

Energy Justice Network



...helping communities protect themselves from polluting energy and waste technologies

ENERGYJUSTICE.net

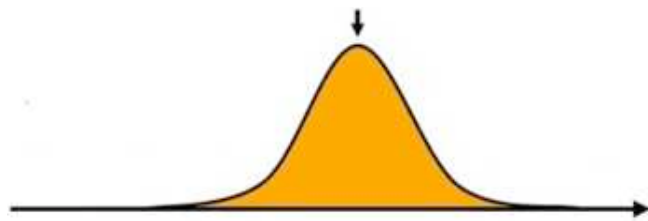
June 2009

Major Energy Transition Underway

- Peak Coal, Oil and Gas
- Energy Policy Act of 2005
- Global Warming
- Rising oil, gas and coal prices making both the clean and dirty alternatives more viable

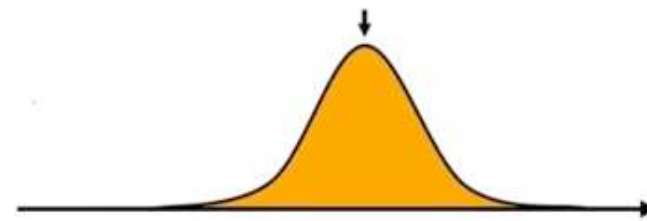


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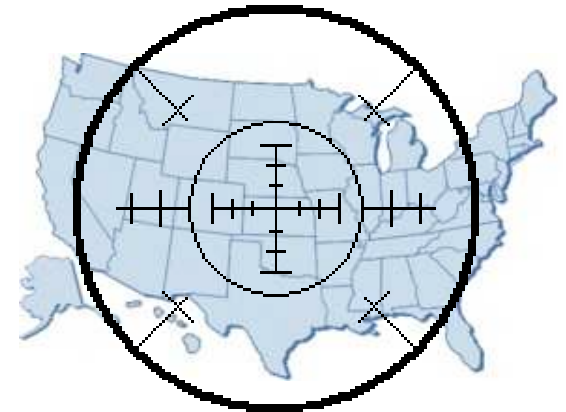
Global Oil Production

You are here



North American Natural Gas Production

Current U.S. Proposals



- **45+ Nuclear Reactors**
- **150+ Coal Plants**
- **420+ Ethanol Biorefineries**
- **46 Liquefied Natural Gas Import Terminals**
(17 more in Canada and Mexico)
- **4 Oil Refineries (and many expansions)**
- **20+ Coal-to-oil refineries**
- **numerous waste incineration and waste-to-fuels schemes for trash, tires and "biomass" wastes**

...every state is a target

...the number of proposals in each sector is increasing

Grassroots Opposition

- The single most effective weapon against new dirty energy facilities is grassroots resistance
- Grassroots opposition has stopped 60-90% of the proposals for nuclear reactors, trash incinerators and natural gas power plants since the 1970s
- Grassroots opposition is the largest and least-funded sector of the environmental movement
- Mainstream environmental groups make things more difficult by promoting “biomass,” “biofuels” (ethanol...), “clean coal” and nuclear power.



Environmental Hierarchy of Waste Management & Energy Production Methods / Fuels / Technologies

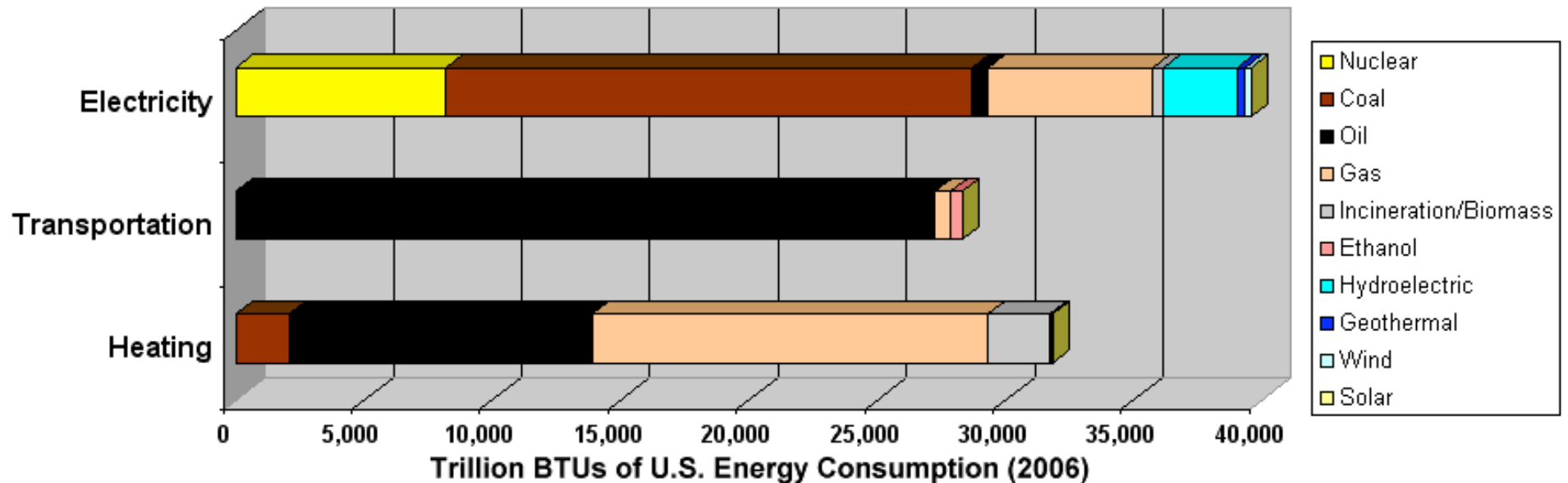
Cleanest	← Solid Waste Management →								Dirtiest	
<p>Redesign <u>Manufacturing</u></p> <p>Make products durable, recycled and recyclable</p> <p>Use materials which are more environmentally sustainable</p>	<p>Toxics Use Reduction</p> <p>Reduce amounts of toxic chemicals in production</p> <p>Replace toxic chemicals with less toxic or non-toxic alternatives</p>	<p>Reduce Consumption Reduction</p> <p>Use less</p> <p>Buy less</p> <p>Buy stuff with less packaging</p> <p>Avoid disposables & non-recyclables</p>	<p>Packaging Reduction</p> <p>Bring your own bag</p>	<p>Reuse</p> <p><u>Reuse</u></p> <p>Thrift</p> <p>Charity</p> <p>collection</p> <p>Dumpster diving</p>	<p>Source Separate</p> <p>Avoid mixing different types of materials</p>	<p>Recycle</p> <p><u>Recycle</u></p> <p>Recycling things into other products that can't be recycled – like paper into tissue paper</p>	<p>←Solutions <u>Compost</u></p>	<p>Problems→ <u>Landfill</u></p> <p>Land fill</p> <p>Mine Fill</p> <p>Monofill</p>	<p>Disposal / Dispersal</p> <p><u>Deregulate</u></p> <p>Land Application</p> <p>Beneficial Use</p> <p>Recycling toxic or radioactive wastes into consumer products or building materials</p>	<p><u>Incinerate</u></p> <p>Mass Burn</p> <p>Co-firing</p> <p>Fluidized Bed</p> <p>Gasification</p> <p>Plasma Arc</p> <p>Pyrolysis</p>

Cleanest	← Electricity Production →								Dirtiest	
<p>Conservation</p> <p>Lighting</p>	<p>Efficiency</p> <p>Lighting</p> <p>Motors</p> <p>Appliances</p> <p>Geothermal heat pumps</p>	<p>Clean Renewables</p> <p>←Solutions Problems→</p> <p><u>Solar</u> <u>Wind</u> <u>Micro-hydro</u> <u>Geothermal</u> <u>Ocean</u></p> <p>Electric grid can be run 100% on intermittent technologies using hydrogen to balance the load. This should be done with grid-tied closed-loop systems where clean renewable energy would be used to split water when there is excess electricity and fuel cells would turn the hydrogen back into water and electricity when needed.</p>				<p><u>Hydroelectric</u></p>	<p><u>Natural Gas</u></p> <p>Simple Cycle</p> <p>Combined Cycle</p> <p>Fuel Cell</p>	<p>Dirty Energy</p> <p><u>Oil</u></p> <p>Incineration (see "biomass feedstocks" list below)</p>	<p><u>Coal</u></p> <p>Conventional</p> <p>Gasification ('Clean coal')</p>	<p><u>Nuclear</u></p> <p>Fission [Fusion]</p>

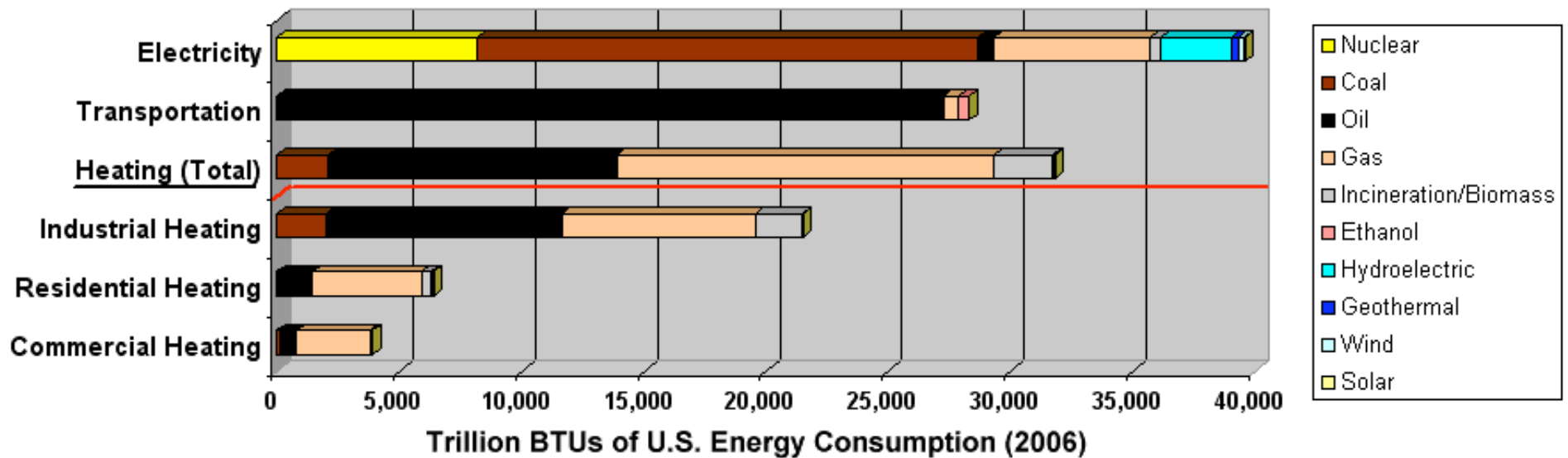
Cleanest	← Transportation & Heating Fuels →								Dirtiest					
<p>Conservation</p> <p>Mass Transit</p> <p>Carpooling</p> <p>Telecommuting</p> <p>Reduce Sprawl</p> <p>Trails-to-Rails</p> <p>Bicycling</p> <p>Walking</p>	<p>Efficiency</p> <p>Fuel Efficiency Standards</p> <p>Hybrids</p> <p>Weatherization</p> <p>Geothermal heat pumps</p>	<p>Clean Energy</p> <p>←Solutions Problems→</p> <p><u>Clean Electricity</u> <u>Sustainable Biodiesel</u></p> <p>Plug-in Hybrids or Full Electric Vehicles (electricity must come from clean sources)</p> <p>From used vegetable oils or algae</p> <p><i>[can meet a very small portion of fuel demand]</i></p>				<p><u>Biodiesel</u></p> <p>Soybeans</p> <p>Sugarcane</p> <p>Palm Oil</p>	<p><u>Ethanol</u></p> <p>Corn-based ethanol</p> <p>Cellulosic ethanol (from biofuel feedstocks – see below)</p>	<p><u>Natural Gas</u></p>	<p><u>Landfill Gas</u></p> <p>Boiler</p> <p>Piped into natural gas lines</p>	<p>Dirty Energy</p> <p><u>Oil</u></p> <p>[and other petroleum products]</p>	<p><u>Waste-Based Fuels</u></p> <p>Trash / sludge-to-ethanol (cellulosic ethanol)</p> <p>Thermal depolymerization</p>	<p><u>Coal</u></p> <p>Coal-based liquid fuels</p>	<p><u>Tires</u></p> <p>Cement Kilns</p> <p>Paper Mills</p>	<p><u>Hazardous Waste</u></p> <p>Cement Kilns</p> <p>Chemical Plants</p>

Least Dirty	← Biomass / Biofuel Feedstocks →								Most Dirty	
<p><u>Digester Gas</u></p> <p>Sludge</p> <p>Animal waste</p> <p>Food waste</p>	<p><u>Landfill Gas</u></p>	<p><u>Trees</u></p> <p>Tree Trimmings ("Urban Wood Waste")</p> <p>Forest Cutting</p>	<p><u>Energy Crops</u></p> <p>Phytoremediation plants</p> <p>Biotech</p>	<p><u>Agricultural Crop Residue</u></p>	<p><u>Paper / Lumber Mill Wood Waste</u></p>	<p><u>Animal Factory Wastes</u></p> <p>Poultry litter</p>	<p><u>Construction / Demolition Wood Waste</u></p> <p>Painted/treated wood</p>	<p><u>Sewage Sludge</u></p>	<p><u>Tires</u></p>	<p><u>Municipal Solid Waste</u></p>

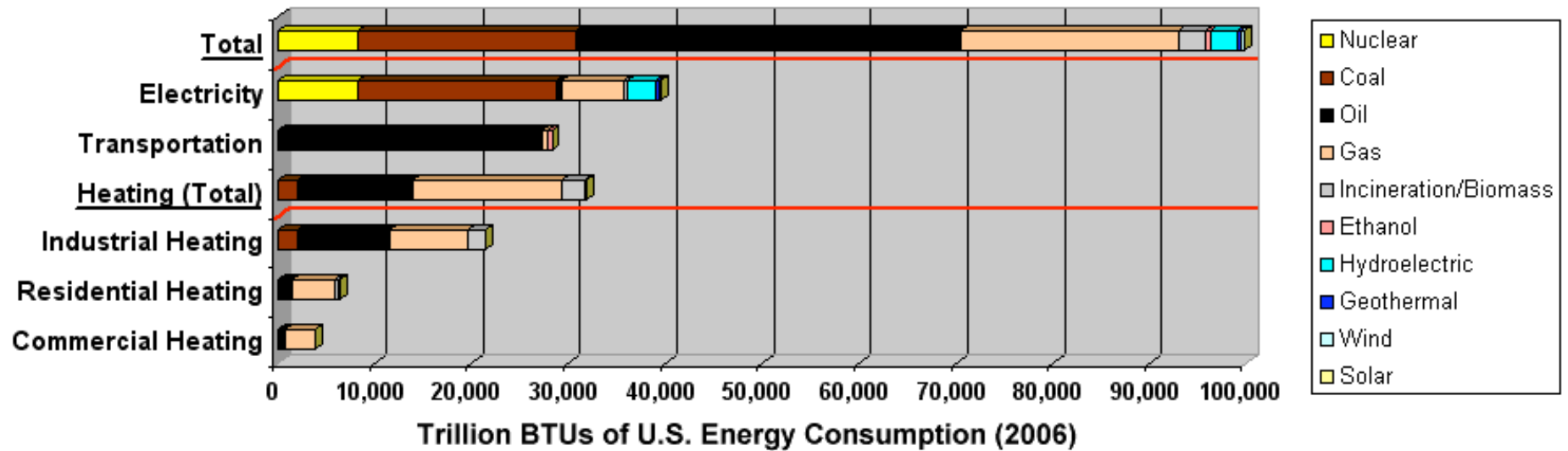
Where U.S. Energy Comes From



Where U.S. Energy Comes From



Where U.S. Energy Comes From



Nuclear Power



Nuclear Power

- Most Racist
- Most Expensive
- Most Dangerous
- Uranium = foreign source of energy
- Global warming pollution
- Reactors release nuclear pollution
- Accidents / Terrorism Risk
- Waste Containment is Impossible
- Not Enough Uranium for Nuke Revival

