

Apr 11th, 9:30 AM - 10:00 AM

Nuclear energy

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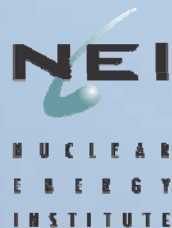
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Nuclear Energy

Native American Forum on Nuclear Issues

University of Nevada – Las Vegas

April 11, 2008

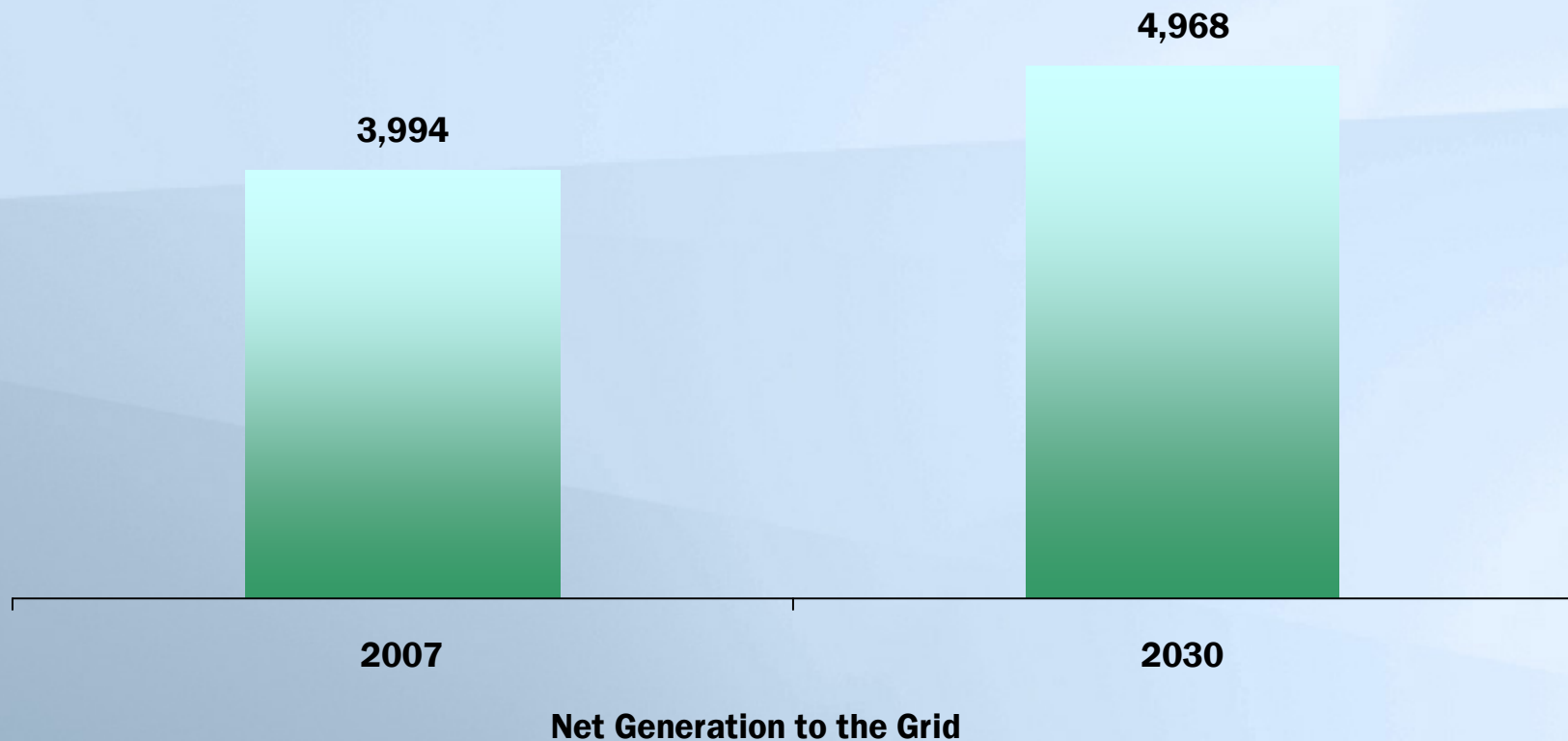


Steven P. Kraft
Senior Director
Used Fuel Management
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Why Nuclear Energy?

- **The lesson of the last 20 years in U.S. electricity policy:**
 - Diversified fuel and technology portfolio is essential
 - All fuels and technologies (nuclear, coal, natural gas, renewables, efficiency) have a legitimate role
- **The challenge for the future:**
 - Preserving/restoring diversified portfolio
 - Ensuring resource adequacy, particularly in competitive markets
- **Expanded use of nuclear energy is part of the answer**
 - Integrated used fuel management supports nuclear competitiveness

