



U.S. DEPARTMENT OF  
**ENERGY**

**Nuclear Energy**

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## **DOE Nuclear Energy Programs: The Future of Nuclear Energy**

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December 18, 2009  
Nuclear Energy Advisory Committee

# Nuclear Energy in the Obama Administration

- **President Obama: “We must harness the power of nuclear energy on behalf of our efforts to combat climate change, and to advance peace and opportunity for all people.”**
- **Secretary Chu: “President Obama and I are committed to restarting the nuclear industry in the United States.”**



## Key Observations

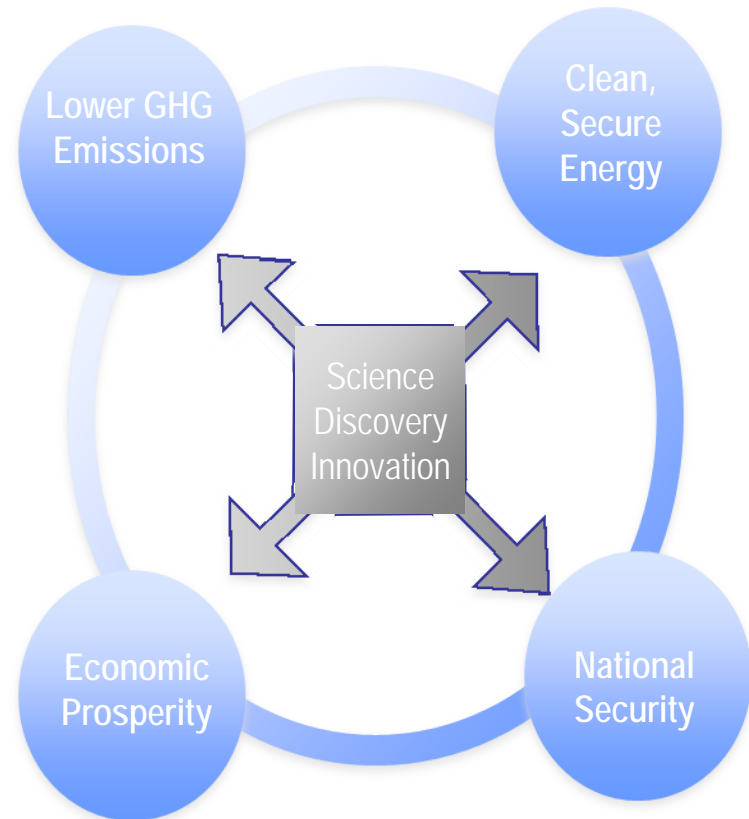
- **U.S. is among the countries highest in electricity use and CO2 emissions.**
- **The Department of Energy (DOE) aims to reduce CO2 emissions 80% by 2050.**
- **Nuclear power produces 20% of our total electricity and over 70% of our non-greenhouse gas emitting electricity.**
- **To meet DOE's ambitious goals, approximately 30% of electricity generation must be derived from nuclear power by 2030.**
- **In 2007, electricity generation accounted for 40%, transportation accounted for 33% and process heat accounted for 16% of our total CO2 emissions.**



# Nuclear Energy and Secretary Chu's Priorities

## Nuclear Energy

- **Science, Discovery & Innovation**
  - Embraces but also moves beyond incremental improvement of existing reactor and fuel cycle technologies to achieve transformational advances in knowledge and application.
- **Clean, Secure Energy**
  - Continues to provide at least 70% of the U.S. non-carbon generated electricity.
- **National Security**
  - Conducts and engages in partnerships and r&d is essential to understanding and reducing the risk of nuclear proliferation as nuclear-based power generation expands globally.
  - Contributes to reduction of petroleum imports through electrification of the transportation sector.
- **Economic Prosperity**
  - Advances U.S. technology leadership and global competitiveness and creates significant long-term employment and reliable and affordable electricity.
  - Contributes to reenergizing the U.S. nuclear infrastructure for global competitiveness.
- **Lower GHG Emissions**
  - Recognized as essential to addressing global climate change.





