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CCST Nuclear Presentations 10 31 06

Attached find California Council on Science and Technology (CCST) nuclear power presentations dated 31 October 2006.

Additional submitted attachment is included below.

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Nuclear Power in the U.S.

John Redding, President
Nuclear Power Development Corp.

California Council on
Science and Technology
October 31, 2006

http://www.ccst.us/meetings/speakers/presentations/2006/October/103106Redding.ppt

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Nuclear Power Quiz

1. In the U.S. there are ___ nuclear power plants that generate __% of our electricity.
2. In the world there are ____ operating nuclear plants that generate __% of the world's electricity.
3. There are ____ nuclear plants under construction or ordered in the world.
4. There are ____new nuclear plants in the planning process in the U.S.
5. Extra Credit: _____ gets 72% of electricity from nuclear power.

Bonus Question:
What nuclear plant is this?

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Answers

	Operating Units	% of Total	New plants
World	441	16%	38
U.S.	103	20%	14-24
CA	4	13%	Nada

PG&E's Diablo Canyon

Vermont:

Nuclear power represents 73% of the electricity generated in the state of Vermont.

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Science and Technology in the State's Interest

CALIFORNIA COUNCIL ON SCIENCE AND TECHNOLOGY

Top Ten Science and Technology Issues in California

2. Energy Supply

How can California best ensure an ongoing, sustainable, and economical supply of energy for electric power and transportation?

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Resurgence of Nuclear Power

Company	Design	Units	Date for Filing COL Application
Dominion	ESBWR	1	2007
NuStart Energy (TVA)	AP1000	2	2007
NuStart Energy (Entergy)	ESBWR	1	2007/2008
Entergy	ESBWR	1	2008
Southern Co.	AP1000	1-2	2008
Progress Energy	AP1000	2-4	2007
South Carolina Electric & Gas	AP1000	1-2	2007
Duke Energy	AP1000	2	2008
UniStar Nuclear (Constellation)	U.S. EPR	1-4	2008
NRG Energy	ABWR	2	2007

TOTAL NEW UNITS: 14 to 24

Nuclear Power
Development Corp.

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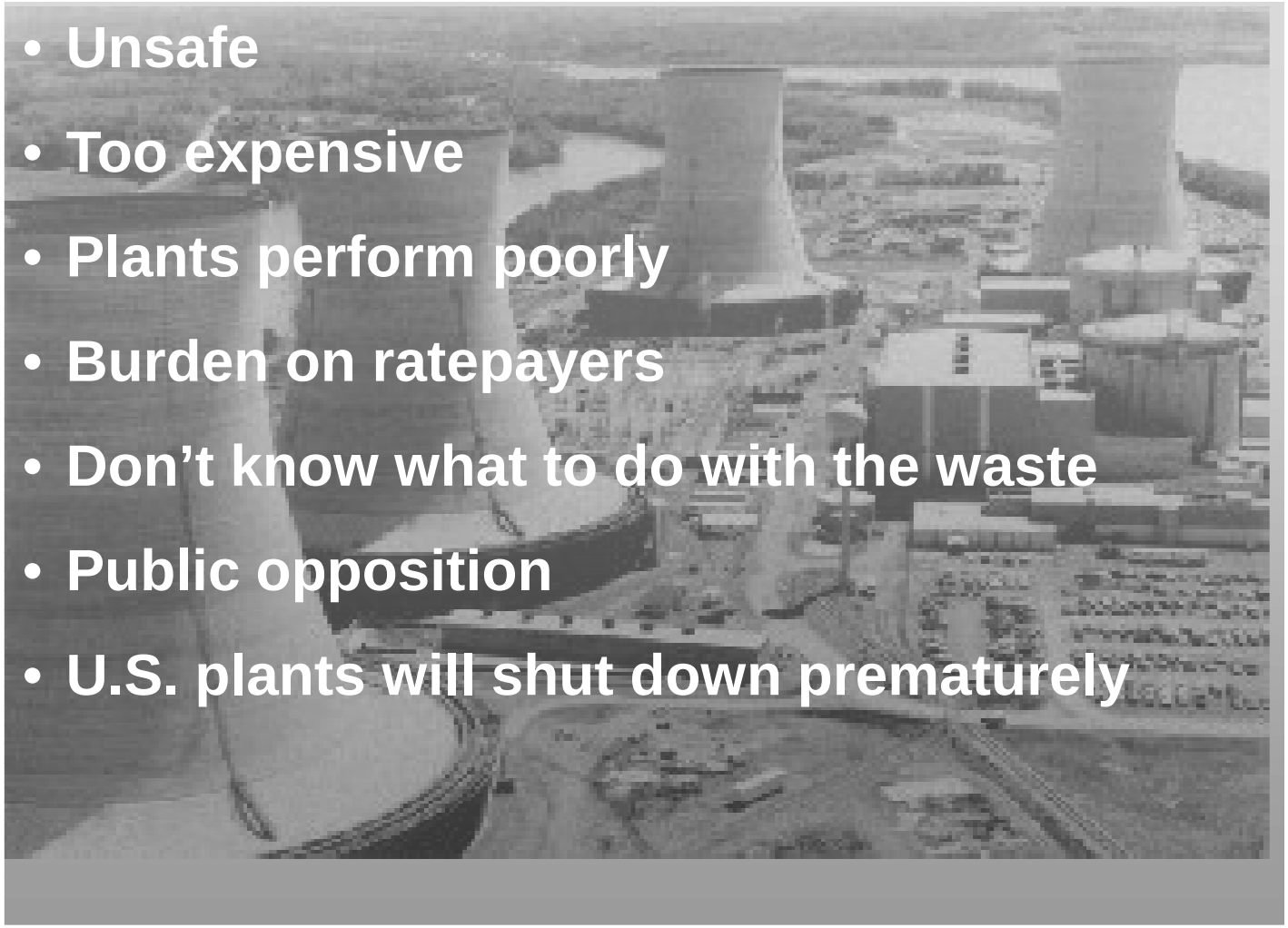
The Old View



- Unsafe
- Too expensive
- Plants perform poorly
- Burden on ratepayers
- Don’t know what to do with the waste
- Public opposition
- U.S. plants will shut down prematurely

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The New View

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Fast Review of Supporting Data

But you don't have to take my word for it…

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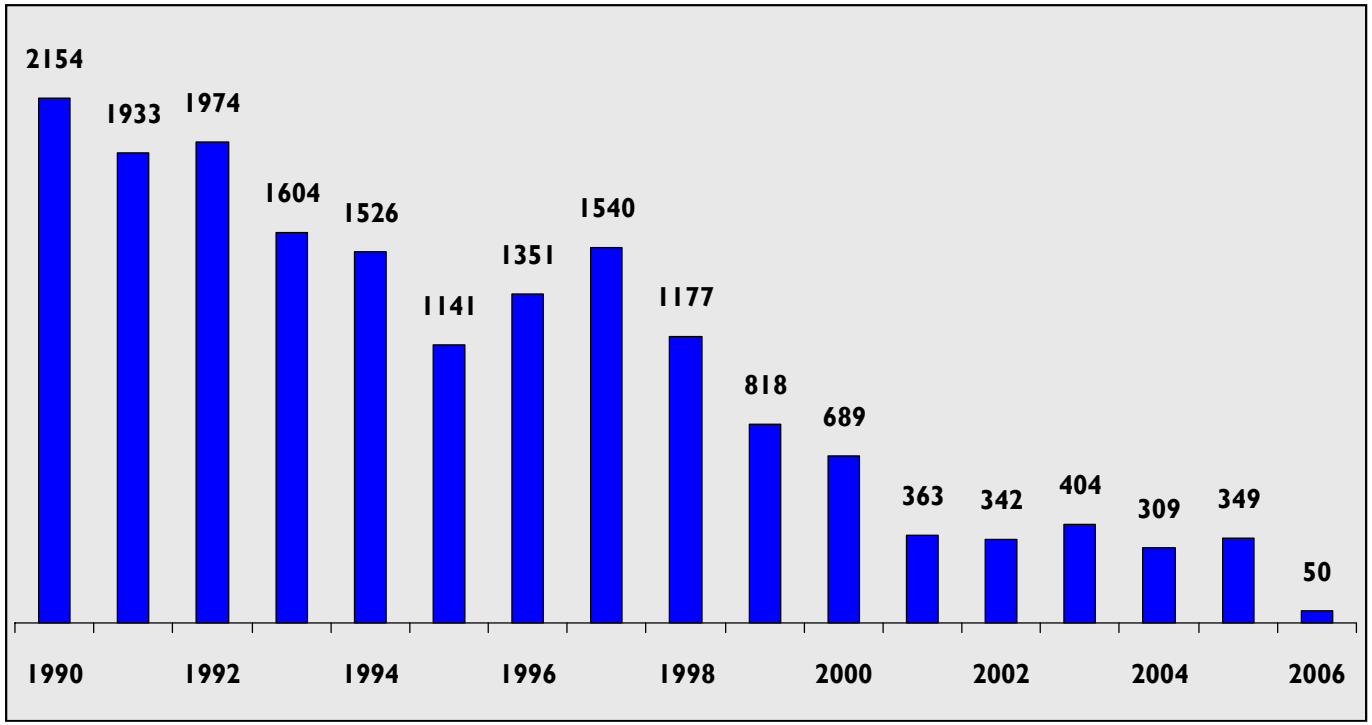
Event Reports to the NRC



Source: Scientech

Updated: 7/06

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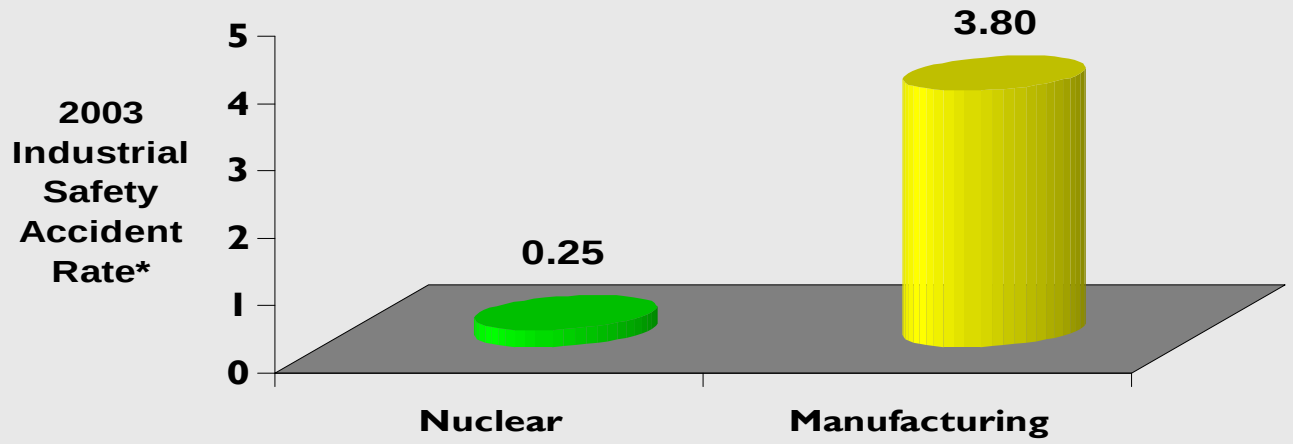
Industrial Safety



*Number of accidents resulting in lost work, restricted work or job transfer per 200,000 worker-hours

Sources: World Association of Nuclear Operators and Bureau of Labor Statistics

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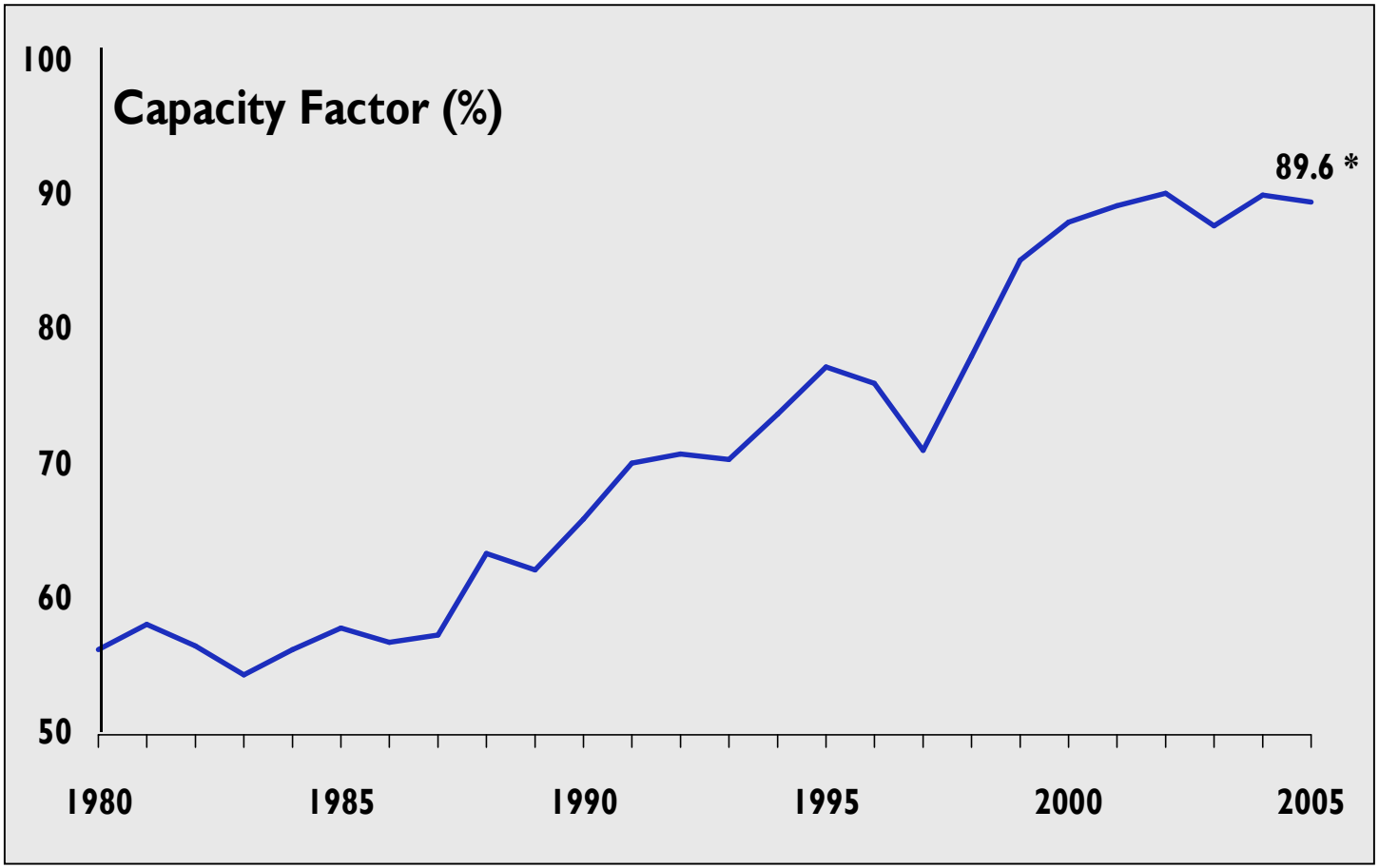
Reliable Power Producer



