U.S. DEPARTMENT OF ENERGY | Office of Nuclear Energy

Delivering Innovative Solutions for America's Energy Challenges

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U.S. Department of Energy

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Innovation and Competitiveness

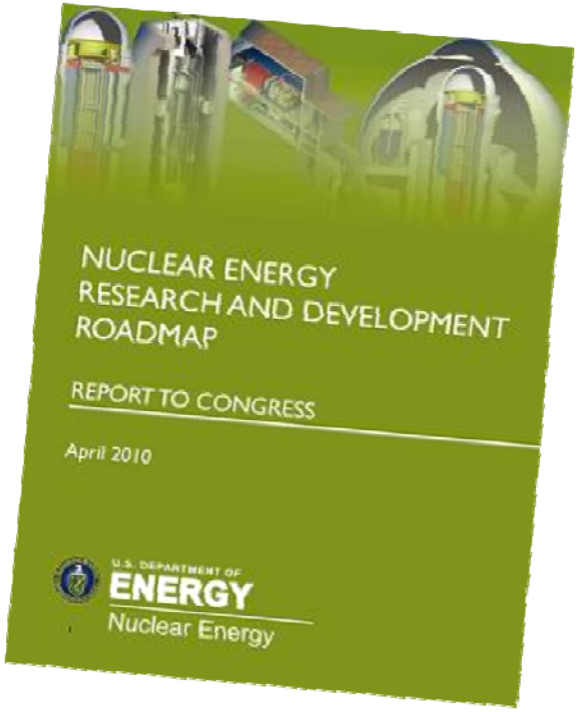
"This is our generation's Sputnik moment. … We'll invest in biomedical research, information technology, and especially clean energy technology -– an investment that will strengthen our security, protect our planet, and create countless new jobs for our people."

"So tonight, I challenge you to join me in setting a new goal: By 2035, 80 percent of America's electricity will come from clean energy sources. Some folks want wind and solar. Others want nuclear, clean coal and natural gas. To meet this goal, we will need them all…"

President Barack Obama
State of the Union Address
January 25, 2011

R&D in the FY 2012 Budget

- Nuclear Energy R&D Objectives
  1. Develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors
  2. Develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals
  3. Develop sustainable nuclear fuel cycles
  4. Understand and minimize the risks of nuclear proliferation and terrorism
- Four complementary R&D programs in the FY 2012 budget
  - Reactor Concepts
  - Fuel Cycle
  - Nuclear Energy Enabling Technologies
  - International Nuclear Energy Cooperation



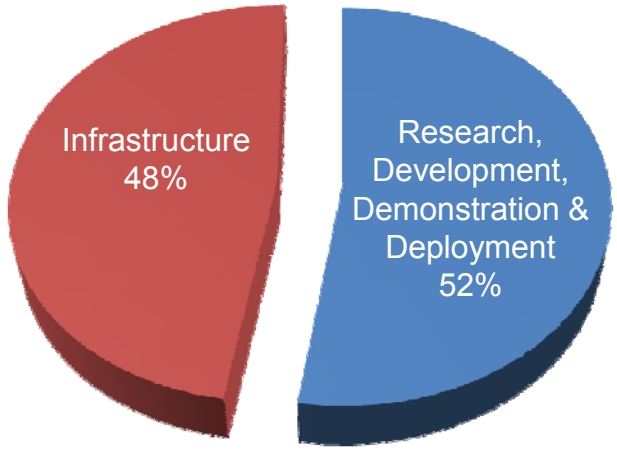
FY 2012 Budget Request Breakdown ($k)

