Nuclear Energy
Part of a Clean Energy Portfolio

South Dakota Public Utilities Commission

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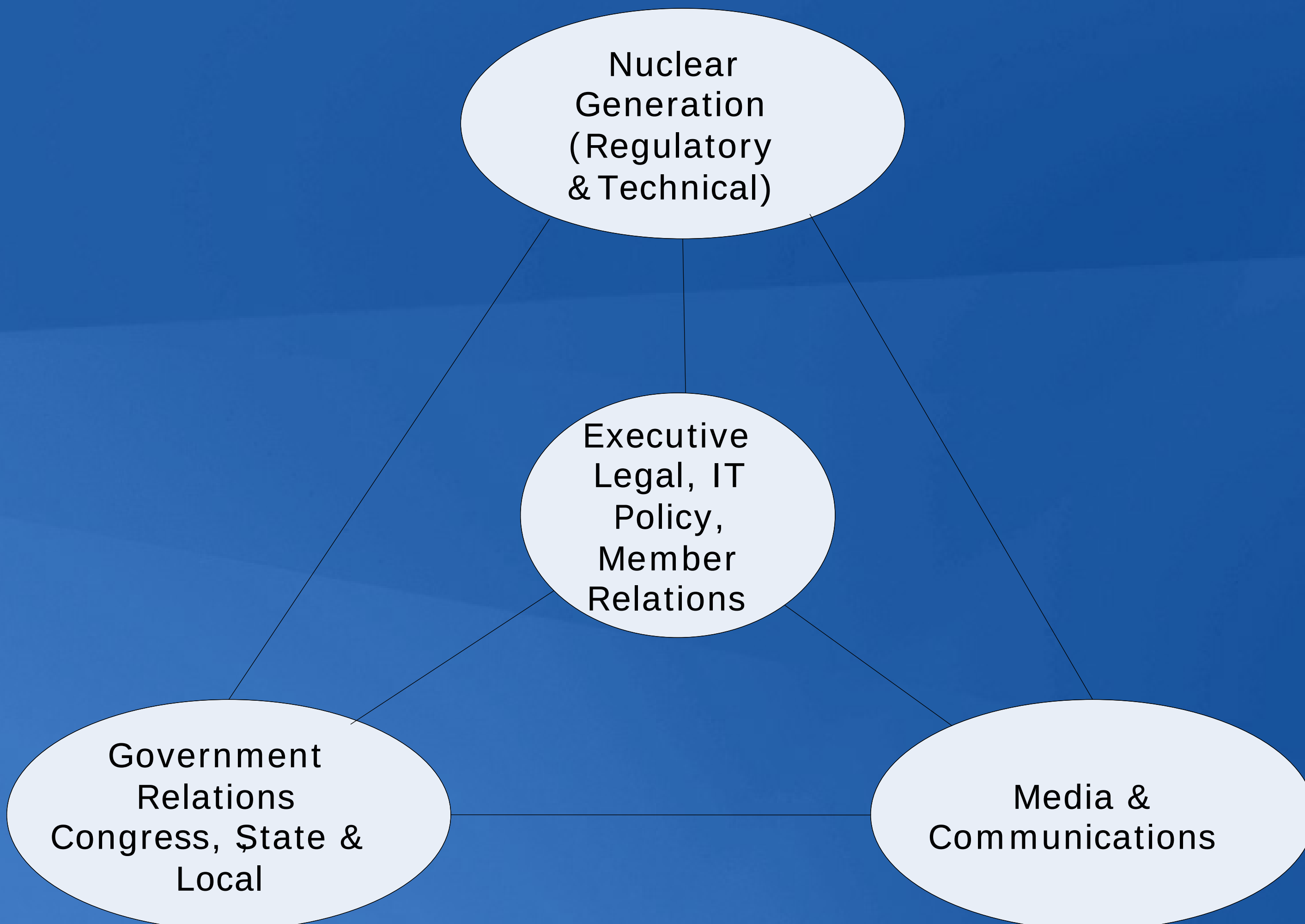
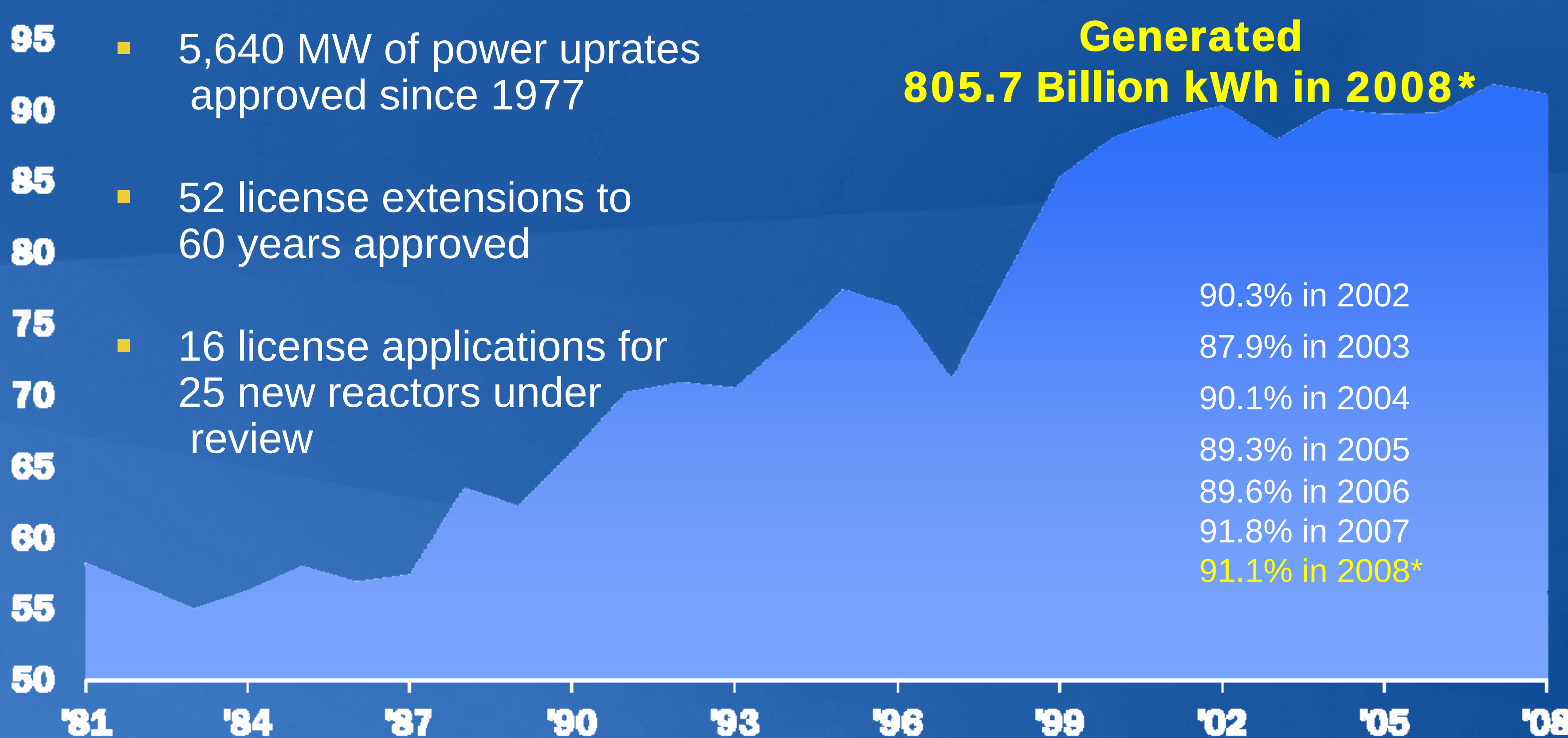
Nuclear Energy Institute