* 2005 Preliminary

Source: Global Energy Decisions / Energy Information Administration

Updated: 4/06

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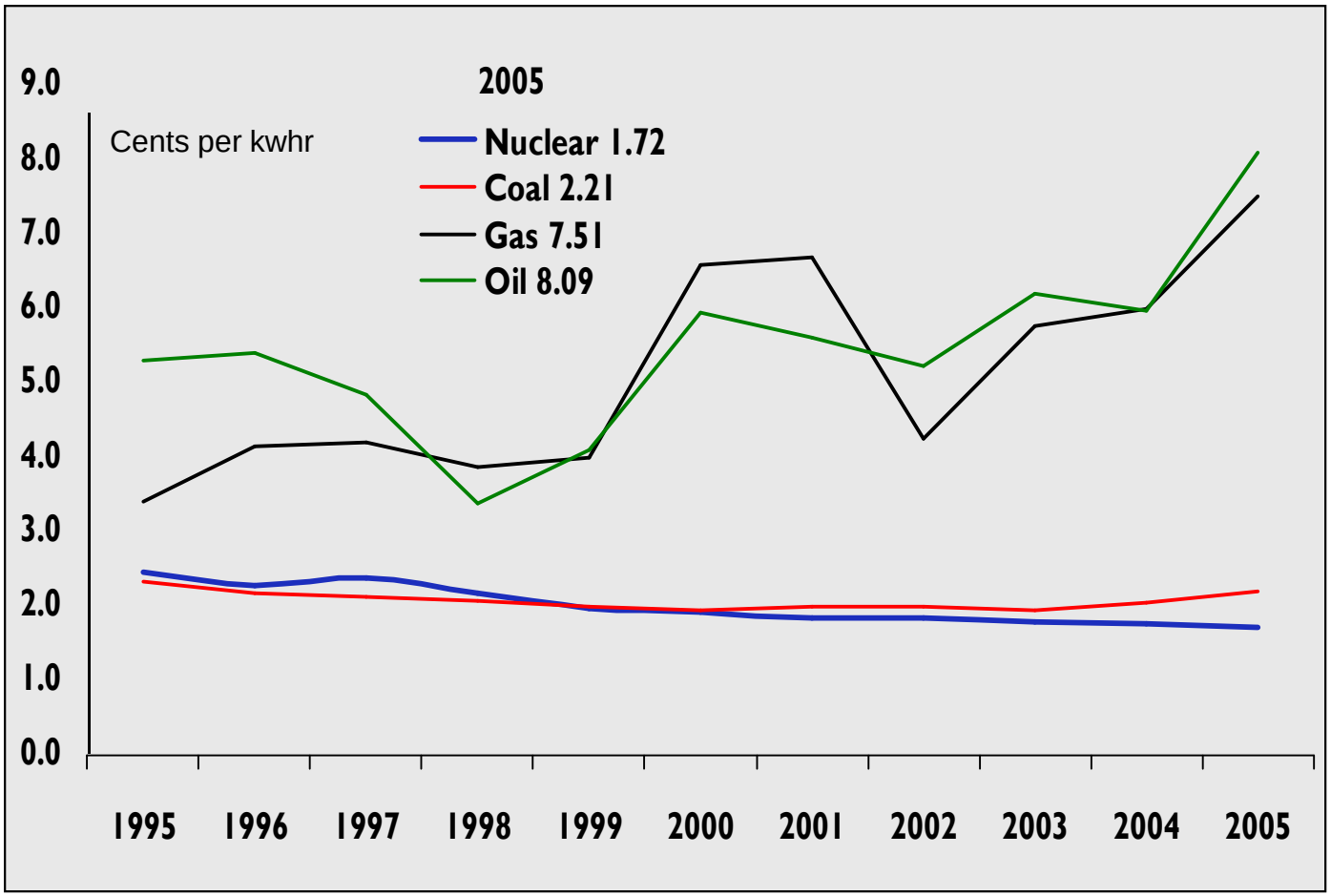
Low Production Costs



Production Costs = Operations and Maintenance Costs + Fuel Costs
Source: Global Energy Decisions
Updated: 6/06

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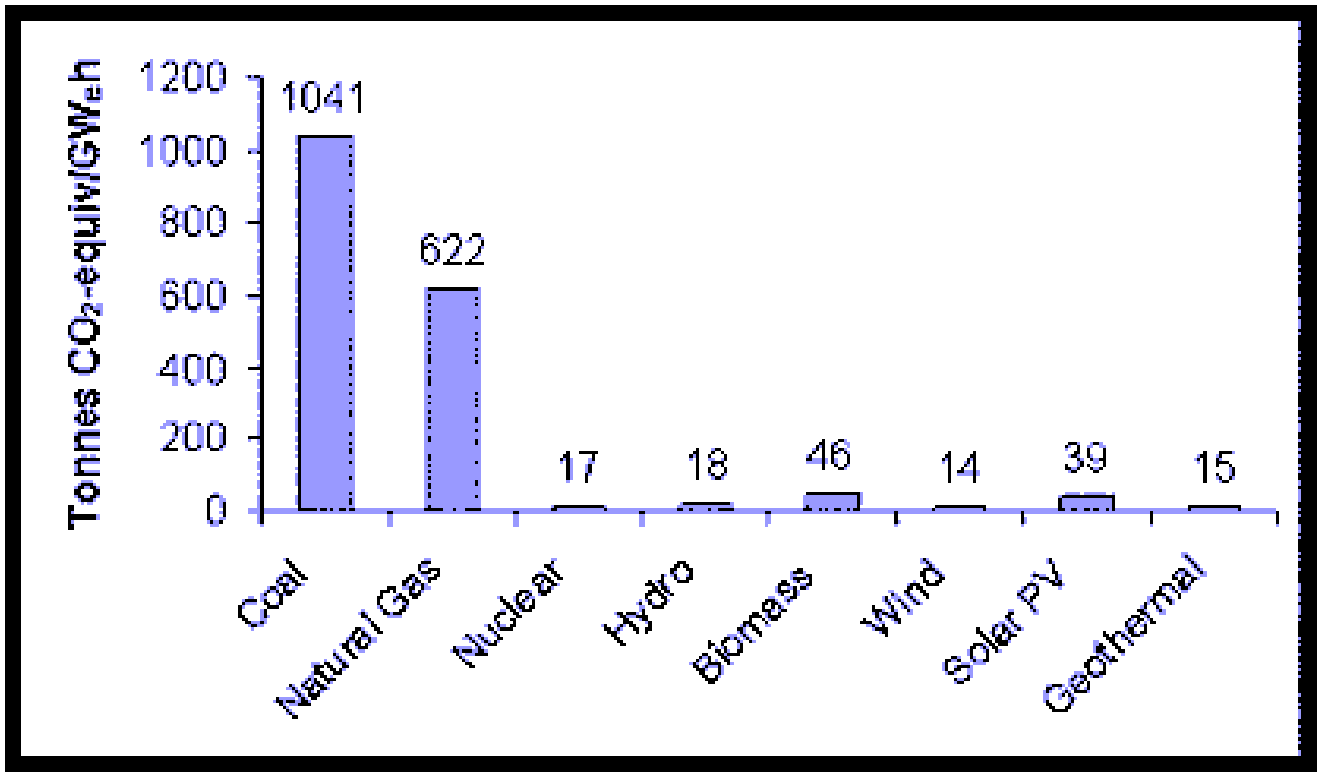
Life Cycle CO2 Emissions



Source: "Life-Cycle Assessment of Electricity Generation Systems and Applications for Climate Change Policy Analysis," Paul J. Meier, University of Wisconsin-Madison, August, 2002.

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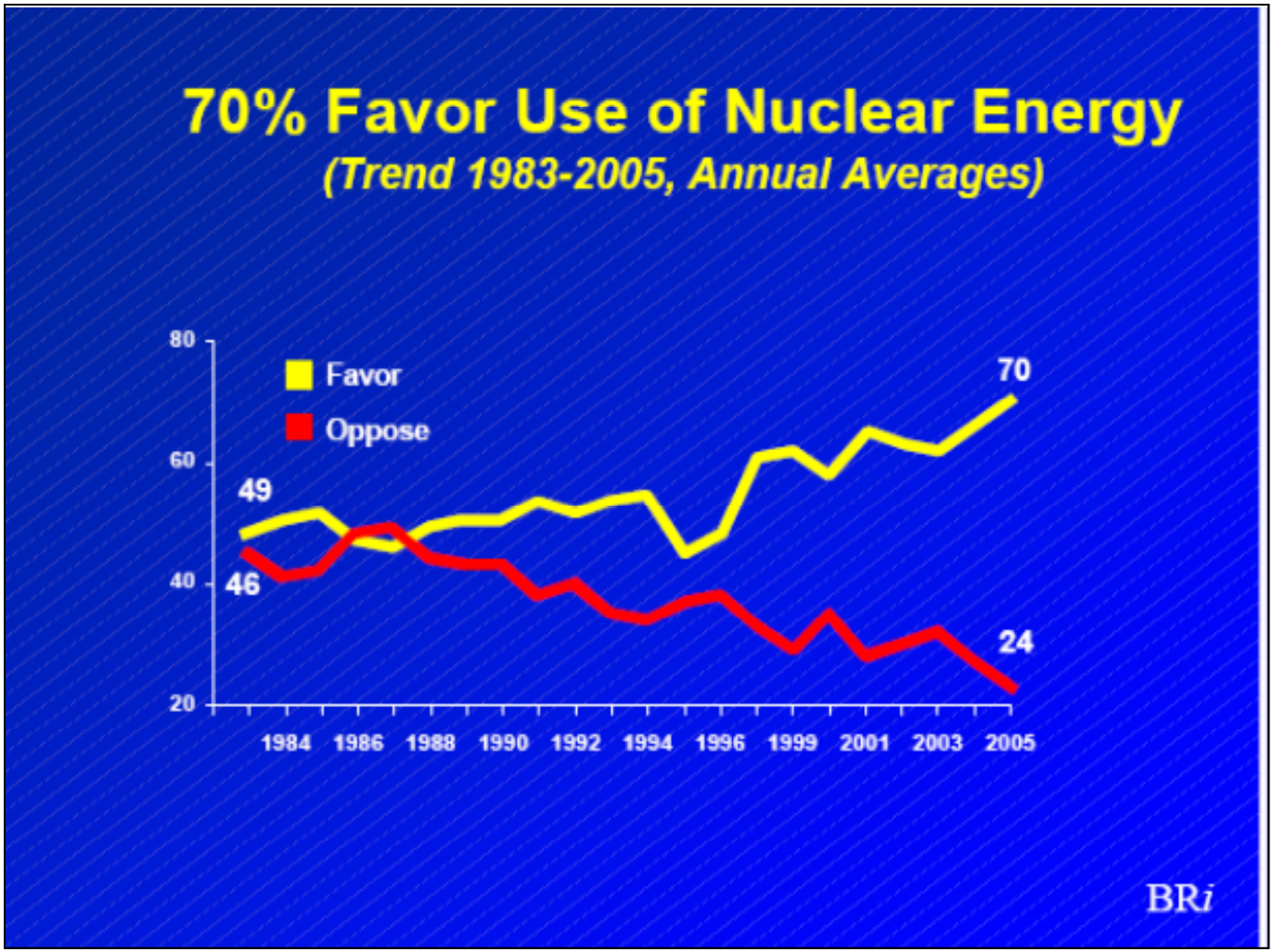
Public Support



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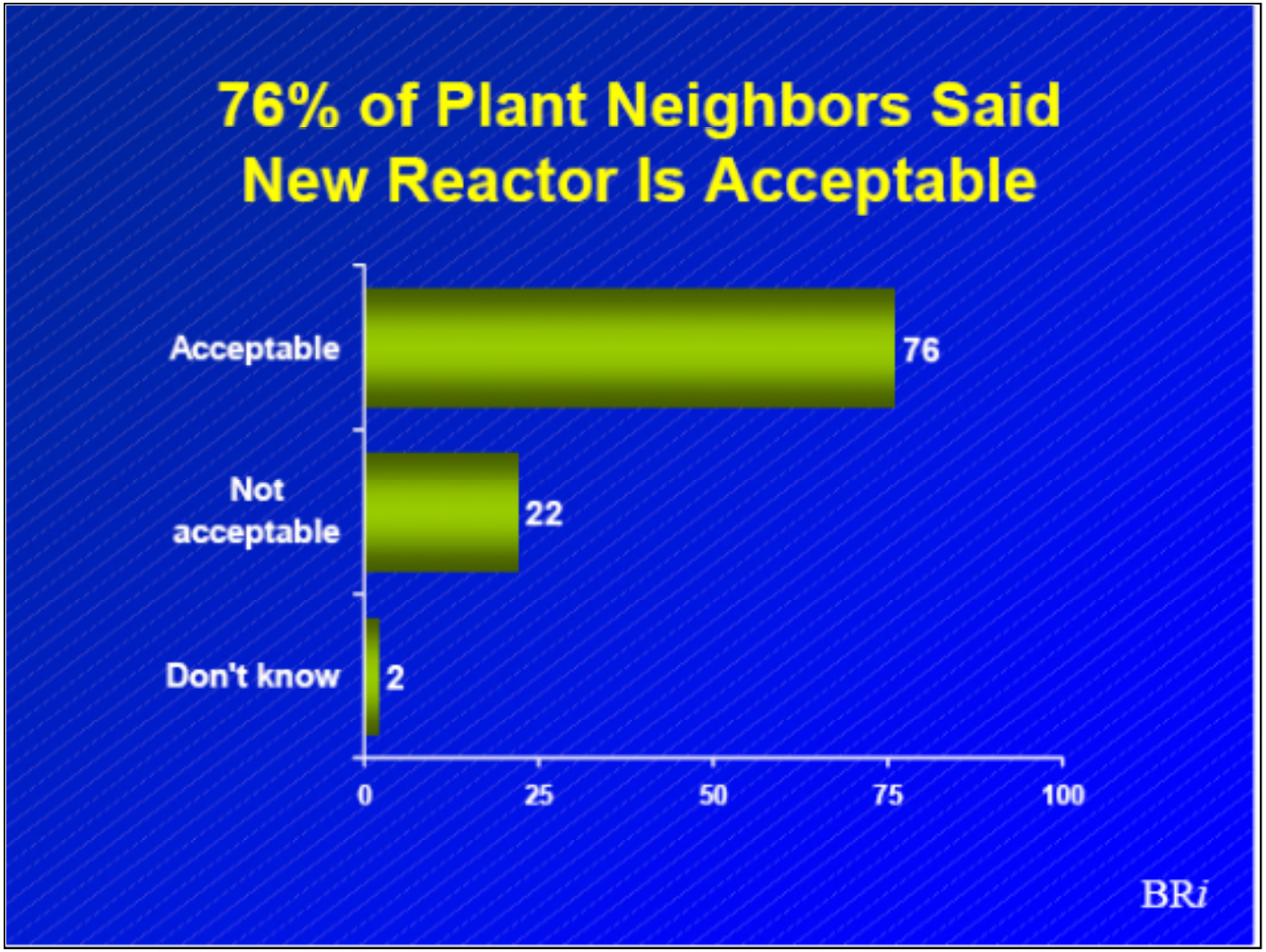
Public Support