Program	FY 2012 Request
Research, Development, Demonstration & Deployment	
LWR SMR Licensing Technical Support	67,000
Reactor Concepts RD&D[a]	125,000
Fuel Cycle Research and Development[a]	155,010
Nuclear Energy Enabling Technologies[a]	97,364
International Nuclear Energy Cooperation	3,000
Integrated University Program	0
Infrastructure	
Radiological Facilities Management	64,888
Idaho Facilities Management	150,000
Idaho Sitewide S&S	98,500
Program Direction	93,133
Use of Prior Year Balances	-1,367
Total NE:	**852,528**

a) up to 20% of R&D funds are competitively awarded to universities

FY 2012 Request

Total: $852,528



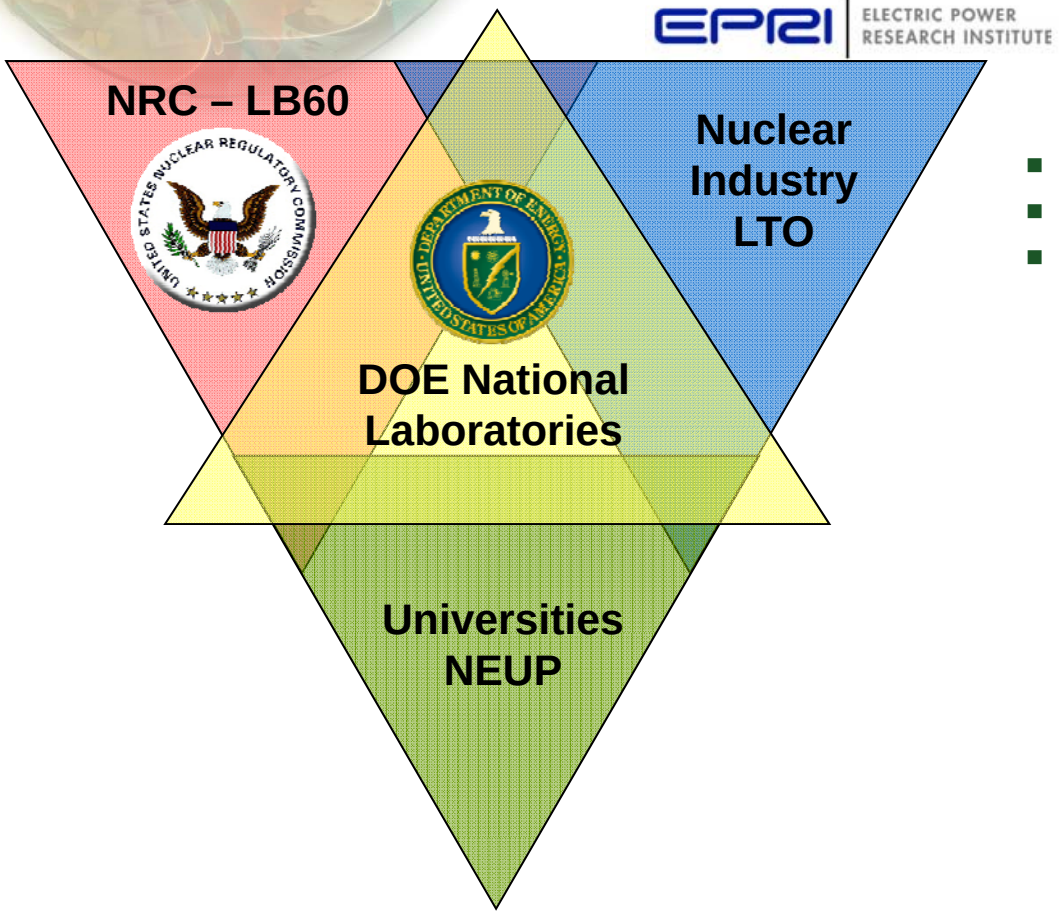
Reactor Concepts Research, Development, and Demonstration

Budget Summary
$ in thousands

Program Element	FY 2012 Request
Small Modular Reactor Advanced Concepts R&D	28,674
Next Generation Nuclear Plant (NGNP)	49,572
Light Water Reactor Sustainability	21,384
Advanced Reactor Concepts	21,870
SBIR/STTR	3,500
Total:	**125,000**

- **Mission**
  - Develop new and advanced reactor designs and technologies that advance the state of reactor technology to broaden applicability, improve competitiveness, contribute to our nation's energy portfolio, and address environmental challenges
- **FY 2012 Planned Accomplishments**
  - Conduct R&D on advanced SMR designs
  - Establish critical path R&D activities and work with industry to establish the business plan and approach for the long-term execution of NGNP
  - Research technologies that support safe and economical long-term operation of the existing nuclear fleet
  - Conduct R&D on Advanced Reactor Concepts