Sustained Reliability and Productivity

U.S. Nuclear Capacity Factor, Percent

- 5,640 MW of power uprates approved since 1977
- 52 license extensions to 60 years approved
- 16 license applications for 25 new reactors under review



* NEI Estimate

Source: Ventyx Velocity Suite / Energy Information Administration

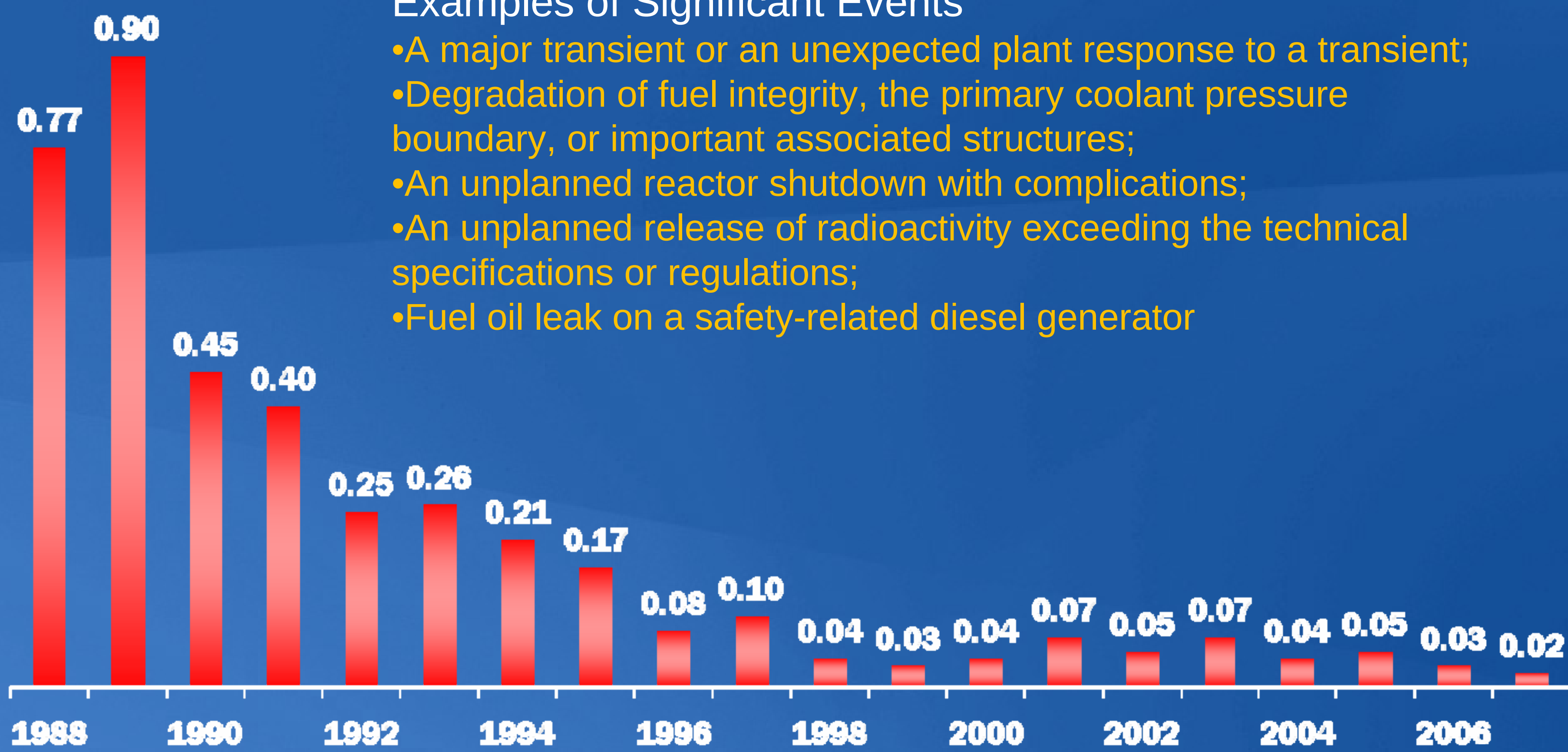
Updated: 1/09

Significant Events at U.S. Nuclear Plants:

Annual Industry Average, Fiscal Year 1988-2007

Examples of Significant Events

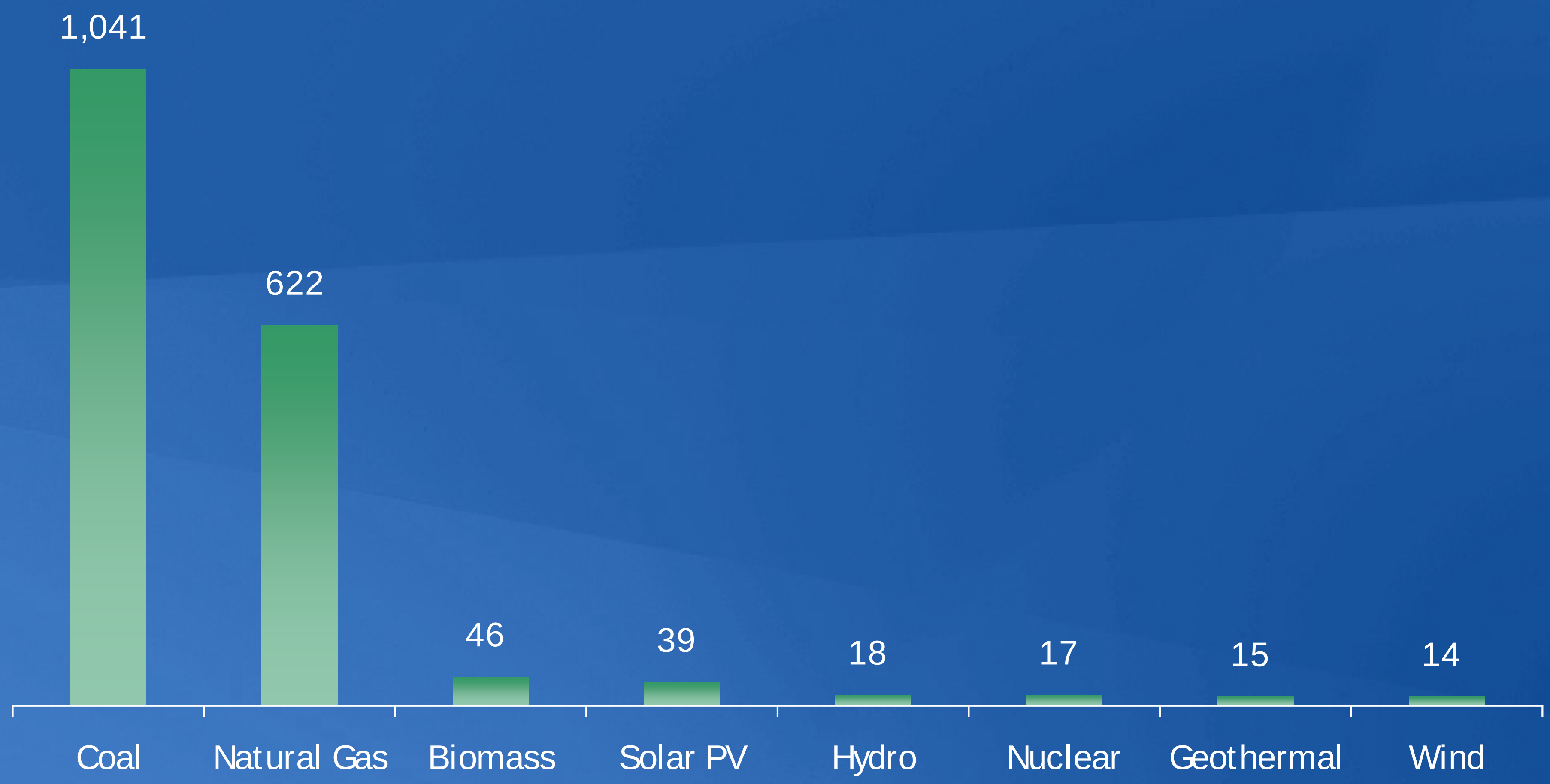
•A major transient or an unexpected plant response to a transient;
•Degradation of fuel integrity, the primary coolant pressure boundary, or important associated structures;
•An unplanned reactor shutdown with complications;
•An unplanned release of radioactivity exceeding the technical specifications or regulations;
•Fuel oil leak on a safety-related diesel generator