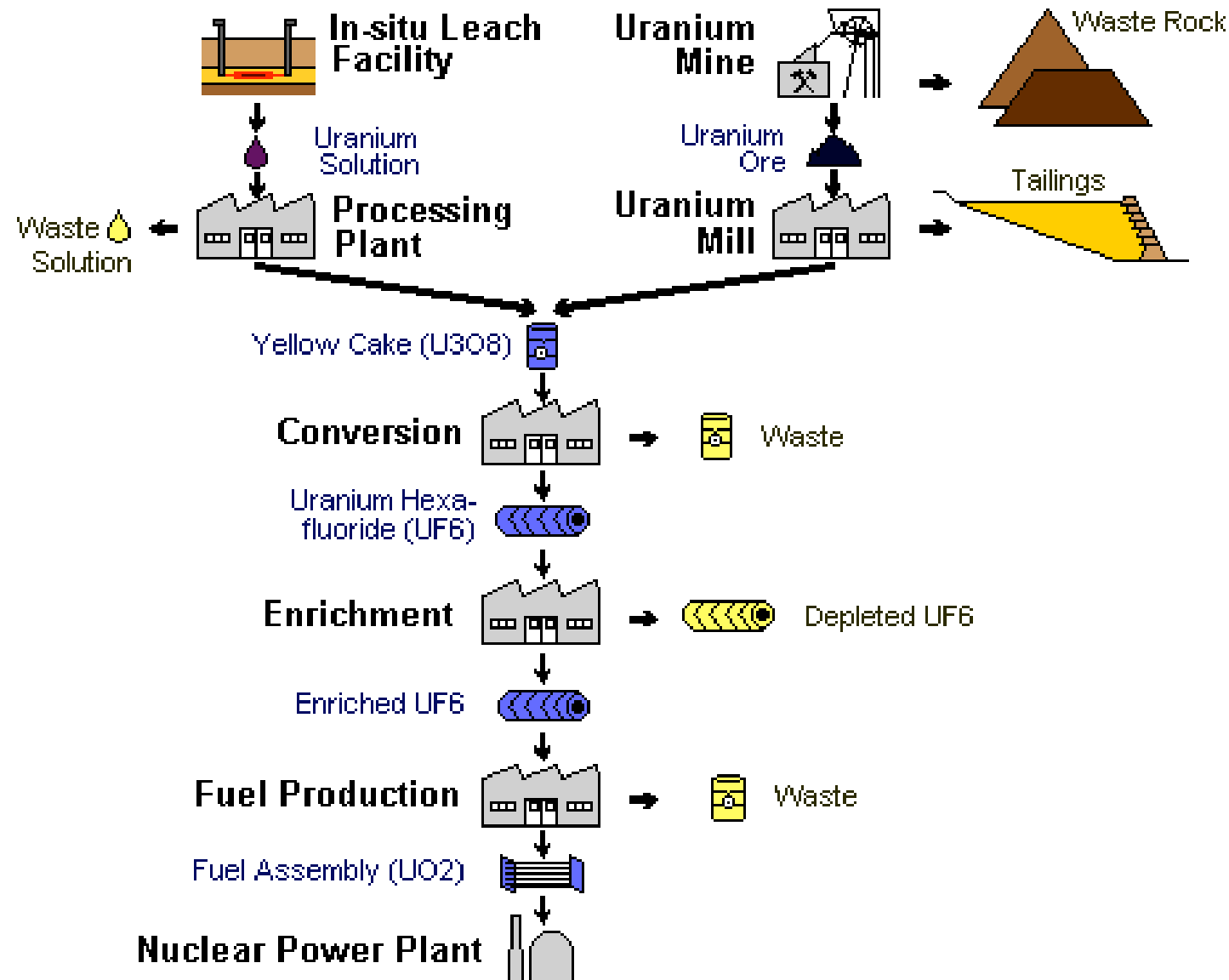


Mining → Milling → Conversion → Enrichment

→ War

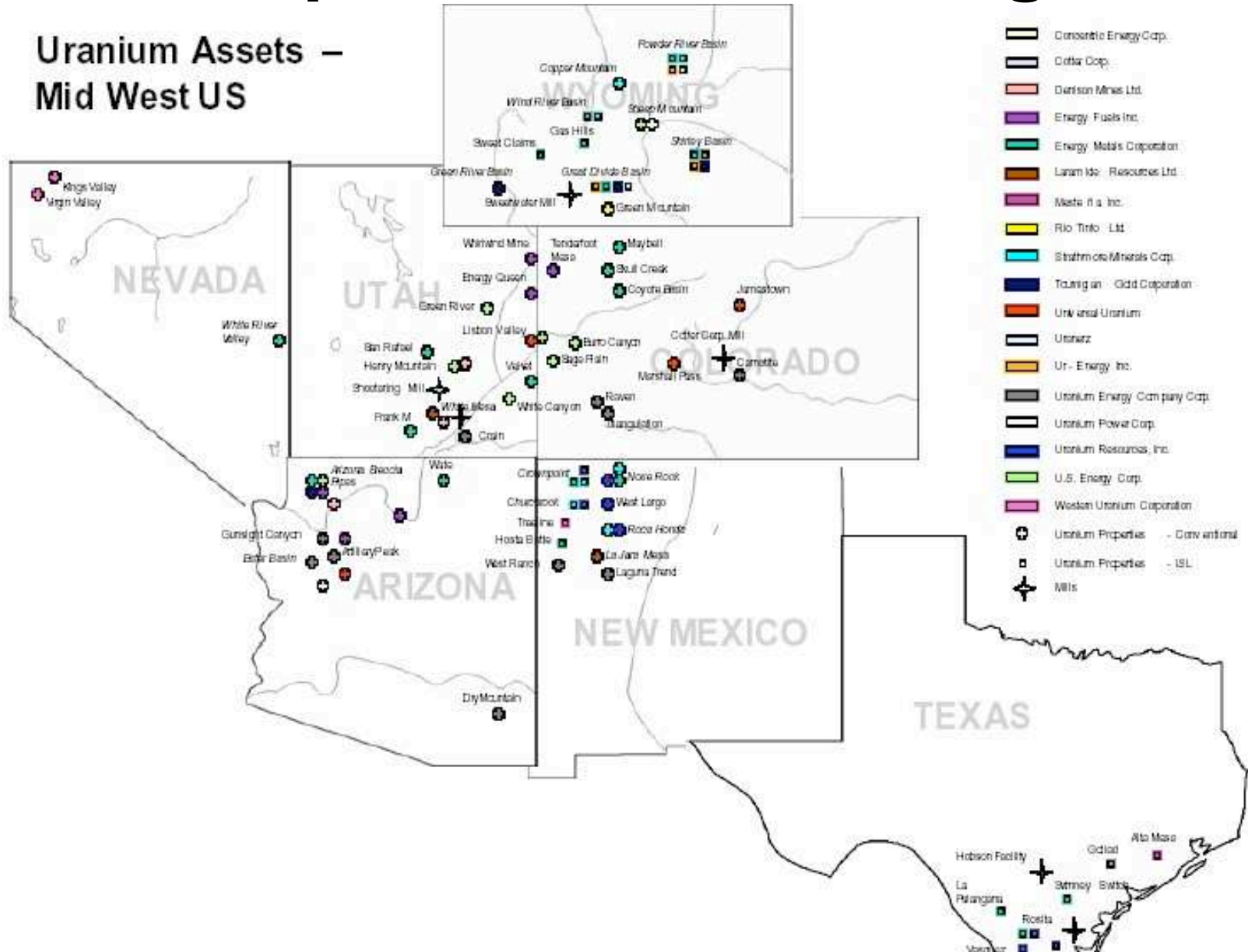
→ Fuel Fabrication → Reactor → Waste Disposal

Nuclear Fuel Production Chain



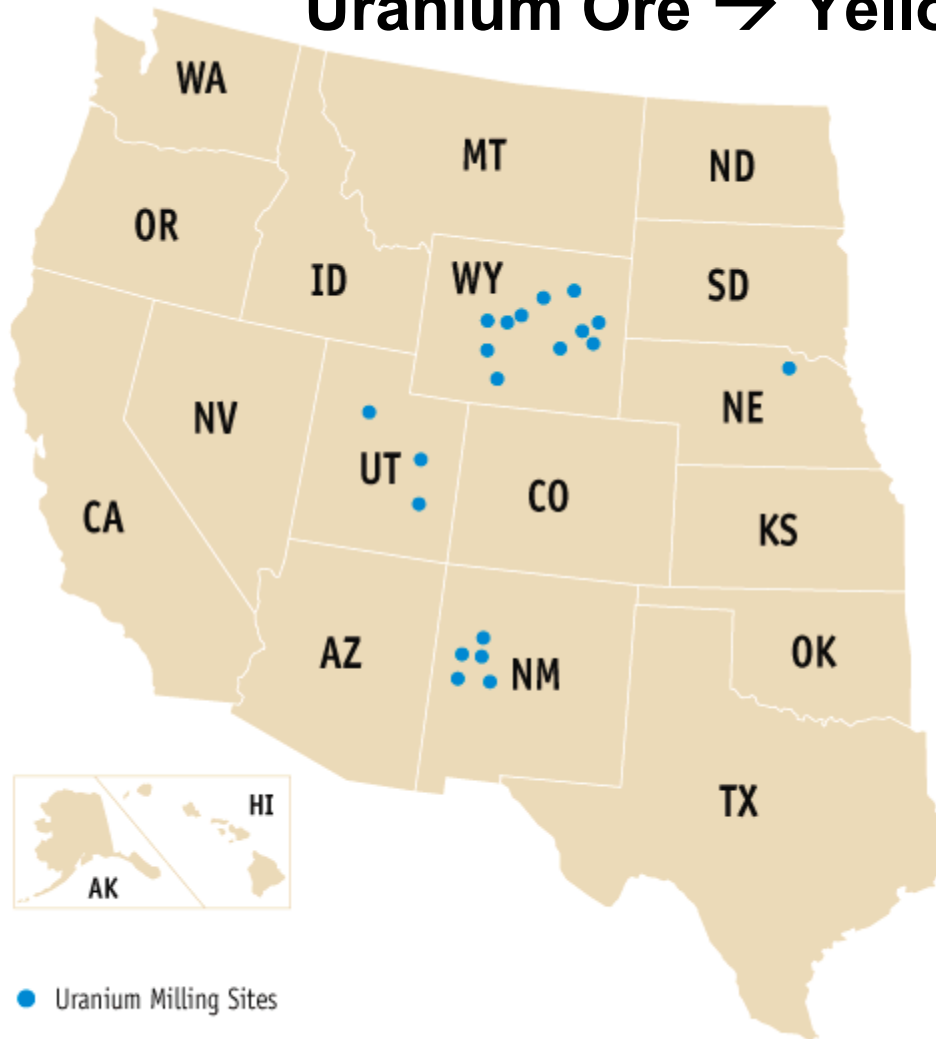
Step 1: Uranium Mining

Uranium Assets – Mid West US



Step 2: Uranium Milling

Uranium Ore \rightarrow Yellow Cake (U_3O_8)



Note: Uranium mills are located in western states because the population density is lower.

Step 3: Uranium Conversion

Yellow Cake (U_3O_8) \rightarrow Uranium Hexafluoride (UF_6)

- Only one plant operating in U.S.: Honeywell's Converdyn facility in Metropolis, IL (converdyn.com)
- Facility being expanded:
- June 18, 2007: Converdyn announced that, after the installation of new equipment, the nameplate annual capacity of the Metropolis uranium conversion now is 17,600 MTU as UF_6 (up from 14,000). The next level of planned expansion is to 18,000 MTU as UF_6 in the 2012 timeframe or when market conditions dictate the need.



Step 3: Uranium Conversion

Saturday, January 4, 1986, a 12.5 t UF_6 cylinder ruptured at the Sequoyah Fuels Corporation (SFC) uranium conversion plant site in Gore, Oklahoma, USA, resulting in a massive release of uranium hexafluoride lasting for a period of about 40 minutes. One SFC worker was killed and some workers were hospitalized.

The accident happened when an overfilled cylinder was heated in an attempt to remove excess UF_6 . When the solid UF_6 liquefied, the associated volume increase breached the cylinder.

This photo shows the 1.32 m long rupture. At its midpoint, the opening is about 20 cm wide. The cylinder wall is 16 mm thick steel. Water is draining out after rinsing out the cylinder.



Step 4: Uranium Enrichment

Uranium Hexafluoride (UF_6) → Enriched Uranium Hexafluoride

- **Paducah Gaseous Diffusion Plant (Paducah, KY)**
 - 1988: Kentucky Radiation Control Branch finds radioactive technetium-99 in private drinking water wells near the plant.
- **Piketon Centrifuge Plant (Portsmouth, OH)**
- **New proposal in Hobbs, NM** (after being rejected in Louisiana and Tennessee; 1997: NRC rejects permit for Homer, LA site due to environmental racism)
- Very energy intensive – old coal plants used to power it
- Massive fluoride pollution



BY STEVE DURBIN, THE C-J

Step 4 (waste): Depleted Uranium

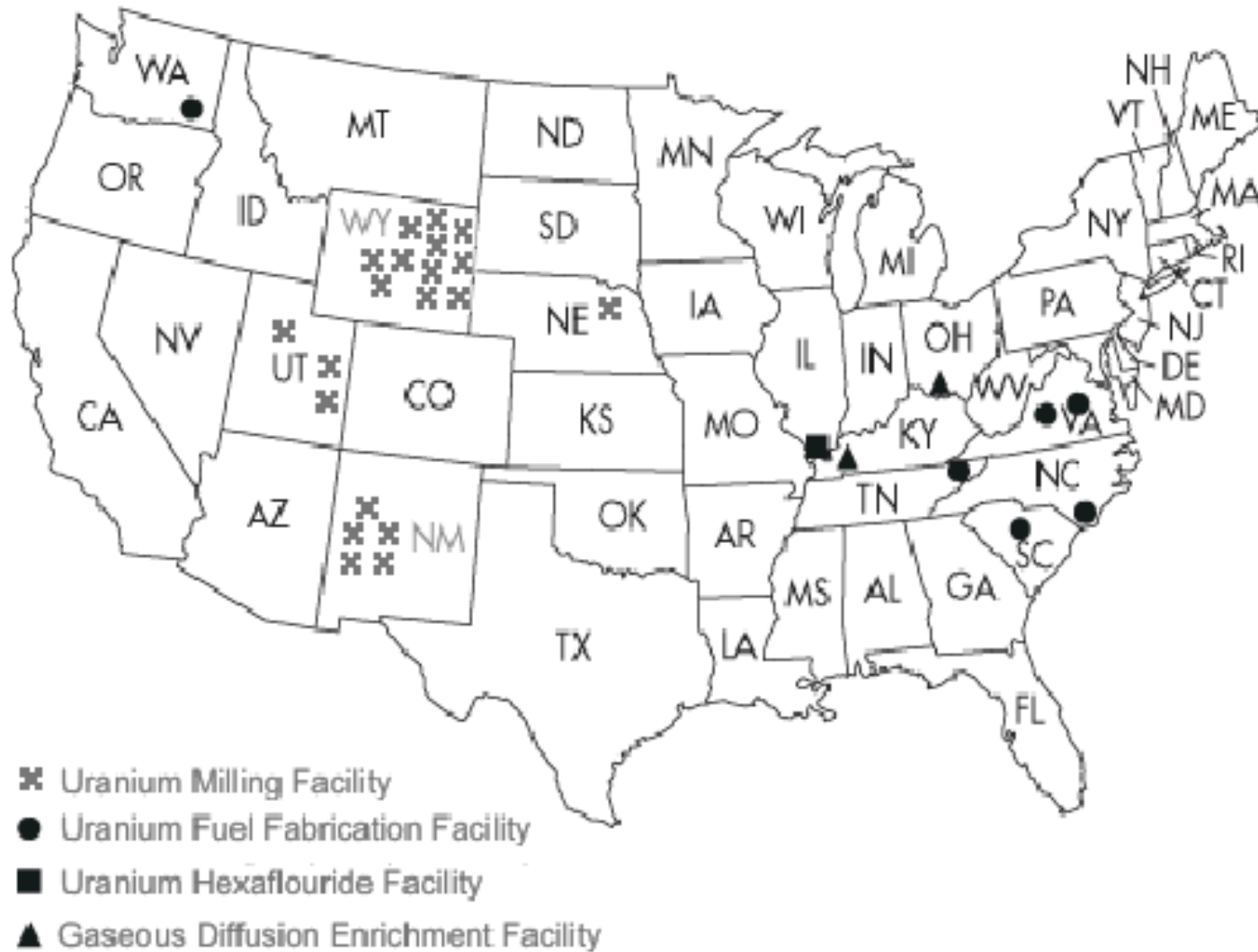


For each ton of enriched uranium, 7 tons of depleted uranium (DU) are generated. The DU is also referred to as "tails", not to be confused with the mill tailings. DU still contains 0.2 - 0.35% of uranium-235.