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Cost to Build New Nuclear Plants

• Nuclear fuel	0.45	Cents per kwhr
• Nuclear waste fee	0.10	
• O&M costs	1.30	
• G&A	0.35	
• Capital costs*	2.26	
• TOTAL	4.46	
• With Incentives	3.00	

Plant suppliers offering fixed price contracts

* For cost to construct equal to $1635/kw without financing

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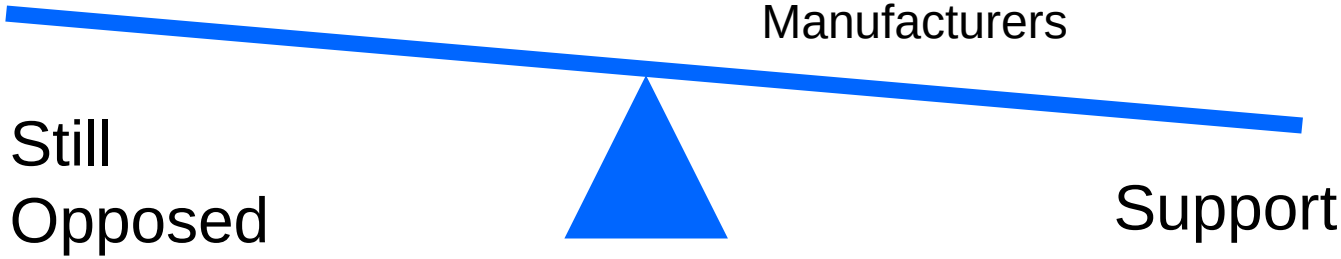
Who's For and Who's Against

- NRDC
- Sierra Club
- Union of Concerned Scientists

- Environmental leaders
- Most Americans
- Communities with plants
- Leading newspapers
- U.S. Congress
- Most U.S. utilities
- National Association of Manufacturers



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Yucca Mt.

The Nuclear Waste Issue

Myth #1: **Individuals living near the spent fuel repository will be exposed to deadly levels of radiation.**

Fact: The regulatory standards are very protective of the public. Exposure will be no more than 15 millirem per year vs. 300 millirem per year of background radiation.

Myth #2: Spent fuel shipments are the equivalent of the equivalent of "mobile Chernobyls" and an accident involving one could endanger hundreds of thousands.

Fact: The shipping containers are extremely robust, it is unrealistic to think the entire contents would vaporize and spread, and there have been thousands of shipments of spent fuel in the last 25 years without any release of radiation.

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The Moratorium on Nuclear Power

- Public Resource Code 25524.2. says that the CEC may not certify a new nuclear plant until:

  "(a) The commission finds that there has been developed and that the United States through its authorized agency has approved and there exists a demonstrated technology or means for the disposal of high-level nuclear waste."

- The U.S. Supreme Court reviewed the law in 1983
  - *Pacific Gas & Elec. Co. v. State Energy Resources Conservation and Development Commission,* 461 U.S. 190 (1983)]
  - Upheld the right of the federal government to make safety determinations
  - Upheld the State's right to make economic ones
  - Supreme Court decision found that without a permanent waste disposal site, nuclear waste management could lead to unknown negative economic consequences.
- Wisconsin is the only other state with this moratorium

The foundation for the moratorium is the possible negative economic impacts on ratepayers.

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Does the Moratorium Still Make Sense?

- Benefits of existing nuclear plants:
  - "The direct benefit of obtaining energy and capacity from California's nuclear power plants is on the order of $1.5 billion to $2.5 billion per year (as measured by the cost of replacement power).
  - The indirect benefit of reduced demand for natural gas ranges from $218 million to $581 million per year.
  - The social benefits of reduced air emissions, including greenhouse gas emissions, range from $67 million to as much as $678 million per year."*
  - Total of $1.8B to $3.8B per year
- Lost benefits of one new plant (1000 MWs) is $400M to $850M per year

To build a new plant or not to build a new plant?
Which has more economic impact?

* NUCLEAR POWER IN CALIFORNIA: STATUS REPORT, Page 169, Prepared for the 2005 Integrated Energy Policy Report, March 2005

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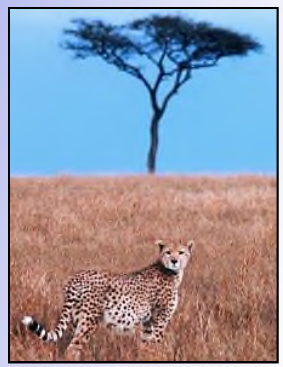
"He who waits until the whole animal is visible spears its tail."

East African Proverb



CCST Meeting
October 31, 2006

It's Time to End the Moratorium

- When the law was written in 1983, it did not envision wholesale or retail competition. We believe it does not or at least should not apply to non-utility generators
- The CEC's finding was not reached in the proper economic context. The benefits to California of new nuclear plants far outweigh any possible negative economic impacts.
- The CEC erred in reaching its finding because there are sufficient reasons to conclude that a means to dispose of spent nuclear waste exists.
  - ☞ The Nuclear Regulatory Commission has affirmed that the Waste Confidence Decision is still valid.
  - ☞ Yucca Mt. has been studied for 20 years at a cost of $7B.
  - ☞ DOE will submit a license application to the NRC in 2008.
  - ☞ On site fuel storage is being used to bridge the gap and is safe.
  - ☞ A new nuclear plant could safely store used fuel for 50 years.
  - ☞ DOE takes title to used fuel.

The pursuit of the perfect is the enemy of the good.

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The Bottom Line

	Cents per kwhr
• **Bundled rates 2006 (energy only)**	7.15 for E20T 8.96 for E20S
• **Advanced Coal**	5.0 4.6 with recycling of fly ash
• **Nuclear**	4.5 3.0 with incentives in EPA of 2005

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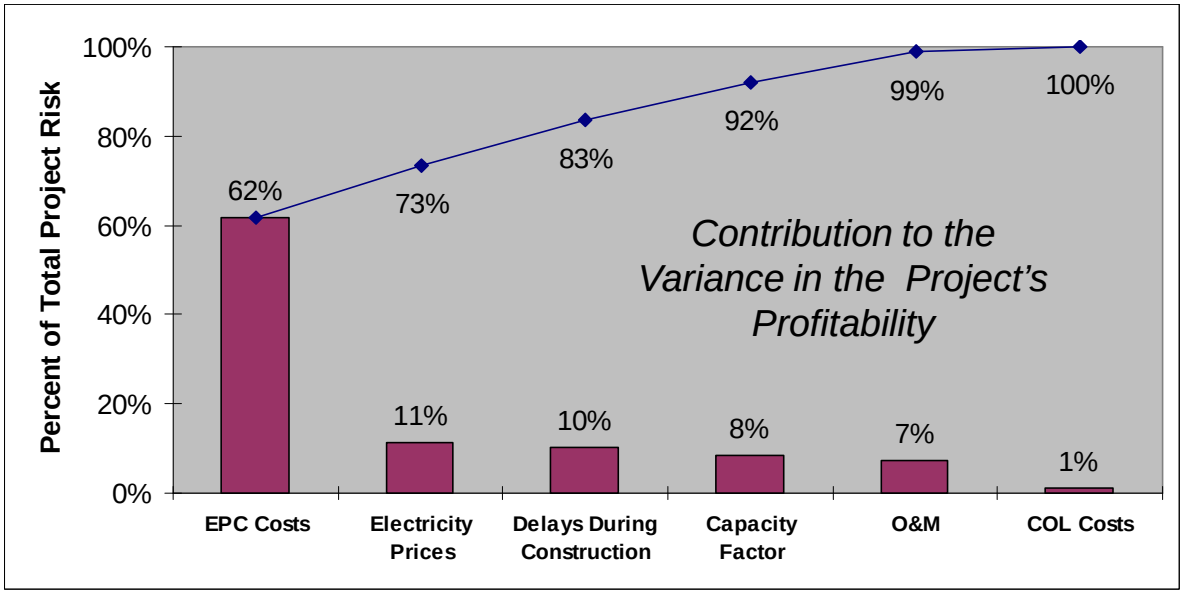
Nuclear Plant Economics

Prior to Construction and Financing:

- 85% of the risk can be addressed
- Less than 10% of the project's equity is invested

Cents per Kwhr	
Fuel	0.45
Waste fee	0.10
O&M	1.30
G&A	0.34
Capital	2.63
TOTAL	4.82
Loan Guarantee	0.64
Prod. Tax Credit (equiv.)	0.78
TOTAL with incentives	3.45



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Cost Impact of CO2 Trading

	Emission rate	Heat rate	"Emission Performance"	Yearly emissions (1000 MWs)	Environmental cost @ $8/ton
	lbs CO2/MBTU	*BTU/kwhr*	*tons CO2/Mwhr*	*tons CO2 per year*	*$ per year*
Coal	205	8,400	0.861	6,788,124	$ 28,477,008
Baseload CC	117	7,000	0.410	3,228,498	$ -
Peaking units	117	10,000	0.585	4,612,140	$ 11,069,136
Nuclear	0	9,600	0.000	-	$ (25,827,984)

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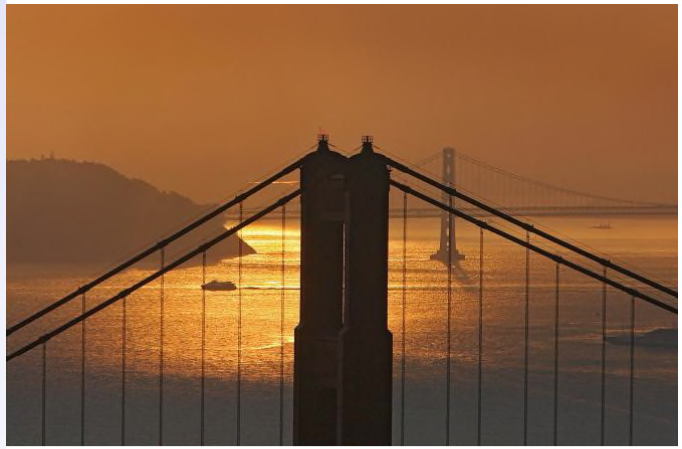
CA and Nuclear Electricity are Compatible



The concept of sustainability includes both economic growth to meet basic human needs and preservation of resources for future generations.

Nuclear power is:
"ongoing, sustainable, and economic"