Source: NRC Information Digest, 1988 is the earliest year data is available.
Updated: 4/09

Comparison of Life-Cycle Emissions

Tons of Carbon Dioxide Equivalent per Gigawatt-Hour



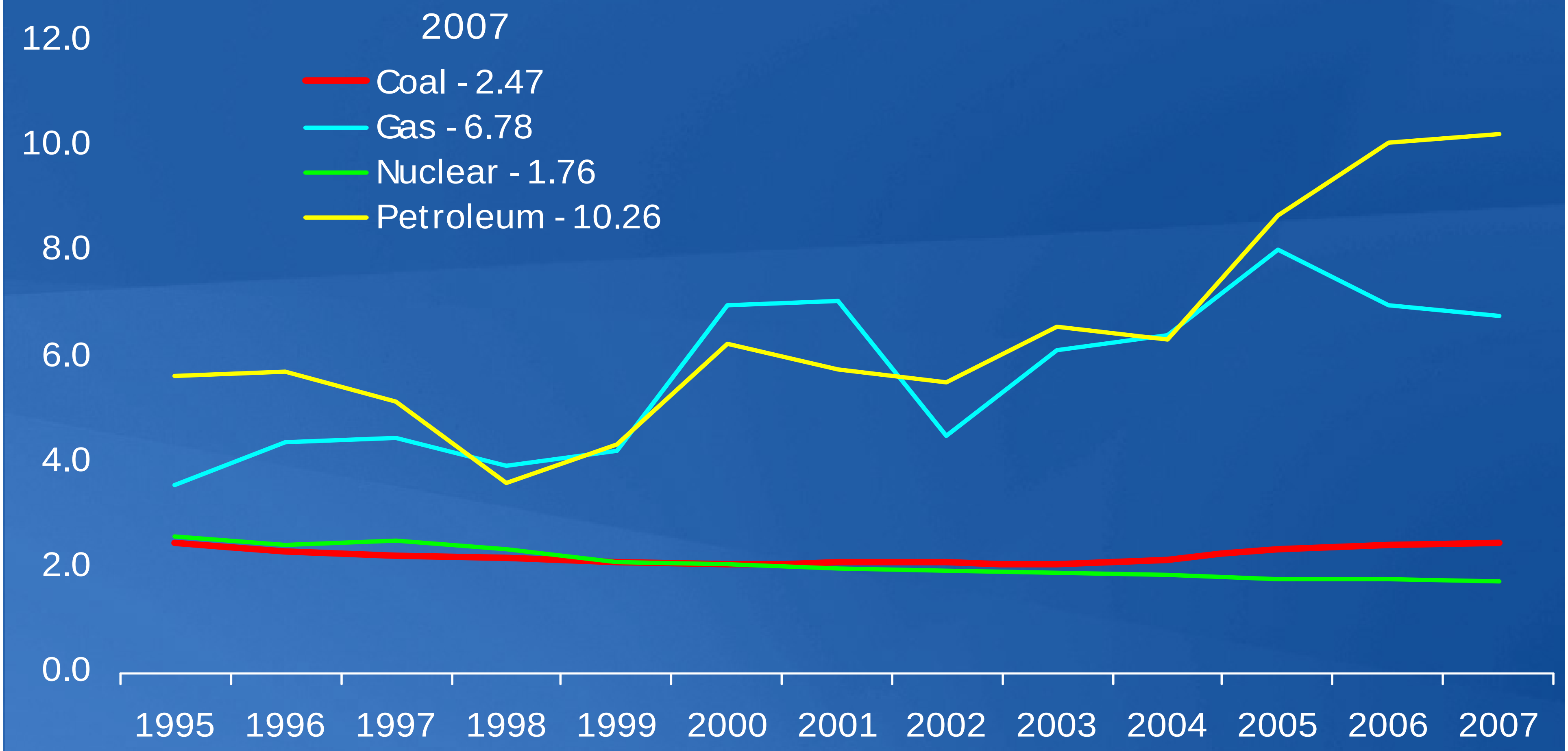
Source: "Life-Cycle Assessment of Electricity Generation Systems and Applications for Climate Change Policy Analysis," Paul J. Meier, University of Wisconsin-Madison, August 2002.

Security
Industry Post 9-11 Actions

- $1.8+ Billion in plant security upgrades
  - Increased security workforce by 60%
  - Additional equipment & modifications
- Force-on-force exercises
  - Includes extensive insider role
- Industry & NRC aircraft impact assessments
  - Public health & safety assured
- Communication protocols established with Federal, State and Local authorities including NORAD

U.S. Electricity Production Costs

1995-2007, *In 2007 cents per kilowatt-hour*



Production Costs = Operations and Maintenance Costs + Fuel Costs

Source: Global Energy Decisions
Updated: 5/08

New Nuclear Power Plants Will Be Competitive

- FP&L: Nuclear superior in 8 of 9 scenarios
- SCE&G: A pure natural gas strategy would cost consumers $15 million/yr more with $15/ton carbon tax
- Brattle Group analysis:

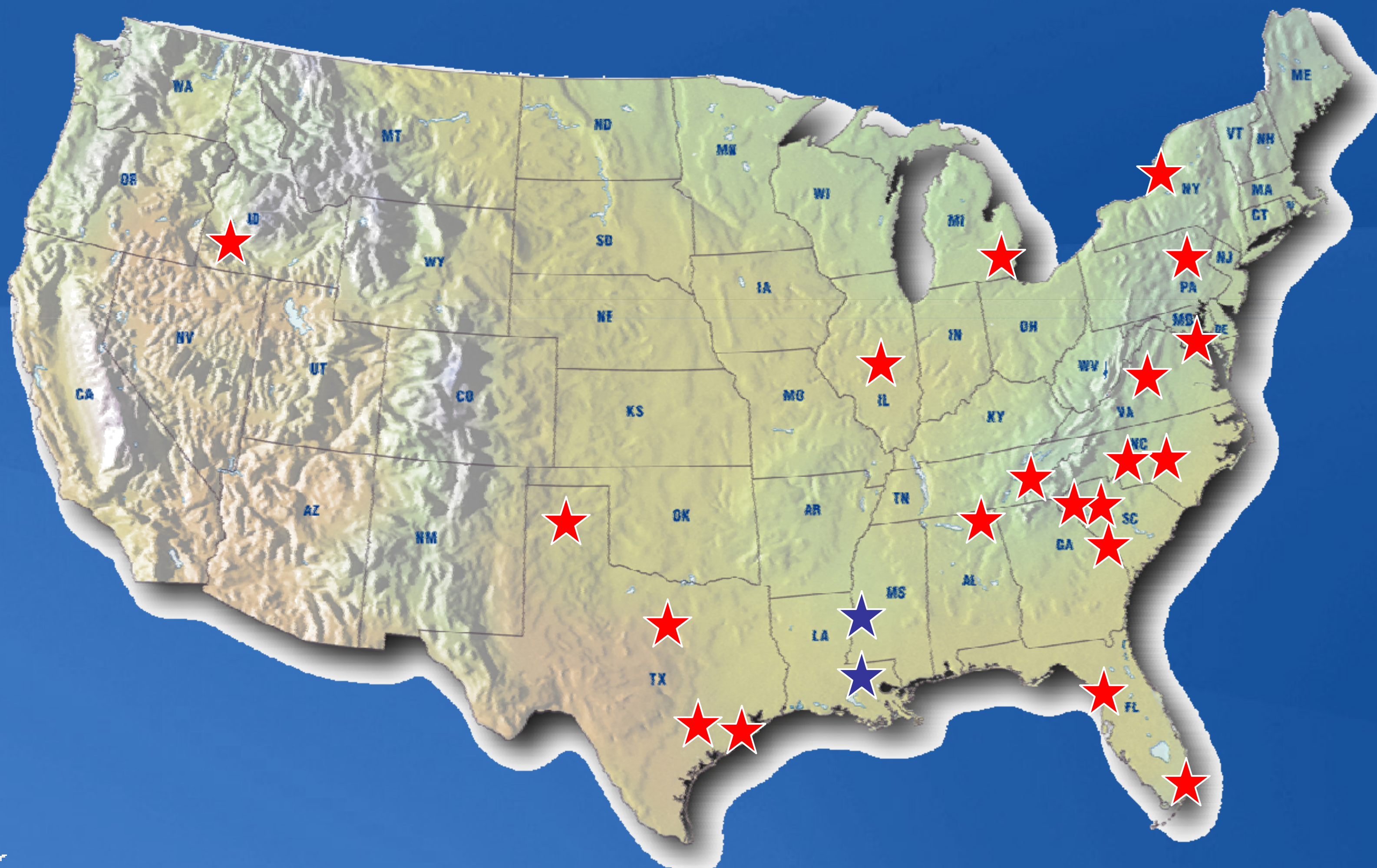
Technology	Nuclear	SCPC w/CCS	IGCC w/CCS	Gas CC w/CCS
Capital Cost ($/kWe)	4,038	4,037	3,387	1,558
Levelized Cost ($/MWh)	83.40	141.90	124.50	103.10