U.S. Needs 25 Percent More Electricity by 2030 BkWh

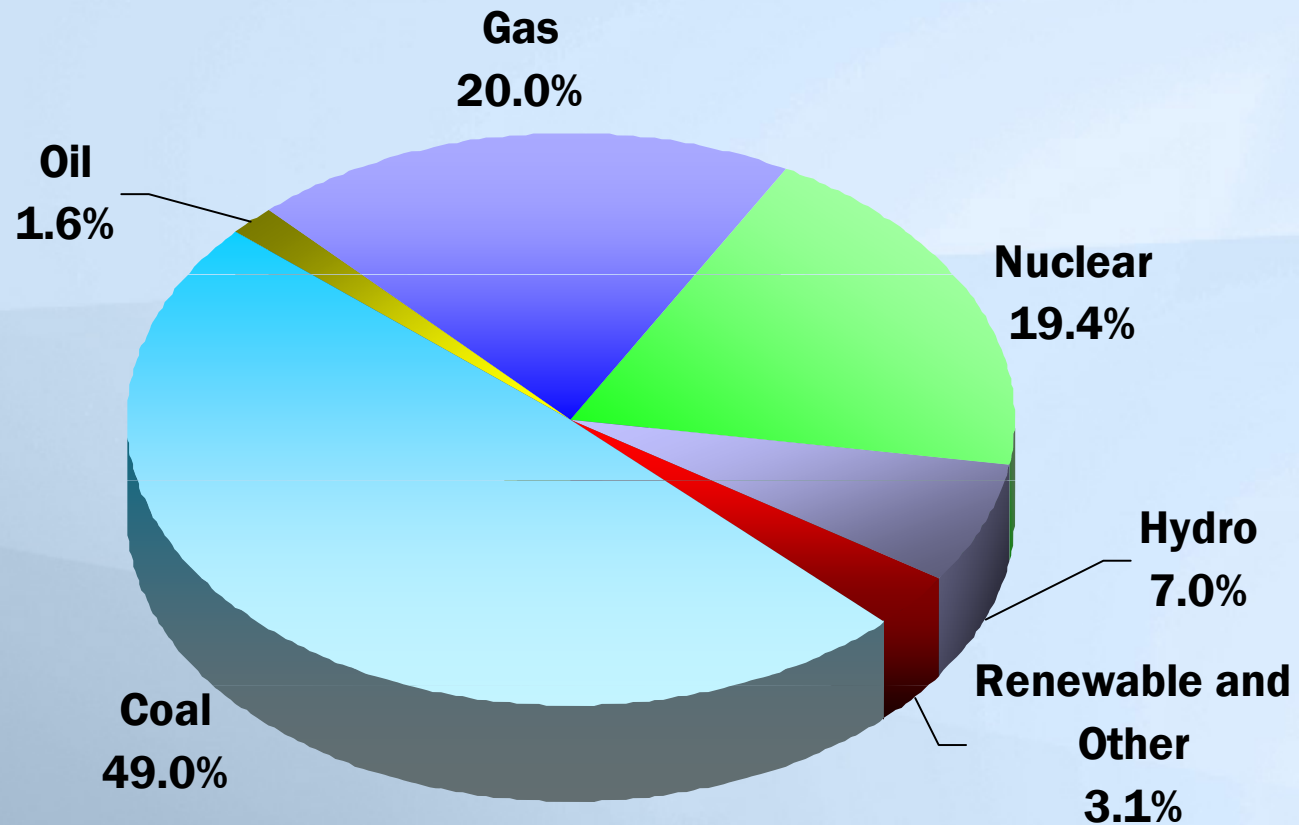


Source: Energy Information Administration Annual Energy Outlook 2008

Updated: 3/08

U.S. Electricity Generation Shares

2006



Source: Global Energy Decisions / Energy Information Administration

Updated: 10/07

Sustained Reliability and Productivity

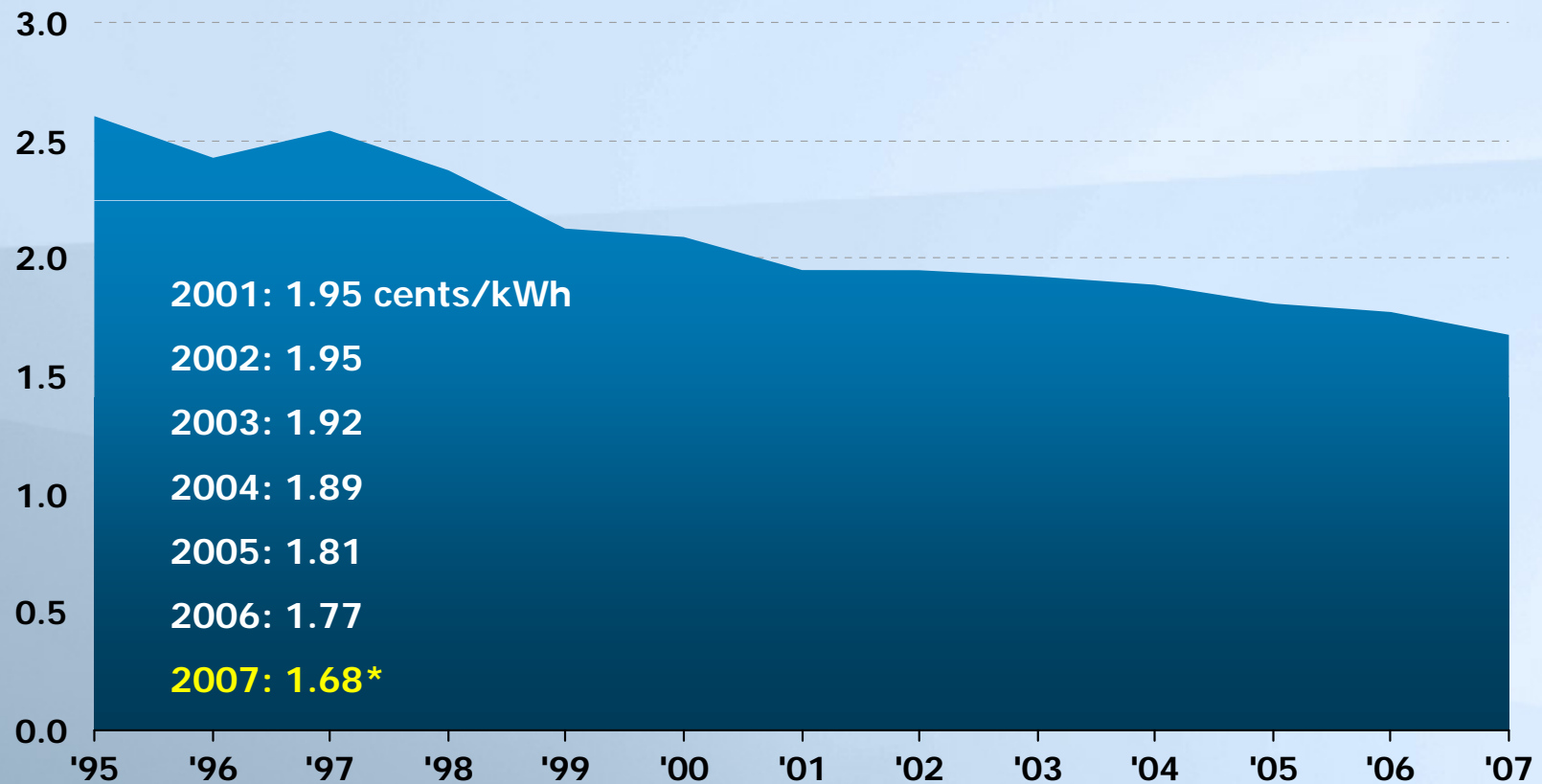
U.S. Nuclear Capacity Factor, Percent



89.4% in 2001
90.3% in 2002
87.9% in 2003
90.1% in 2004
89.3% in 2005
89.6% in 2006
91.8% in 2007*

