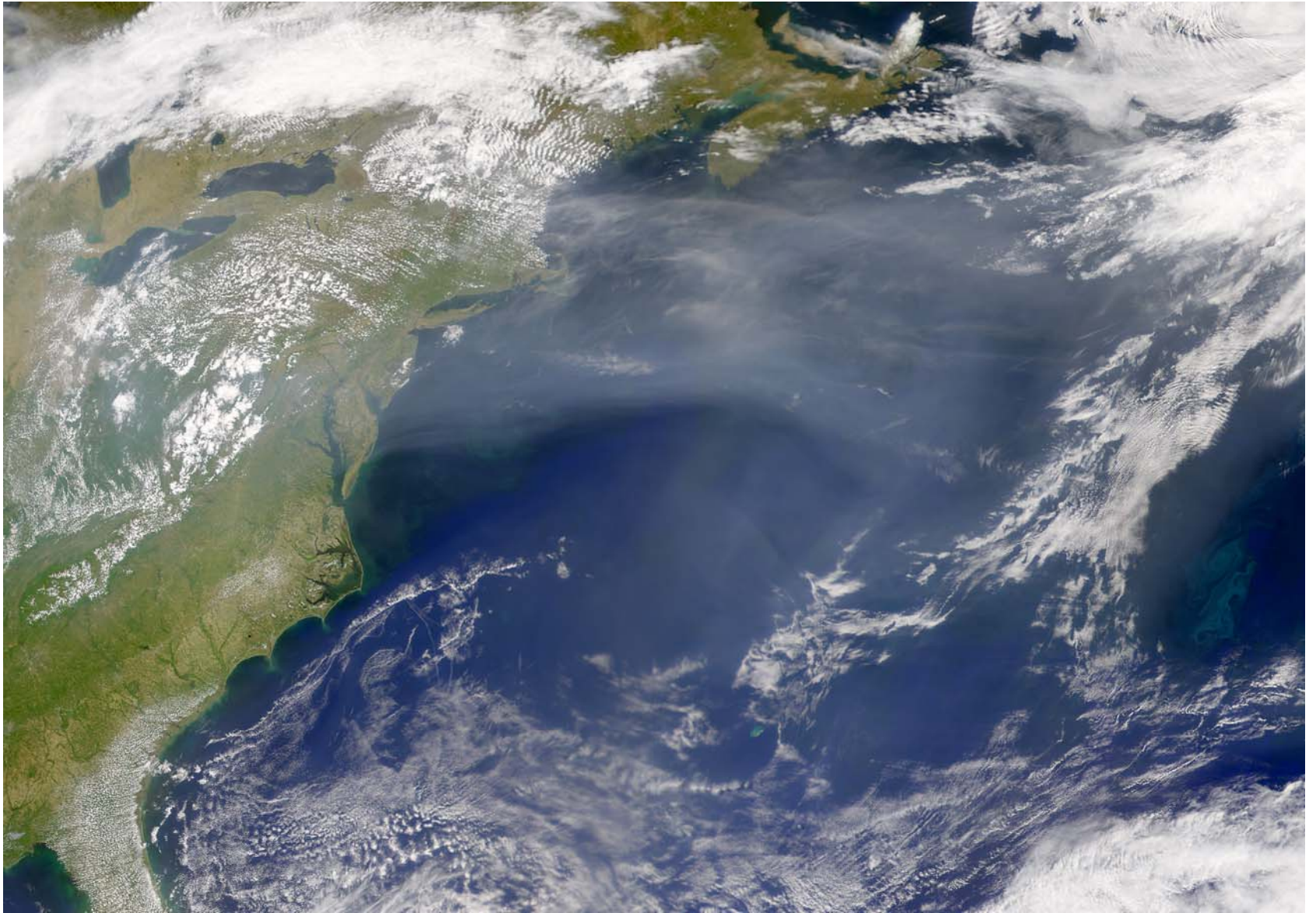
WHAT IS OUR GOAL??