Source: "Integrated Resource Plan for Connecticut," The Brattle Group, January 2008

Challenges to New Deployment

- Financing
- Workforce
  - Formed community college/university partnerships
- Supply chain
  - Manufacturers outreach forums
  - Supply & demand generating opportunities

Potential New US Nuclear Plants



Construction & Licensing Then and Now

THEN	NOW
Design as you build	Plant designed before major construction begins
No design standardization	Standard NRC-certified designs – 70+% Standard
Inefficient construction management practices	Lessons learned from overseas projects; Increased planning; Modular construction
Changing regulatory standards and requirements	More stable process: NRC approves site, design, construction & operation before construction begins and significant capital is placed "at risk"
Main opportunity for public intervention when plant is essentially complete	More opportunities to intervene at well-defined points in process. Intervention at the end of the process must be based on objective evidence that acceptance criteria, defined in the license, have not been, and will not be met

Future Designs

- Small Light-Water Reactors (40MW - 125MW), Gas-Cooled High Temperature & Fast Reactors
- Generation – potential deployment – 2018/19
- Process heat – High Temperature Reactors
  - Industrial applications – 2020s
  - Replace natural gas as heat source
    - Petro-chemical industry
    - Hydrogen manufacture
    - Coal/gas to liquid fuels
    - Water purification, desalination, fertilizers …
  - Reduce industrial non-generating carbon footprint

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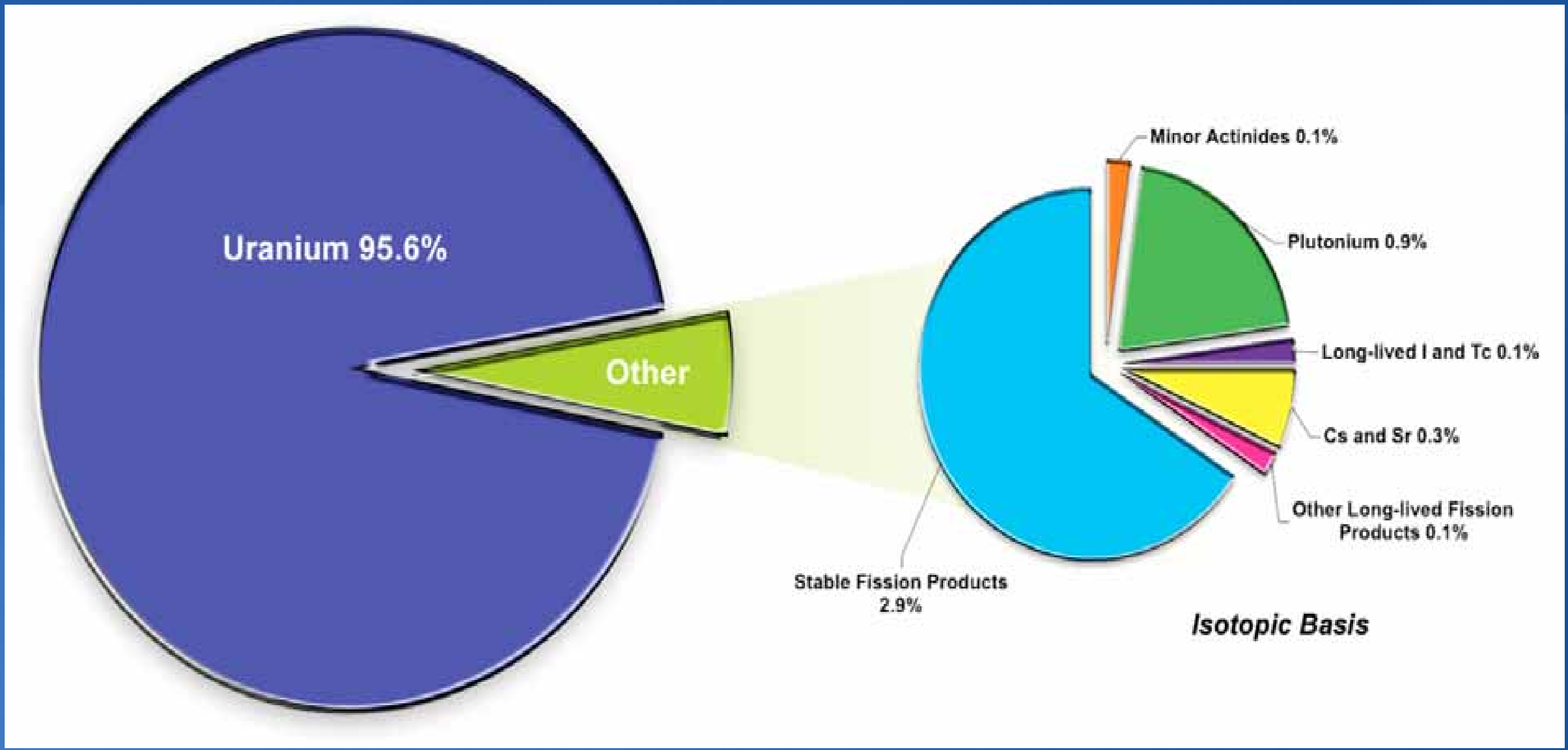
Used Fuel Management
What's Used – What's Left



Strategic Direction
Four-Part Integrated Program

- Form a Executive Commission to assess options while continuing the Yucca Mtn license review
  - Adjust fee structure to fund only licensing while options being considered
- Establish R&D centers to develop advanced, more economic, proliferation resistant recycling process
- Move used fuel to interim storage locations & recycle the used fuel--reduce toxicity, heat load & volume
- Isolate waste product in a geologic facility