http://ccst.us/meetings/speakers/presentations/2006/October/103106Stamos.ppt

Nuclear Power: The Return

John Stamos

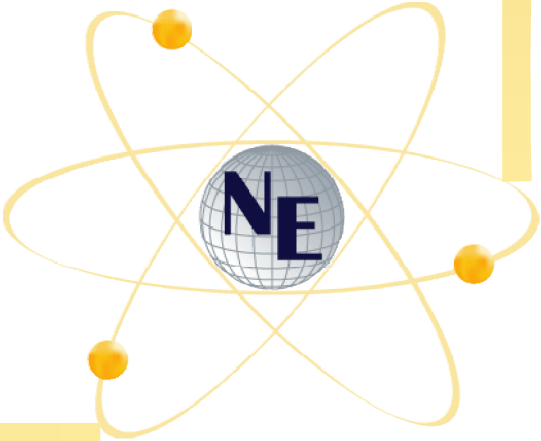
Office of Nuclear Energy

United States Department of Energy

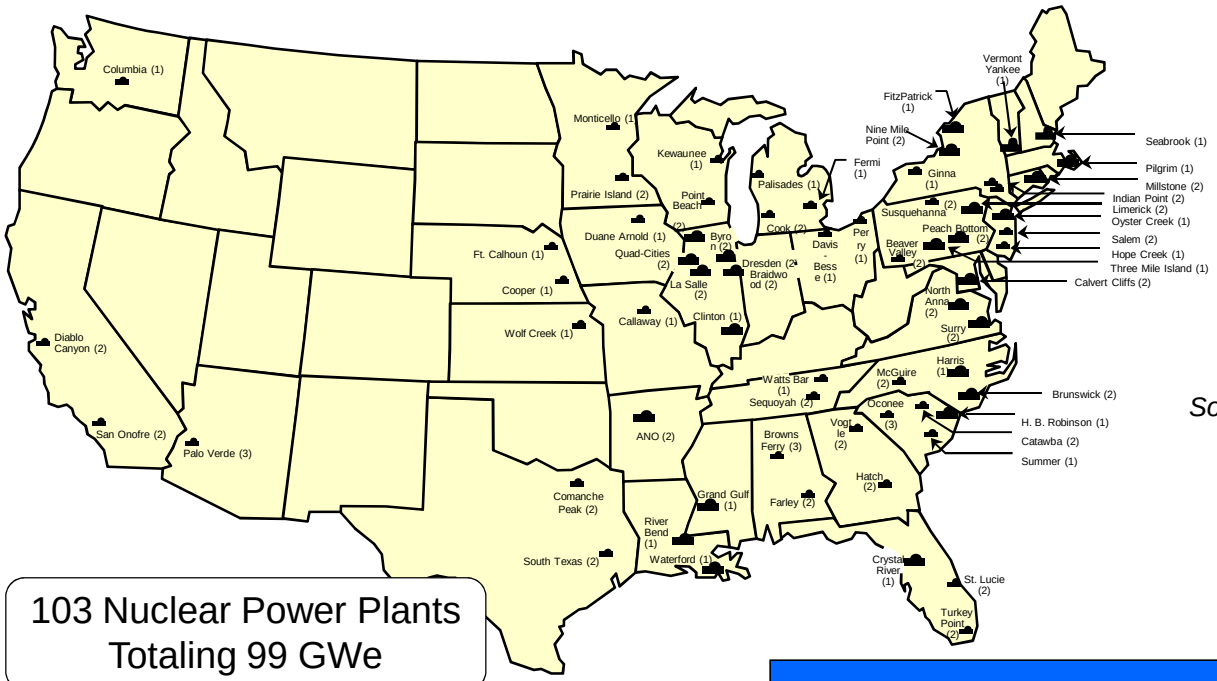
Presentation to the

California Council on Science and Technology

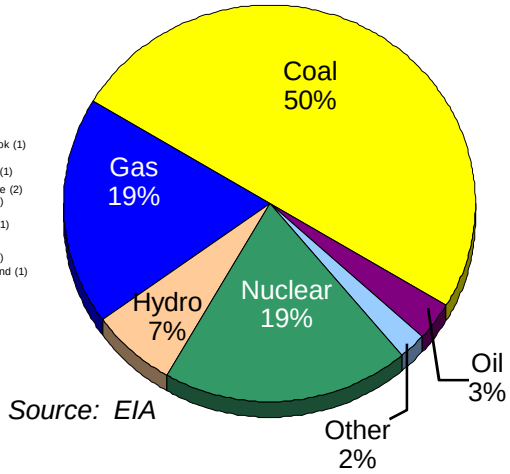
October 31, 2006



Nuclear Energy—A Quiet, Dependable Servant



103 Nuclear Power Plants
Totaling 99 GWe



Source: EIA

Electricity Production

Nearly 800 BkWh generated and saving 680 MMTCO$_2$ each year

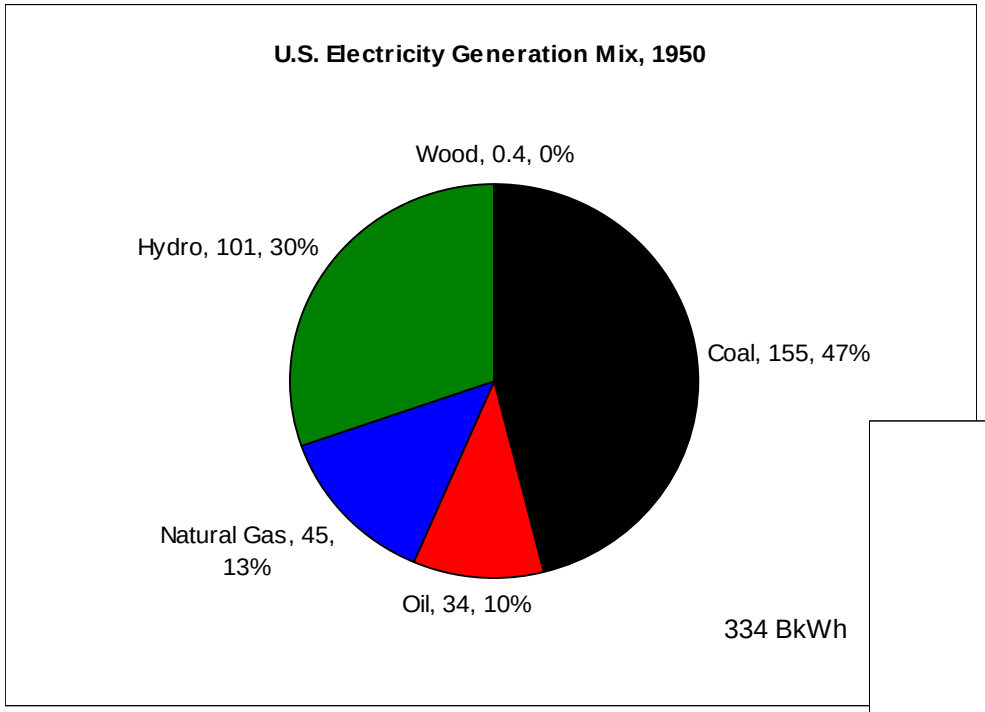
- **No new order has been placed for nearly 30 years.**
- **By staying on this path, nuclear power would provide about 1% of our electricity by 2050.**

President Eisenhower: *Atoms for Peace*

- **Contributions of uranium and fissionable materials to an international Atomic Energy Agency**
- **That fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine, and other peaceful activities**
  - **A special purpose would be to provide abundant electrical energy in the power-starved areas of the world "to serve the needs rather than the fears of mankind"**

December 8, 1953

Fossil Fuels for Generation– 2/3 to 4/5 of the Mix



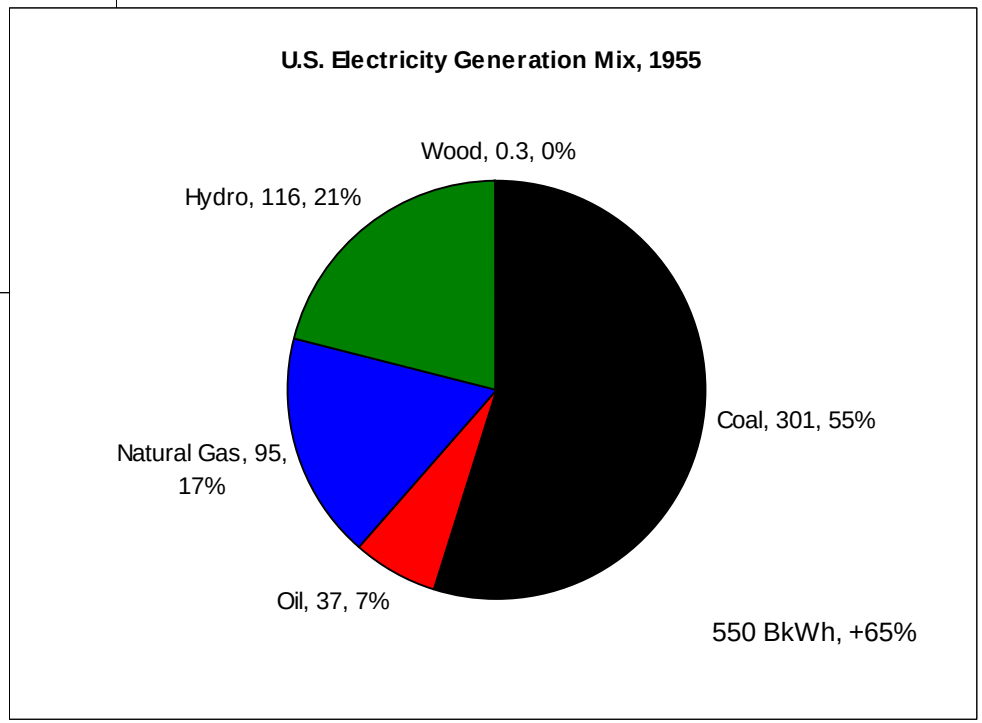


TABLE 5

ENERGY COST ESTIMATES
300 MWE "POTENTIAL" NUCLEAR PLANTS

Factor	Pressurized Water Reactor	Boiling Water Reactor	Organic Cooled Reactor	Sodium Graphite Reactor	Heavy Water Moderated Natural Uranium Reactor	Fast Breeder Reactor	Gas Cooled Reactor (Natural U Fuel)	Boiling Water Reactor w/Superheat	Conventional Coal-Fired Plant @ 35¢/10^6 Btu
Operating Date	April 1966	June 1967	Jan 1967	Jan 1968	Jan 1969	Jan 1969	-	-	
Fuel Exposure - MWD/MT	19,000	19,000	19,000	19,000	7,000	50,000	-	-	
Fuel Fabrication Cost - $/Kg	70	90	75	70	15	3,850	-	-	
Capital Cost - $/Kw	244	263	220	303	360	255	-	-	168
Capital Cost - Mills/Kwh	4.40	4.31	3.53	4.47	5.80	4.43	-	3.91	3.32
Fuel Cost - Mills/Kwh	2.56	2.29	1.83	2.00	1.21	1.99	-	1.96	3.25
Operation and Maint. - Mills/Kwh	0.59	0.61	1.09	0.70	0.91	0.79	-	0.61	0.38
Nuclear Insurance - Mills/Kwh	0.25	0.24	0.22	0.25	0.28	0.25	-	0.23	-
Total Energy Cost - Mills/Kwh	7.80	7.45	6.67	7.42	8.20	7.46	-	6.71	6.95
1 - Cost of coal in cents/10^6 Btu for Equal Energy Cost	44	40	32	40	48	40	-	32	-
2 - Cost of gas in cents/10^6 Btu for Equal Energy Cost	51	47	39	47	55	47	-	39	-
3 - Cost of oil in cents/10^6 Btu for Equal Energy Cost	52	48	40	48	57	49	-	40	-

Notes:

All plants are based on the following:

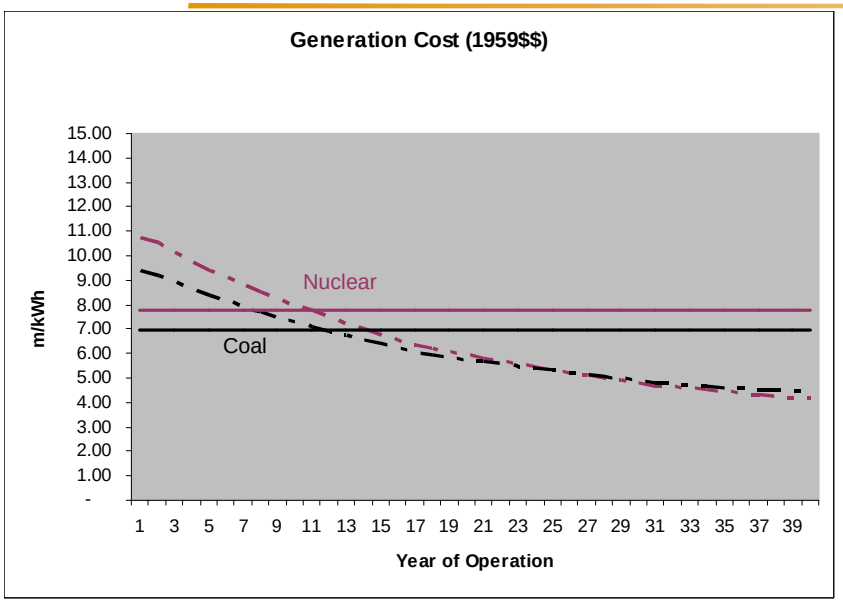
(a) Load factor 80%.

(b) Fixed charges 14% annual on investment (excl. of fuel).

(c) AEC lease charge for enriched Uranium 4%.

(d) Credit for Plutonium produced $12/gram.

Economy of Nuclear Power
Late 1950s

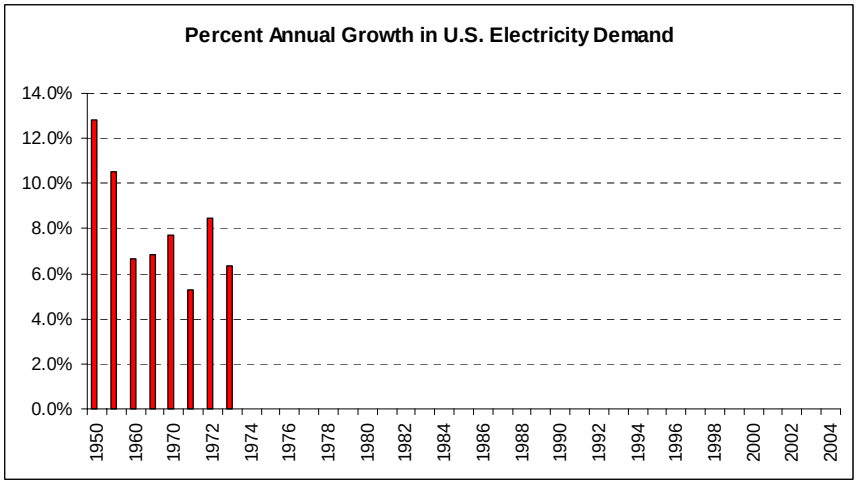


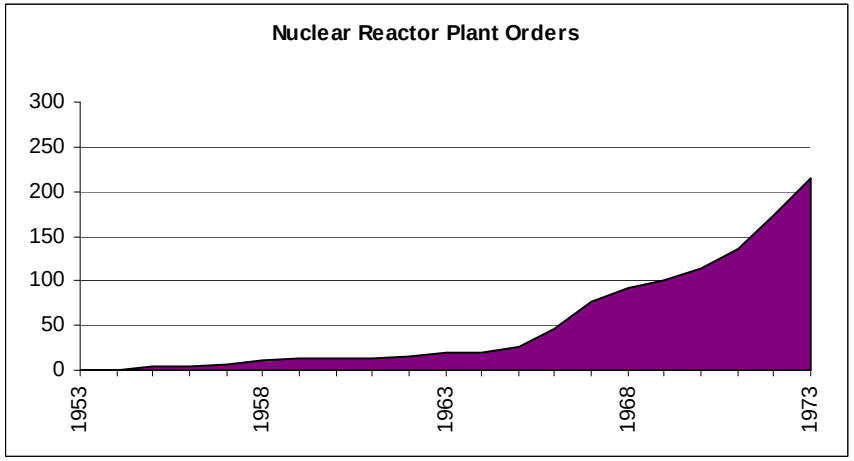
- A nuclear plant vs. conventional coal where coal costs $0.35 per MMBtu.

Cooperative Power Reactor Demonstration Program—Demonstration and 1st Round

- Shippingport (modified naval PWR-60 MWe), 1957
- Fermi 1 (Na, breeder-61 MWe), 1963
- Yankee Rowe (PWR-167 MWe), 1960
- Hallam (Na-graphite-75 MWe), 1962
- *Dresden (BWR-200 MWe),1960*
- *Indian Point (PWR-257 MWe), 1963*

