Native American Forum on Nuclear Issues

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Nuclear energy

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Nuclear Energy

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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

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Generation to the Grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>3,994</td>
</tr>
<tr>
<td>2030</td>
<td>4,968</td>
</tr>
</tbody>
</table>

Source: Energy Information Administration Annual Energy Outlook 2008
Updated: 3/08
U.S. Electricity Generation Shares

2006

- **Gas**: 20.0%
- **Nuclear**: 19.4%
- **Renewable and Hydro**: 7.0%
- **Coal**: 49.0%
- **Oil**: 1.6%
- **Other**: 3.1%

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*

Source: Global Energy Decisions / Energy Information Administration

* Preliminary
Solid Economic Performance Continues

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

- 2001: 1.95 cents/kWh
- 2002: 1.95
- 2003: 1.92
- 2004: 1.89
- 2005: 1.81
- 2006: 1.77
- **2007: 1.68***

Source: Global Energy Decisions
Comparison of Life-Cycle Emissions
Tons of Carbon Dioxide Equivalent per 1 million kWhs

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

2006

- Nuclear: 70.8%
- Wind: 2.4%
- Hydro: 25.4%
- Solar: 0.0%
- Geothermal: 1.3%

Source: Global Energy Decisions / Energy Information Administration
Updated: 11/07
U.S. Electric Power Industry CO₂ Avoided
Million Metric Tons, 2006

- Nuclear: 681.2 million metric tons
- Hydro: 241.9 million metric tons
- Geothermal: 22.2 million metric tons
- Wind: 12.8 million metric tons
- Solar: 0.4 million metric tons

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

CO₂ emissions prevented by U.S. nuclear power plants (2006) equals CO₂ from 131 million cars

CO₂ emitted by all 136 million U.S. passenger cars (2005)

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\textsubscript{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

- Nuclear: 3.12
- Hydro: 1.01
- Geothermal: 0.09
- Wind: 0.05
- Solar: 0.00

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

- 81% Important Future Role
- 81% Renew Licenses
- 75% Prepare to Build
- 62% Definitely Build
- 59% Acceptable at Nearest Site

Source: Bisconti Research Inc.
October 2007 poll of 1,000 U.S. adults; margin of error is +/- 3%
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

Recycled Nuclear Fuel

Advanced Recycling Reactors

Used Fuel Recycling, Interim Storage

Nuclear Waste

Disposal