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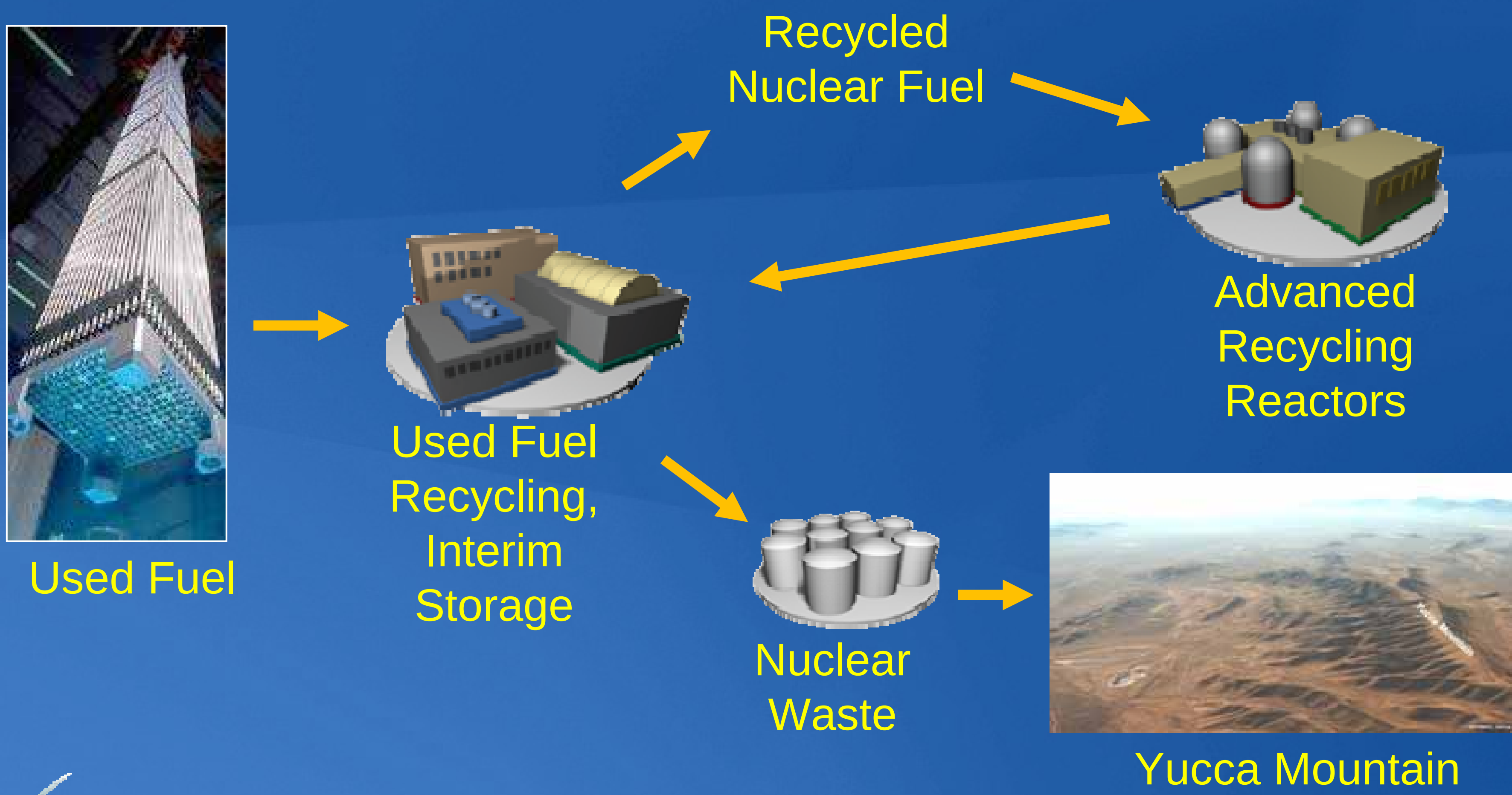
Used Fuel Management



Benefits of Nuclear Generation

- Does not emit greenhouse gas while generating
- Stable, low-cost electricity
- Jobs – Each new reactor
  - 400 – 700 direct jobs plus an equivalent number of indirect jobs for three generations
- Tax revenue & economy -- each reactor
  - $20 million/yr in state & local taxes
  - Value to the economy -- $430+ million/yr

2050 Climate Change Goal
80% Reduction in CO_2 Emissions

- Massive & complex transformation in generation & distribution
  - Electricity & energy costs will rise
- No silver bullet