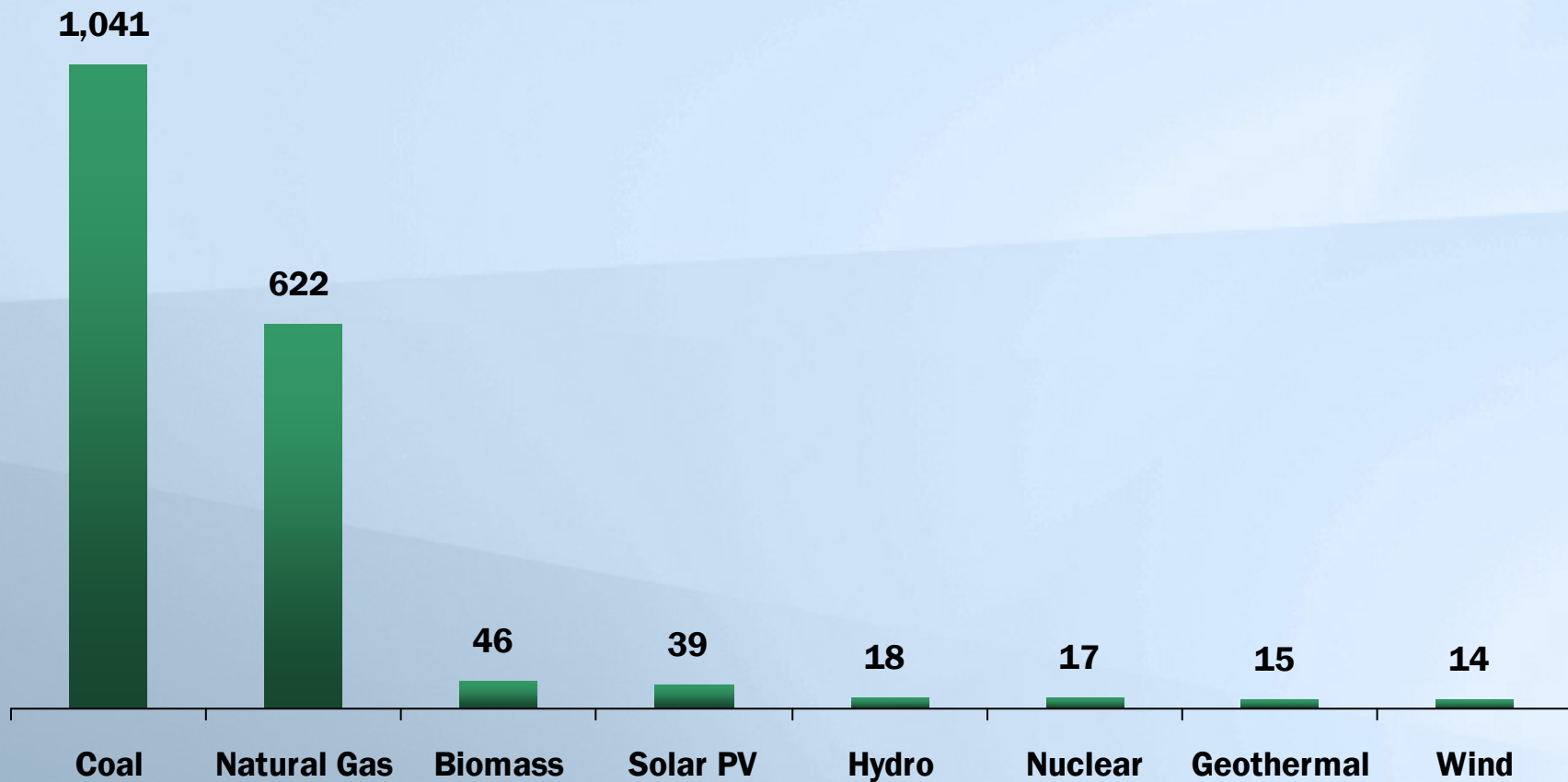
Solid Economic Performance Continues

U.S. Nuclear Production Cost, in 2007 cents/kWh



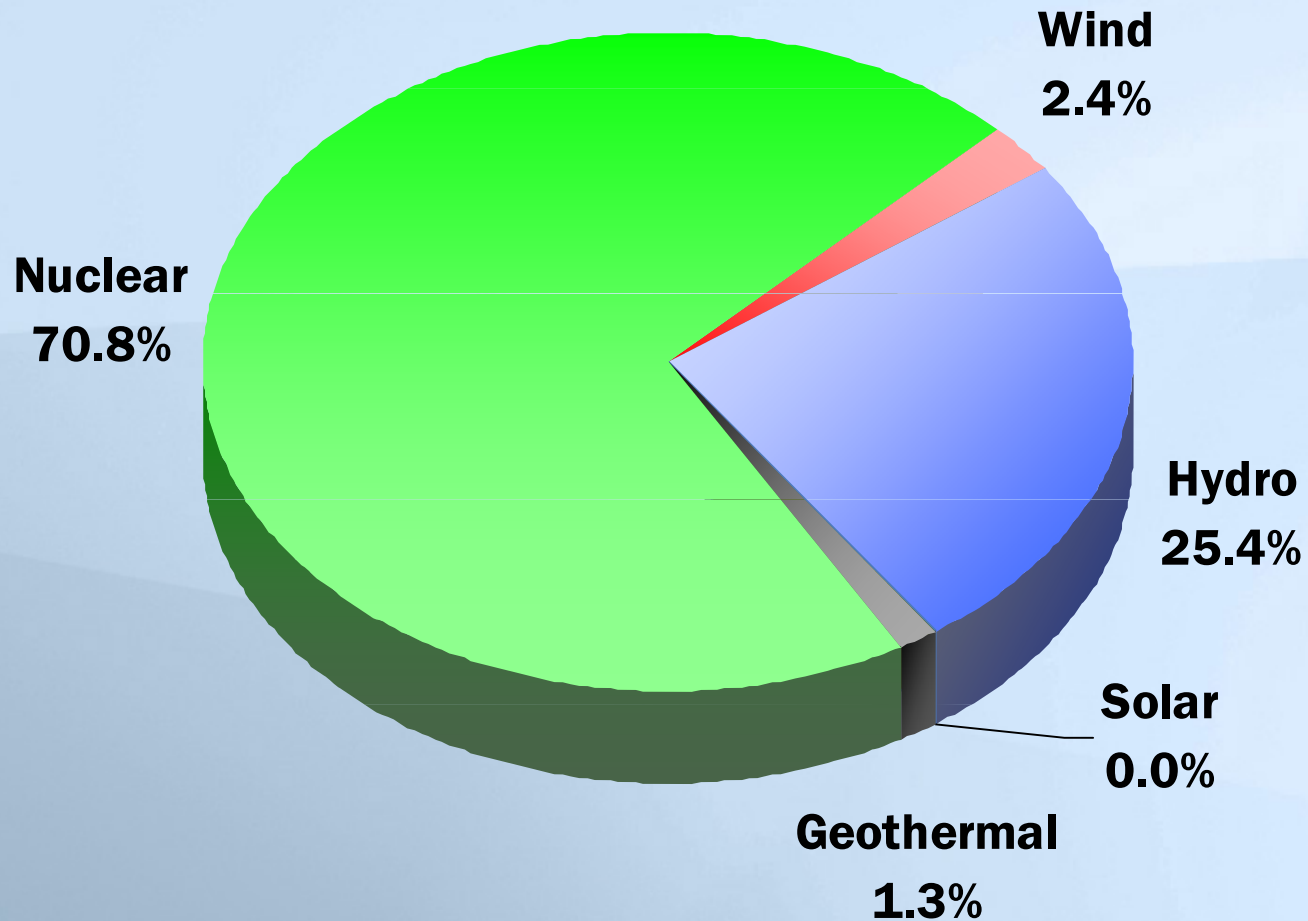
Comparison of Life-Cycle Emissions

Tons of Carbon Dioxide Equivalent per 1 million kWhs



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

U.S. Electricity Sources Which Do Not Emit Greenhouse Gases 2006