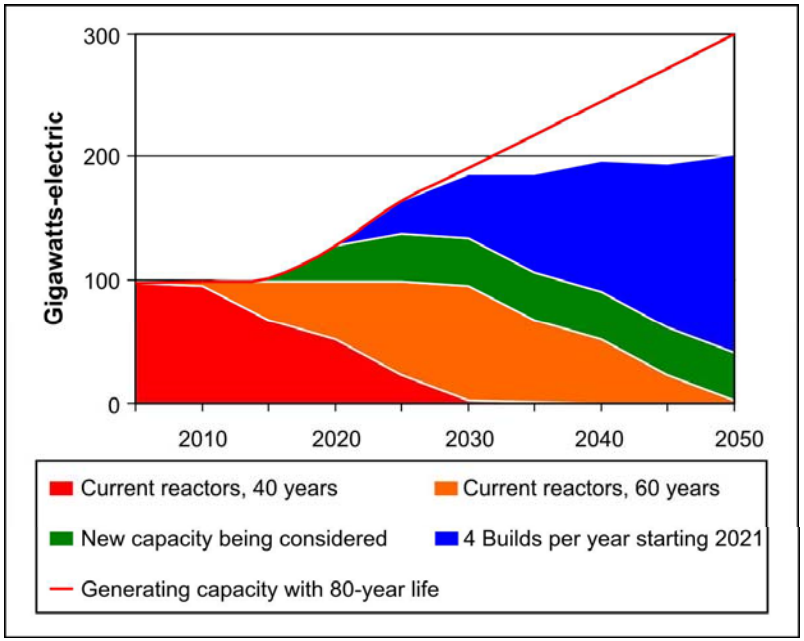
Light Water Reactor Sustainability



Nuclear Sector Mission Statement

EPRI Nuclear Power Council Executive Committee, Feb. 2, 2011

- Maximize the utilization of existing nuclear plants
- Enable the development of advanced nuclear plants
- Support the long-term sustainability of nuclear resources

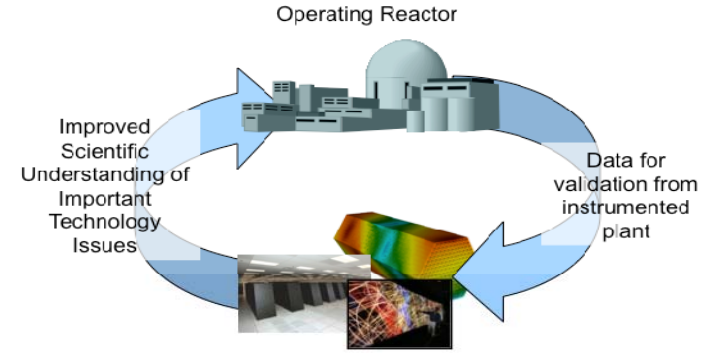


Innovation: Modeling and Simulation Hub

"At Oak Ridge National Laboratory, they're using supercomputers to get a lot more power out of our nuclear facilities."

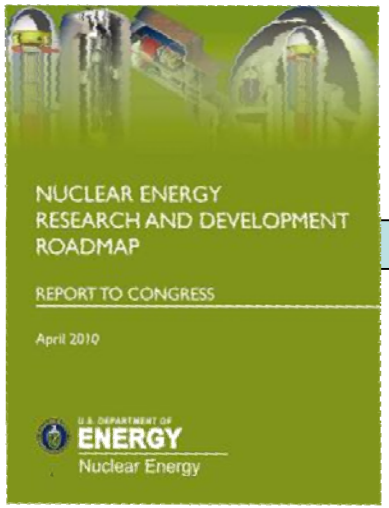
-- President Obama, 2011 State of the Union Address