- TO MOVE THE USA TO A SUSTAINABLE SOCIETY
- WITH EQUALITY OF OPPORTUNITY FOR ALL OF THE WORLDS CITIZENS
- WITH JUSTICE FOR ALL WORLDS CITIZENS

World Population Unequal Wealth 2005

| Year | 2005 | 2015 |
|------------------------|-----------------------|-----------------------|
| Annual Oil Consumed | 29,200,000,000 Brls | 23,750,000,000 Brls |
| Global Population | 6,100,000,000 People | 6,800,000,000 People |
| Equal Fuel for All | 4.31 gallons gas/Year | 3.14 gallons gas/Year |
| Fuel for USA Person | 865 gallons gas/Year | 646 gallons gas/Year |
| US % Global Population | 4.7% | 4.6% |
| Air Quality | Getting Bad | Getting Worse |

Smog Over North America



“Space Ship Earth Must Be Sustainable”

Where are we going to live if we are not separated from the consequences of our own actions ????

Love Your Maker as Yourself



Today 2005

Love What You Have



Tomorrow 2030 ??

Martians will not want to come here, but we will want to go there.

We Are Not Responsible For Our Own Actions!!!

- Madison Avenue Tells Me So!!
- My Government Tells Me So!!
- My Life Style Tells Me So!!
- My Wealth Tells Me So!!
- Corporate America Tells Me So!!
- **My Conscience Appears To Be Silent**

Each of Us Must Become Responsible For Our Own Actions

Responsible

Actions

- Buy Fuel Efficient Car
- Buy Solar PV & Hot Water
- Conserve Energy
- Conserve Water
- Recycle all Materials
- Buy What You Really Need
- Save Money
- Repair & Maintain

Not Responsible

Actions

- Buy a Gas Guzzler
- Use SDG&E
- Waste, you can afford it
- Rain will come, flush now
- Land fills are not full
- More/Bigger is Better
- Go into Debt to Buy Stuff
- Throw Away & Buy New

Each of Us Must Become Responsible For Our Own Actions

Responsible

Tax Policy

- Support Fuel Consumption Taxes For Fusion/Solar R&D
- Support Sewer Taxes for Companies & Cars that use Air as a Sewer
- Support Balanced Federal & State Budgets

Not Responsible

Tax Policy

- Fight To Keep From Paying Your Fare Share
- Assume that air will clean itself without your intervention it always has
- Spend Your Children's Future

Each of Us Must Become Responsible For Our Own Actions

Responsible

Advocacy

- Support Nuclear Fission
- Support Nuclear Fusion
- Support Renewable Energy
- Support Public Transportation

Earth Citizens

- Stewardship of Earth
- Value All Species
- Manage Ocean Fisheries
- Farm Land Wisely
- **Love Your Maker as Yourself**

Not Responsible

Advocacy

- Let Utilities Decide
- Let Utilities Decide
- Let Utilities Decide
- Fight Mass Transit