– Need all clean generating sources if impact on economy is to be minimized

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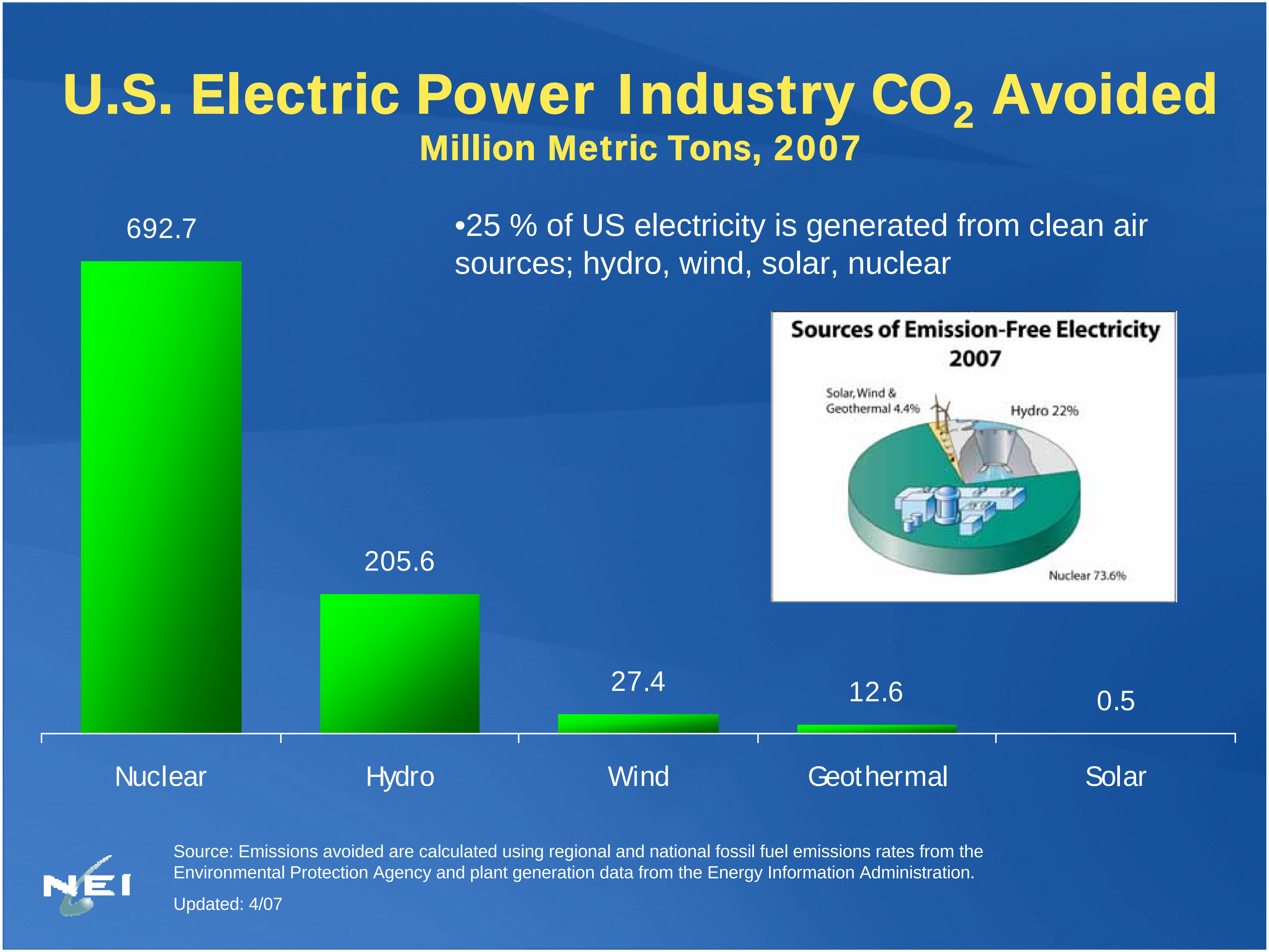
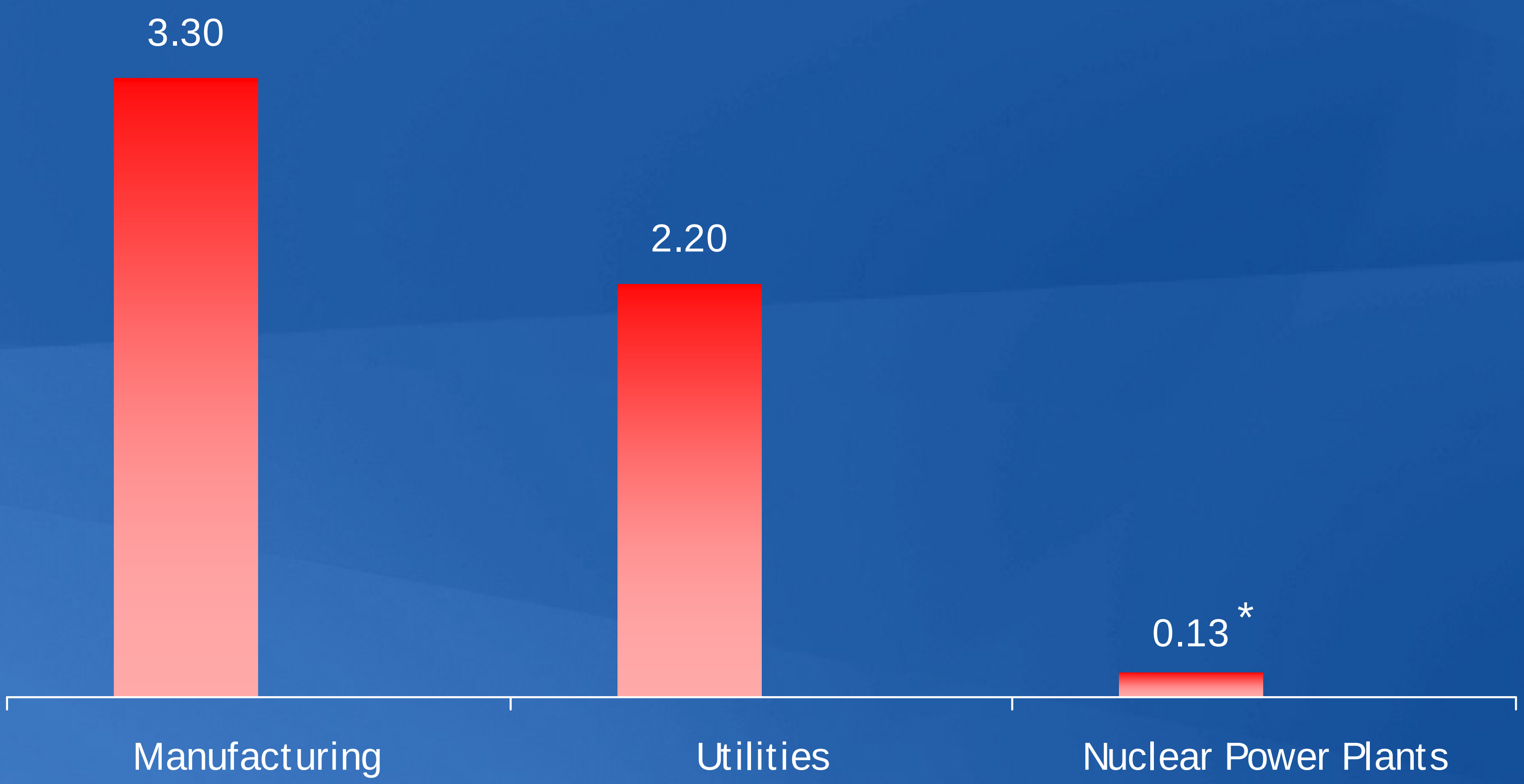
Additional Information


U.S. Electric Power Industry CO_2 Avoided
Million Metric Tons, 2007
•25 % of US electricity is generated from clean air sources; hydro, wind, solar, nuclear
692.7
205.6
27.4
12.6
0.5
Nuclear
Hydro
Wind
Geothermal
Solar
Sources of Emission-Free Electricity 2007
Solar, Wind & Geothermal 4.4%
Hydro 22%
Nuclear 73.6%
Source: Emissions avoided are calculated using regional and national fossil fuel emissions rates from the Environmental Protection Agency and plant generation data from the Energy Information Administration.
Updated: 4/07

High Industrial Safety Standards

2007



ISAR = Number of accidents resulting in lost work, restricted work, or fatalities per 200,000 worker hours. Electric utilities and manufacturing do not include fatality data.

*Includes non-utility personnel for provisional 2008 results

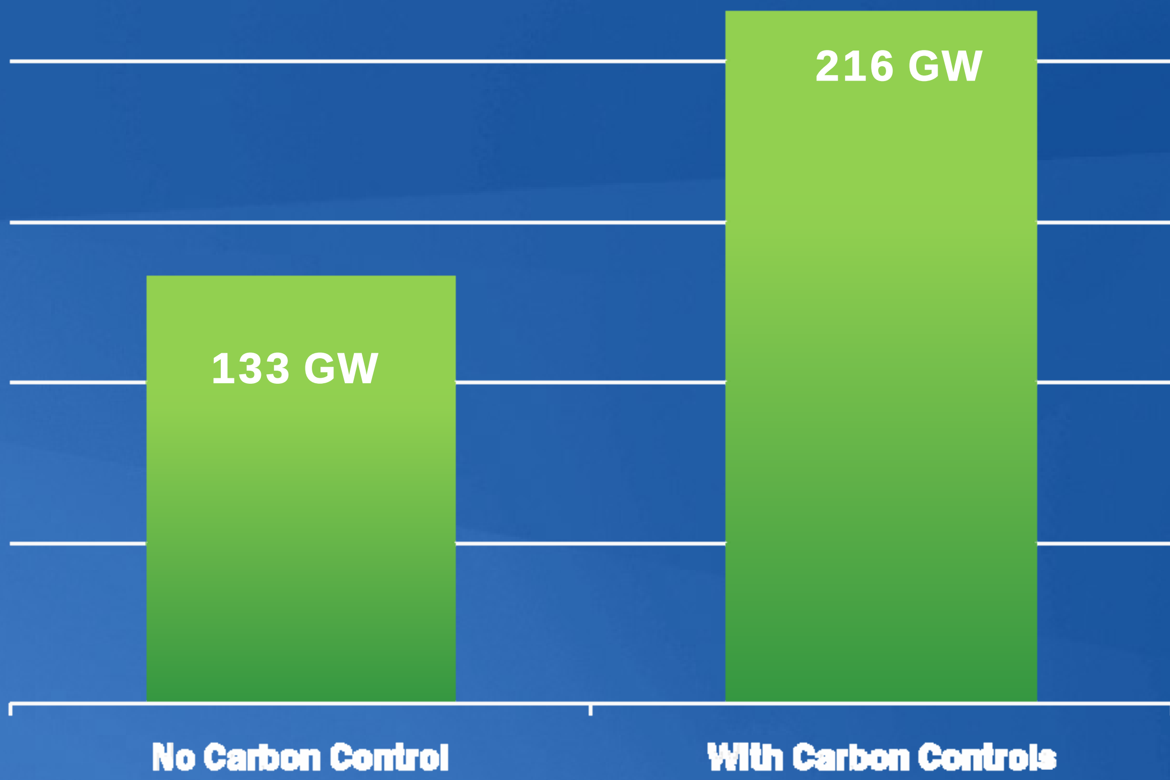
Sources: Nuclear (World Association of Nuclear Operators), 2006 Data for Electric Utilities and Manufacturing (U.S. Bureau of Labor Statistics).