www.energyjustice.net/nuclear/du/

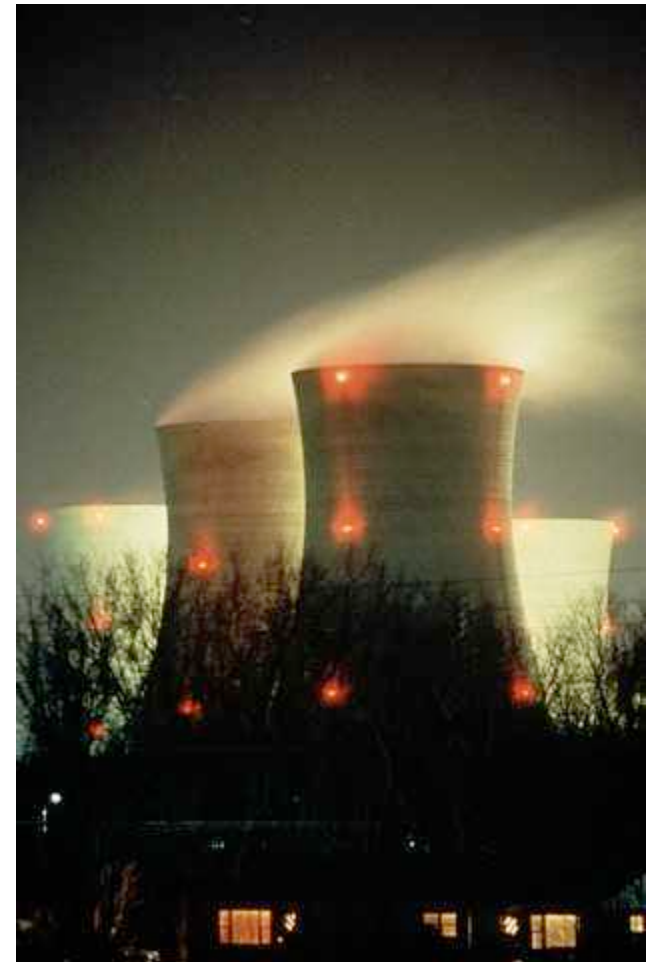
Step 5: Fuel Fabrication

Enriched Uranium Hexafluoride \rightarrow UO_2 Fuel Rods



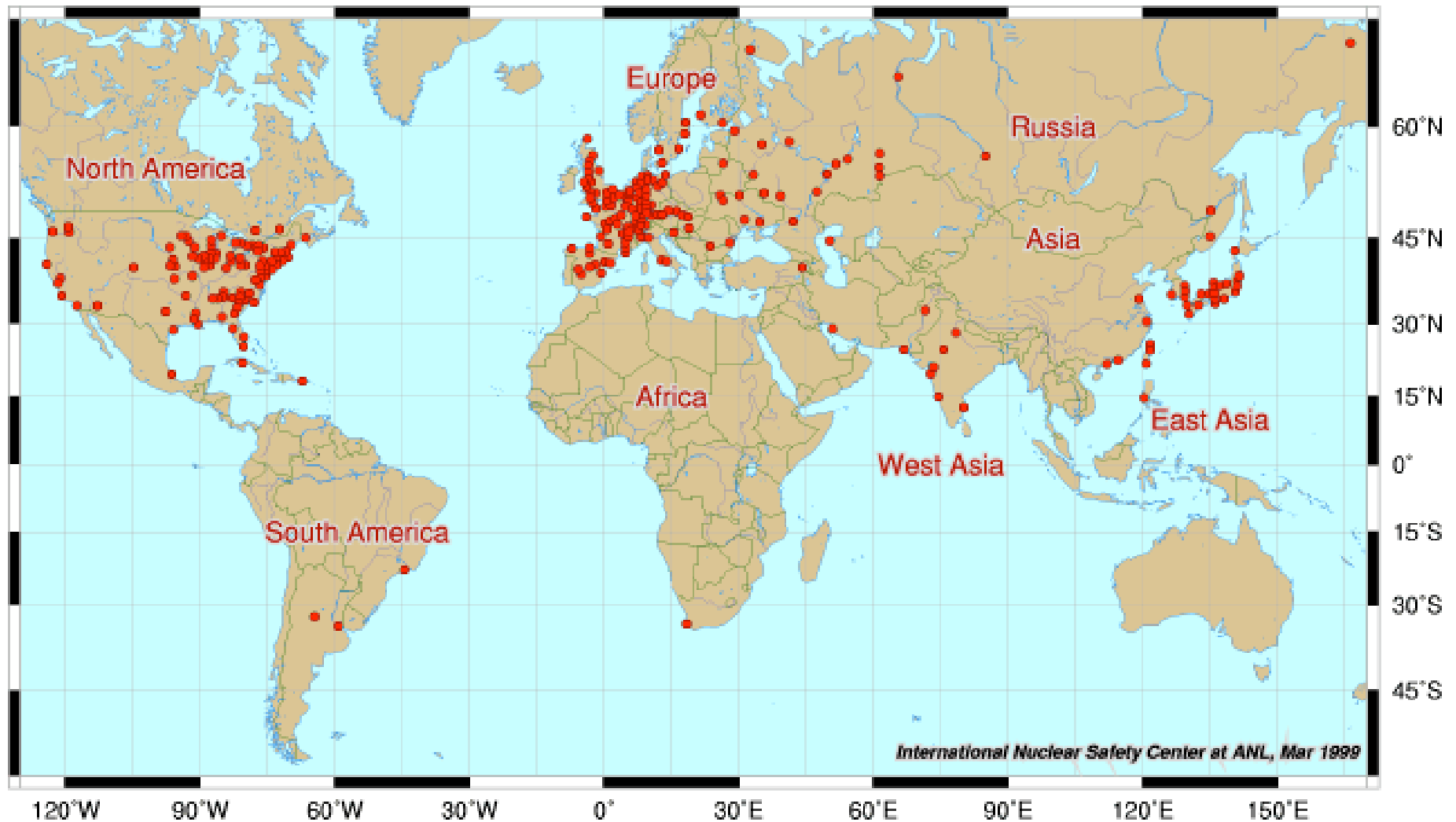
Step 6: Nuclear Reactors

- 104 operating
 - Started 1970s & 1980s
 - Wanted 1,000 built by year 2000
 - Only got as many as 116
 - Provides 20% of electricity
 - No New Reactors Ordered in U.S. since 1979 meltdown at Three Mile Island Unit 2 in PA
- 45 new reactors currently proposed
- Huge water use
- Radioactive air and water emissions



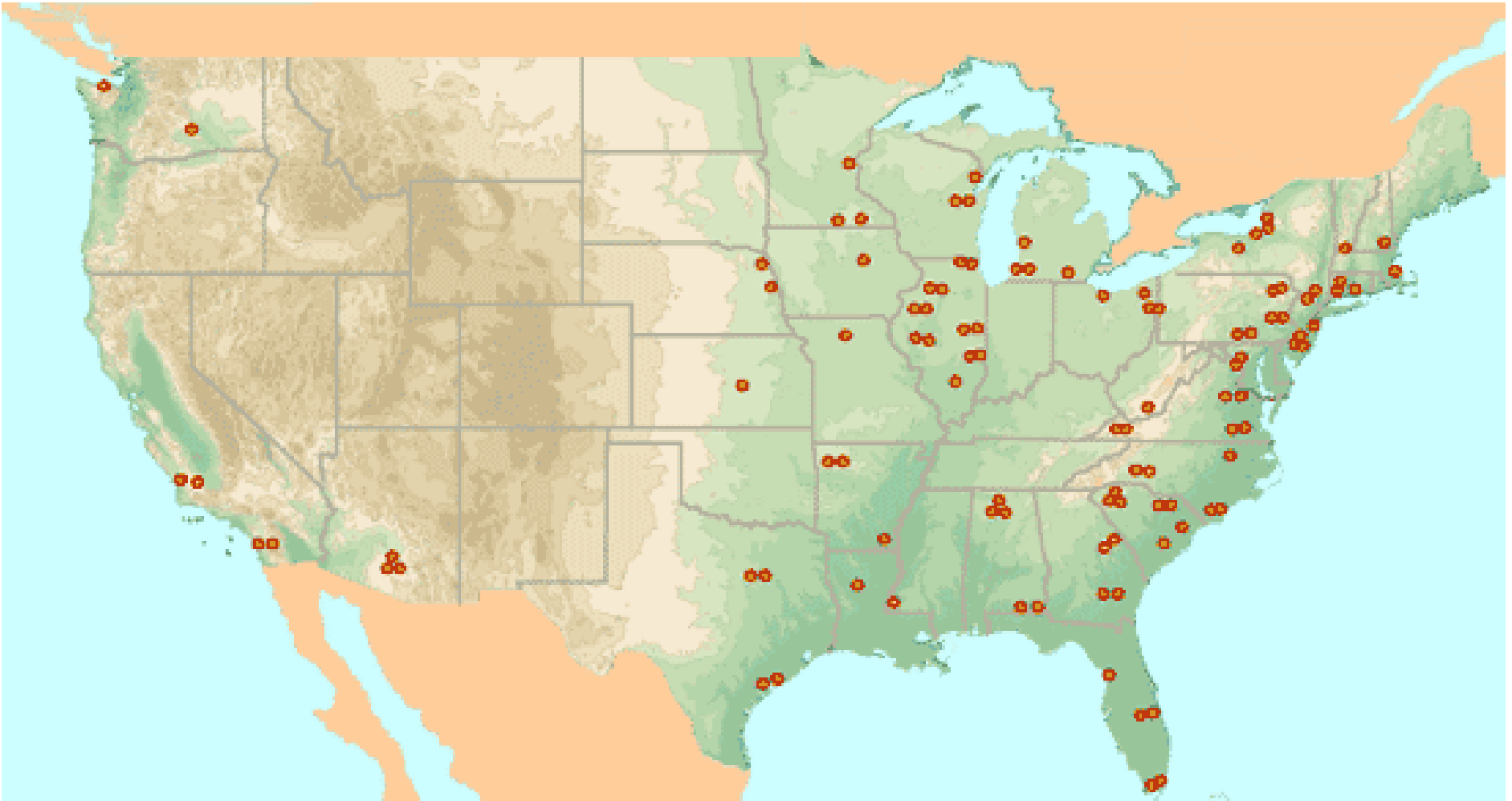
Nuclear Power

Existing Reactors – World Map



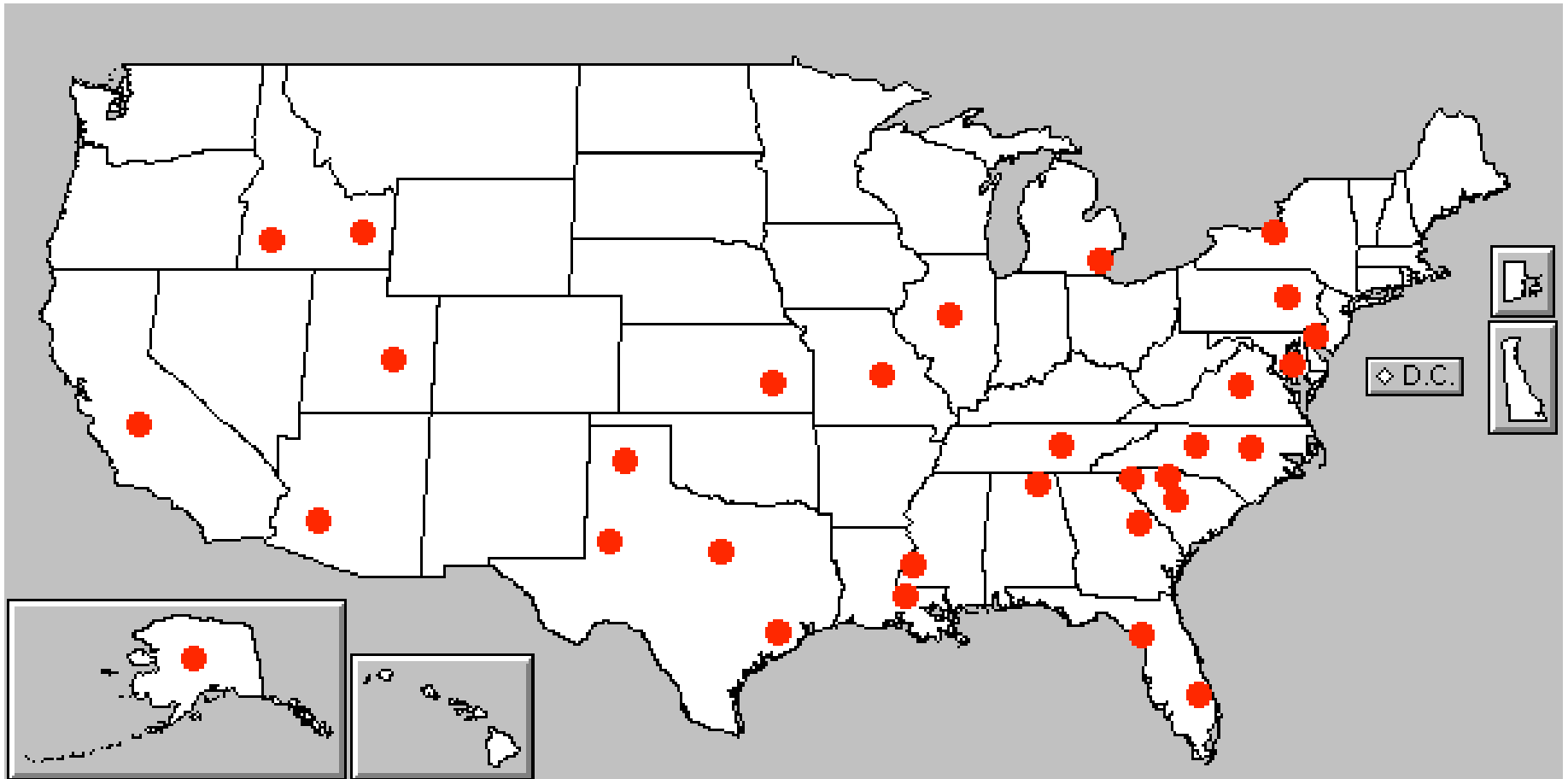
Nuclear Power

Existing Reactors – U.S. Map



Nuclear Power

Proposed New Reactors



Step 7: Nuclear Waste



Step 7: Nuclear Waste

“Low-Level” Radioactive Waste

- Primarily from nuclear power (very little is from nuclear medicine, contrary to public relations perceptions)
- All 6 “low-level” nuclear waste dumps in the U.S. are leaking; 4 are now closed:
 - Barnwell, SC (still open)
 - Richland, WA (still open)
 - Beatty, NV
 - Sheffield, IL
 - Maxey Flats, KY
 - West Valley, NY
- Efforts to site new LLRW dumps in 13 states since 1980 have all be stopped; closest attempts were in communities of color (Sierra Blanca, TX and Ward Valley, CA)

“Low level” waste includes ALL nuclear reactor waste except the fuel rods. It is not defined by health effects or radioactivity levels and does *not* mean low hazard.

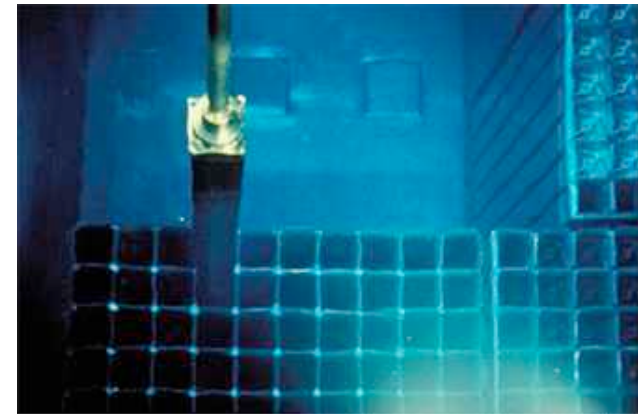


Step 7: Nuclear Waste

High-Level Radioactive Waste

- “Spent” nuclear fuel is roughly 1 million times more radioactive than when it went into the reactor
- Yucca Mountain, Nevada
 - Water leaks through (can’t keep waste dry)
 - Sits on and among active fault lines
 - Resides on Western Shoshone tribal lands
 - Far away from nuclear reactor locations, requiring transportation through 43 states
 - Plagued by falsified science and political corruption
 - Unlikely to ever be built
- About 60 native American tribes have been targeted for “temporary” storage of high-level nuclear waste.

Highly-irradiated nuclear power plant fuel rods.