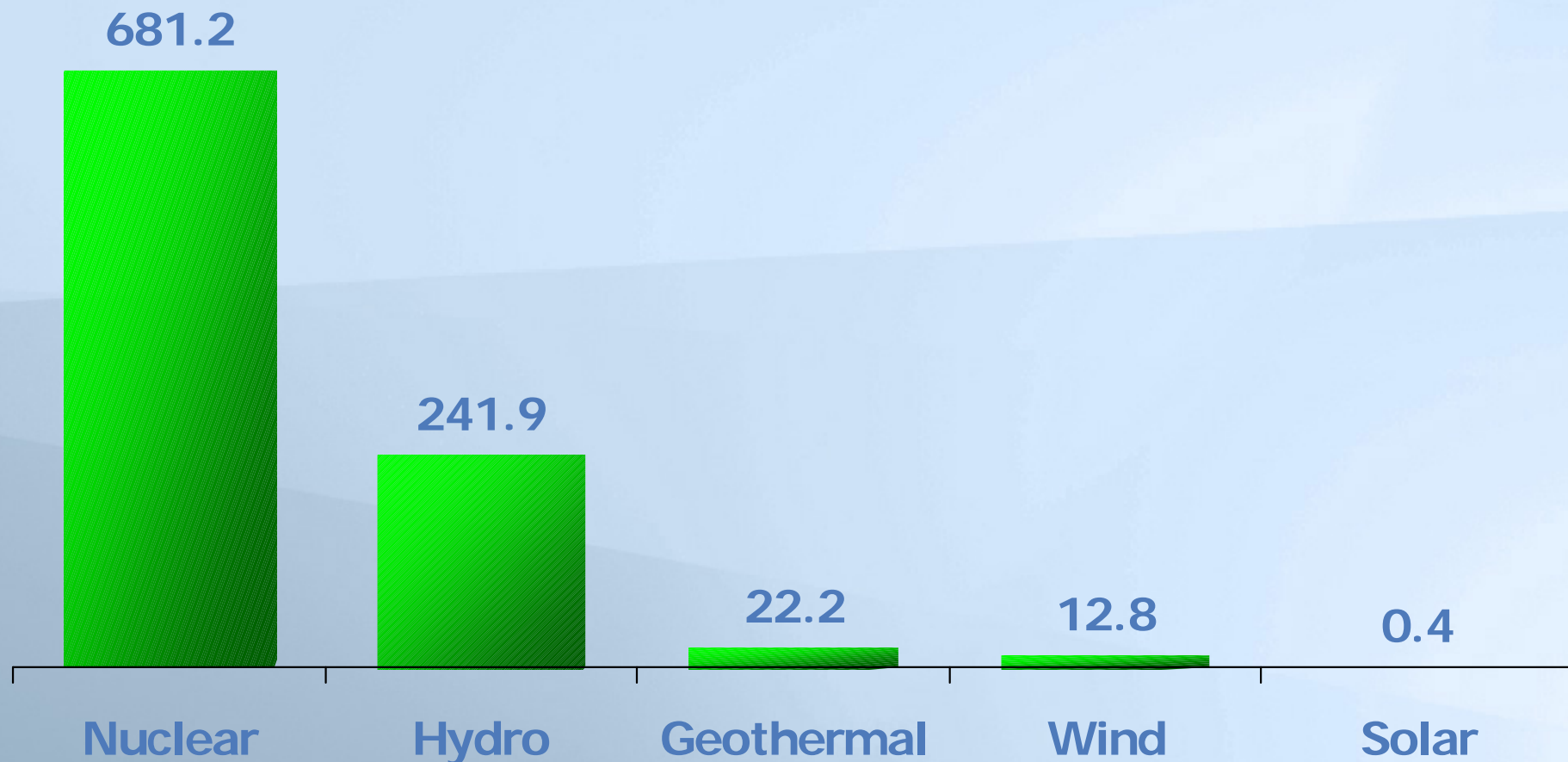


Source: Global Energy Decisions / Energy Information Administration

Updated: 11/07

U.S. Electric Power Industry CO₂ Avoided

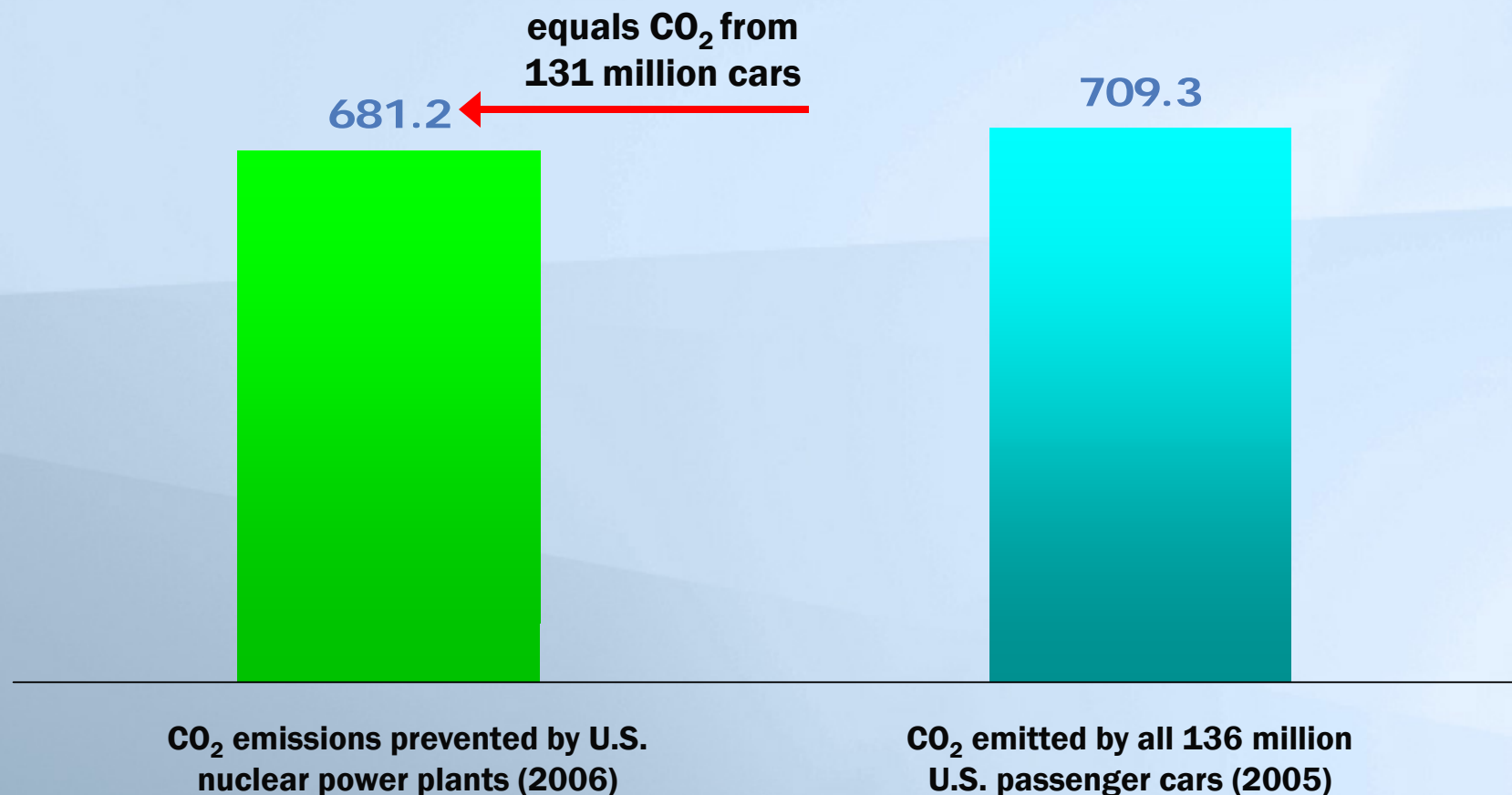
Million Metric Tons, 2006



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

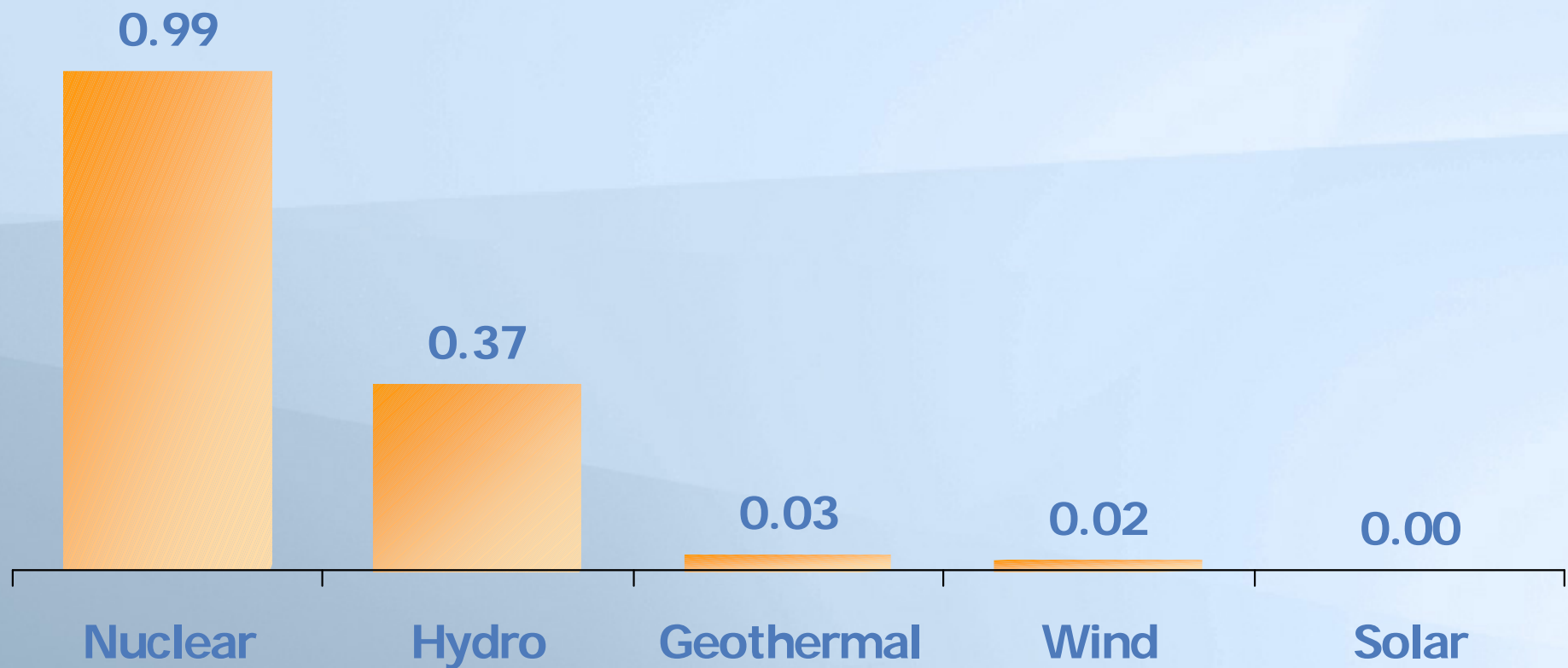
Perspective on CO₂ Emissions Prevented By U.S. Nuclear Plants 2006



Source: Emissions avoided by nuclear power are calculated using regional fossil fuel emission rates from the Environmental Protection Agency and plant generation data from the Energy Information Administration. Car emissions from EPA, Office of Transportation and Air Quality Emissions Facts (April 2000).
Updated: 4/07