New Generating Capacity Needed

Assumes 0.7% Annual Growth in Peak Load

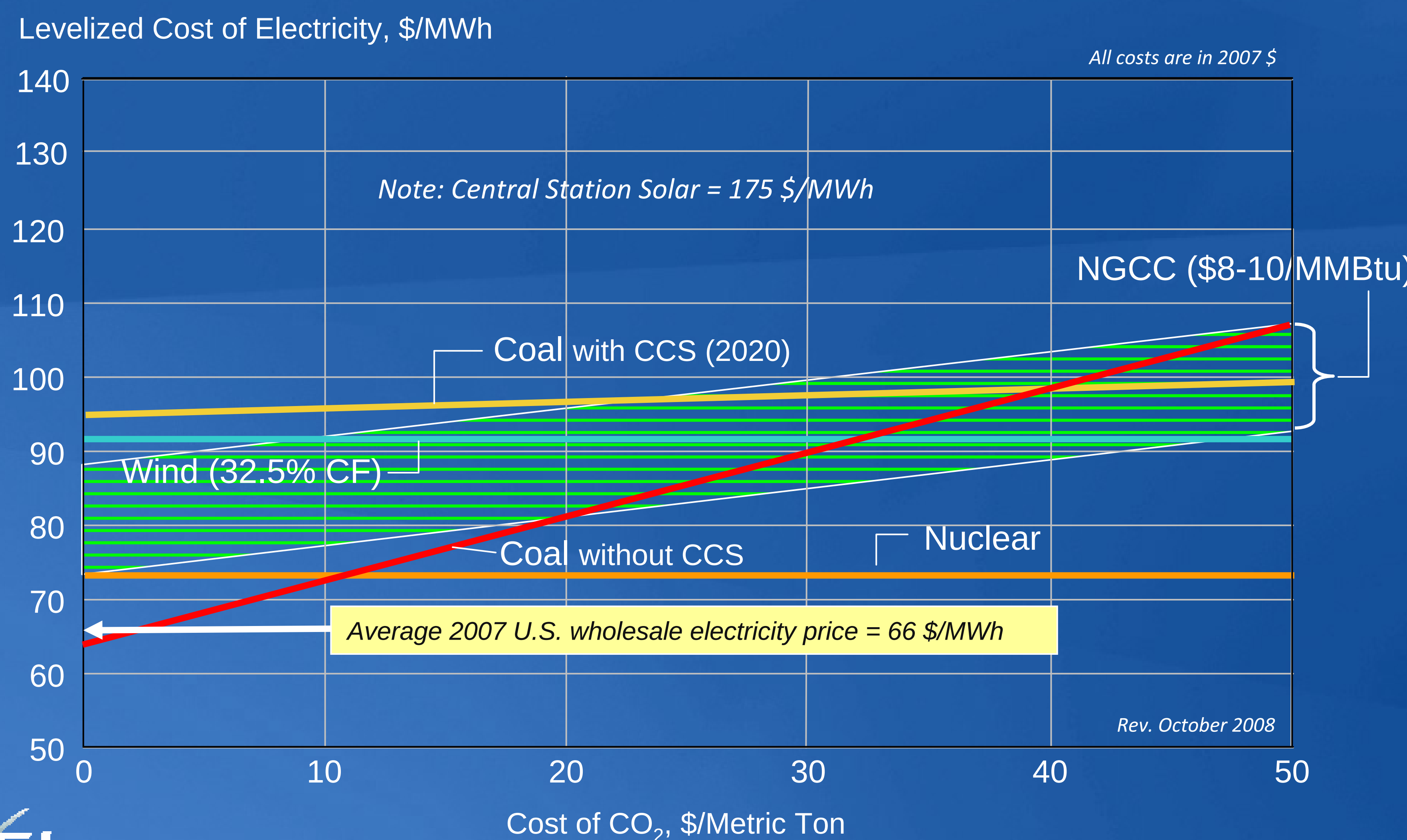
<u>Average Electricity Growth Rate 2000 to date: 1.5%/yr</u>

Average Electricity Growth Rate in 1990s: 1.8%



Source: The Brattle Group, "Transforming America's Power Industry: The Investment Challenge 2010-2030," November 2008

Comparative Costs of New Generation Options: 2015-2020



Source: "Integrated Generation Technology Options, EPRI Report 1018329

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EPRI ELECTRIC POWER RESEARCH INSTITUTE

Emissions Prevented by U.S. Nuclear Power Plants

	SO_2 (million short tons)	NOx (million short tons)	CO_2 (million metric tons)
Prevented by Nuclear Plants in 2007	3.04	0.98	692.7
Reduced at Fossil Plants as a result of 1990 Clean Air Act Amendments (1990-2005)	5.15	4.29	CO_2 emissions are not regulated by Clean Air Act

Source: Environmental Protection Agency, Energy Information Administration, Nuclear Energy Institute
Updated: 5/08

Lifecycle Emissions for Electricity Generation in Germany Grams per MWh

Generation type	SO2	NOx	Particulates	CO2
Nuclear	32	70	7	19,700
Coal	326	560	182	815,000
Gas	3	277	18	362,000
Oil	1,611	985	67	935,000
Wind	15	20	4.6	6,460
PV (Home Application)	104	99	6.1	53,300

Source: "*ExternE - Externalities of Energy. National Implementation in Germany*"; W. Krewitt, P. Mayerhofer, R. Friedrich, A. Trukenmüller, T. Heck, A. Greßmann, F. Raptis, F. Kaspar, J. Sachau, K. Rennings, J. Diekmann, B. Praetorius; IER, Stuttgart; 1998.

Emissions Produced by 1 Kilowatt-hour of Electricity Based on Life-Cycle Analysis

Generation Option	Greenhouse gas emissions gram equiv. (in CO2/kWh)	Sulfur dioxide emissions (in milligrams/kWh)	Nitrogen oxide emissions (in milligrams/kWh)	NMVOC (in milligrams /kWh**)	Particulate matter (in milligrams /kWh)
Hydropower	2 – 48	5 – 60	3 – 42	0	5
Nuclear	2 – 59	3 – 50	2 – 100	0	2
Wind	7 – 124	21 – 87	14 – 50	0	5 – 35
Solar photovoltaic	13 – 731	24 – 490	16 – 340	70	12 – 190
Biomass forestry waste combustion	15 – 101	12 – 140	701 – 1,950	0	217 – 320
Natural gas (combined cycle)	389 – 511	4 – 15,000[*]	13 – 1,500	72 – 164	1 – 10
Coal – modern plant	790 – 1,182	700 – 32,321	700 – 5,273	18 – 29	30 – 663