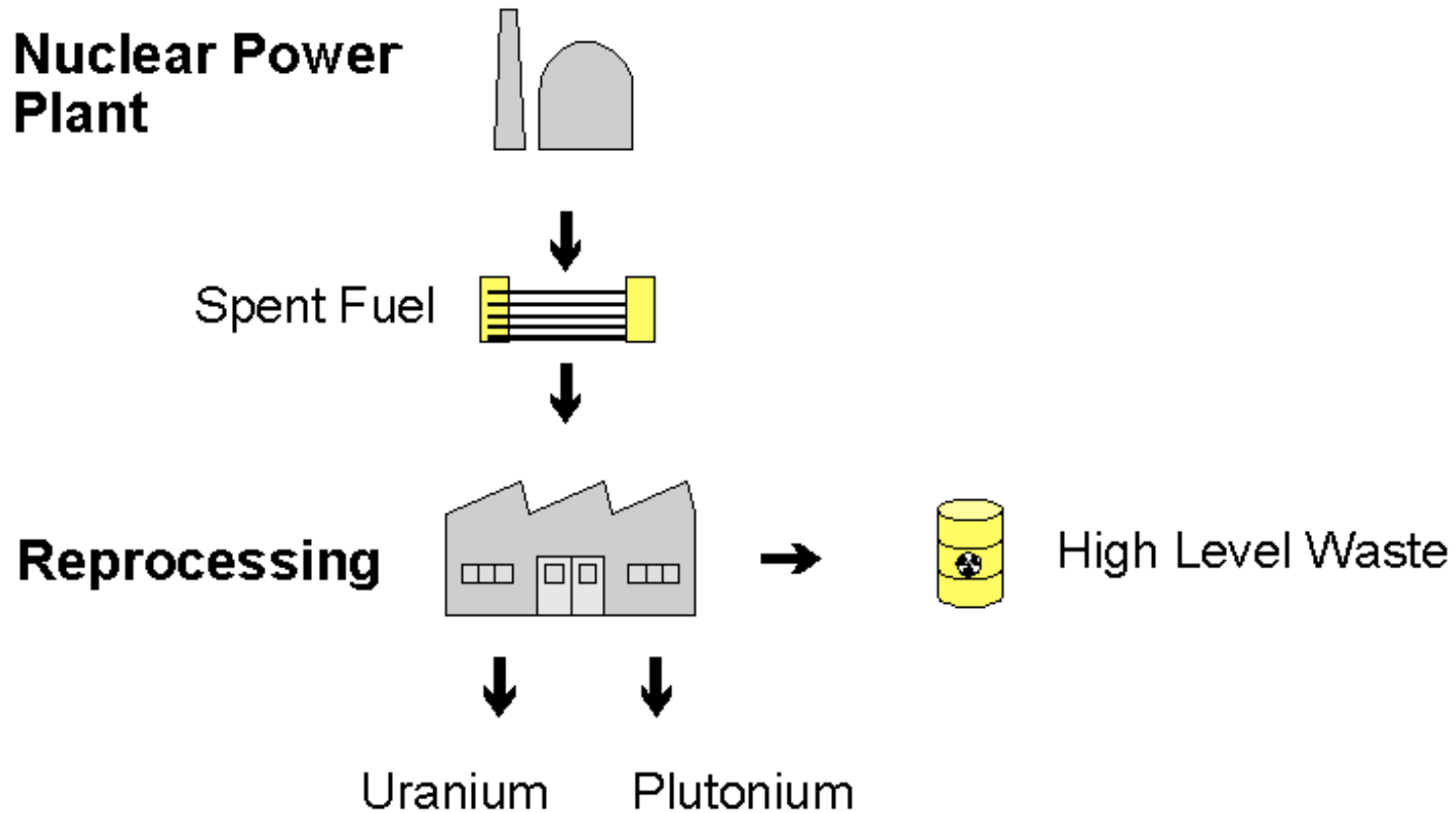


Step 7: Nuclear Waste

Shipping Routes to Yucca Mountain, Nevada



Step 7b: Reprocessing



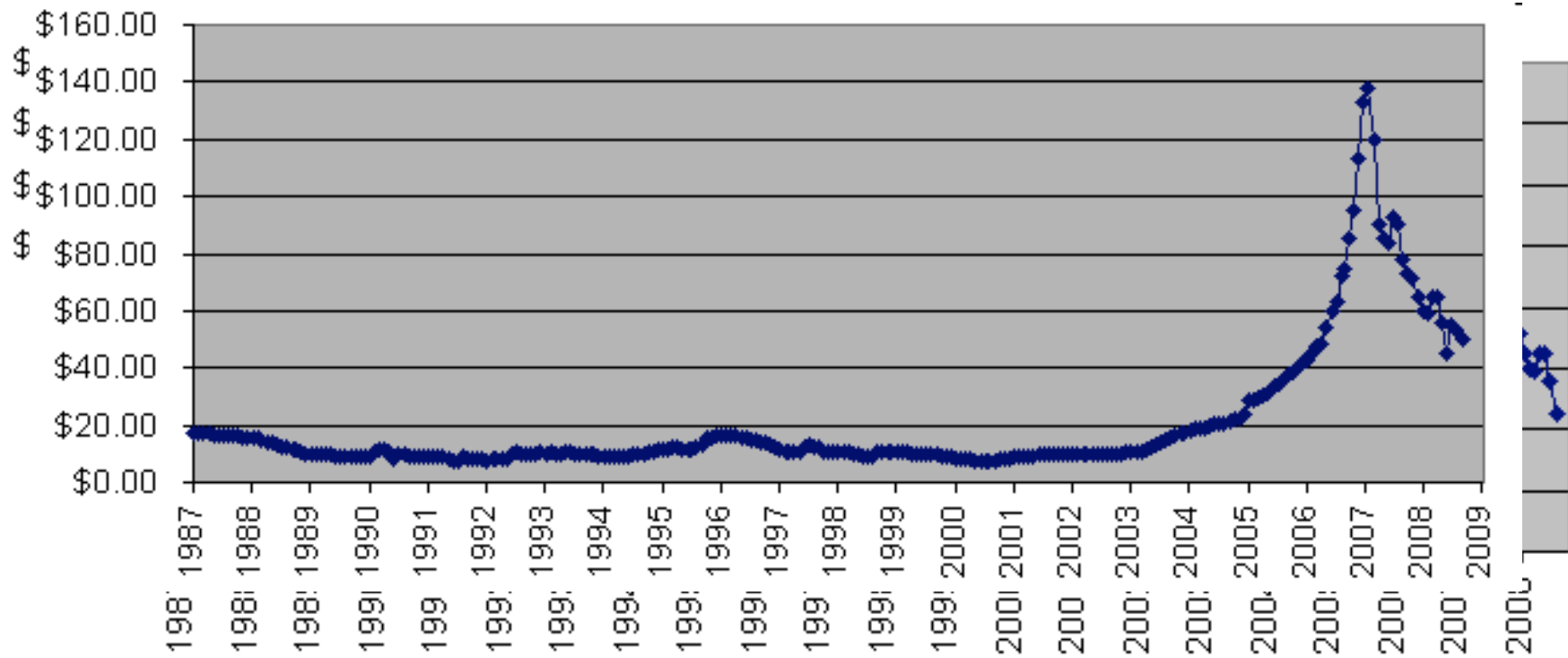
Nukes and Global Warming

- Not Enough Time
- Not Enough Money
- Not Enough Uranium
 - Getting very expensive
- Not Safe from accidents or terrorism
- Has global warming emissions
 - CFC-114
 - Fossil Fuels Needed for Nuclear Fuel Chain
- Reactors can't take the heat (shutdowns during hot weather)

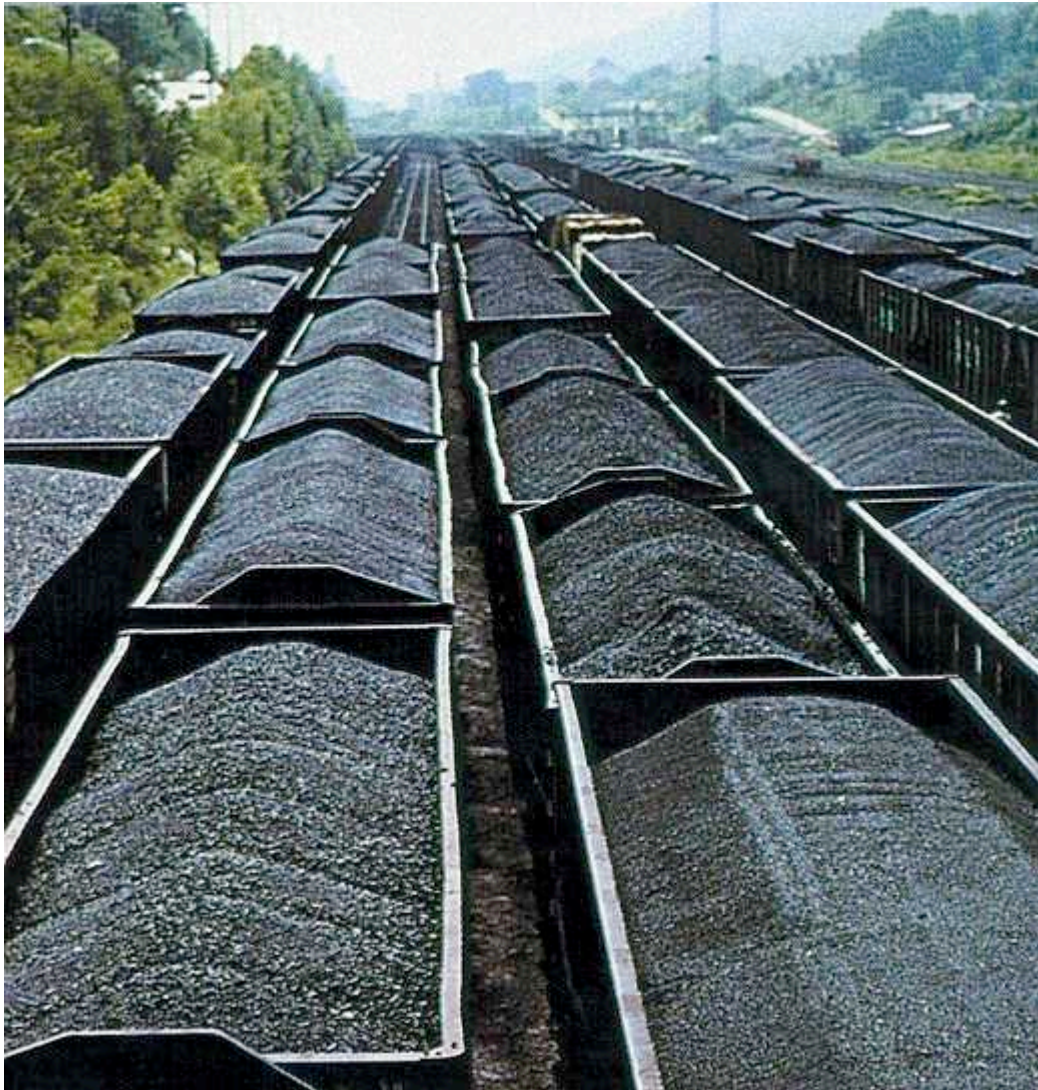


Uranium Prices

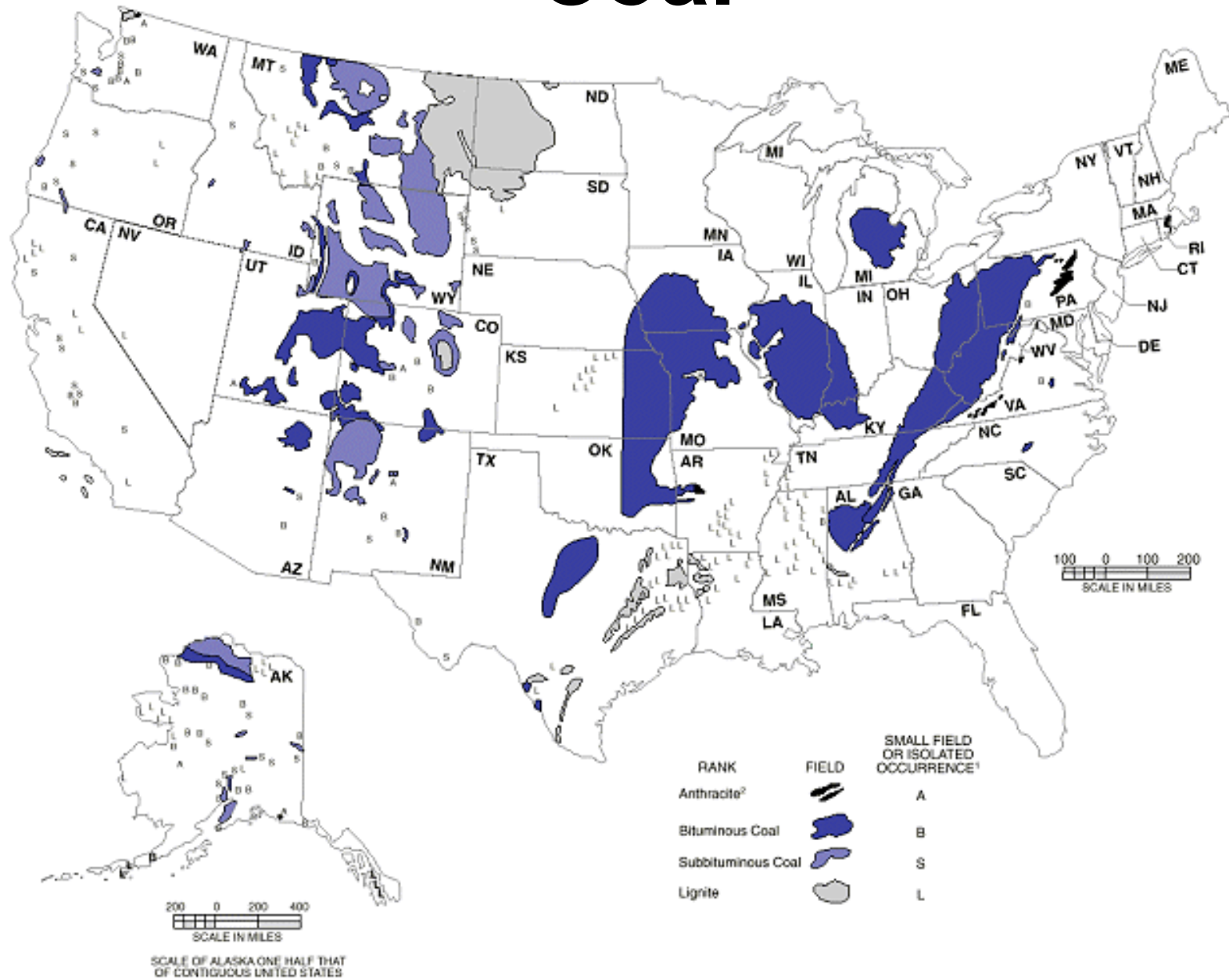
(Ux U₃O₈ Price \$/lb)
[through May 2009]



Coal



Coal

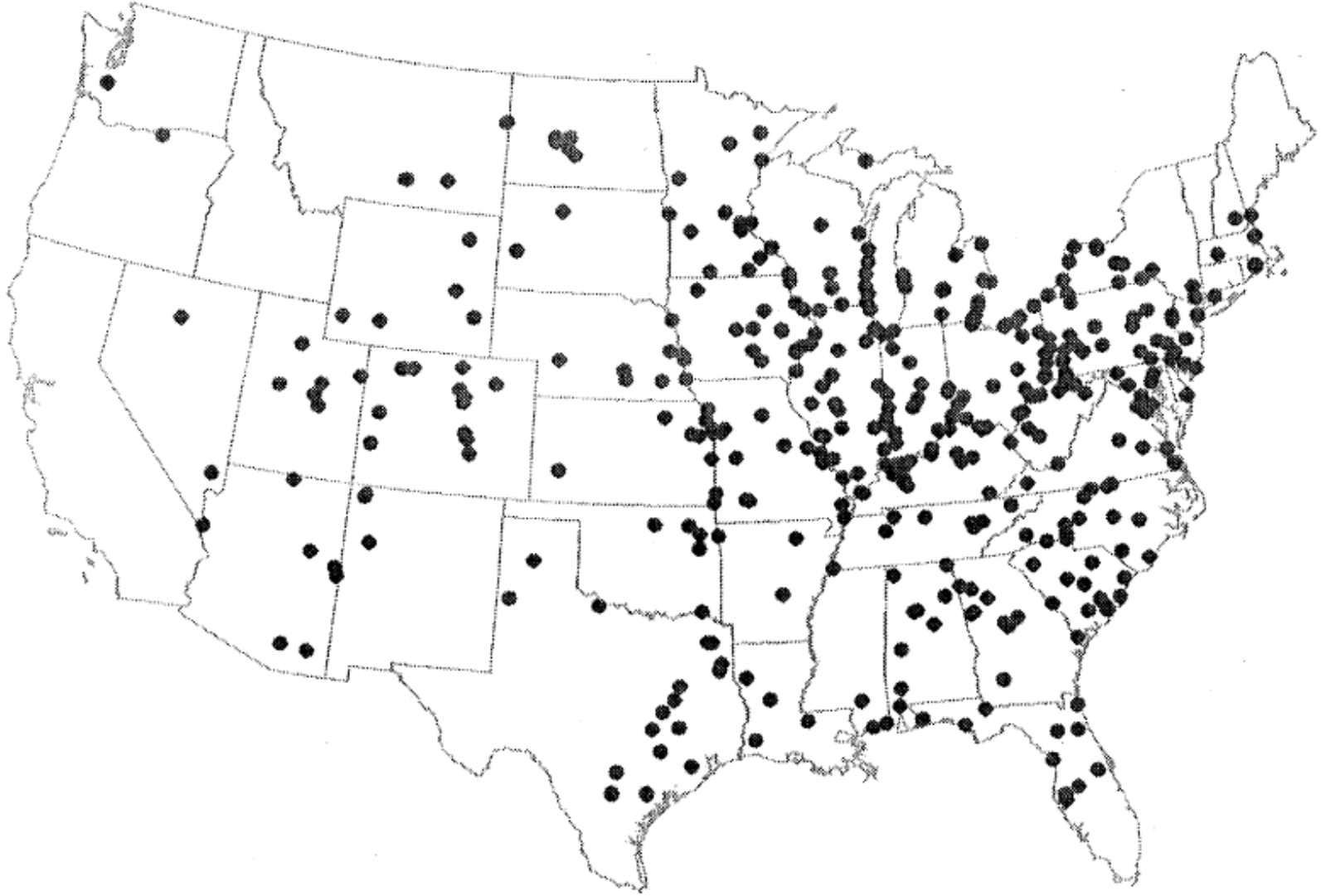


Coal Mining

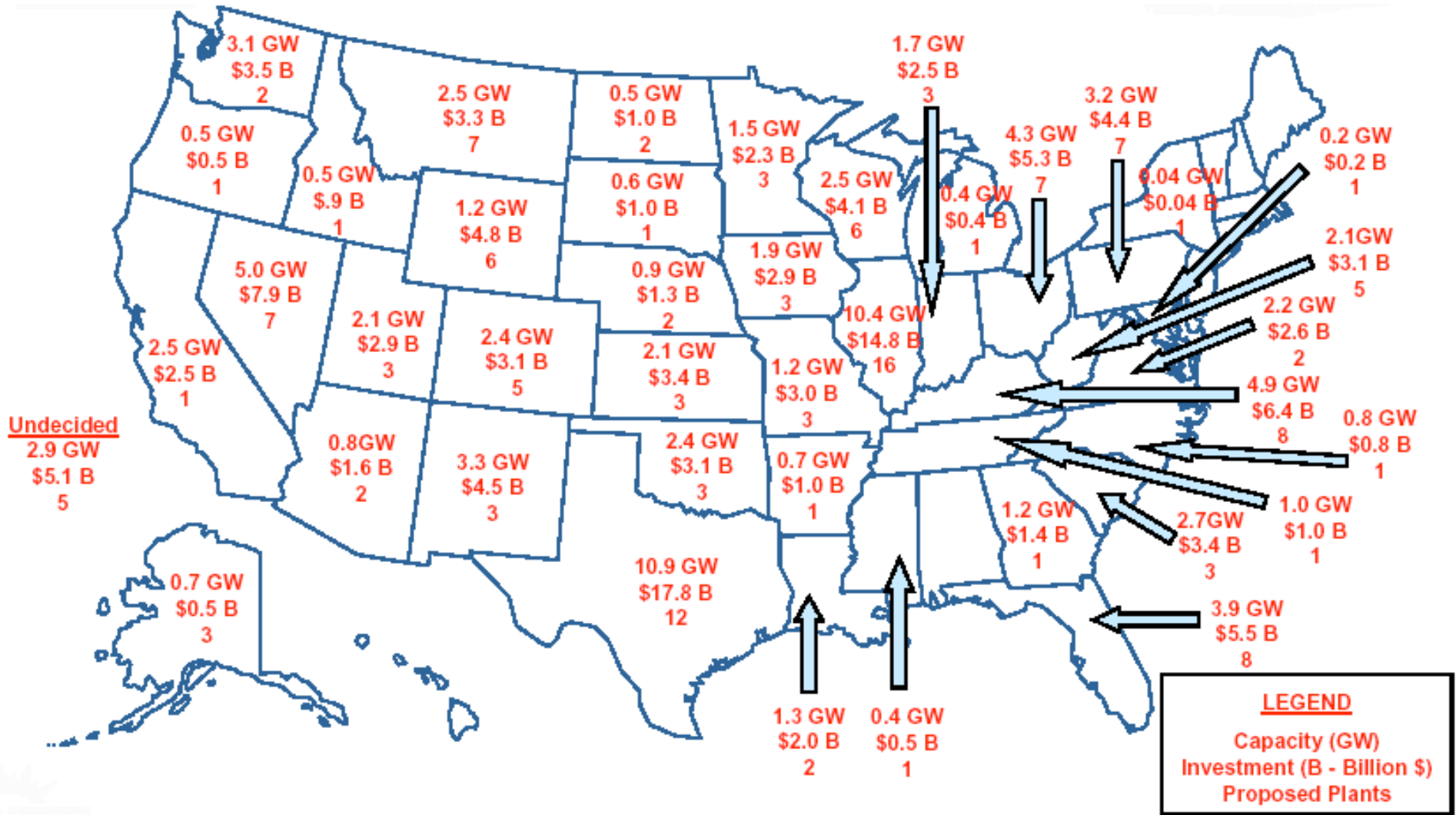
- Biggest Mining States: Wyoming, West Virginia
- Long-wall Mining under homes, highways
- Strip Mining & Mountaintop Removal
- Class war
- Ecological devastation
- Toxic slurry & coal wastes
- Peak Coal