U.S. Electric Power Industry NO_x Avoided

Million Short Tons, 2006

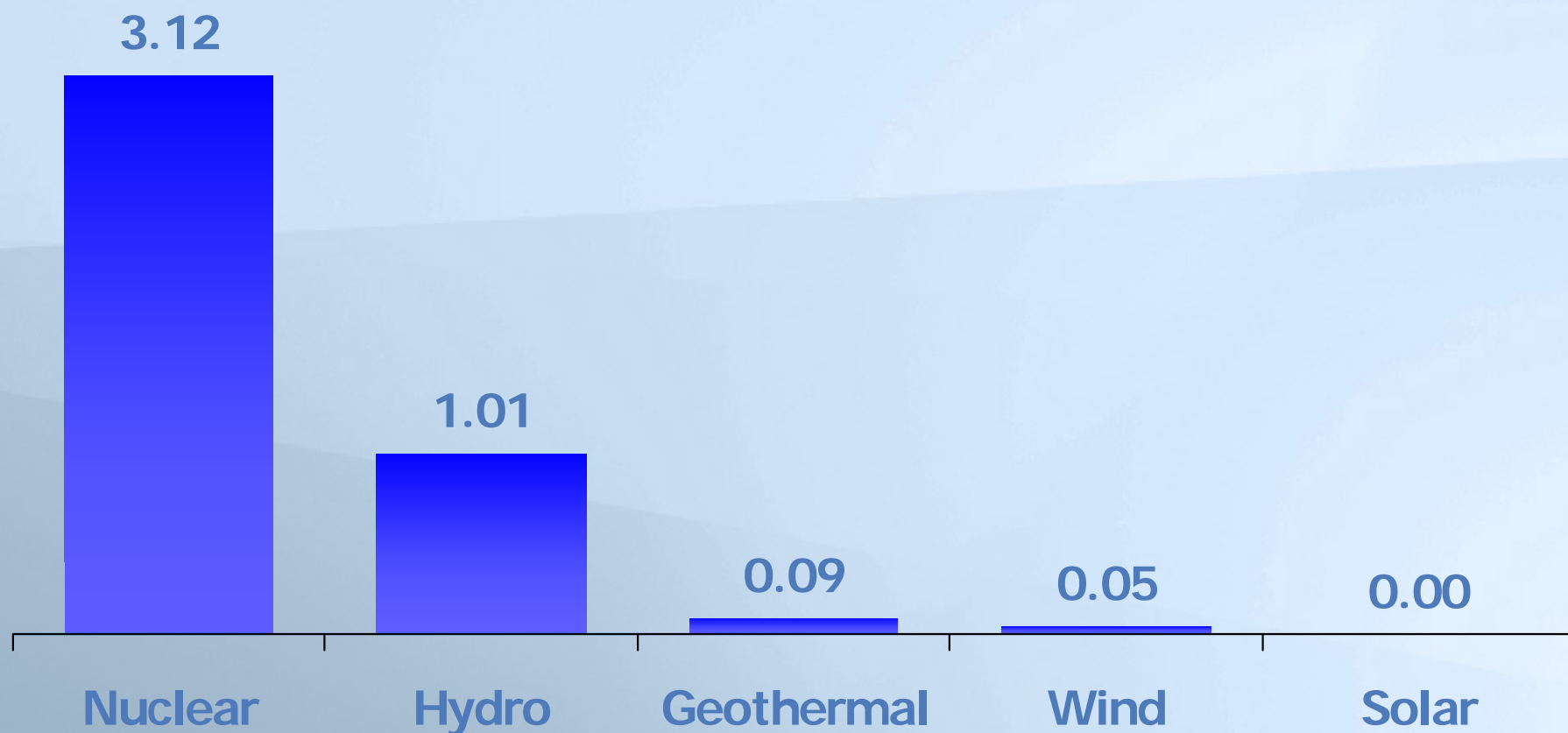


Source: Emissions avoided are calculated using regional and national fossil fuel emissions rates from the Environmental Protection Agency and plant generation data from the Energy Information Administration.