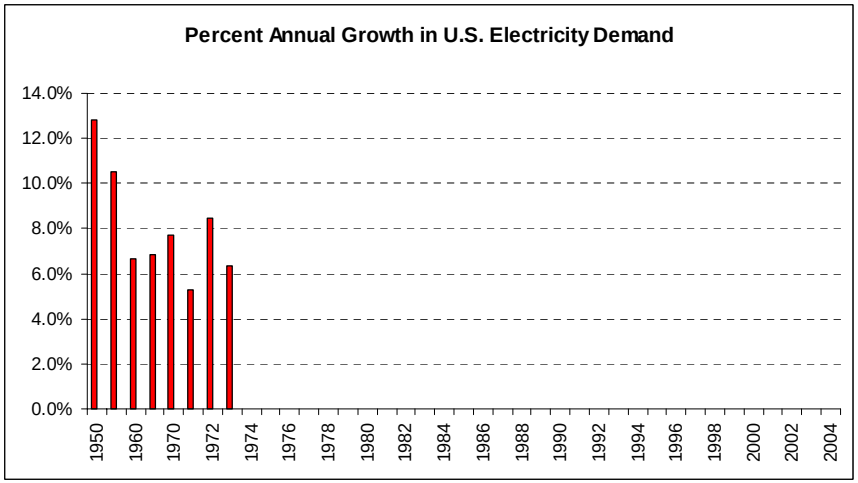
Electricity Consumption Kept Growing

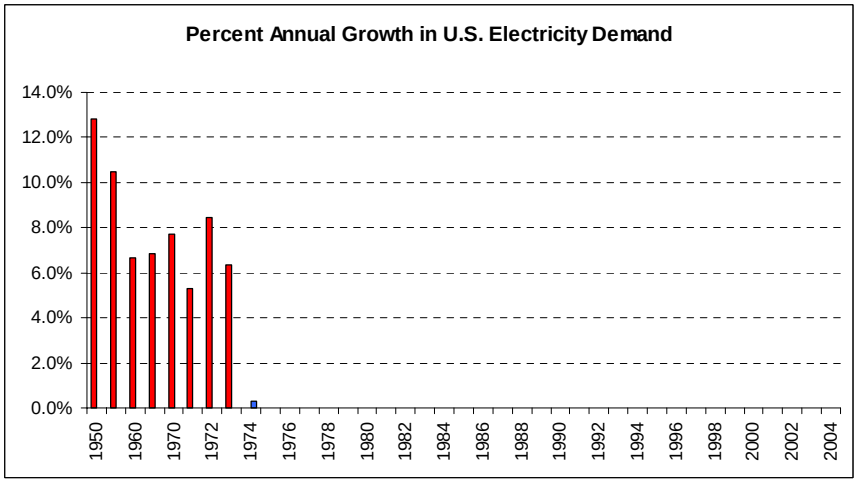


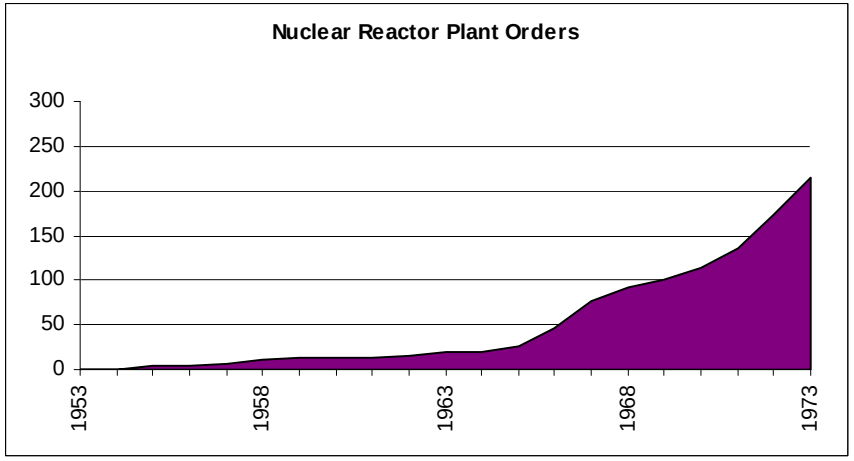


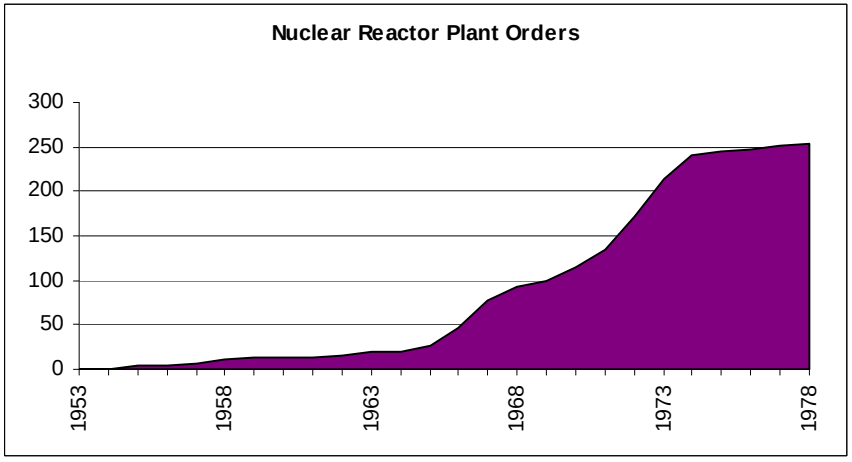
Between 1965 - 1969, 80 reactors were ordered, followed by another 115 in the four years 1970 – 1973

Electricity Consumption Kept Growing (But Much More Slowly)

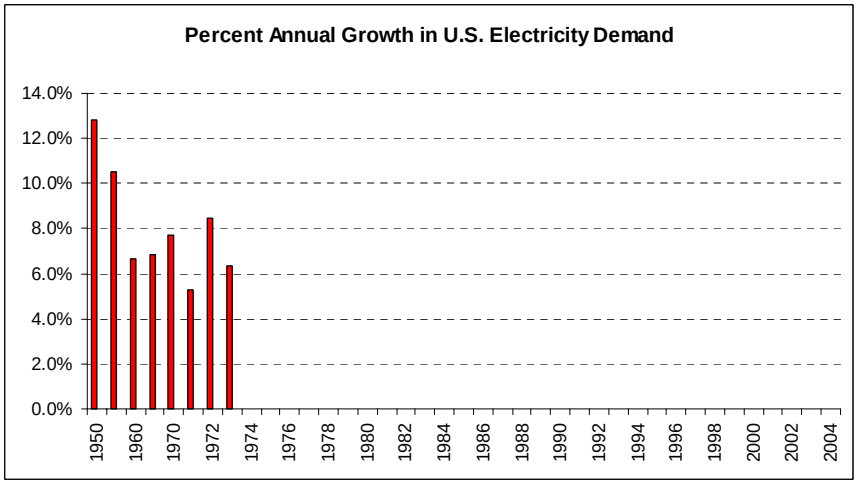


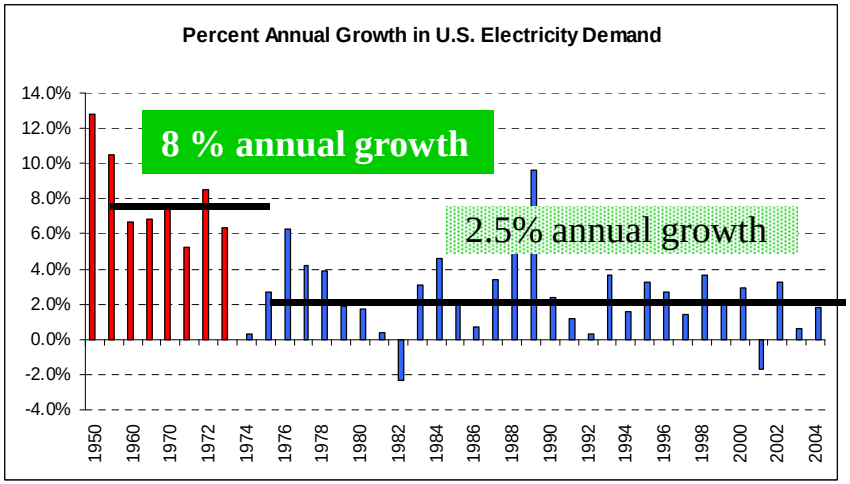


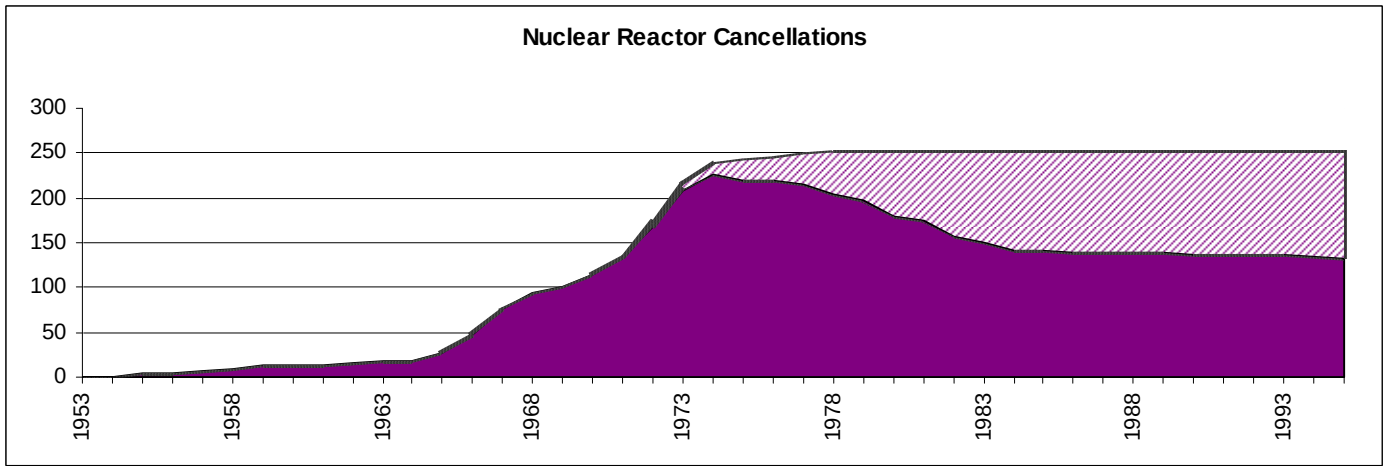




. . . Leading to Second Thoughts



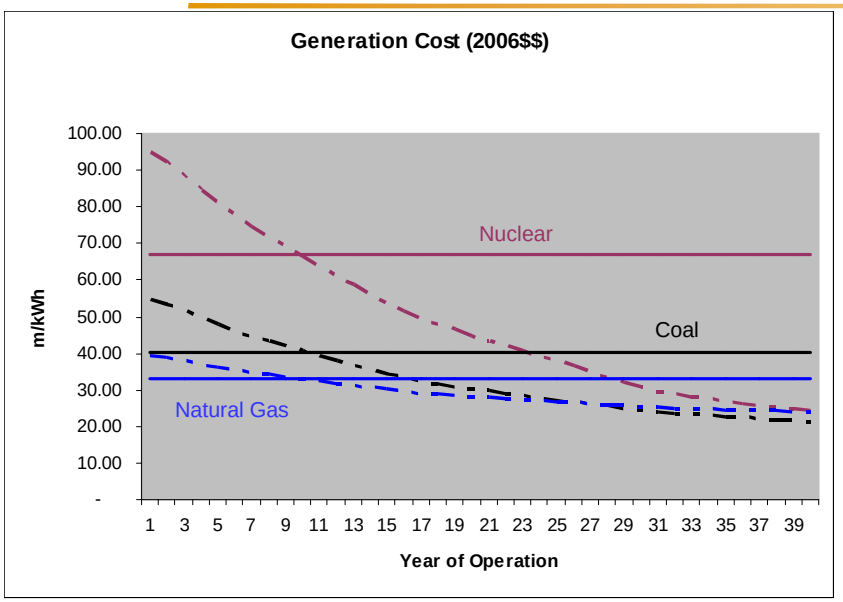




Environmentalism

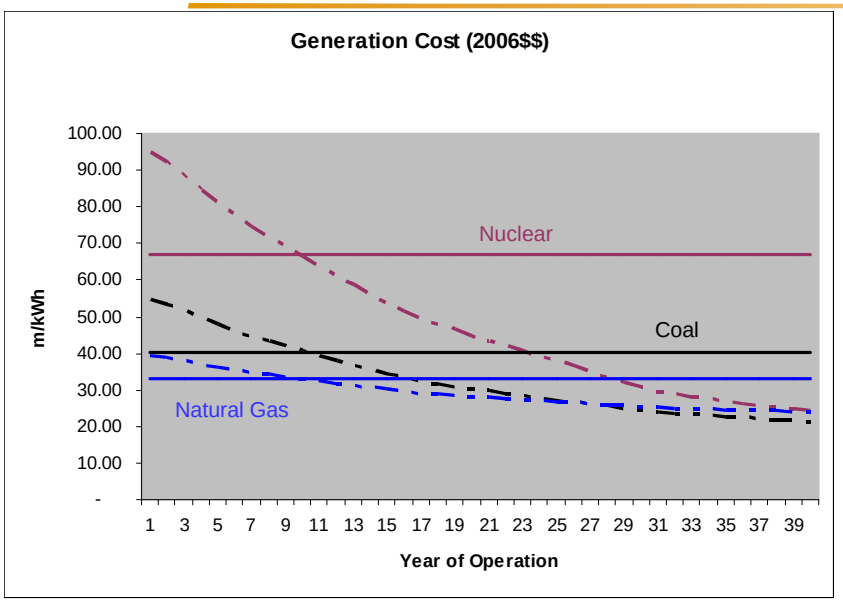
- Don’t pollute
- Save energy
- Small and decentralization are beautiful
- Nuclear power is too expensive and “dangerous”

Economy of Nuclear Power



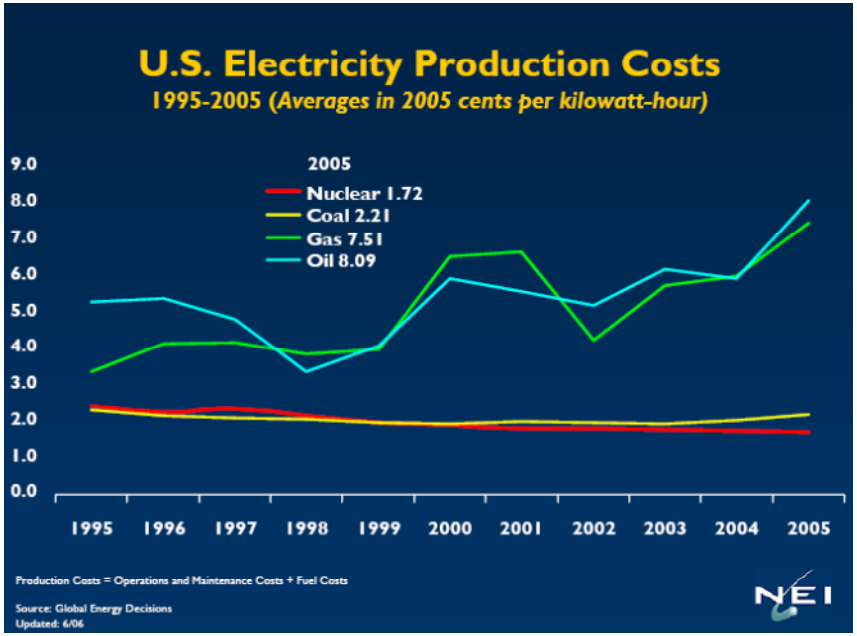
- A nuclear plant vs. scrubbed, pulverized coal or natural gas combined cycle, where natural gas costs $3 per MMBtu.

Economy of Nuclear Power

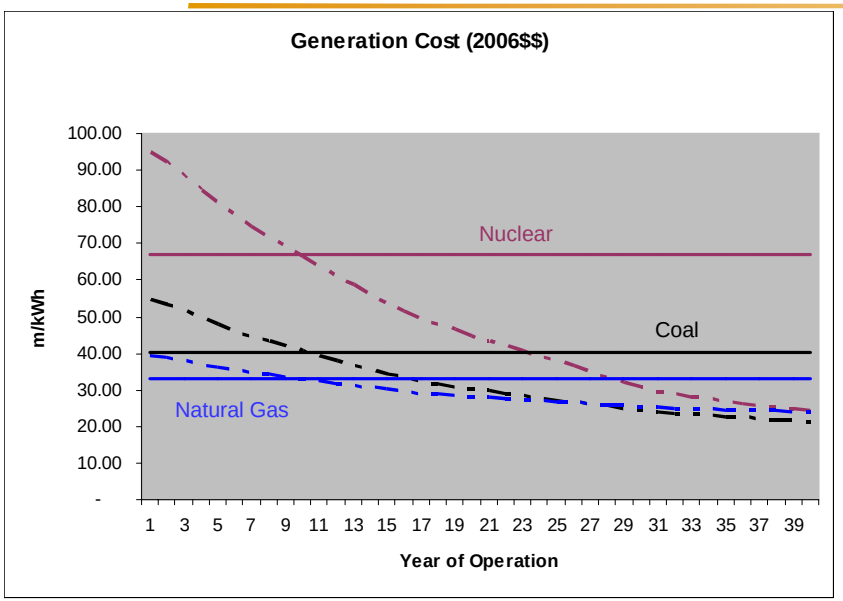


- A nuclear plant vs. scrubbed, pulverized coal or natural gas combined cycle, where natural gas costs $3 per MMBtu.