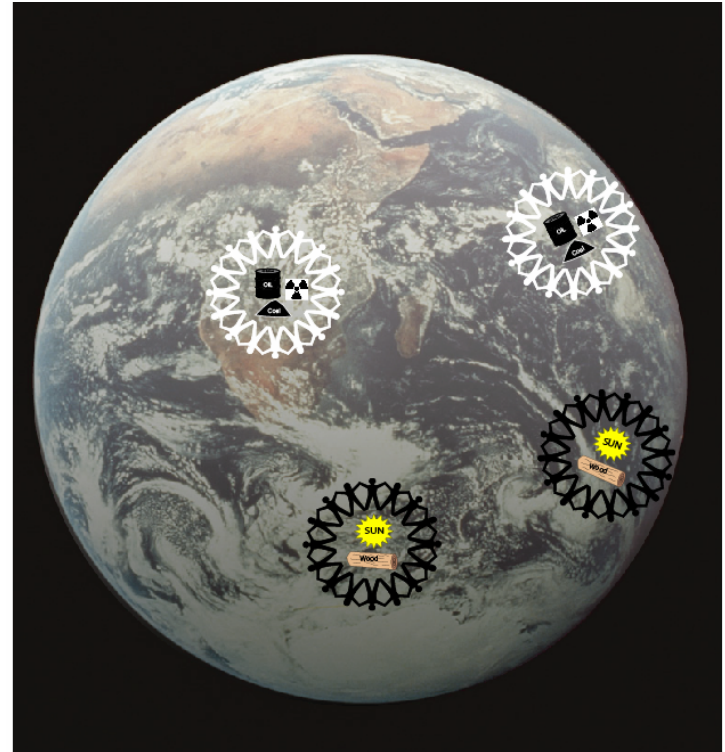
Earth Citizens

- Consumer is King
- Only Man Counts
- Catch All You Can
- Use More Chemicals
- **Love What You Have**

YOUR CHOICE "PEACE OR WAR"