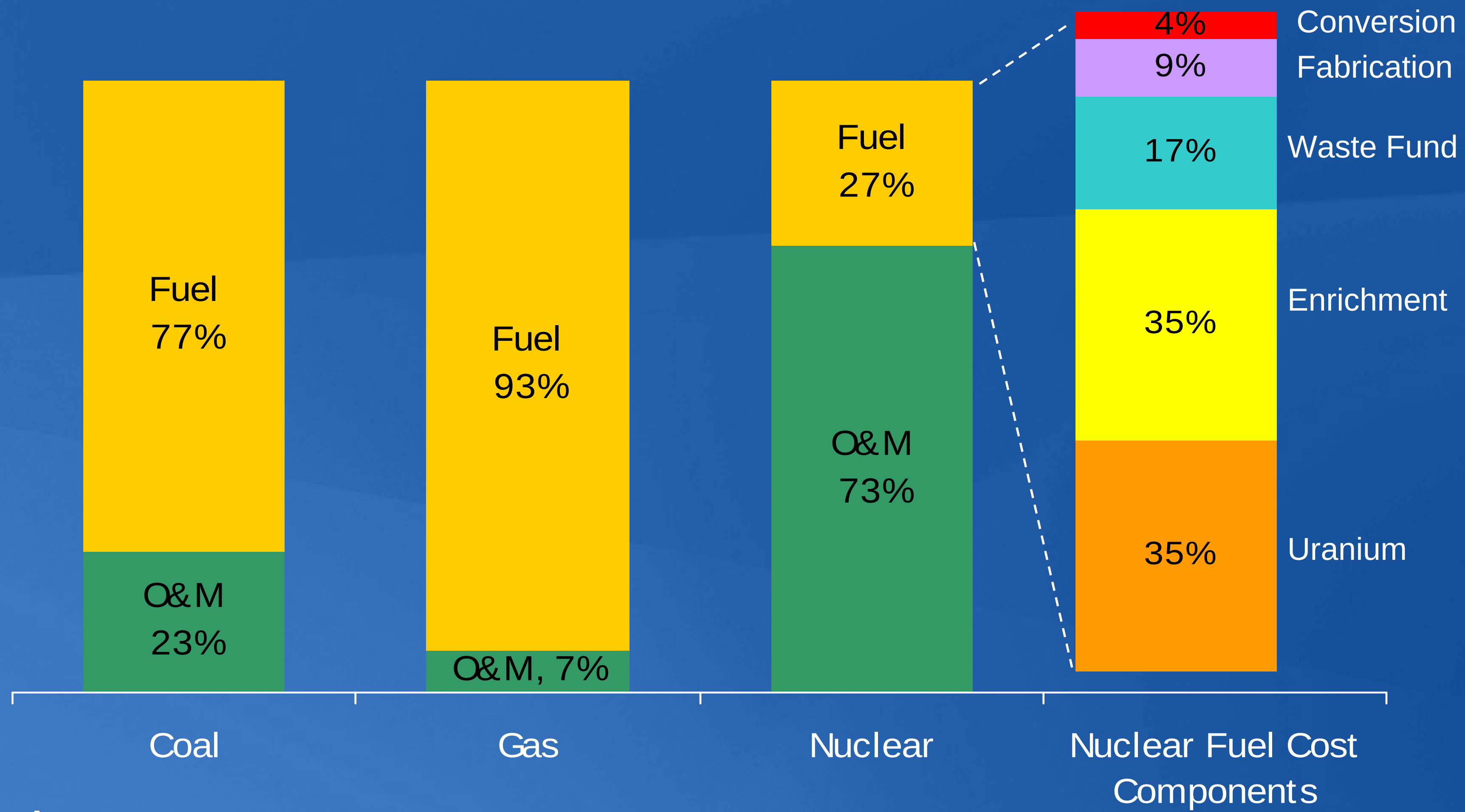
[*] The sulfur content of natural gas when it comes out of the ground can have a wide range of values. When the hydrogen sulfide content is more that 1 percent, the gas is usually known as “sour gas.” Normally, almost all of the sulfur is removed from the gas and sequestered as solid sulfur before the gas is used to generate electricity. Only in the exceptional case when the hydrogen sulfide is burned would the high values of sulfur dioxide emissions occur.

** NMVOC means non-methane volatile organic compounds.

Source: “Hydropower-Internalized Costs and Externalized Benefits,” Frans H. Koch, International Energy Agency (IEA)-Implementing Agreement for Hydropower Technologies and Programs, Ottawa, Canada, 2000.

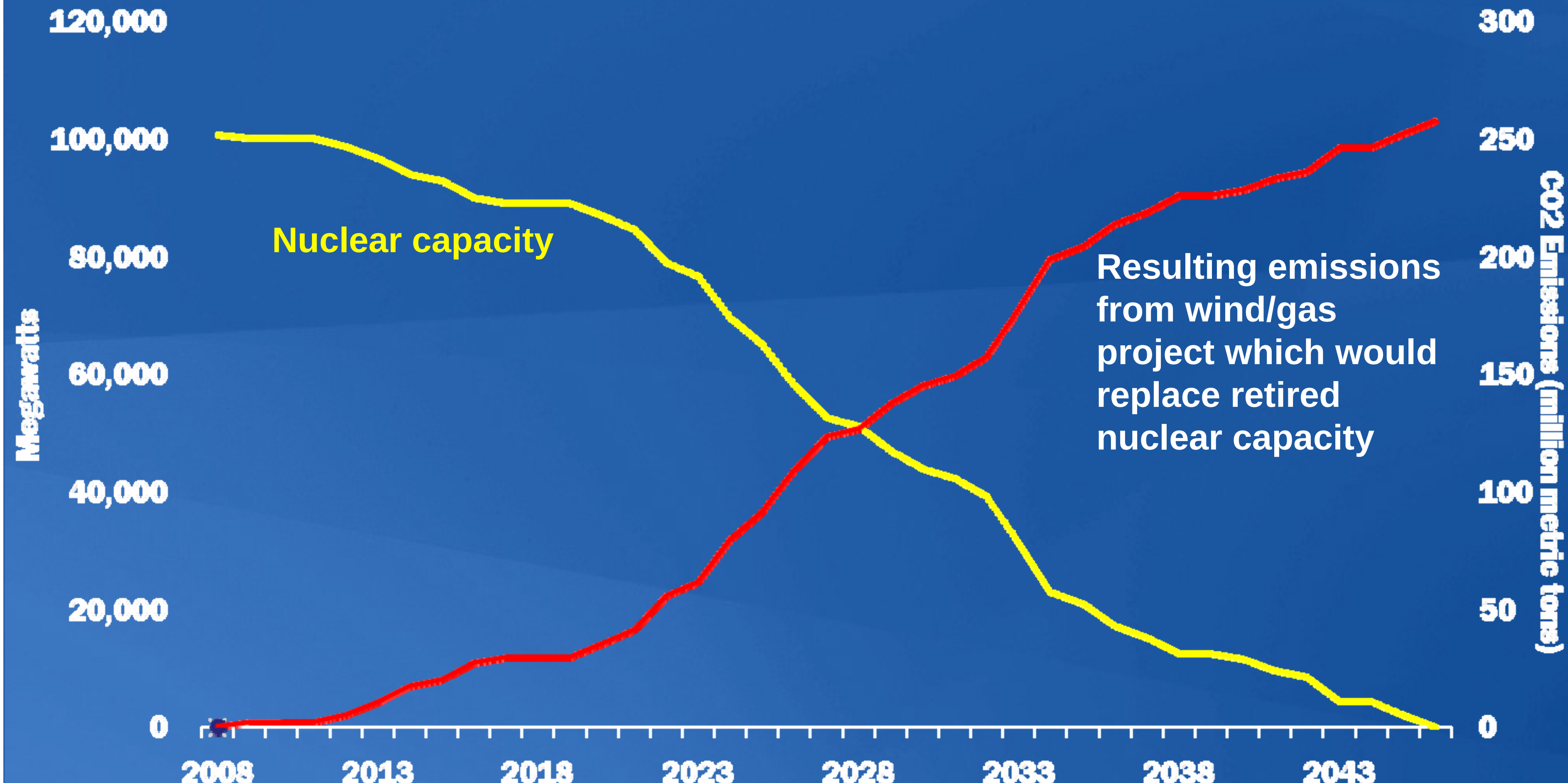
Fuel as a Percentage of Electric Power Production Costs

2007



Source: Ventyx Velocity Suite; Energy Resources International, Inc.
Updated: 5/08

CO_2 Emissions Resulting from U.S. Nuclear Plant License Expirations



Assumptions: Gas / Wind Project - 65% natural gas and 35% wind. Nuclear fleet average capacity factor is 90%. Nuclear capacity figures are based on today's expiration dates – does not include the license renewal of 53 nuclear units.

Sources: Capacity—EIA; License Expiration—NRC; Emission rates— Ventyx Velocity Suite / EPA CEMS and EIA

Updated: 1/09