## NE Mission Statement

- **The primary mission of the Office of Nuclear Energy is to advance nuclear power as a resource capable of making major contributions in meeting the nation's energy supply, environmental, and energy security needs by resolving technical, cost, safety, security and regulatory issues, through research, development, and demonstration.**
  
- **In addition to its primary mission, the Office of Nuclear Energy performs several mission-related functions including providing:**
  - **international engagement in support of the safe, secure, and peaceful use of nuclear energy as well as support to other Department offices and other federal agencies on issues related to the international use of civilian nuclear energy**
  - **the capability to develop and furnish nuclear power systems for use in national security and space exploration missions**
  - **oversight for specifically assigned front-end fuel cycle responsibilities**
  - **stewardship of the DOE Idaho Site**



# FY 2010 Budget

## Nuclear Energy

<b>Program:</b>	<b>FY 2009 Appropriation</b>	<b>FY 2010 Cong. Request</b>	<b>FY 2010 Appropriation</b>
<b>Research &amp; Development</b>			
University Research	5,000	0	5,000
Nuclear Power 2010	177,500	20,000	105,000
Generation IV	178,649 <sup>ab/</sup>	176,000 <sup>b/</sup>	220,137 <sup>b/</sup>
Nuclear Hydrogen Initiative	7,343 <sup>ab/</sup>	0	0
Fuel Cycle R&D	142,652 <sup>ab/</sup>	222,000 <sup>b/</sup>	136,000 <sup>b/</sup>
<b>Infrastructure</b>			
Radiological Facilities	66,146	77,000	72,000 <sup>c/</sup>
Idaho Facilities Management	140,000	203,402	173,000
Idaho Sitewide S&S	78,811	83,358	83,358
Program Direction	73,000	77,872	73,000
<b>Congressionally Directed Projects</b>	<b>2,854</b>	<b>0</b>	<b>2,500</b>
<b>Transfer from State Department</b>	<b>3,300</b>	<b>0</b>	<b>0</b>
<b>Use of Prior Year Balance Reduction</b>	<b>-5,000</b>	<b>0</b>	<b>0</b>
<b>Total NE:</b>	<b>870,255<sup>d/</sup></b>	<b>859,632</b>	<b>869,995</b>

a/ SBIR/STTR not included

b/ Up to 20% of R&D funds are competitively awarded under NE University Programs

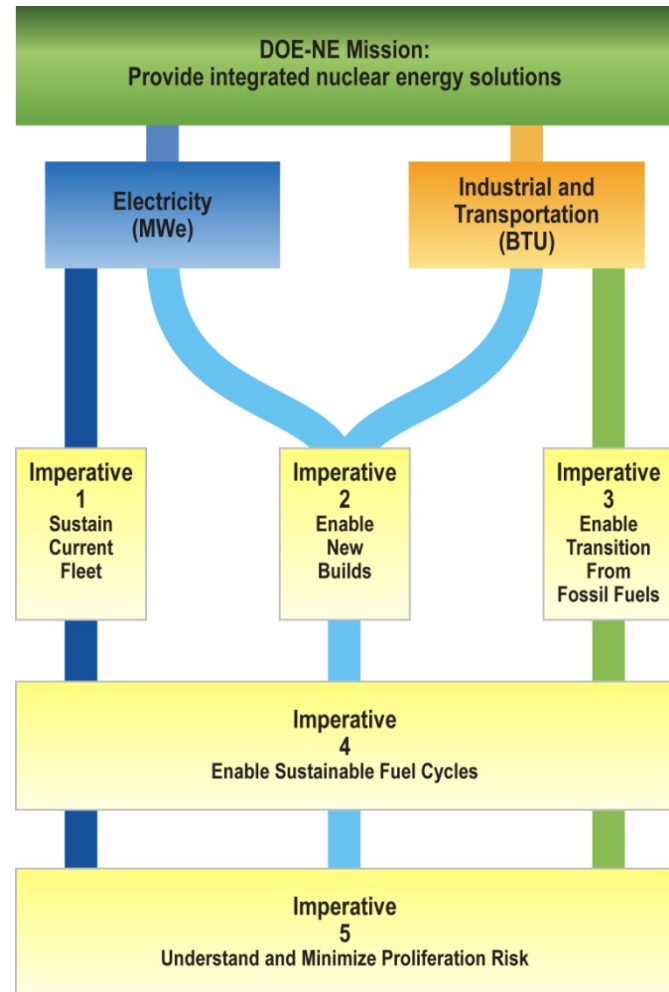
c/ Includes Space and Defense (\$42M), Oak Ridge Nuclear Infrastructure (\$10M), and Los Alamos Nuclear Infrastructure (\$10M), Research Reactor Infrastructure (\$10M)