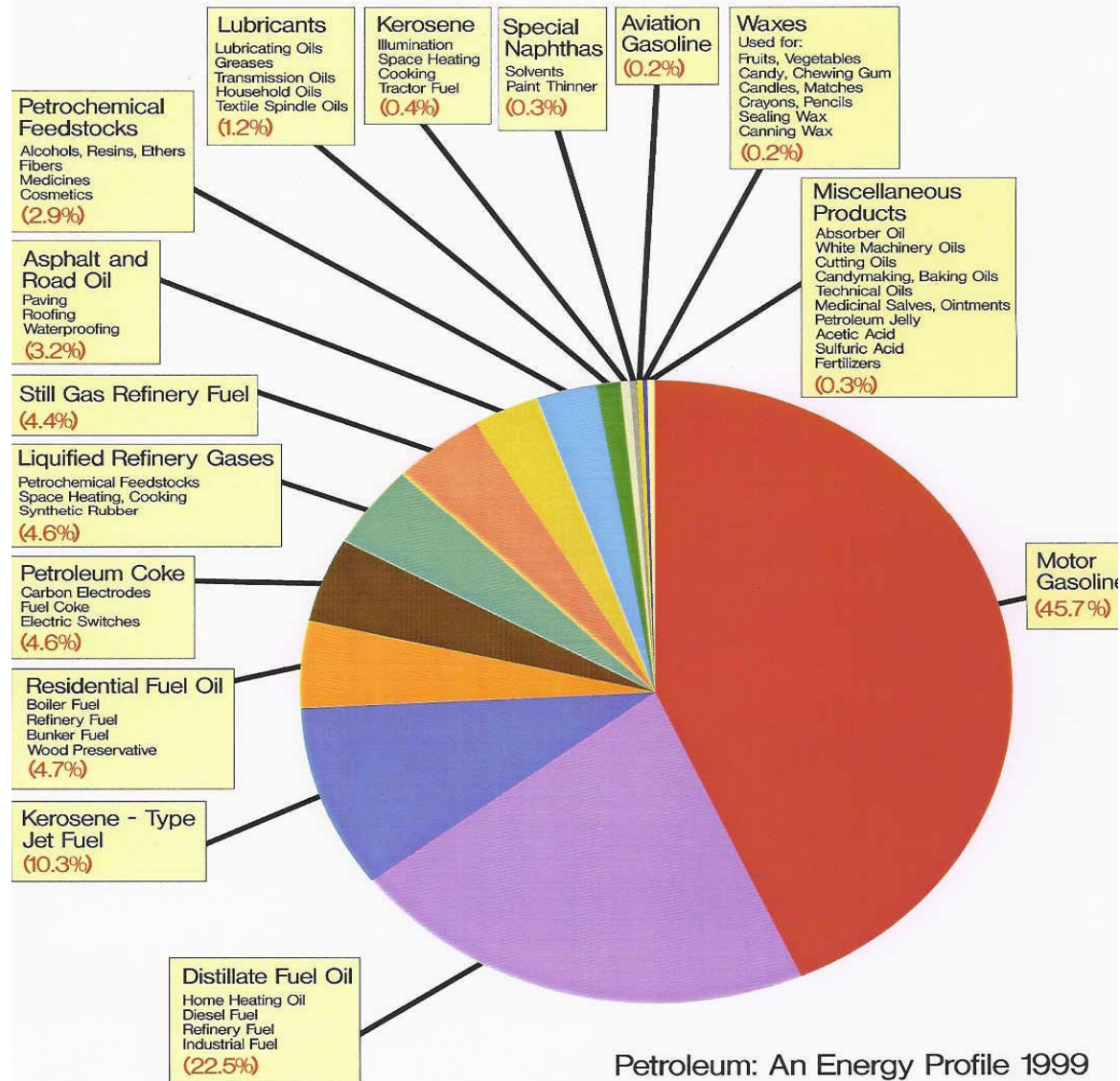


DEMOCRATIC Solar Energy Empowers People
Poverty to Prosperity
Restores the Earth for Animals & Humans
Ends Central Power Politics of Greed
Soft Path is "The Only Path to Peace"
People Join Together "To Give Peace A Chance"

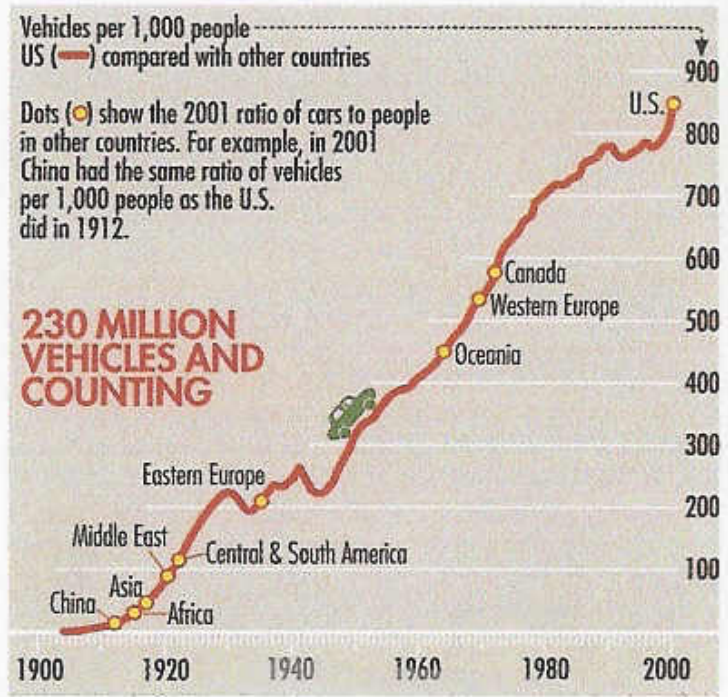


CENTRAL POWER Controls People
Rich Get Richer Poor Get Poorer
Polluts Earth & Air for Animals & Humans
Central Power Politics of Greed
CENTRAL POWER Path is "The Path to Resource War"
People/Nations Fight "Have's versus Have Nots"