Coal – Existing Power Plants



Coal – Proposed Power Plants



Coal Power Plants

- About 420 existing; 150+ proposed
- Biggest States: Pennsylvania, Illinois, Indiana, Kentucky, Ohio
- Most built from 1950s-80s
- African-American communities most affected
- Provides 52% of electricity and 7% of industrial heating fuels
- Air Pollution:
 - Acid Gases (Hydrogen Fluoride, Hydrochloric Acid, Sulfuric Acid)
 - Organic pollutants (Dioxins/furans, Volatile Organic Compounds / PAHs)
 - Toxic metals (mercury, arsenic, lead, cadmium, etc.)
 - Particulate matter
 - Nitrogen Oxides (NO_x), Sulfur Oxides (SO_x)
- Global Warming; Acid Rain
- Asthma, heart attacks, cancer...
- Toxic ash dumped with no groundwater protection; some “recycled” into concrete

Coal Ash Dumps



Coal Ash

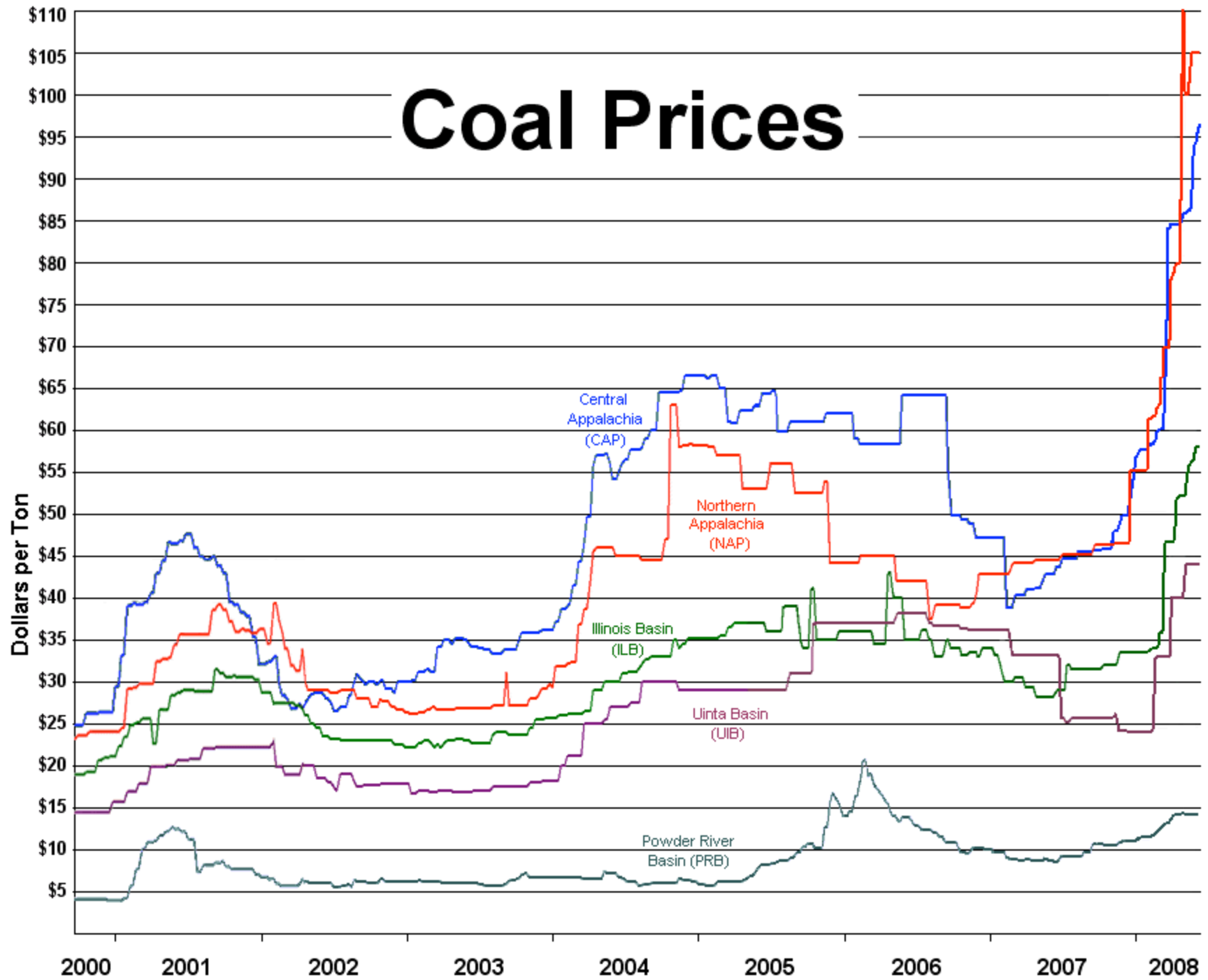
- 2nd largest waste volume in the U.S.
 - Largest volume of waste is from mining
- Ash usually dumped without any liner systems to try to protect groundwater
- Fly ash often “recycled” into concrete for road building and in “green” buildings
 - Energy Policy Act of 2005 requires it for new government buildings
- Toxic metals and other poisons eventually escape... even from concrete
- Spills of coal ash embankments have already poisoned communities and waterways

No Such Thing as Clean Coal!

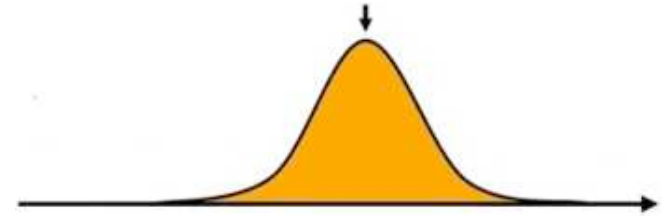
- IGCC: Integrated Gasification Combined Cycle
- FBC: Fluidized Bed Combustor
- Still relies on the same damaging mining practices
- Still releases wide range of pollutants, though some may be transferred into the ash or may be released in different amounts
 - Fluidized Bed Combustors are WORSE for global warming and cancer-causing PAH pollution than normal burners
- Wider range of fuels can be burned, leading to use of more contaminated fuels (waste coal, trash, tires...)
- Use of fancier pollution controls is leading to increased use of high-sulfur coals
- Solid wastes (ash/slag) still produced
- More expensive: investment dollars should go to clean energy!
- Carbon sequestration is a dangerous pipe dream

www.energyjustice.net/coal/igcc/

Coal Prices

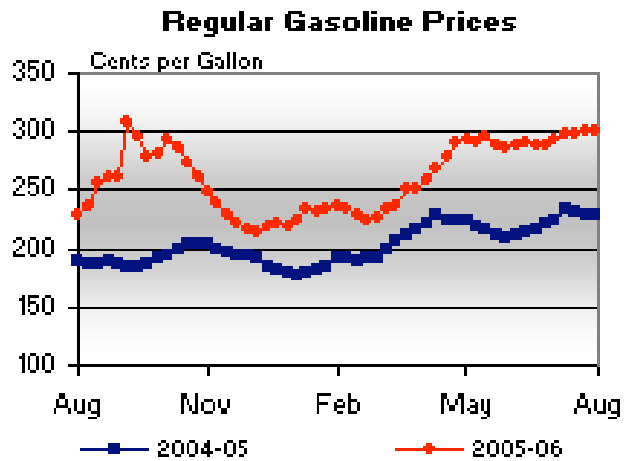


Peak Coal



- **U.S. has world's largest coal reserves, yet coal imports are increasing as U.S. coal supply falls short**
- **Cheap coal already obtained**
- **Coal production east of the Mississippi already peaked... in 1990**
- **U.S. total coal production peaked in terms of energy value in 2002; in terms of tonnage, production may not peak until 2032**
- **Global Peak Coal: 2025 (if not sooner)**
- **New coal power plants will experience peak coal in their lifetime**

Oil



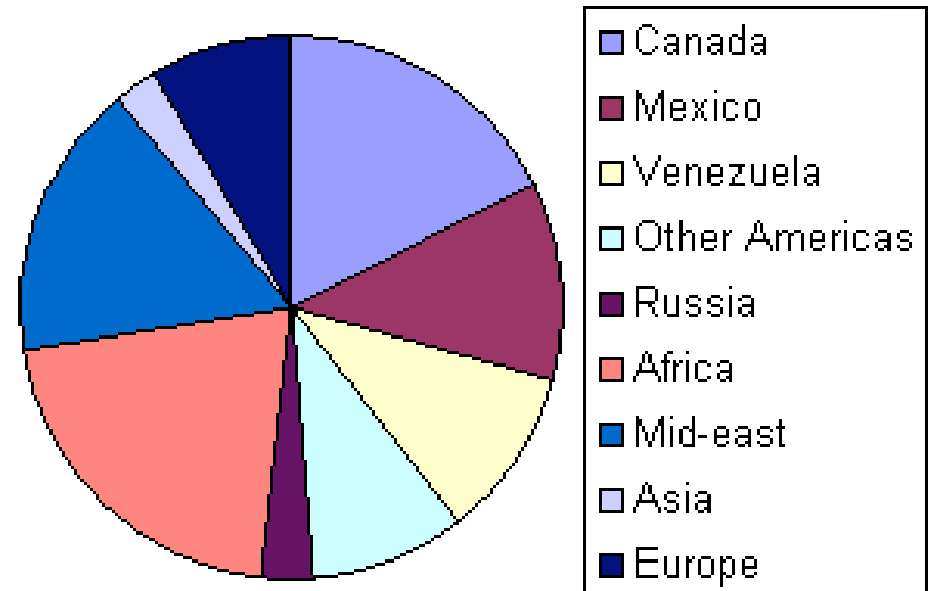
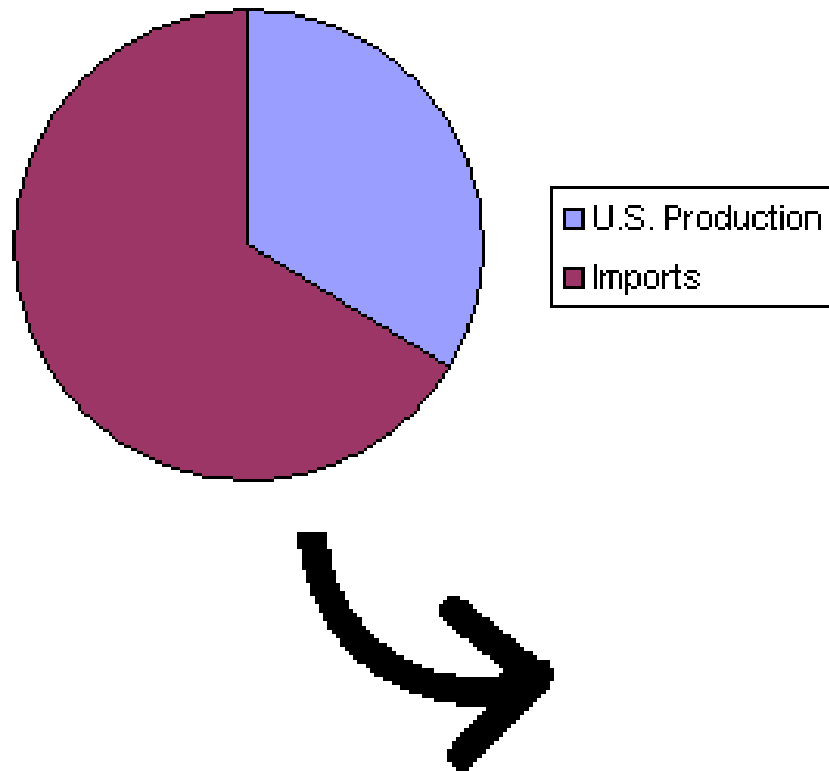
The pipeline is gushing, while here we lie in tombs...

Mass graves for the pump and the price is set.

-Rage Against the Machine

Oil Imports

- 66% of U.S. oil consumption is from imports
- Half of imported oil is from the Americas
- 17% from Middle East; 21% from Africa; 8% Europe



Oil & War

- Half of U.S. discretionary spending (your federal tax dollars) go to fund current or past military ventures
- U.S. spends as much on its military than the rest of the world combined
- Most of this is used to wage wars for oil (and more recently, for natural gas)

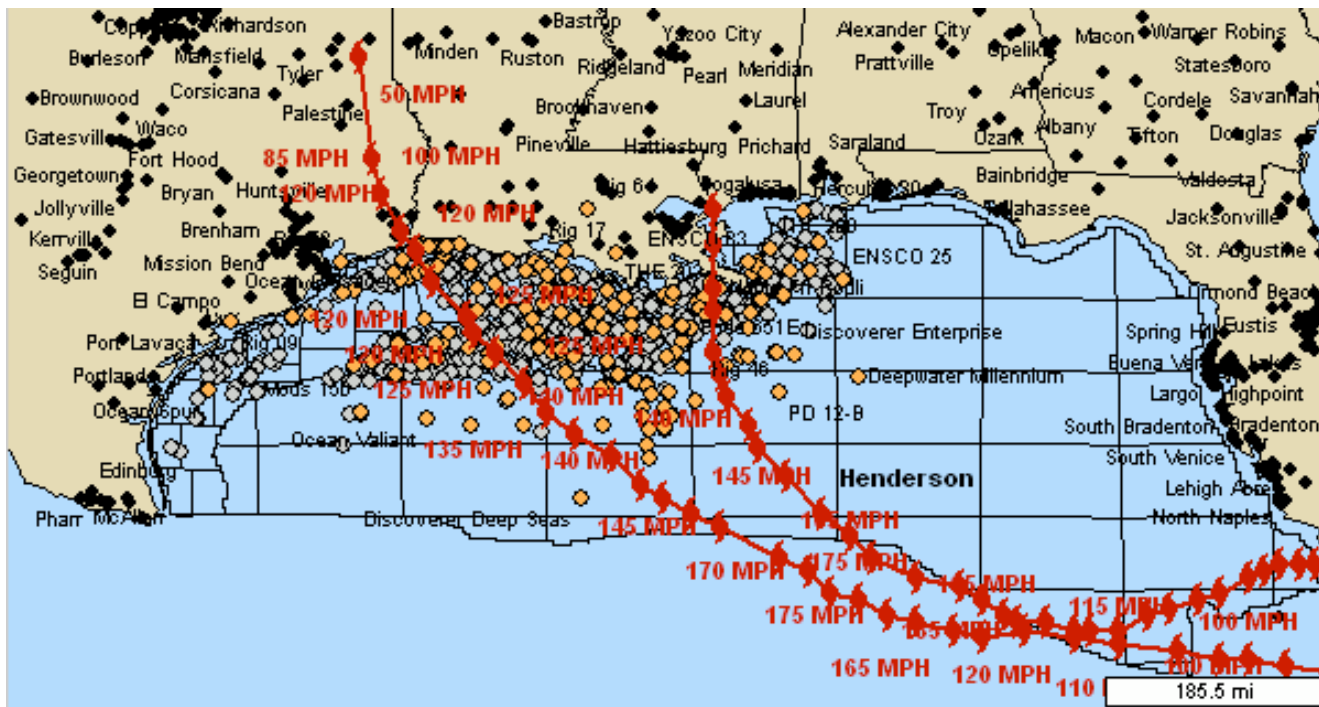
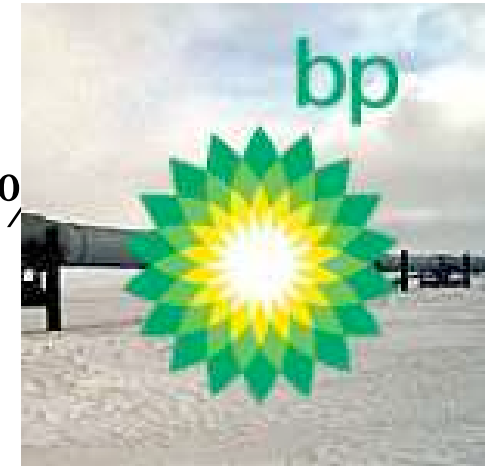
***Yes the car is our wheelchair
My witness your coughing
Oily silence mocks the legless
Ones who travel now in coffins***



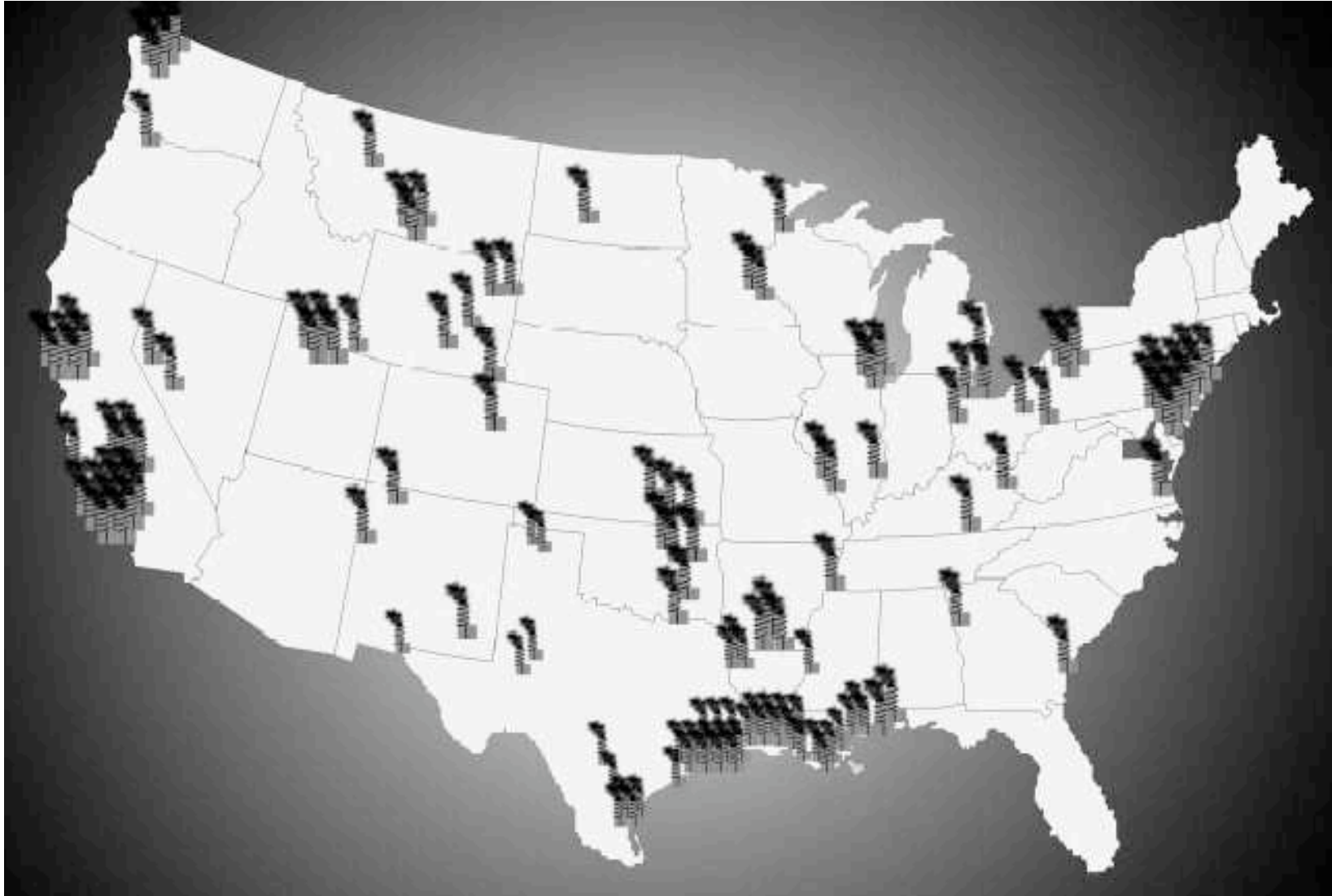
-Rage Against the Machine

Oil Production – U.S.