Updated: 4/07

U.S. Electric Power Industry SO₂ Avoided

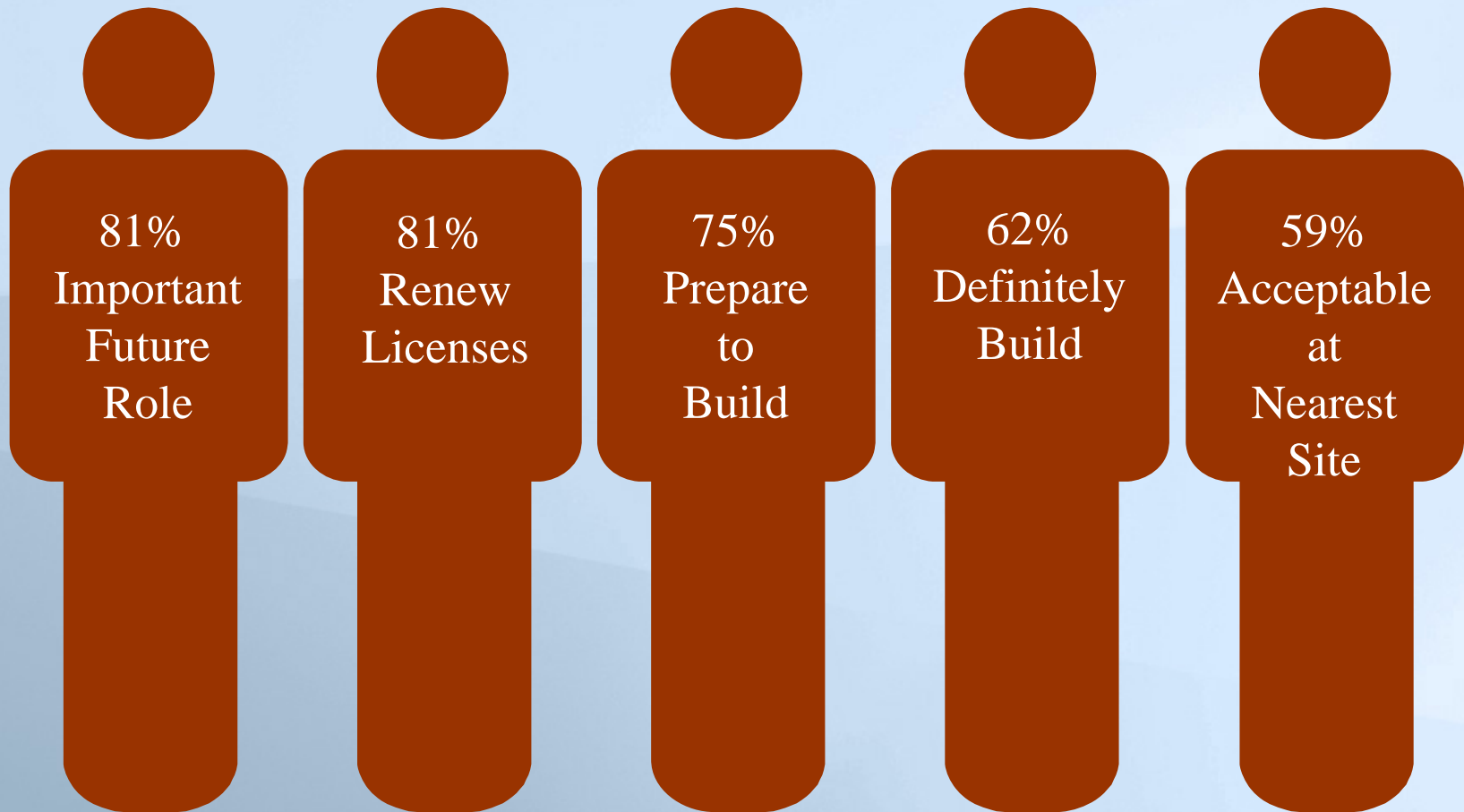
Million Short Tons, 2006



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

Strong Public Support Continues



Nuclear Facts

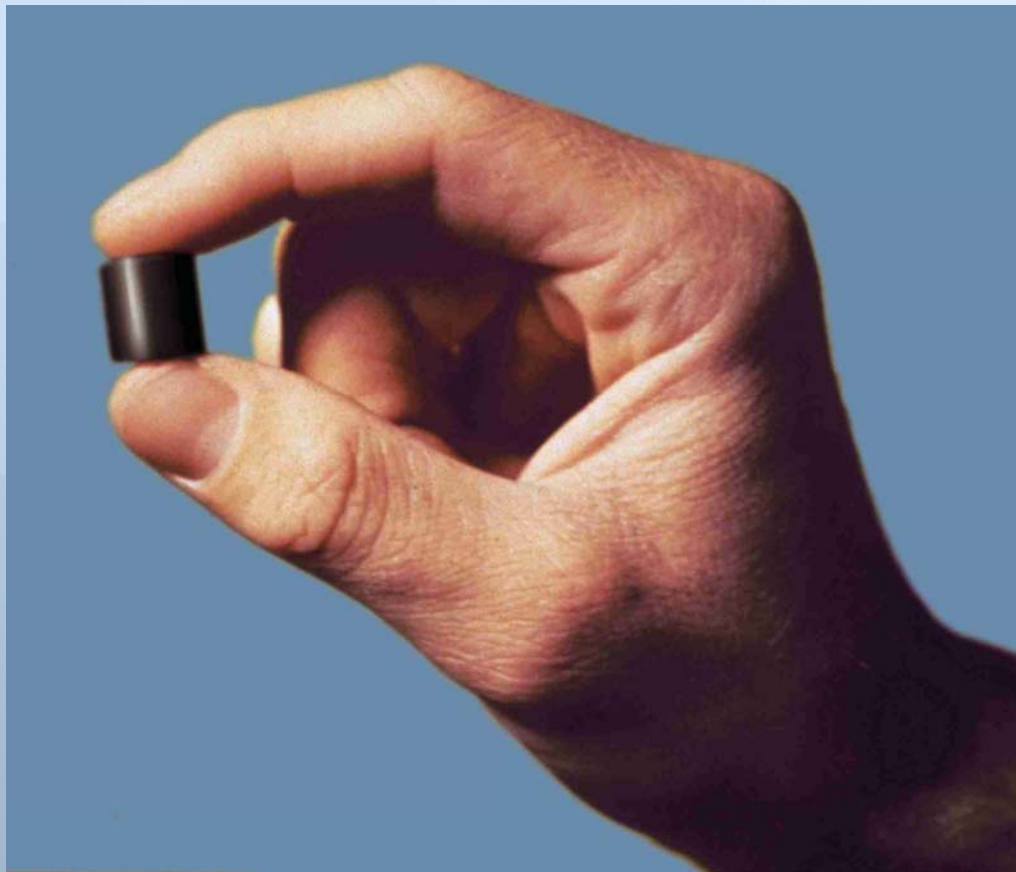
- **104 operating commercial nuclear plants at 65 sites in 31 states (15 plants shutdown with fuel on site)**
- **All operating plants have received or are pursuing 20 year license extension**
- **Provide 20% of U.S. electricity generation, emits no controlled pollutants**
- **Average Production Costs – 1.68 ¢/kWh, Coal – 2.37¢/kWh, Natural Gas – 6.75 ¢/kWh, Oil – 9.63 ¢/kWh**
- **One uranium pellet equals 17,000 cubic feet of NG, 1,780 lbs. of coal or 149 gal. of oil**

Used Nuclear Fuel

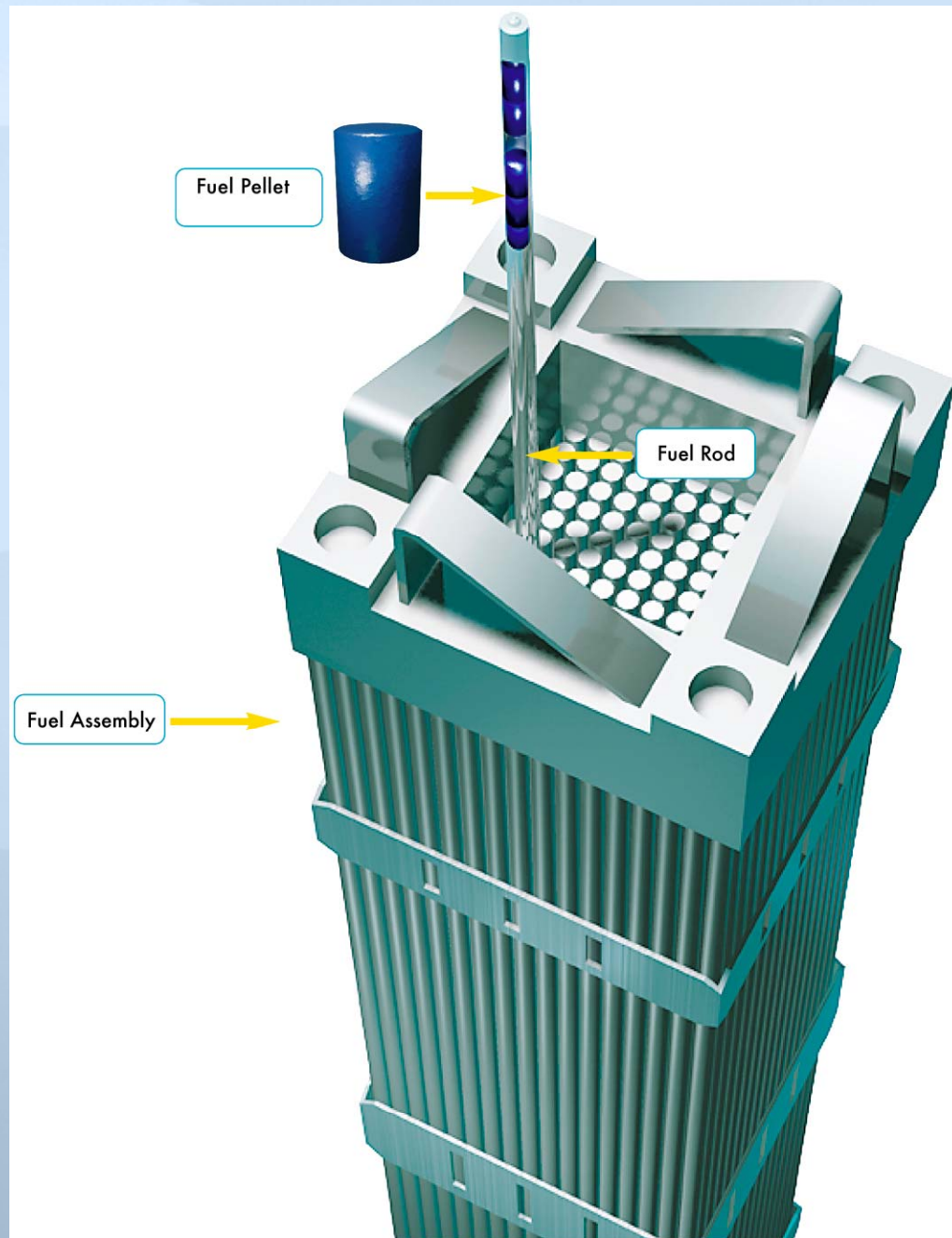
- **Solid ceramic pellets encased in metal clad rods**
- **40 years of nuclear electricity have produced only a small amount**
 - **entire inventory would cover a single football field approximately 7 yards deep**



Ceramic Uranium Dioxide Fuel Pellets are Approximately the Same Diameter as Pencil