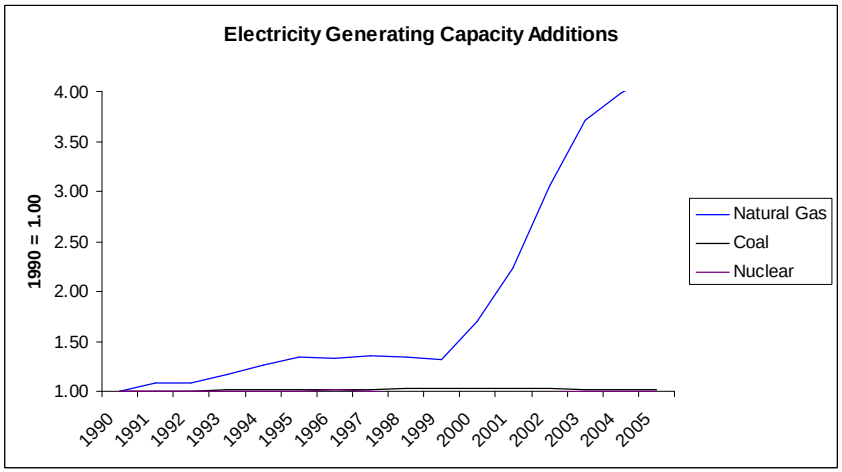
- Absent capital recovery, nuclear power is the lowest cost baseload technology.

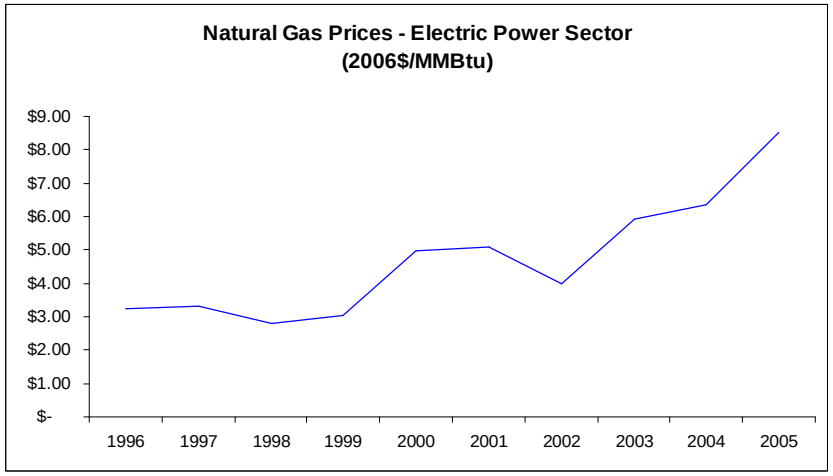


Economy of Nuclear Power



- A nuclear plant vs. scrubbed, pulverized coal or natural gas combined cycle, where natural gas costs $3 per MMBtu.

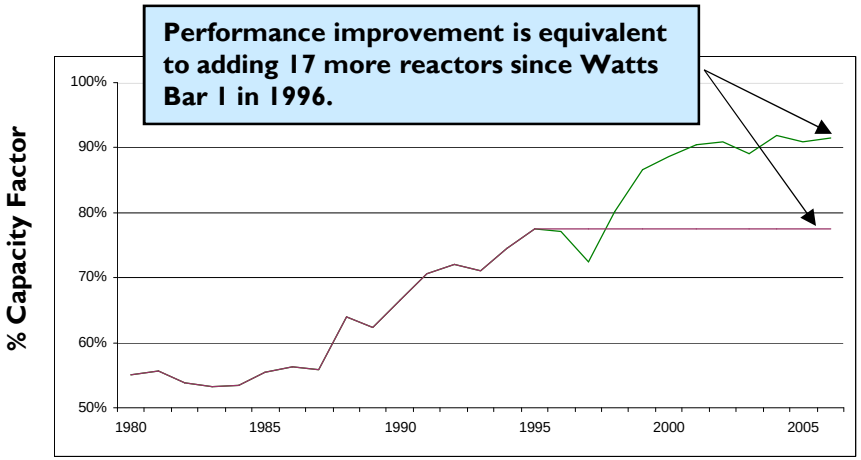




Time to Rethink?

- Besides too volatile natural gas prices, nuclear power has proven its economic productivity.
- The idea that all the electricity demand produced by fossil fuels and nuclear power could be met by reducing demand with increased energy efficiency and expanded renewables to provide the remainder became untenable.

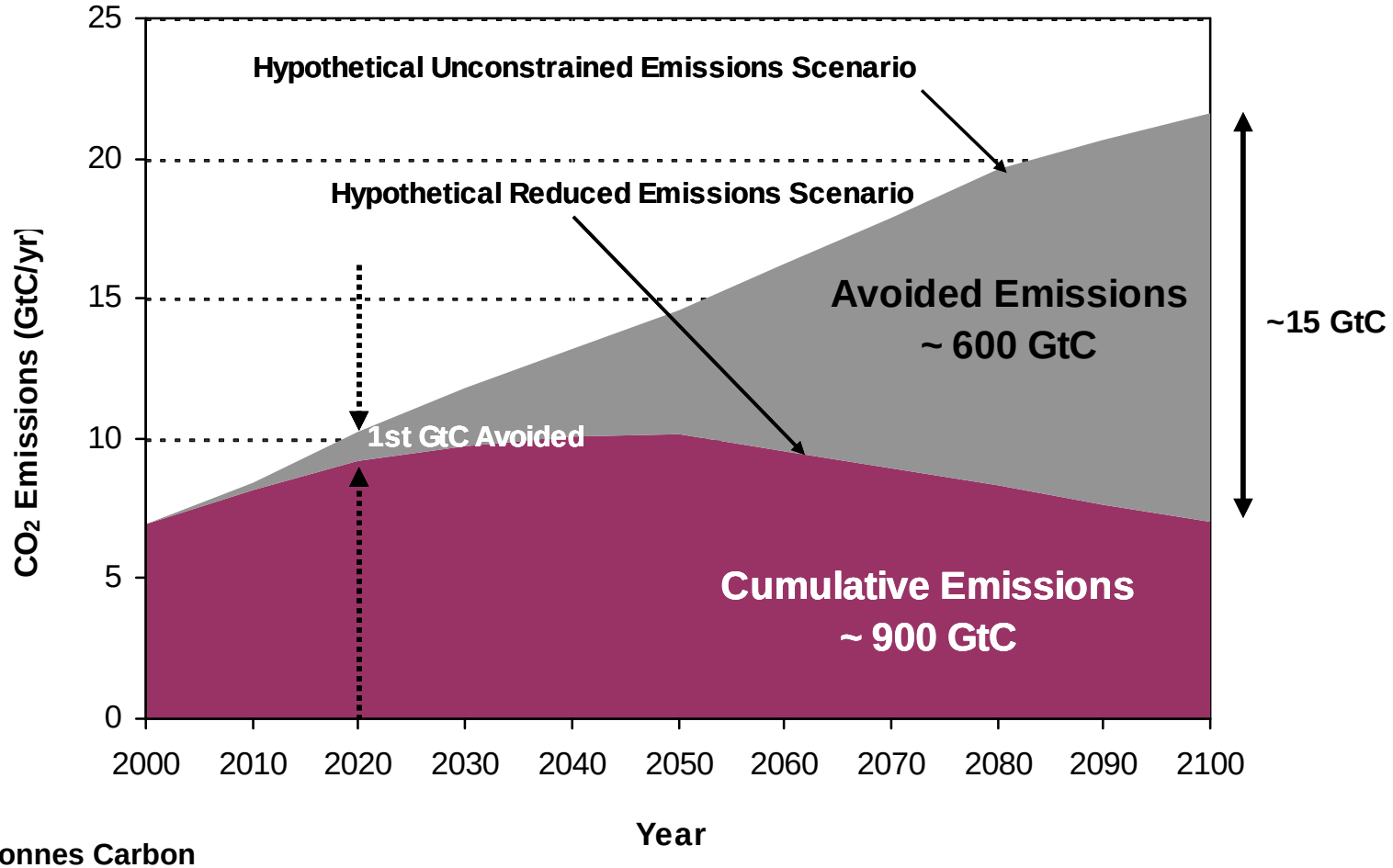
Nuclear Capacity Factor is at an All-Time High



Source: Energy Information Administration data

- Concerns about reducing carbon-dioxide emissions continue to grow, while solutions devoid of expanded nuclear power seem less plausible.

Example of A Reduced GHG Emissions Future



GtC = Giga-Tonnes Carbon

How Big is a "Gigaton" ?

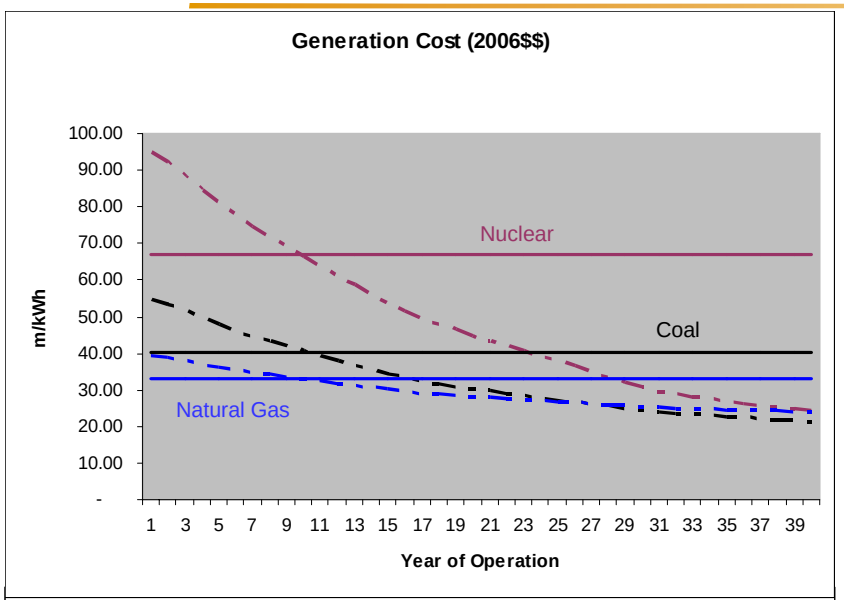
Using Today's Technology, These Actions Can Cut Emissions by 1 GtC/Year

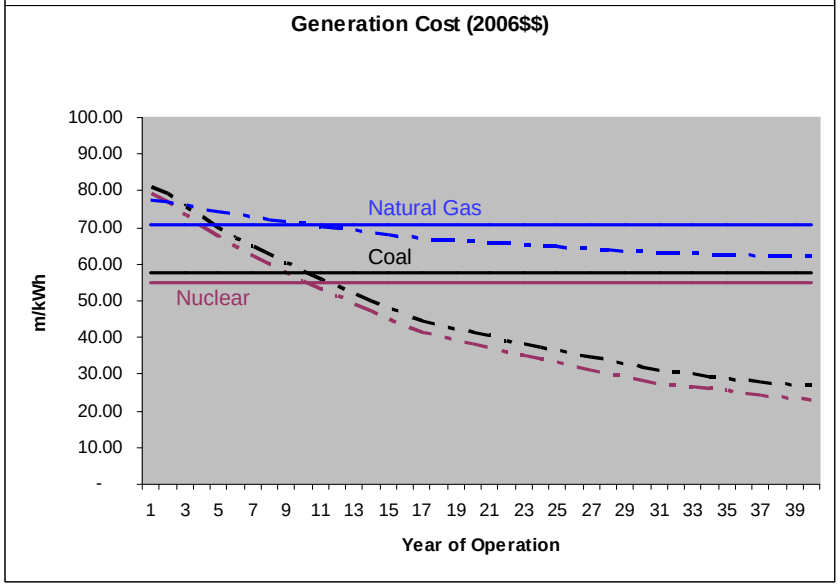
Today's Technology	Actions that Provide 1 Gigaton/Year of Mitigation
Coal-Fired Power Plants	Build 1,000 "zero-emission" 500-MW coal-fired power plants (in lieu of coal-fired plants without CO_2 capture and storage)
Geologic Sequestration	Install 3,700 sequestration sites like Norway's Sliepner project (0.27 MtC/year)
Nuclear	Build 500 new nuclear power plants, each 1 GW in size (in lieu of new coal-fired power plants without CO_2 capture and storage)
Efficiency	Deploy 1 billion new cars at 40 miles per gallon (mpg) instead of 20 mpg
Wind Energy	Install capacity to produce 50 times the current global wind generation (in lieu of coal-fired power plants without CO_2 capture and storage)
Solar Photovoltaics	Install capacity to produce 1,000 times the current global solar PV generation (in lieu of coal-fired power plants without CO_2 capture and storage)
Biomass fuels from plantations	Convert a barren area about 15 times the size of Iowa's farmland (about 30 million acres) to biomass crop production
CO_2 Storage in New Forest.	Convert a barren area about 30 times the size of Iowa's farmland to new forest

Environmentalism

- Don’t pollute
- Save energy
- Small and decentralization are beautiful
- ***And maybe nuclear power can help***

Economy of Nuclear Power

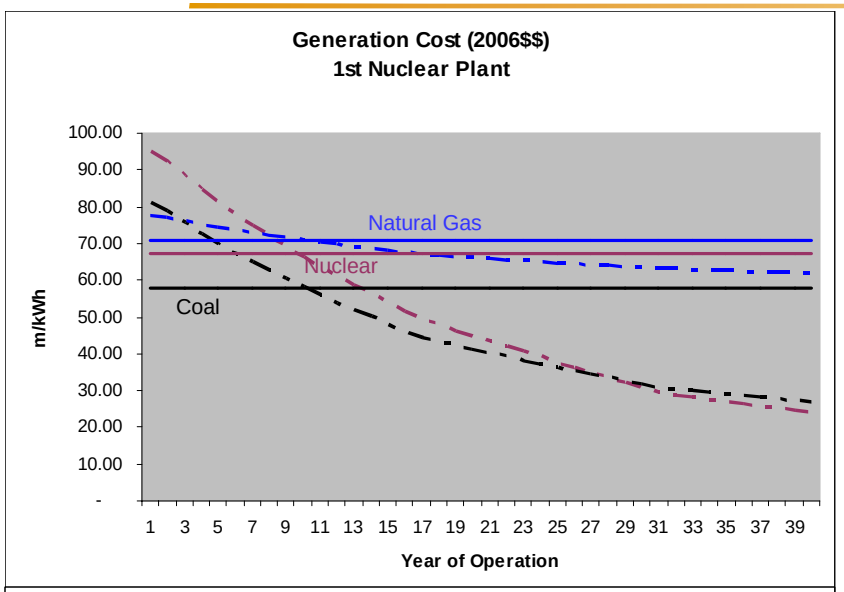


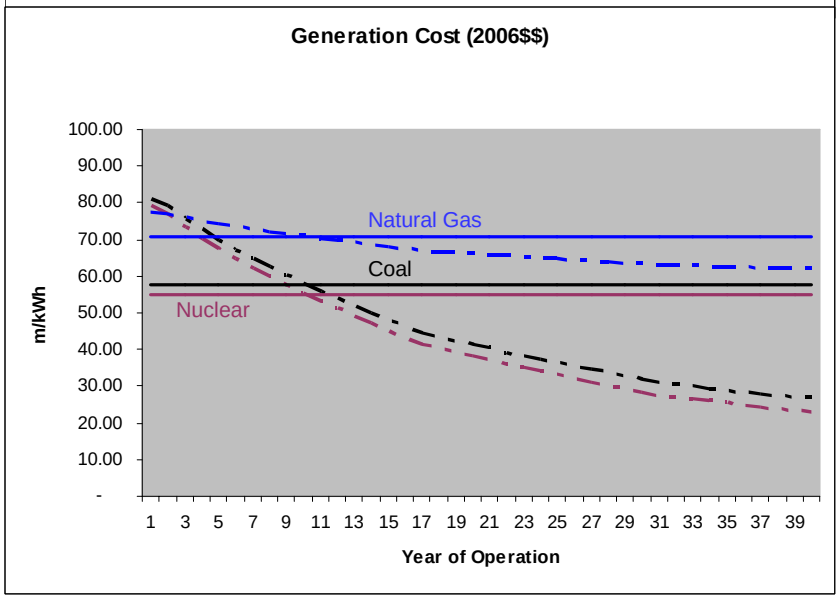


- A 1st-of-a-Kind nuclear plant vs. scrubbed, pulverized coal or natural gas combined cycle, where natural gas costs $3 per MMBtu.