d/ Does not include (\$487M) for the MOX Fuel Fabrication Facility which was transferred to back to NNSA in FY 2010



# Key Imperatives

- **Extend life, improve performance, and sustain health and safety of the current fleet**
- **Enable new plant builds and improve the affordability of nuclear energy**
- **Enable transition away from fossil fuels in the transportation and industrial sectors**
- **Enable sustainable fuel cycles**
- **Understand and minimize proliferation risk**

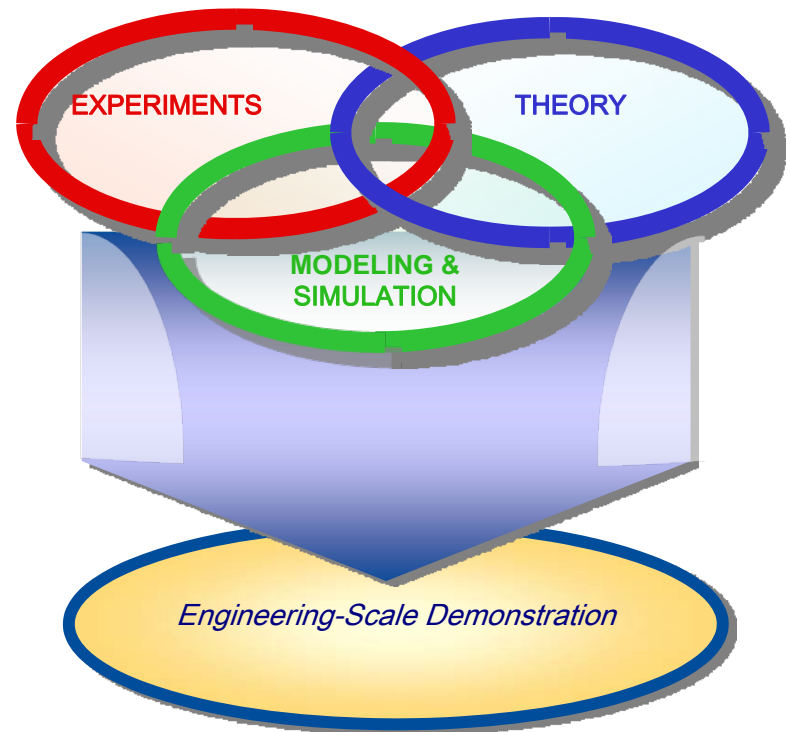




# Solution-Driven, Goal-Oriented, Science-Based Approach to Nuclear Energy Development

## Solution-Driven, Goal-Oriented, Science Based Approach to Nuclear Energy Development

- **Experiments** – Small-scale experiments aimed at observation of isolated phenomena or measurements of fundamental properties. However, targeted integral experiments also will be needed in some cases.
- **Theory** – Theories are developed to explain the integral behavior of the system. These theories are benchmarked and validated against observations during integral experiments.
- **Modeling and Simulation** – In early-phases of development, modeling and simulation (M&S) tools are used to address scaling issues when large-scale applications are considered. A key objective of the M&S effort is to reduce the number of prototypes and large-scale experiments needed before demonstration and deployment.
- **Demonstrations** – Nuclear systems must be deployed before they can impact and benefit society. Ultimately, new technologies, regulatory frameworks, and business models must be integrated into first-of-kind system demonstrations and prototypes whose construction and operation provide top-level validation of integrated system technical and financial performance.



Major elements of the science-based approach





# New Initiative: Modeling and Simulation Hub