Petroleum Products and Uses



Petroleum: An Energy Profile 1999
Energy Information Administration



Source: Transportation Energy Data Book/Stacy Davis

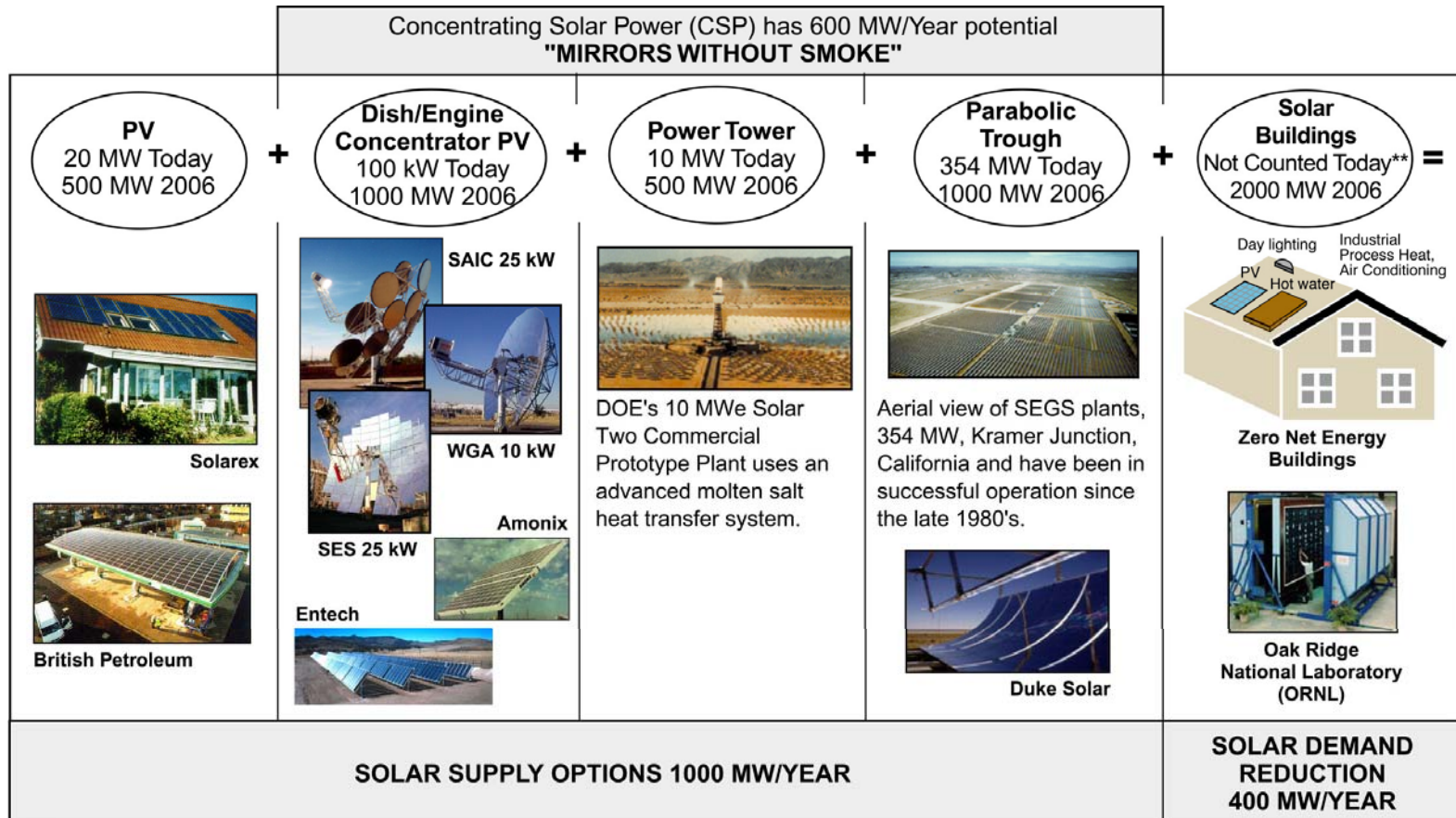
| | Traditional internal combustion engine | Gas/electric hybrid | Ethanol E85 (in an internal combustion engine) | Fuel cell (hydrogen produced from natural gas) |
|---|--|---------------------|--|--|
| Amount of energy from fossil fuels (internal combustion engine = 1) | 1.00 | 0.71 | 0.67 | 0.59 |
| Greenhouse gas emissions grams per mile | 403 | 287 | 325 | 196 |

NEW FUELS, SAME OLD FOSSILS

Hydrogen and other alternative fuels aren't all green once we account for the net, or "well-to-wheel," energy used, which includes the energy needed to extract, refine and distribute the fuel

Source: Center for Transportation Research/Michael Wang

“Don’t put all National energy eggs in coal/oil/gas basket” Solar Has Fuel Price Escalation Resistant Eggs.