- An Nth-of-a-Kind nuclear plant vs. IGCC with CO_2 sequestration or natural gas combined cycle, where natural gas costs $9 per MMBtu.

Economy of Nuclear Power





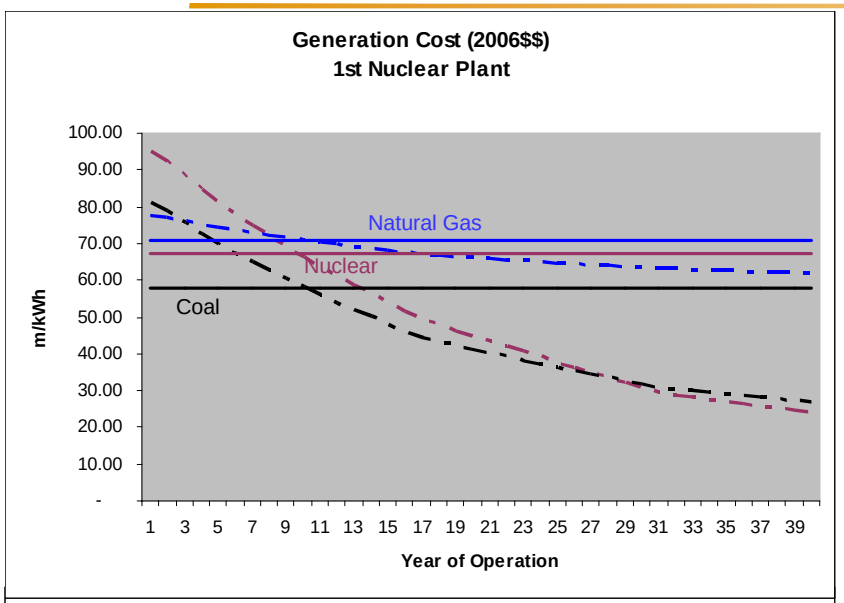
- A 1st-of-a-Kind nuclear plant vs. IGCC with CO_2 sequestration or natural gas combined cycle, where natural gas costs $9 per MMBtu.

- A Nth-of-a-Kind nuclear plant vs. IGCC with CO_2 sequestration or natural gas combined cycle, where natural gas costs $9 per MMBtu.

Energy Policy Act of 2005 (EPAct)

- Signed into law on August 8, 2005
- Provides 3 key incentives for construction and operation of new advanced nuclear power plants
  - Section 638, “Standby Support” – Energy (Part of NP 2010)
  - Section 1306, “Production Credits” – Treasury
  - Section 1703, “Loan Guarantees” – Energy
- Designed to reduce regulatory and financial uncertainties for “first movers.”

Economy of Nuclear Power



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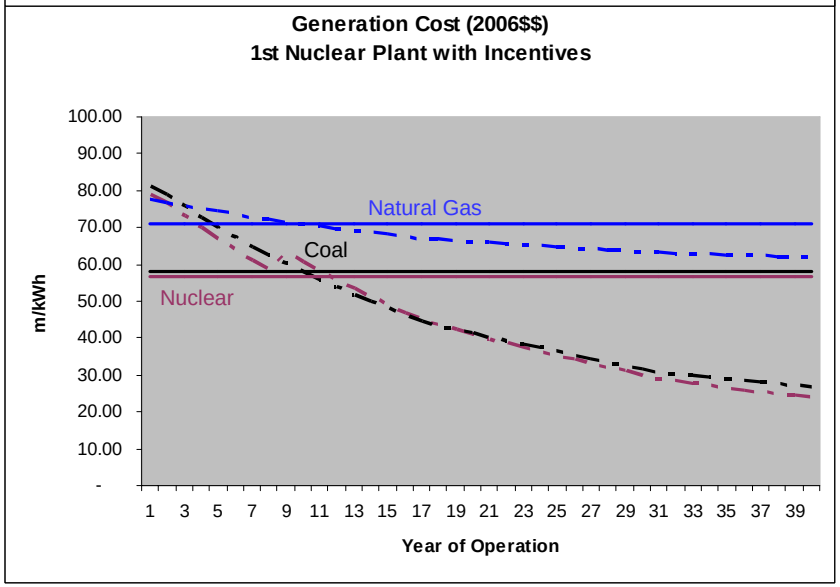
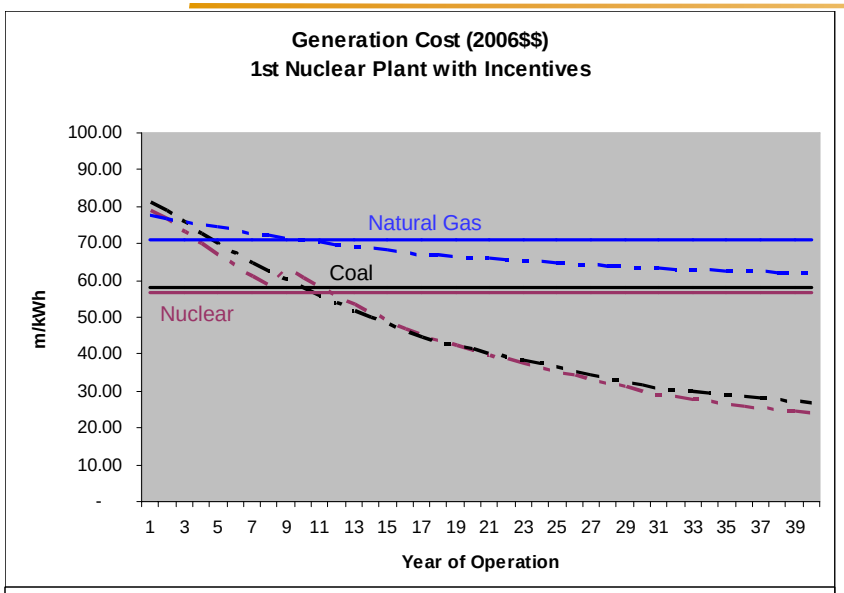
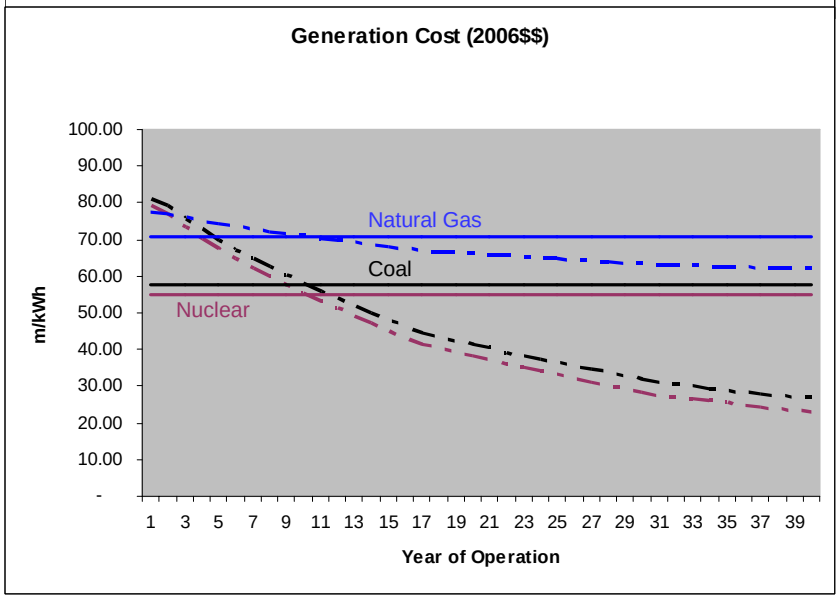


- A 1st-of-a-Kind nuclear plant with economic incentives vs. IGCC with CO_2 sequestration or natural gas combined cycle, where natural gas costs $9 per MMBtu.

Economy of Nuclear Power



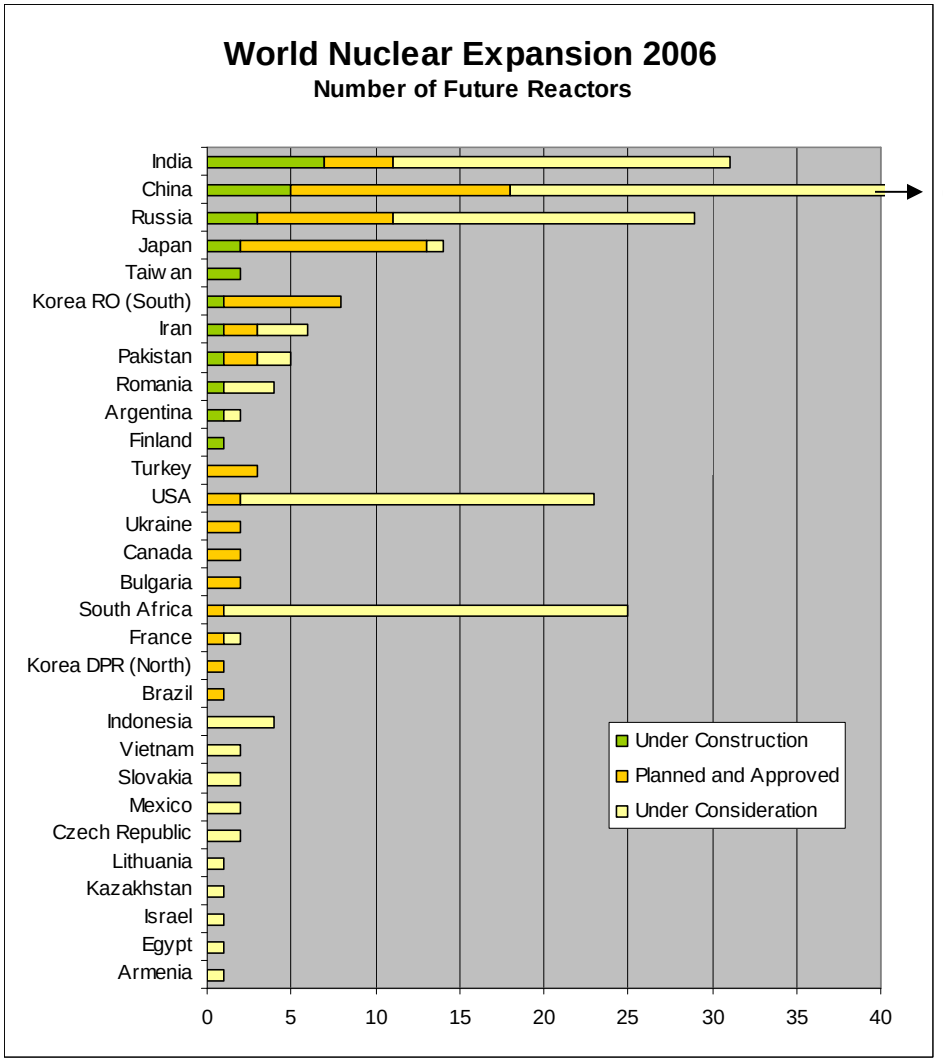


- A 1st-of-a-Kind nuclear plant with incentives vs. IGCC with CO_2 sequestration or natural gas combined cycle, where natural gas costs $9 per MMBtu.

- A Nth-of-a-Kind nuclear plant vs. IGCC with CO_2 sequestration or natural gas combined cycle, where natural gas costs $9 per MMBtu.