- Highly vulnerable to supply disruption
- One year after hurricanes Katrina and Rita hit the Gulf Coast, 12% of oil and 9% of gas production were still offline
- Aug 2006: Leaky Alaska pipeline down for repairs due to BP's mismanagement



Oil Refining



Oil Production & Use

- Oil is used for 96% of transportation fuels, 37% of heating and 1.6% of electricity
- New oil refineries planned in Arizona, North Dakota, South Dakota and Utah
- Expansions of existing refineries planned
- Peak oil!!!

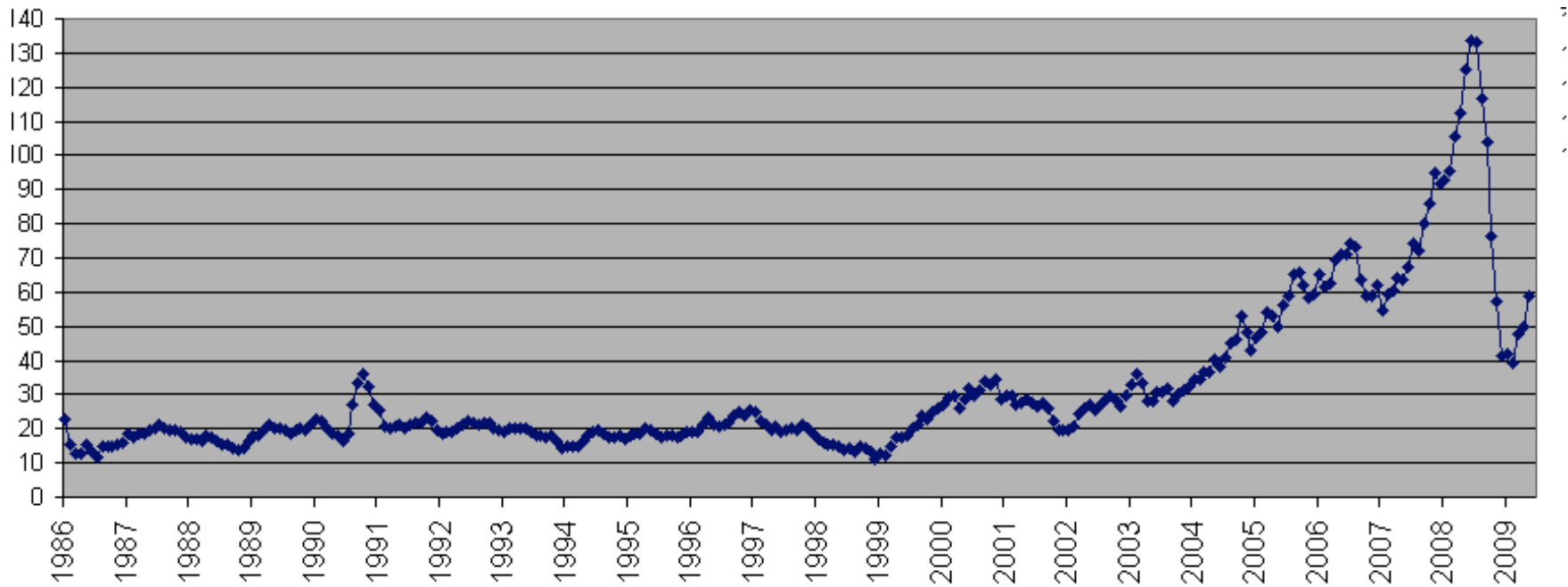


Oil Burning Power Plants



Oil Prices

**U.S. Oil Price
(Dollars per Barrel)
[through May 2009]**

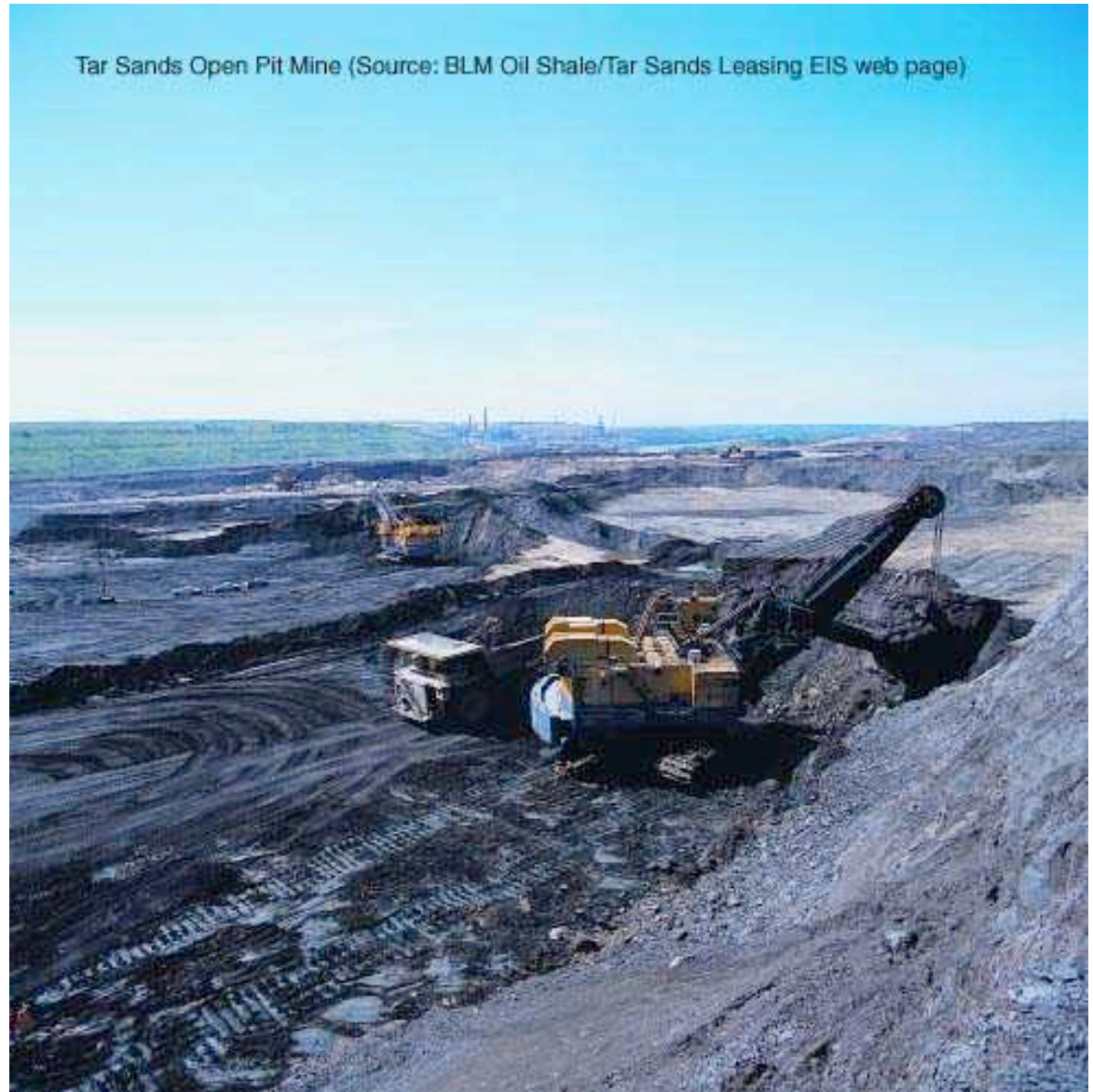


Unconventional Oil

- Coal-to-oil
- Tar sands
- Oil shale

Problems:

- Extremely destructive
- Energy-intensive
- Expensive
- Insufficient



Natural Gas

- 97% of natural gas comes to U.S. via pipeline from U.S. and Canada
- U.S. and Canada gas production is peaking
- Global peak: 2020
- Became very expensive
- 400 new gas-fired power plants; over 1000 were proposed
- 48% of heating
16% of electricity
2% of transportation

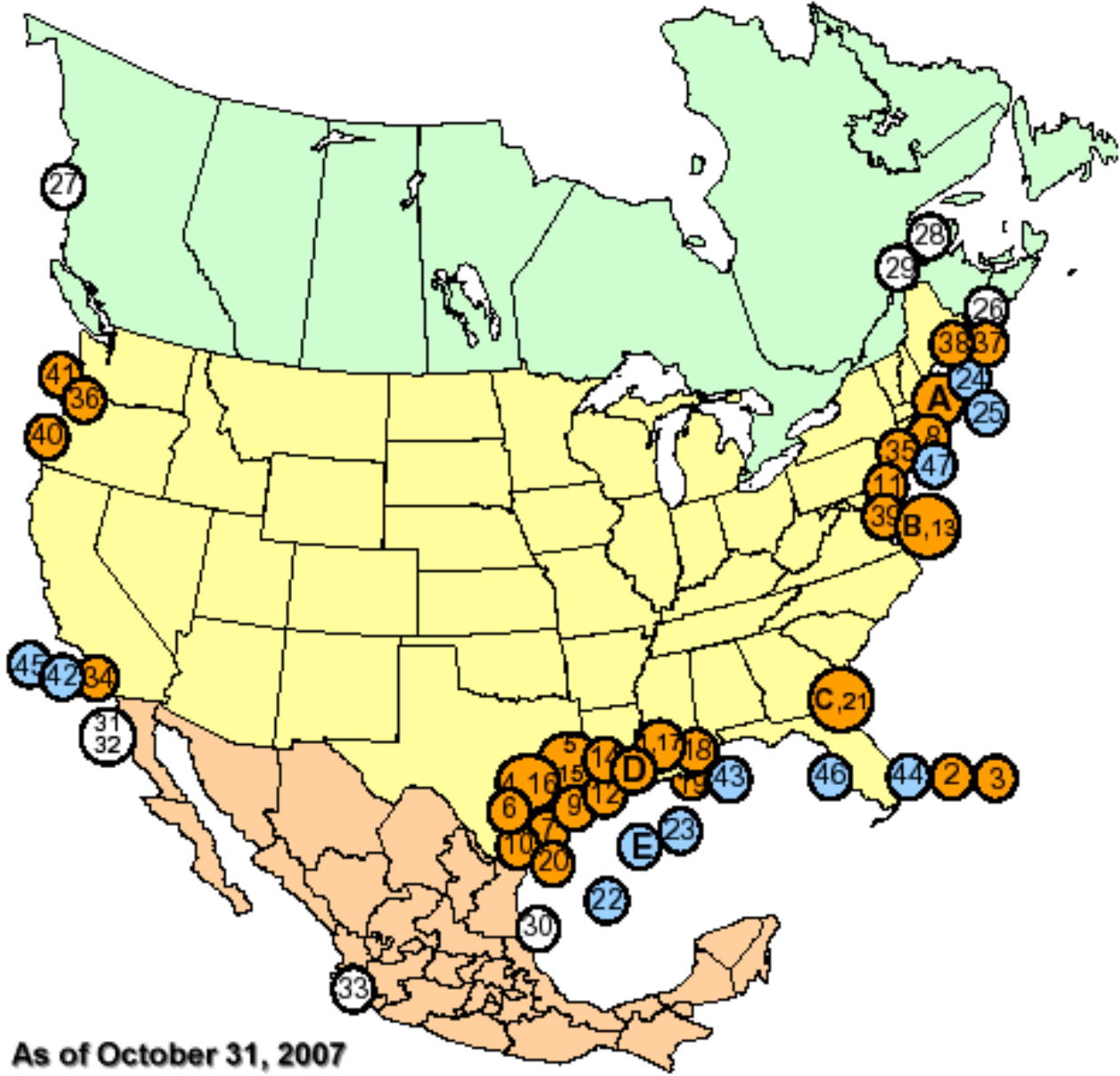


Liquefied Natural Gas (LNG)

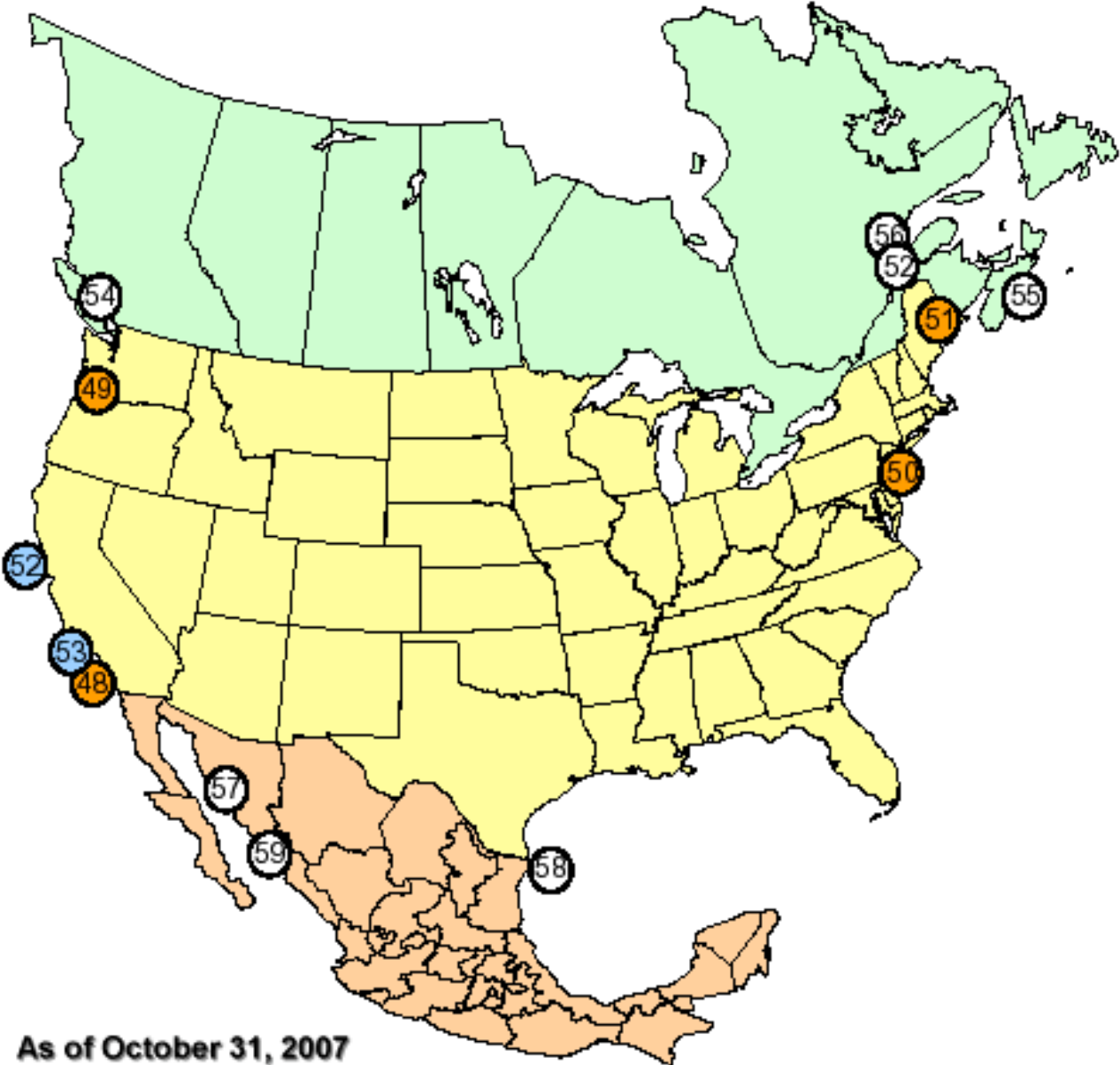
- 5 existing liquefied natural gas (LNG) terminals in the U.S.
- 59 more planned in North America (down from 69 proposals in May 2006)
- More war for gas (Afghanistan)
- Competition with China and India
- Dangerous to communities:
 - Terrorist targets
 - Accidents
- Short-term fix



Liquefied Natural Gas (LNG)