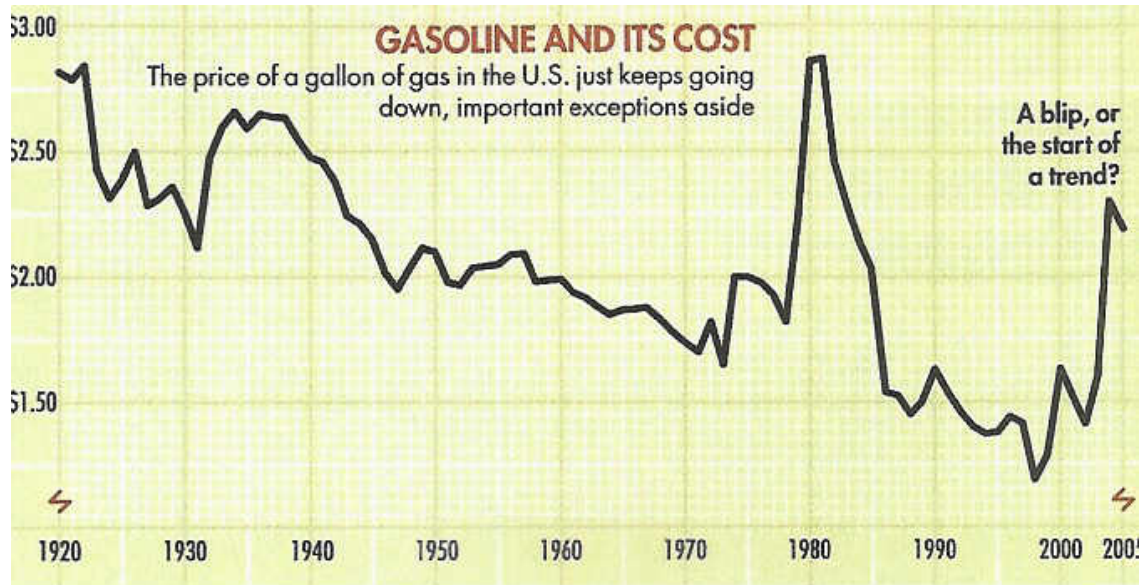


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** near 2000 MW today

Solar could provide .7% of National capacity by 2006.

Restore DOE solar energy line item funding to 2001 level while keeping solar building at 2003 DOE request.



GASOLINE'S END: NOWHERE IN SIGHT

Engines are growing smaller yet more powerful, while gas gets cheaper. The result: a big hurdle for alternative fuels, which still require significant amounts of fossil fuels to produce.

| | 1975 | 1987 | 2004 |
|--------------------|-----------|-----------|-----------|
| Average mpg | 13.1 | 22.1 | 20.8 |
| Average weight | 4,060 lbs | 3,220 lbs | 4,066 lbs |
| Average horsepower | 137 | 118 | 208 |
| Average 0-60 | 14.1 secs | 13.1 secs | 10.0 secs |