World Nuclear Expansion

- Nearly 250 reactors are being built, planned, or under consideration world-wide



Uranium Resources

Known Recoverable Resources of Uranium (@$80/kgU, $31/lb U3O8)

	tonnes U	
Australia	1,074,000	30%
Kazakhstan	622,000	18%
Canada	439,000	12%
South Africa	298,000	8%
Namibia	213,000	6%
Brazil	143,000	4%
Russian Fed.	158,000	4%
USA	102,000	3%
Uzbekistan	93,000	3%
Other	395,000	11%
World total	3,537,000	100%

	tonnes U	years
Current usage	68,000	
Years remaining		52

Known Recoverable Resources of Uranium (@$130/kgU, $50/lb U3O8)

	tonnes U	
Australia	1,143,000	24%
Kazakhstan	816,000	17%
Canada	444,000	9%
USA	342,000	7%
South Africa	341,000	7%
Namibia	282,000	6%
Brazil	279,000	6%
Niger	225,000	5%
Russian Fed.	172,000	4%
Uzbekistan	116,000	2%
Ukraine	90,000	2%
Jordan	79,000	2%
India	67,000	1%
China	60,000	1%
Other	287,000	6%
World total	4,743,000	100%

	tonnes U	years
Current usage	68,000	
Years remaining		70

IAEA-NEA Esitmates of Additional Uranium Resources

	tonnes U	
Conventional	10,000,000	
Non-conventional	22,000,000	
Seawater	4,000,000,000	
World total	4,032,000,000	

	tonnes U	years
Current usage	68,000	
Years remaining		59,294
Usage if 3X		11,859

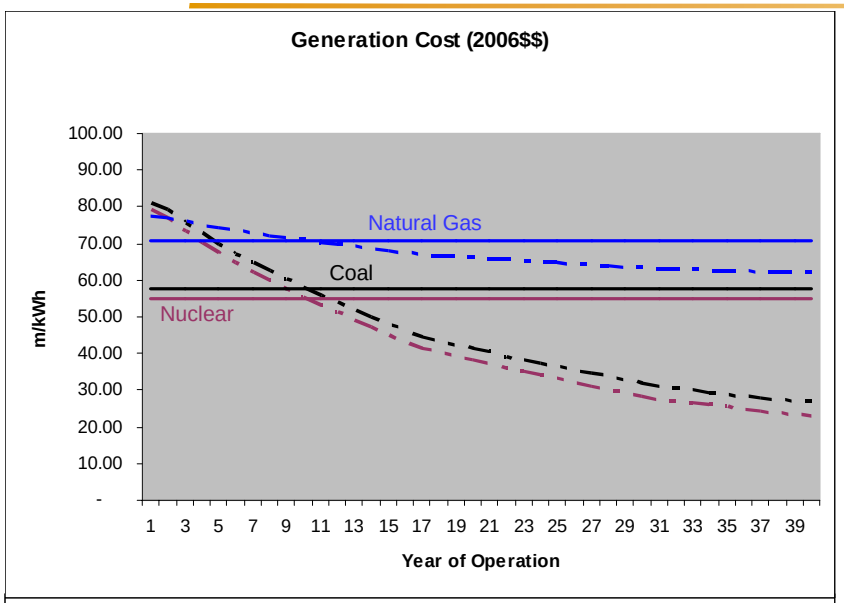
IAEA-NEA Esitmates of Additional Uranium Resources

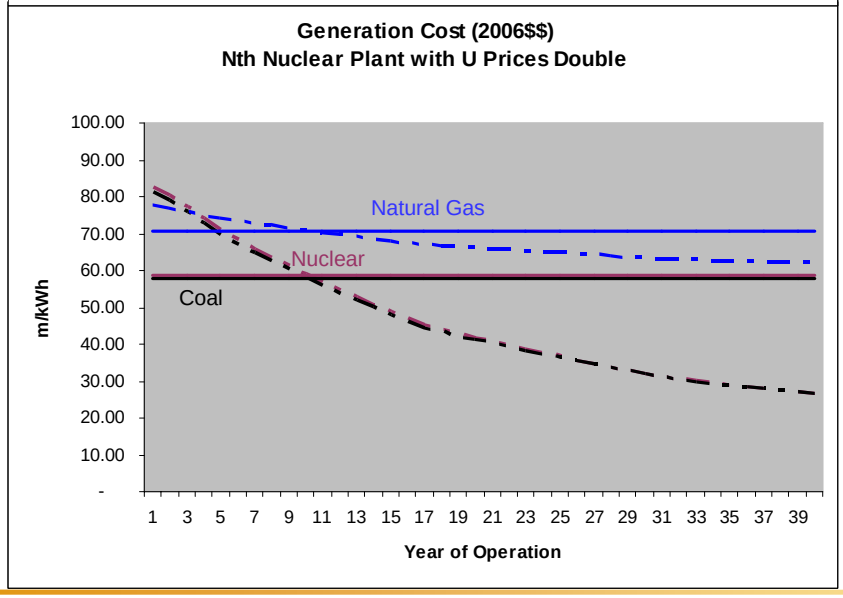
	tonnes U	
Conventional	10,000,000	
Non-conventional	22,000,000	
Seawater	-	
World total	32,000,000	

	tonnes U	years
Current usage	68,000	
Years remaining		471
Usage if 3X		94

Source: World Nuclear Association

Economy of Nuclear Power

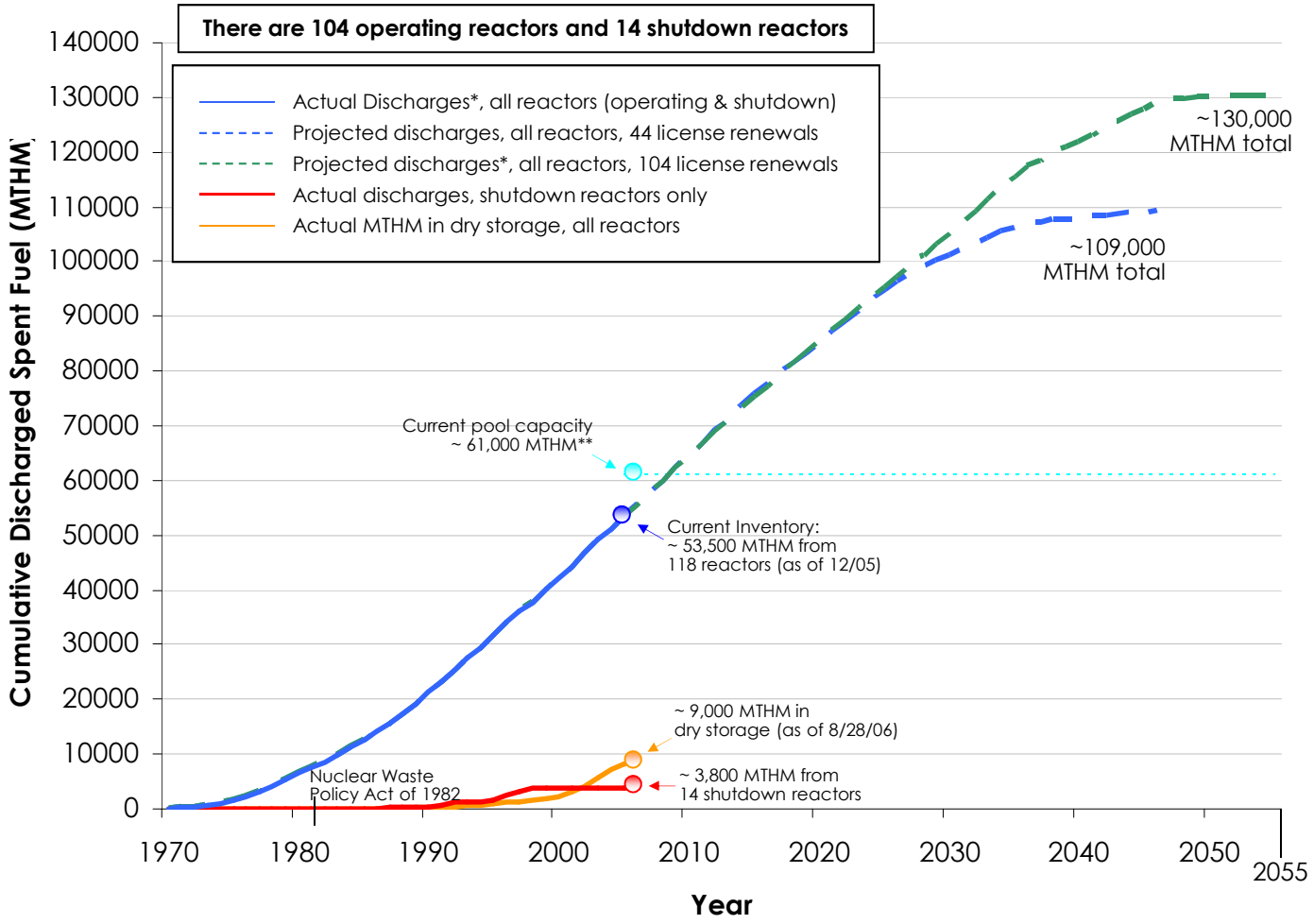




- A N^{th}-of-a-Kind nuclear plant vs. IGCC with CO_2 sequestration or natural gas combined cycle, where natural gas costs $9 per MMBtu

- A N^{th}-of-a-Kind nuclear plant with uranium prices at $100/lb U_3O_8 vs. IGCC with CO_2 sequestration or natural gas combined cycle, where natural gas costs $9 per MMBtu.

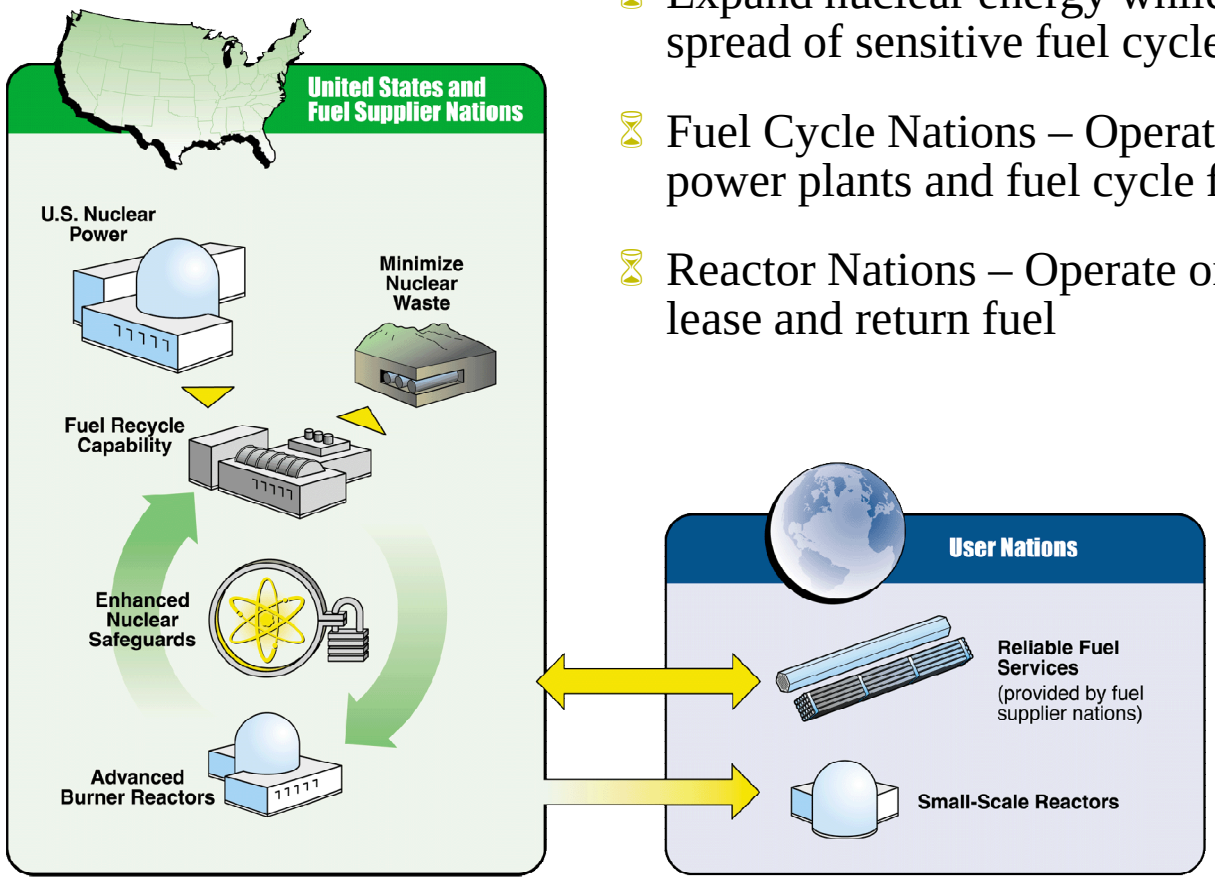
Historical and Projected Commercial Spent Nuclear Fuel Discharges



Sources: * Based on actual discharge data as reported on RW-859's through 12/31/02, and projected discharges, in this case, based on 104 license renewals.

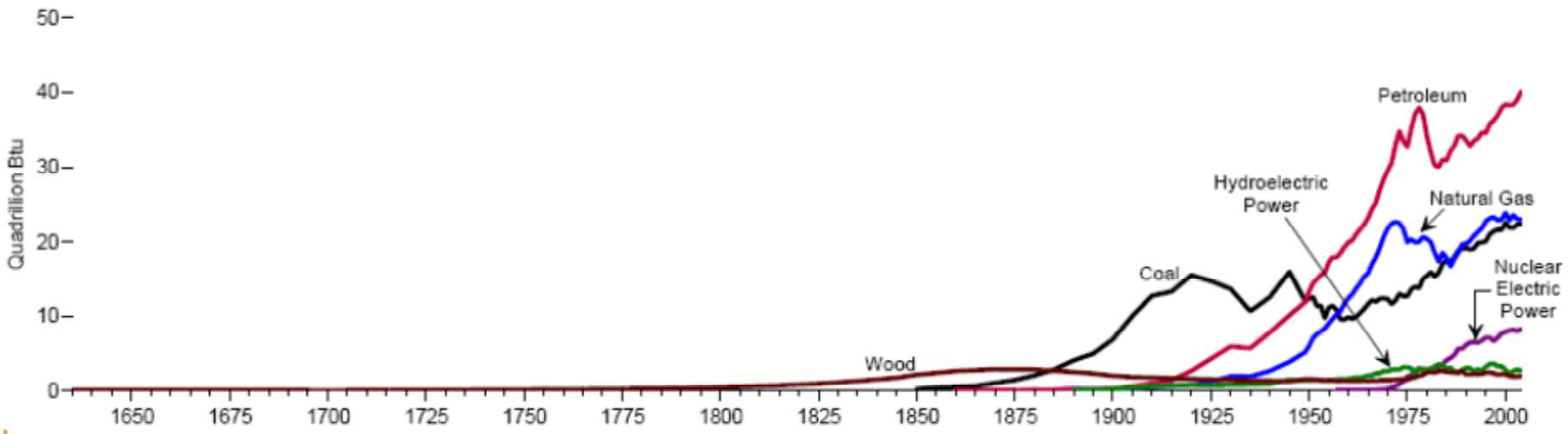
** Based on pool capacities provided in 2002 RW-859 (less FCR) and supplemented by utility storage plans.

Reliable Fuel Service Model



- Expand nuclear energy while preventing spread of sensitive fuel cycle technology
- Fuel Cycle Nations – Operate both nuclear power plants and fuel cycle facilities
- Reactor Nations – Operate only reactors, lease and return fuel

Energy Consumption by Resource



Source: Annual Energy Review 2004, DOE/EIA-0384(2004), August 2005, p. xx

President Eisenhower: *Atoms for Peace*

- **Contributions of uranium and fissionable materials to an international Atomic Energy Agency**
- **That fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine, and other peaceful activities**
  - **A special purpose would be to provide abundant electrical energy in the power-starved areas of the world "to serve the needs rather than the fears of mankind"**

December 8, 1953

President Bush: *Global Nuclear Energy Partnership*

- **"America will work with nations that have advanced civilian nuclear energy programs, such as France, Japan, and Russia. Together, we will develop and deploy innovative, advanced reactors and new methods to recycle spent nuclear fuel. This will allow us to produce more energy, while dramatically reducing the amount of nuclear waste and eliminating the nuclear byproducts that unstable regimes or terrorists could use to make weapons."**
- **"We will also ensure that . . . developing nations have a reliable nuclear fuel supply. In exchange, these countries would agree to use nuclear power only for civilian purposes and forego uranium enrichment and reprocessing activities that can be used to develop nuclear weapons."**

February 18, 2006