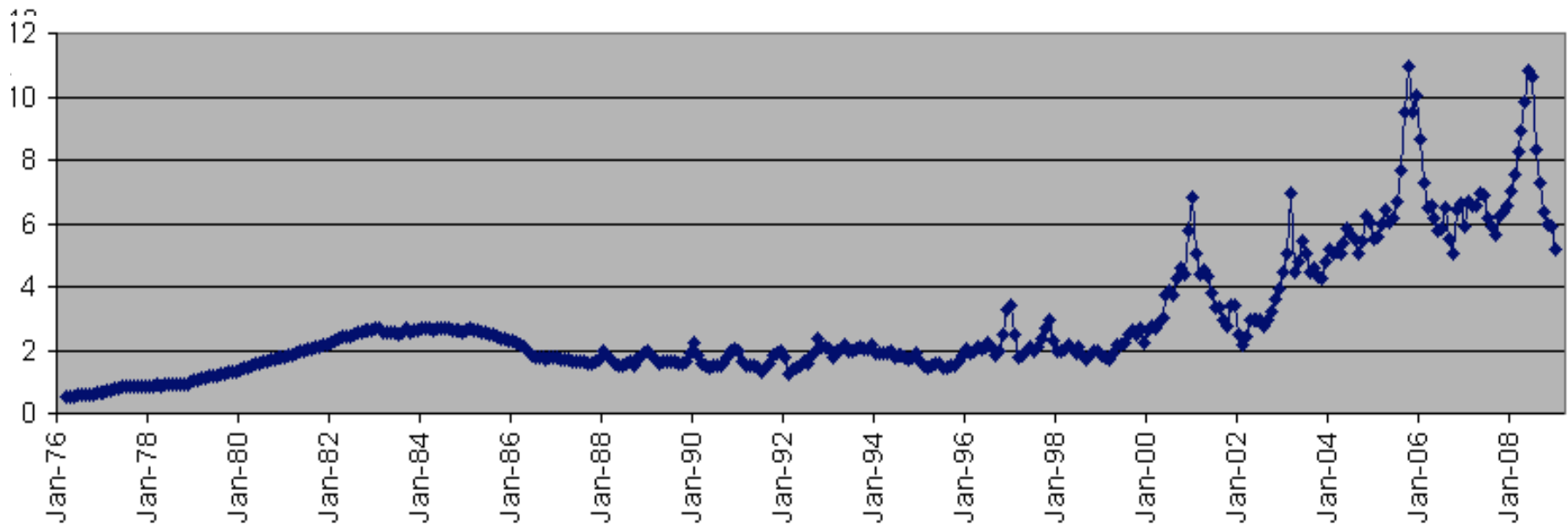


Liquefied Natural Gas (LNG)

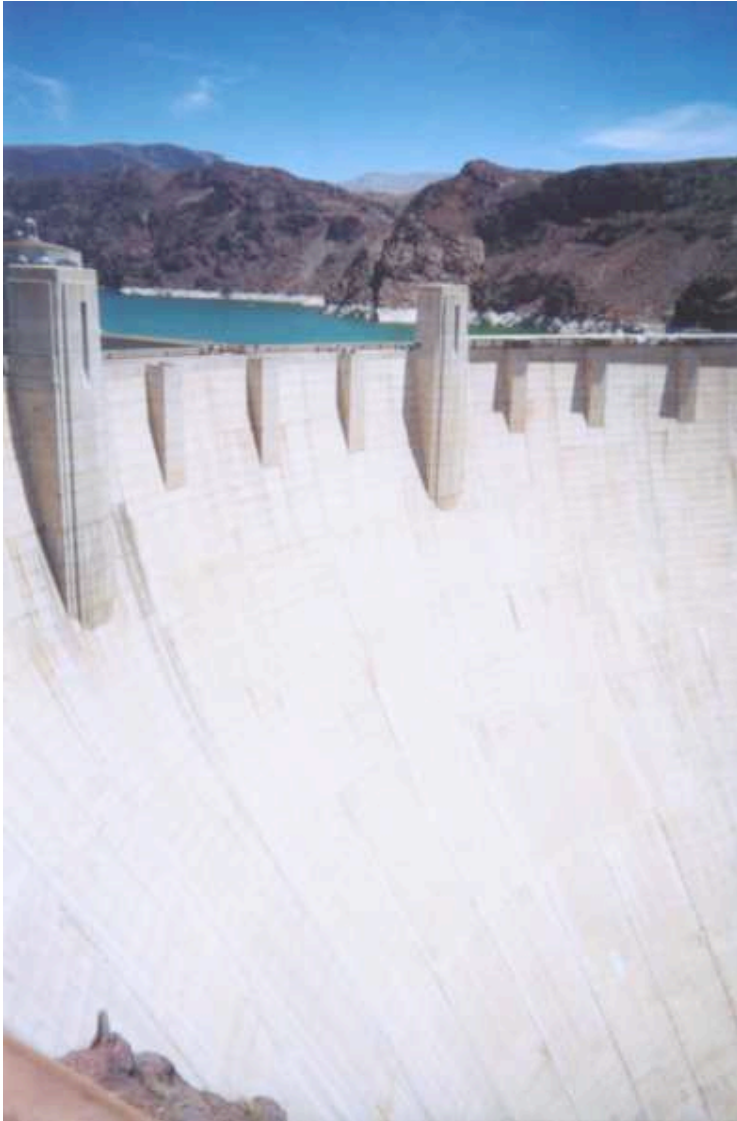


Natural Gas Prices

**U.S. Natural Gas Wellhead Price
(Dollars per Thousand Cubic Feet)
[through April 2009]**



Hydroelectric



Hydroelectric

- 7% of electricity
- Mostly used in Pacific Northwest
- Huge new dams proposed in Manitoba
- Displacement of native people
- Methane emissions
- Mercury releases
- Not much potential



Biomass / Incineration



Biomass / Incineration

Includes...

- Municipal Solid Waste (Trash)
- Tires
- Sewage Sludge
- Construction / Demolition (C&D) Wood Waste
- Animal Factory Wastes
- Paper & Lumber Mill Wood Wastes
- Agricultural Crop Residue
- Energy Crops
- Forest Cutting
- "Urban" Wood Waste (tree trimmings)
- Landfill Gas
- Digester Gas

Biomass / Incineration

- Existing facilities mostly on east coast and mid-west
- Proposals all over the U.S.
- Many contaminants involved
- Harms waste issues (competes with source reduction, composting and recycling)
- Destroys resources
- Biotechnology
- One of the most polluting energy technologies per unit of energy produced (little energy is produced)
- “Green” biomass (energy crops) are foot in the door for more toxic waste streams

“Alternative” Fuels

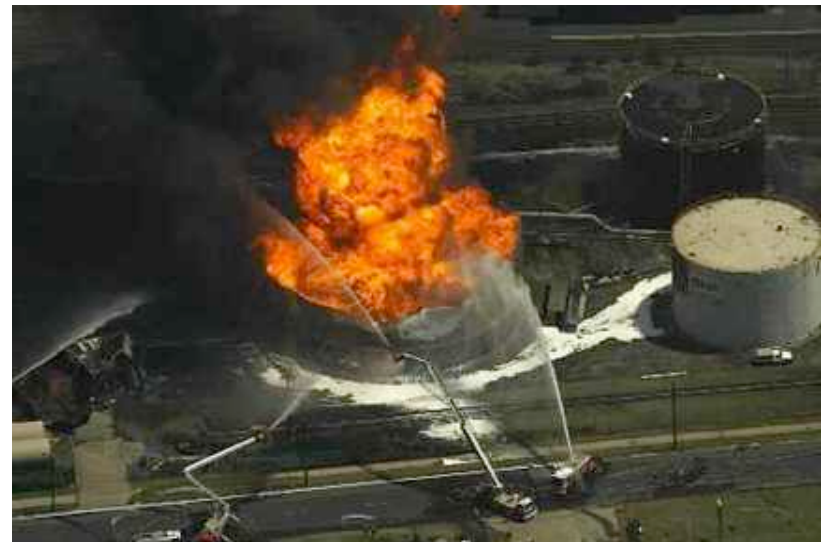
- Natural gas vehicles
- Coal-to-oil
- Biodiesel
- Ethanol
- Cellulosic Ethanol
- “Anything-to-oil”
 - Thermal Depolymerization
 - Plasma / Pyrolysis
- Hydrogen
- Electric vehicles

False Solutions

- Nuclear fission / fusion
- Coal / “clean coal”
- Natural gas
- Incineration (Gasification, Plasma, Pyrolysis...)
- “Biomass” (incineration)
- Landfill gas
- Coal-to-oil
- Ethanol / Cellulosic Ethanol (incl. waste-based fuels)
- Biodiesel
- Thermal Depolymerization (“Anything-to-oil”)
- Hydroelectric Dams
- Geothermal (efficiency only; not open-loop electric generation)
- Hydrogen

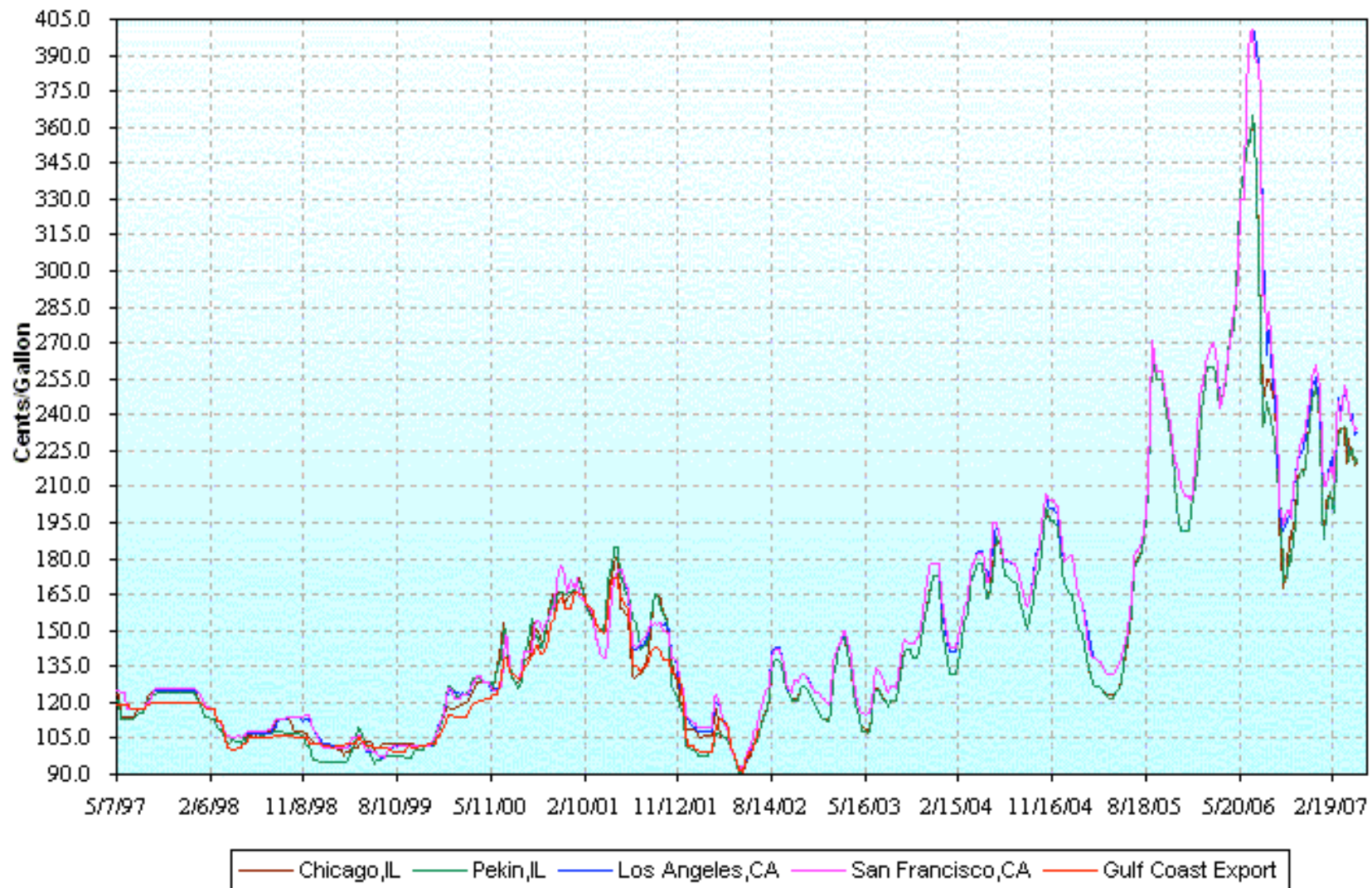
Ethanol

- 166 existing; 420+ proposed
- Biotech corn / herbicides
- Water use
- Imported natural gas-based fertilizer
- Polluting refineries
- Waste products used as animal feed, attracting factory farms
- More money for fewer miles/gallon
- Uses about as much energy as produces
- Competes with food for land



Ethanol Prices

Fuel Ethanol Terminal Market Price - 10 Year History



Data Source: OXY-FUEL News Price Report. 1995-2005 Hart Publications, Inc.

How Facility-Fighters Help Clean Energy

- Stopping dirty energy facilities creates the economic space for clean energy projects
- Every dirty energy project stopped shifts the industry's economics
- We're shaping entire industries, making clean alternatives more economically viable as we fight off each dirty energy project
- These are two ends of the same fight



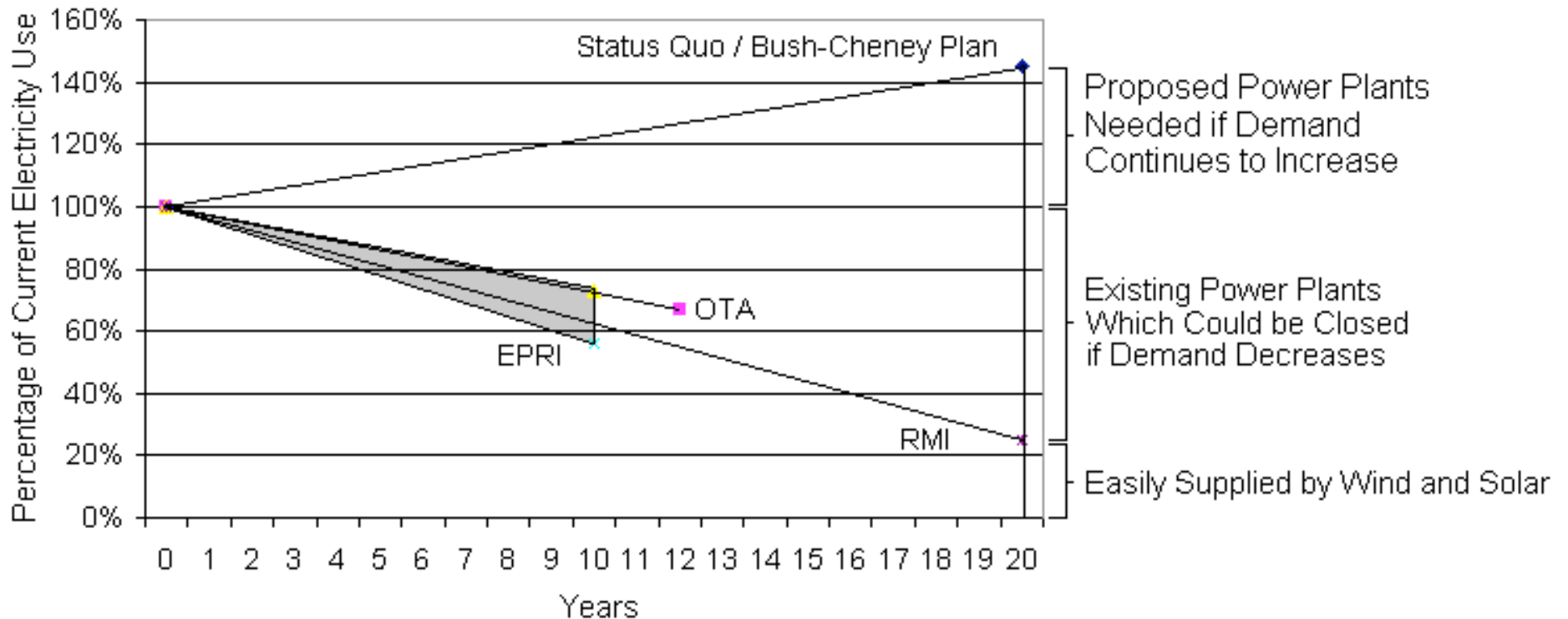
Solutions

- Conservation
- Efficiency
- Wind
- Solar
- Ocean
- Energy storage
- No combustion necessary
 - Replace transportation fuels with clean electricity



Conservation and Efficiency

We can reduce electricity demand by as much as 75% within 20 years.