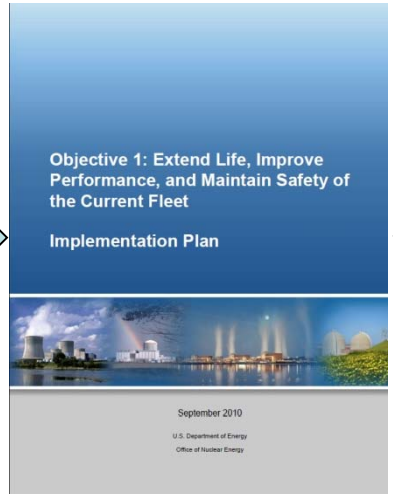
- CASL: The Consortium for Advanced Simulation of Light Water Reactors
  - A unique lab-university-industry partnership with a remarkable set of assets
- CASL vision: Create a virtual reactor for predictive simulation of LWRs
- CASL mission: Develop and apply the virtual reactor to address 3 critical performance goals
  - Reduce capital and operating costs
  - Reduce nuclear waste
  - Enhance nuclear safety
- Selection announced on May 28, 2010
- FY 2012 request: $24.3M



Advanced Modeling and Simulation of the Operating Reactor (aka "Virtual Reactor")

Implementation Plan for Objective #1





- *DOE / EPRI Joint Strategy*
- *Nuclear Materials Aging and Degradation*
- *Advanced Instrumentation, Information, and Control Systems*
- *Risk-Informed Safety Margins Characterization*
- *Advanced LWR Fuel Development*
- *Economics and Efficiency Improvements*

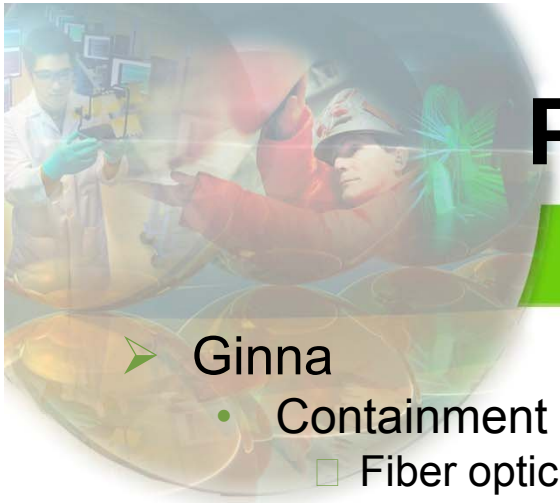
Federal Role

- **National strategic interest in the long-term operation of existing plants**
  - Supports climate change objectives
  - Supports energy security
  - Avoids higher cost to ratepayers for new plant replacements
- **Industry also has an incentive, so cost-share will be employed**
  - Public-private partnerships are a key mechanism
- **Addresses fundamental scientific questions where private investment or capabilities are insufficient to make progress on broadly applicable technology issues for public benefit**
- **Government holds a large theoretical, computational, and experimental capability in nuclear R&D that is not available within the industry**
- **Benefits will extend to the next generation of reactor technologies still in development**
- **The Office of Nuclear Energy has signed Memorandum of Understanding with the Nuclear Regulatory Commission and the Electric Power Research Institute to cooperate on R&D related to the long-term operation of existing plants.**
  - Strong NRC and EPRI roles are critical

Conclusion

- The existing fleet of nuclear power plants provide the majority of the Nation's low-carbon electricity generation
- The continued operation of the existing fleet is in the National interest as a key strategy for meeting climate change and energy supply goals
- Federal efforts are essential to stimulate and encourage industry efforts as well as to address the longer-term, high risk research that industry cannot address
- Sustained R&D on long-term LWR operations is needed to identify issues and develop the technical basis that supports industry efforts to relicense plants for long-term operation

Backup



Pilot Plant Projects

- Ginna
  - Containment assessment
    - Fiber optic strain gage measurement of tendon relaxation
    - Coring and subsequent spectroscopy and strength testing
    - Rebar condition assessment
    - NDE (test various methods)
    - Digital Image Correlation trial
  - Augmented Reactor Internals Aging Assessment (baffle bolts)
  - RPV embrittlement
    - Reconstitute specimens
    - Irradiate further
    - Re-test to expand vessel embrittlement database
- Nine Mile Point Unit 1
  - Investigate top guide cracking
  - Other activities TBD
- Zion D&D
  - Concrete Specimens
  - RPV Specimens