BIGGER CARS, NOT BETTER MILEAGE

Jumps in vehicle size and engine horsepower, 1975-2004

Source: Environmental Protection Agency

**OIL and PEOPLE,
OIL MUST BE USED TO DEVELOP A SUSTAINABLE LIFE STYLE FOR THE UNITED STATES AND THE WORLD**

B. Butler 8/26/2002

| Daily Barrels Consumed by World | Annual Barrels Consumed by World | Total Barrels Consumed by World from beginning or oil use until current Decade | DECADE S | DECADE CENTER YEAR | GLOBAL POPULATION HISTORY AND ESTIMATES** | UNITED STATES POPULATION HISTORY AND ESTIMATES*** | OIL LEFT IN GLOBAL FUEL TANK | GLOBAL GALLONS OF GASOLINE PER PERSON PER YEAR* | UNITED STATES GALLONS OF GASOLINE PER PERSON PER YEAR* | U.S. Population as % of Global Population |
|---------------------------------|----------------------------------|--|---------------|--------------------|---|---|------------------------------|---|--|---|
| 4,000,000 | 1,460,000,000 | 1,460,000,000 | 1930's | 1935 | 1,700,000,000 | 126,000,000 | 99.2% | 0.77 | 98 | 7.41% |
| 6,000,000 | 2,190,000,000 | 3,650,000,000 | 1940's | 1945 | 2,000,000,000 | 140,000,000 | 98.0% | 0.99 | 133 | 7.00% |
| 12,000,000 | 4,380,000,000 | 8,030,000,000 | 1950's | 1955 | 2,500,000,000 | 162,000,000 | 95.6% | 1.58 | 230 | 6.48% |
| 30,000,000 | 10,950,000,000 | 18,980,000,000 | 1960's | 1965 | 2,900,000,000 | 190,000,000 | 89.6% | 3.40 | 490 | 6.55% |
| 58,000,000 | 21,170,000,000 | 40,150,000,000 | 1970's | 1975 | 3,200,000,000 | 213,000,000 | 78.1% | 5.95 | 845 | 6.66% |
| 61,000,000 | 22,265,000,000 | 62,415,000,000 | 1980's | 1985 | 4,600,000,000 | 236,000,000 | 65.9% | 4.36 | 802 | 5.13% |
| 70,000,000 | 25,550,000,000 | 87,965,000,000 | 1990's | 1995 | 5,200,000,000 | 265,000,000 | 52.0% | 4.42 | 820 | 5.10% |
| 80,000,000 | 29,200,000,000 | 117,165,000,000 | 2000's | 2005 | 6,100,000,000 | 287,000,000 | 36.1% | 4.31 | 865 | 4.70% |
| 65,000,000 | 23,725,000,000 | 140,890,000,000 | 2010's | 2015 | 6,800,000,000 | 312,000,000 | 23.1% | 3.14 | 646 | 4.59% |
| 35,000,000 | 12,775,000,000 | 153,665,000,000 | 2020's | 2025 | 7,400,000,000 | 337,000,000 | 16.1% | 1.55 | 322 | 4.55% |
| 25,000,000 | 9,125,000,000 | 162,790,000,000 | 2030's | 2035 | 8,000,000,000 | 364,000,000 | 11.2% | 1.03 | 213 | 4.55% |
| 18,000,000 | 6,570,000,000 | 169,360,000,000 | 2040's | 2045 | 8,800,000,000 | 389,000,000 | 7.6% | 0.67 | 144 | 4.42% |
| 15,000,000 | 5,475,000,000 | 174,835,000,000 | 2050's | 2055 | 9,300,000,000 | <i>389,000,000</i> | 4.6% | 0.53 | 120 | 4.18% |
| 12,000,000 | 4,380,000,000 | 179,215,000,000 | 2060's | 2065 | <i>9,300,000,000</i> | <i>389,000,000</i> | 2.2% | 0.42 | 96 | 4.18% |
| 11,000,000 | 4,015,000,000 | 183,230,000,000 | 2070's | 2075 | <i>9,300,000,000</i> | <i>389,000,000</i> | 0.0% | 0.39 | 88 | 4.18% |

* Assumes U.S uses 10% of global oil supply and One Barrel of Oil equals 85 Gallons of Gasoline

** Time Magazine August 2002

*** United States Census Bureau "Statistical Abstracts of the United States 2001"