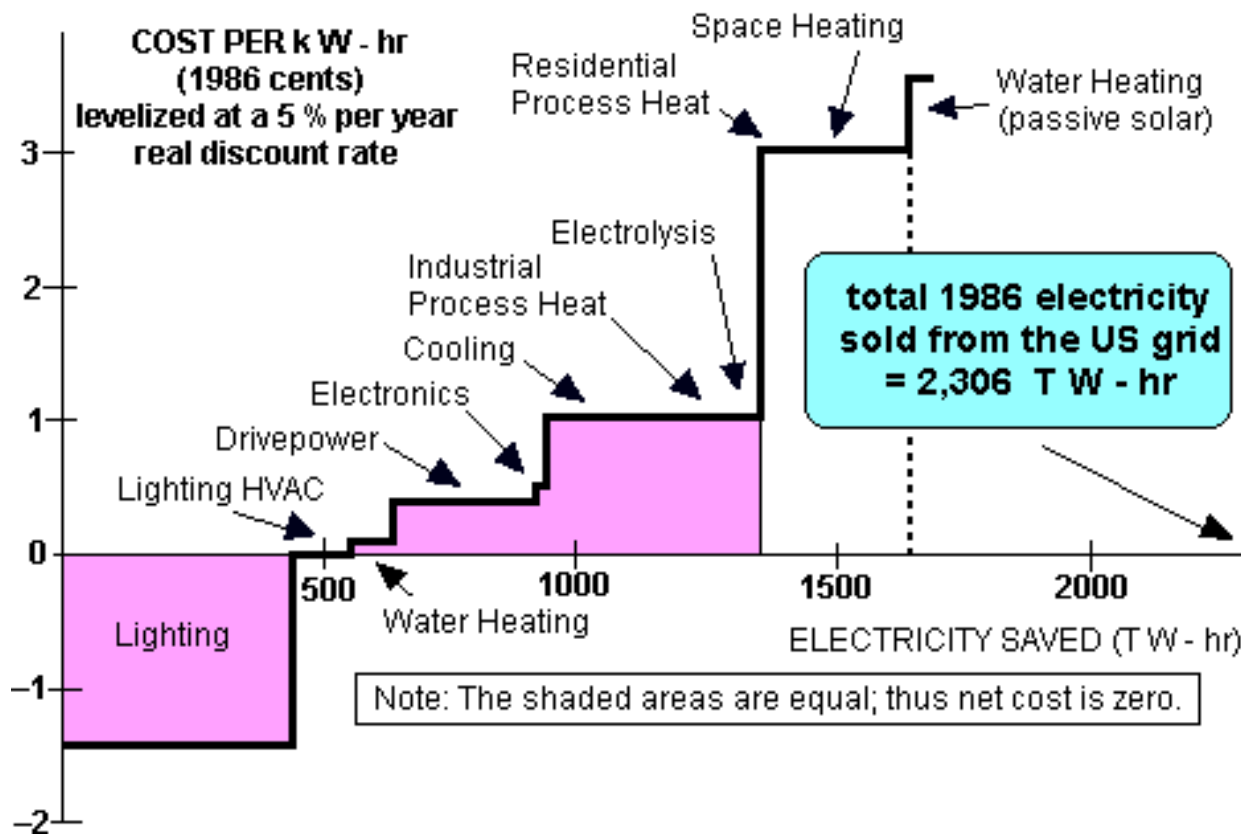


www.energyjustice.net/solutions/c_and_e/

Conservation and Efficiency

Figure 4

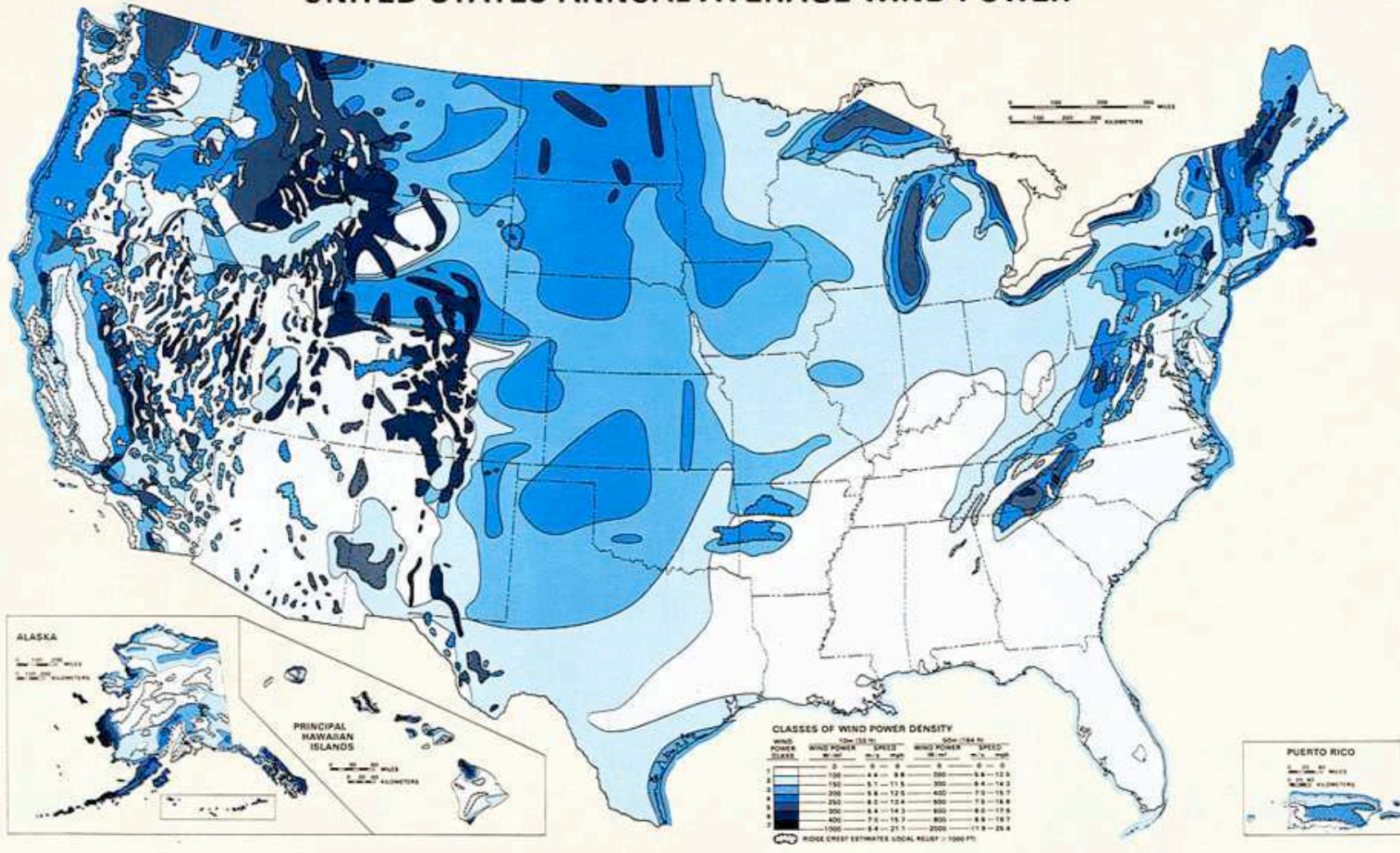
A Preliminary Estimate of the Full Practical Potential for Retrofit Savings of US Electricity at an Average Cost of about 0.6 ¢ per kW-hr



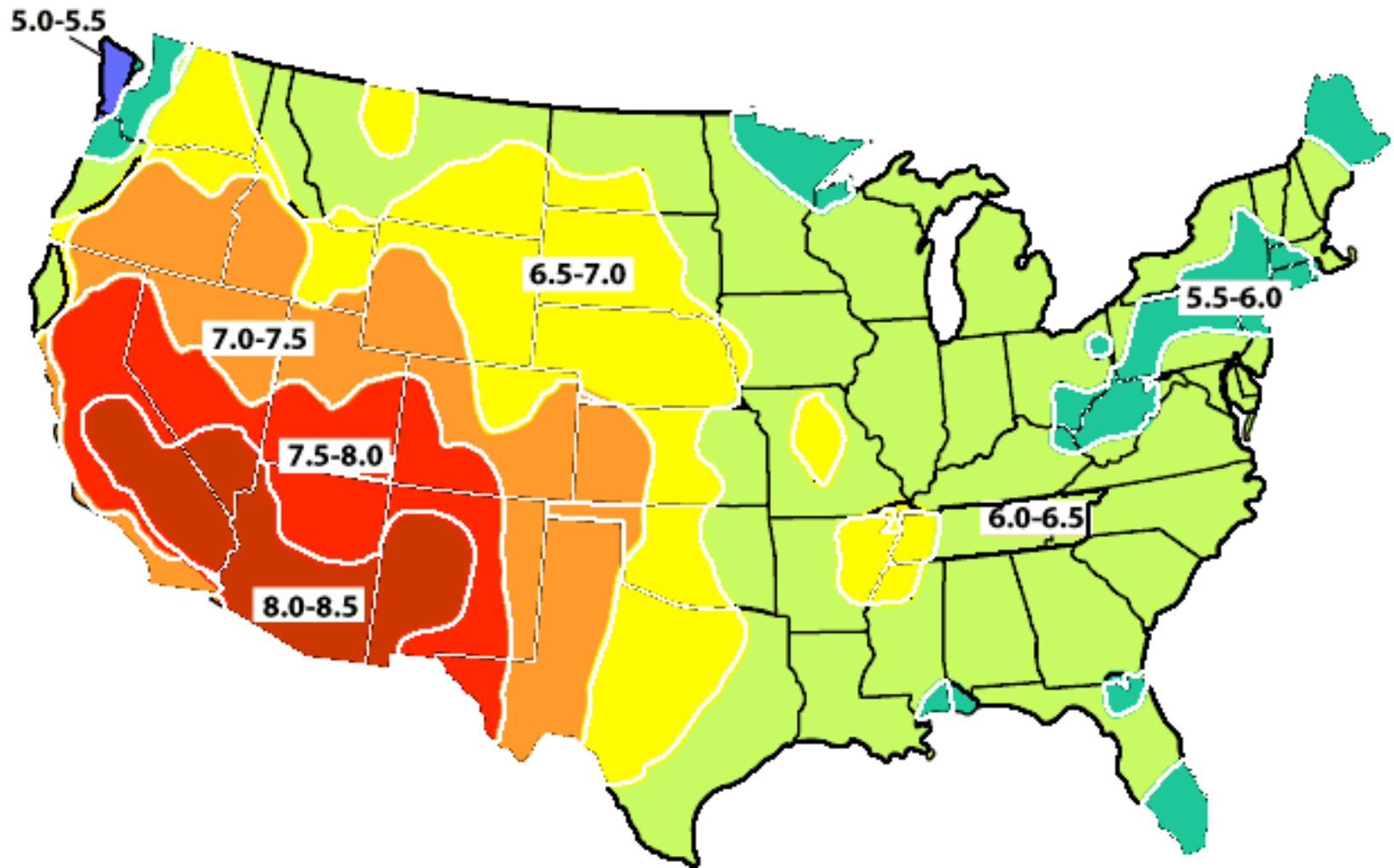
Reducing 75%
within 20
years at
1/10th the
cost of
buying
electricity

Wind Power

UNITED STATES ANNUAL AVERAGE WIND POWER



Solar Power



Transportation Solutions

- **Conservation** tactics

- Mass Transit
- Buy / Work Local
- Carpooling / Car Sharing
- Telecommuting

- Reduce Sprawl
- Trails-to-Rails
- Bicycling
- Walking



- **Efficiency** tactics

- Fuel Efficiency Standards
- Hybrids



- **Wind/solar-powered electric vehicles**

- Plug-in hybrids
- Full electric vehicles



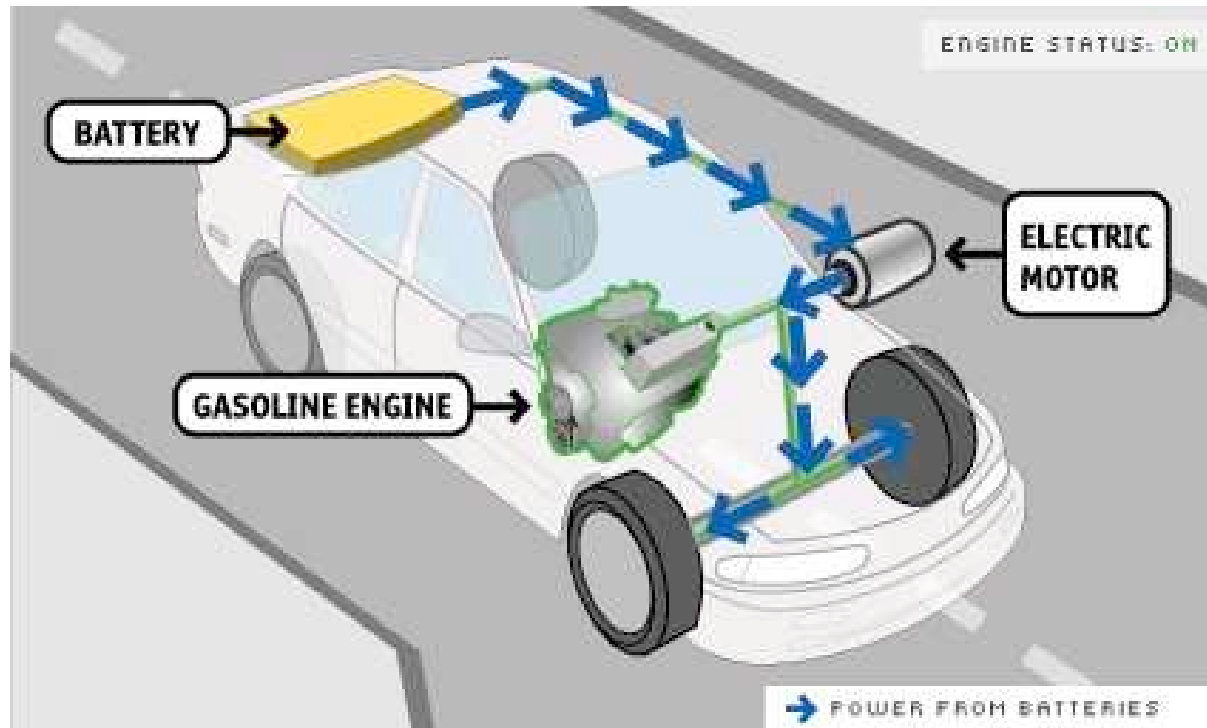
Conservation Tactics

- Mass Transit
- Buy Local
- Work Local
- Carpooling / Car Sharing
- Telecommuting
- Reduce Sprawl
- Trails-to-Rails
- Bicycling
- Walking



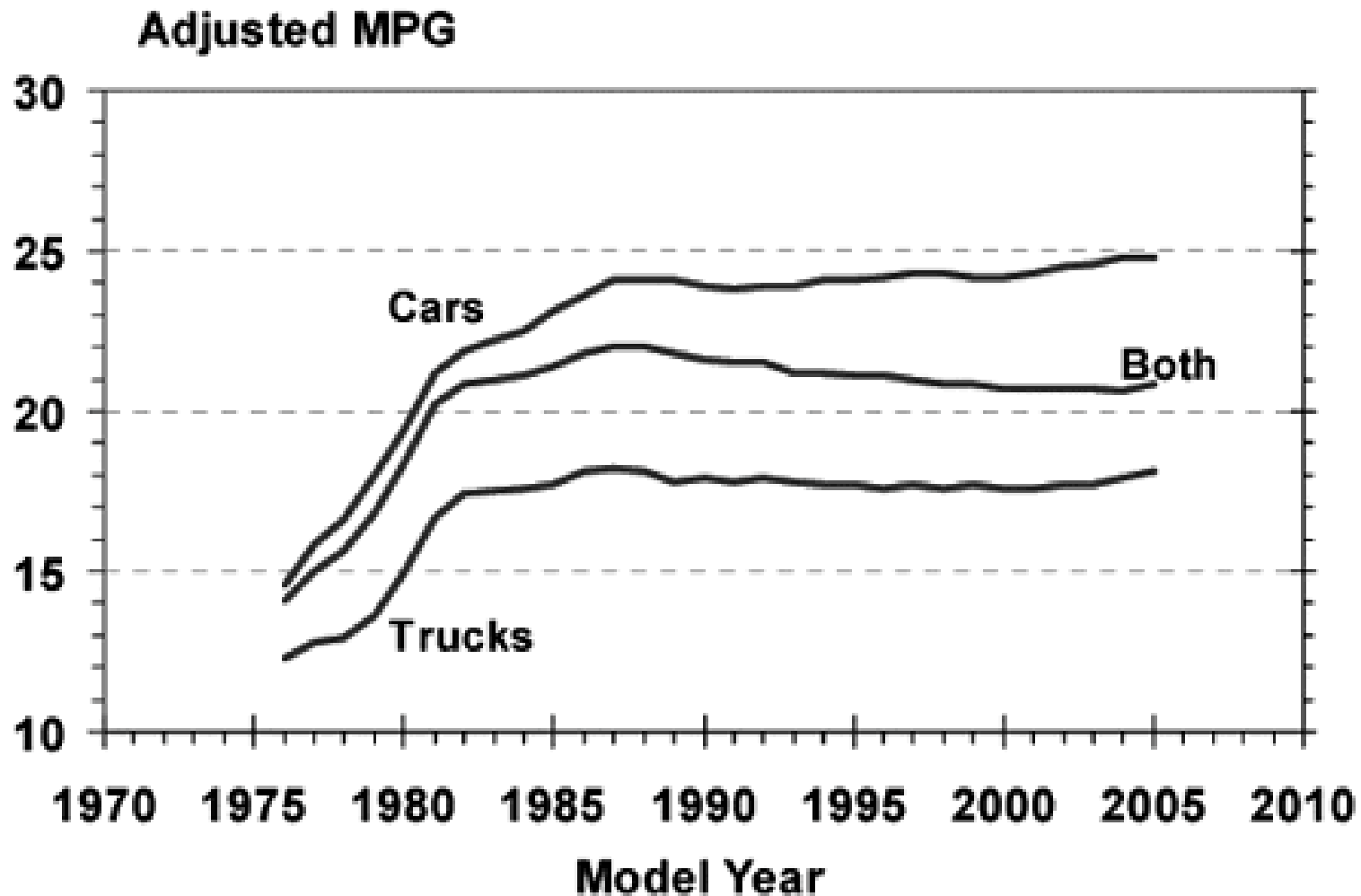
Efficiency Tactics

- Fuel Efficiency Standards
- Hybrids
- Weatherization (heating sector)
- Geothermal heat pumps (heating sector)



U.S. Fuel Economy

Adjusted Fuel Economy by Model Year (Three Year Moving Average)



Triple our Fuel Economy

The average automobile fuel economy in 2004 was 20.8 mpg.

Using hybrid technology, this average can be doubled by 2015.

The Union of Concerned Scientists calls for increasing fuel economy to 40 mpg by 2015 and 55 mpg by 2025.



Electric Vehicles

- **Plug-in hybrid electric vehicles**
- **Full electric cars** (very cheap)
- **Wind-powered electricity** can be used
- **Still costs less than \$1-2** per gallon of gasoline equivalent
- **Electric batteries can go 20-60 miles**; newer ones can do much more



Jobs in Energy Sector

For every \$1 million invested, how many jobs are created?

21.5 Energy Efficiency (Apollo Alliance)

5.9 Renewable Energy (Gamesa wind production plant in Ebensburg, PA)

0.25 Waste Coal (Greene County, PA)

“Energy efficiency is far more labor intensive than generation... These jobs include installation, ongoing operations and maintenance of building systems, and new manufacturing to meet the increased demand for energy efficient appliances and building systems.” (*New Energy for America – The Apollo Jobs Report: Good Jobs & Energy Independence*)



Energy Justice Network



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