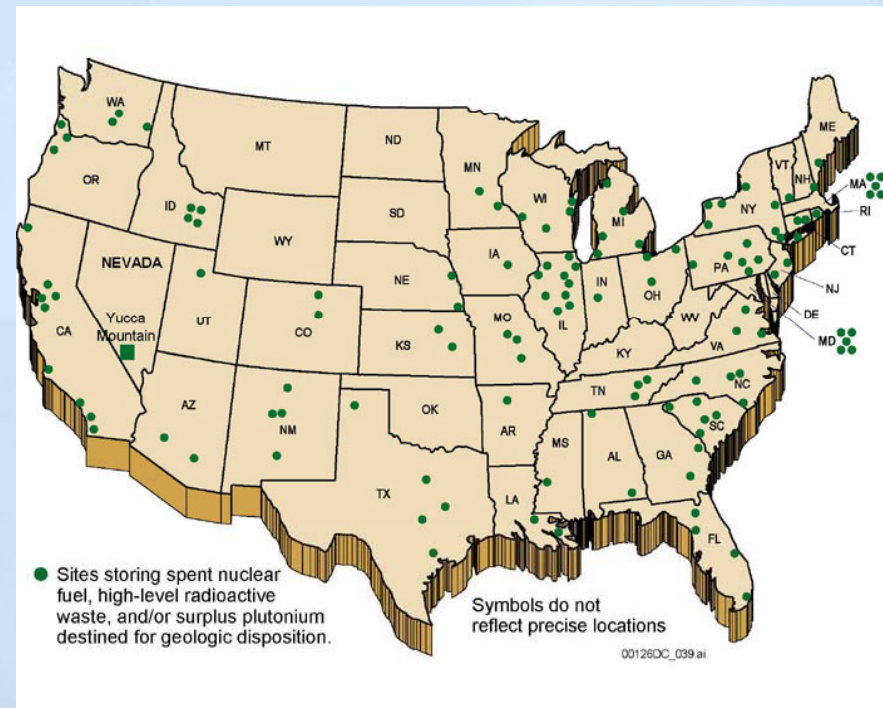


Westinghouse 17x17 Nuclear Fuel Assembly



Used Nuclear Fuel Storage

- **Current used fuel inventory**
 - Approximately 58,000 MTU
- **Current dry storage inventory**
 - 10,500 MTU
 - 900 casks/canisters loaded
 - At 40 sites
- **Future dry storage inventory by 2017**
 - Estimating 22,300 MTU
 - 2,000 casks/canisters loaded
 - At 66 sites for 108 plants



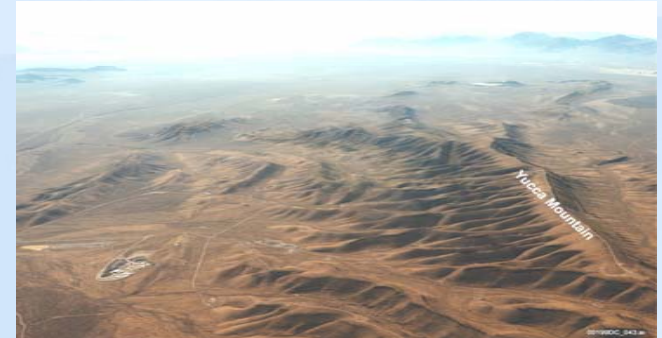
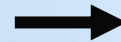
The “Once Through” Fuel Cycle: Current View of Used Fuel Management



Nuclear Plant



Used Fuel



Disposal

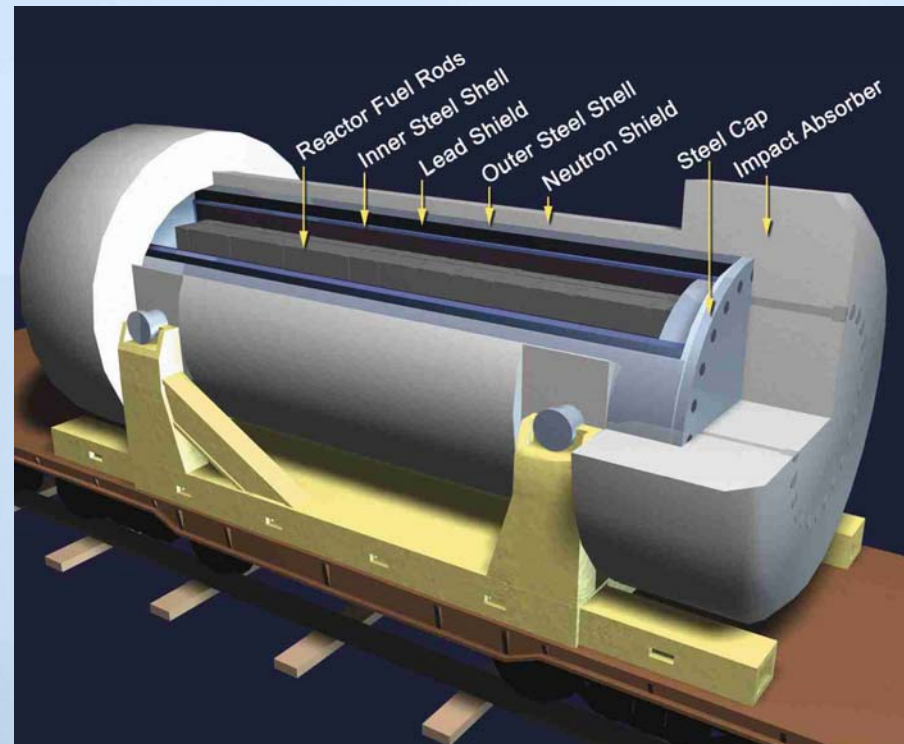
Nuclear Industry Supports Integrated Used Nuclear Fuel Strategy

Three Steps – Three Phases

- **Interim storage**
- **Research, development, and demonstration of advanced nuclear fuel reprocessing and recycling technologies to close the fuel cycle**
- **Disposal**

Artist Rendition of a Transportation Cask

- **Nuclear fuel is transported in strong vault-like containers**
 - Truck containers weigh 25 to 40 tons
 - Rail containers weigh 75 to 125 tons
- **Multiple barriers provide “defense in depth protection”**



Transportation Safety Record

- **Four decades of safety.**
- **Over 3,000 shipments in US.**
 - **78% by truck and 22% by rail.**
 - **Transported over 1.7 million miles**
- **Over 24,000 shipments internationally.**
 - **More than 73,000 MTHM SNF/HLW transported**
- **No injuries, fatalities or environmental damage as a result of the radioactive nature of the cargo**

Robust Design

- **All containers must be certified by the Nuclear Regulatory Commission**
- **Certification requires that rigorous engineering and safety criteria be met**
- **Containers are required to withstand**
 - 30 ft. fall onto an unyielding surface (equivalent to a 120 mph crash into a bridge abutment)
 - Puncture test (40 ft fall onto 6 in spike)
 - 30 minutes fully engulfed in a 1,475 F fire
 - Submergence under 50 ft of water



Used Fuel Management: New Strategic Direction



Used Fuel

