U.S. DEPARTMENT OF ENERGY | Nuclear Energy

Nuclear Energy University Programs (NEUP)

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U.S. Department of Energy

August 8, 2012

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President Obama's Nuclear Energy Goals

"We can build the next-generation nuclear reactors that are smaller and safer and cleaner and cheaper."

Ohio State University-March 22, 2012

"With rising oil prices and a warming climate, nuclear energy will only become more important. That's why, in the United States, we've restarted our nuclear industry as part of a comprehensive strategy to develop every energy source."

Nuclear Security Summit-March 26, 2012

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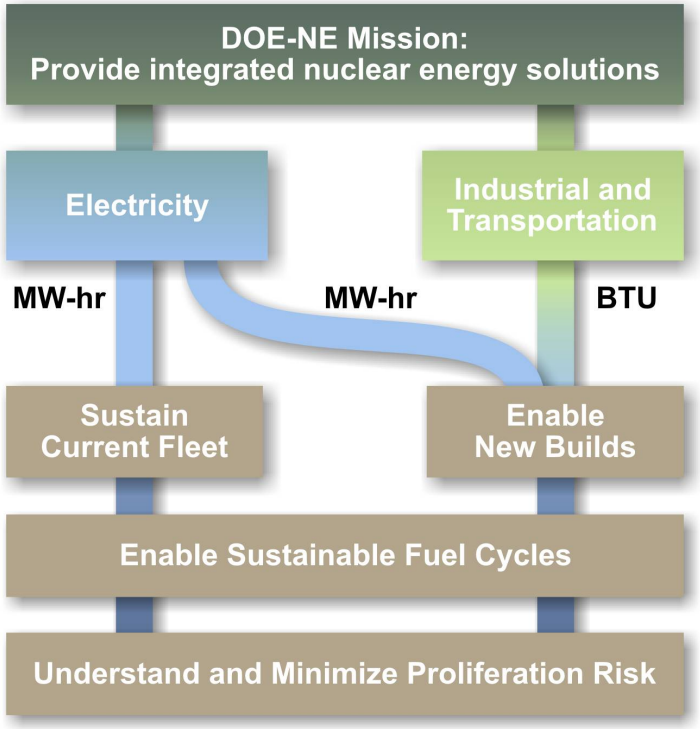
Nuclear Energy Objectives

- Develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors
- Develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals
- Develop sustainable nuclear fuel cycles
- Understand and minimize the risks of nuclear proliferation and terrorism



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FY 2012-2013 Budget Summary

Program	FY 2012 Adjusted	FY 2013 Request	FY 2013 House Appropriations Committee	FY 2013 Senate Appropriations Committee
Integrated University Program	**5,000**	**0**	**5,000**	**0**
SMR Licensing Technical Support	**67,000**	**65,000**	**114,000**	**65,000**
Reactor Concepts RD&D	**114,871**	**73,674**	**126,660**	**73,674**
Fuel Cycle R&D	**186,260**	**175,438**	**138,716**	**193,138**
Nuclear Energy Enabling Technologies	**74,670**	**65,318**	**75,000**	**65,318**
Radiological Facilities Management	**69,510**	**51,000**	**51,000**	**66,000**
Idaho Facilities Management				
O&M	154,097	144,220	154,220	144,220
13-D-905, RHLLW		6,280	6,280	6,280
13-E-200, APIE		1,500	1,500	1,500
Idaho Facilities Management	**154,097**	**152,000**	**162,000**	**152,000**
Idaho Sitewide Safeguards and Security	**93,350**	**95,000**	**93,350**	**93,000**
International Nuclear Energy Cooperation	**2,983**	**3,000**	**3,000**	**3,000**
Program Direction	**91,000**	**90,015**	**90,015**	**92,015**
Nuclear Waste Disposal			**25,000**	
Use of Prior Year Balances/Reprogramming				**(17,700)**
Total, Office of Nuclear Energy	**858,741**	**770,445**	**883,741**	**785,445**

Other Defense Activities
Prior Year Nuclear Waste Fund
Nuclear Waste Disposal (New)

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Reactor Concepts Research, Development and Demonstration

Budget Summary
$ in thousands

Program Element	FY 2012 Enacted	FY 2013 Request
Small Modular Reactor Advanced Concepts R&D	28,001	18,479
Next Generation Nuclear Plant (NGNP)	40,000	21,157
Light Water Reactor Sustainability	25,000	21,661
Advanced Reactor Concepts	21,870	12,377
Total:	**114,871**	**73,674**

- **Mission**
  - Develop new and advanced reactor designs and technologies that advance the state of reactor technology to improve competitiveness and help advance nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs
- **FY 2013 Planned Accomplishments**
  - Conduct R&D to support advanced SMR designs
  - Perform targeted fuels and materials R&D activities to support NGNP
  - Research technologies that support safe and economical long-term operation of the existing nuclear fleet
  - Conduct R&D on Advanced Reactor Concepts

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Fuel Cycle Research and Development

Budget Summary
$ in thousands

Program Element	FY 2012 Enacted	FY 2013 Request
Separations and Waste Forms	32,224	38,628
Advanced Fuels	58,656	40,378
Systems Analysis & Integration	17,029	22,882
Materials Protection, Accounting & Control Technology	5,152	7,203
Used Nuclear Fuel Disposition	59,650	59,668
Fuel Resources	3,607	6,679
Spent Nuclear Fuel Analysis	9,942	-
Total:	**186,260**	**175,438**

- **Mission**
  - Develop used nuclear fuel management strategies and technologies; develop sustainable fuel cycle technologies and options
- **FY 2013 Planned Accomplishments**
  - Continue activities that support the near-term recommendations of the Blue Ribbon Commission on America's Nuclear Future
  - Develop data and models to support geologic disposal and extended storage of used fuel
  - Downselect for qualification testing advanced light water reactor fuel with enhanced accident tolerance
  - Conduct a formal screening for fuel cycle options with potential for significantly improved performance
  - Select a reference separations process to evaluate improvements in operations
  - Deliver adsorbent material that double the adsorbent capacity of uranium from seawater achieved by Japanese researchers

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Nuclear Energy Enabling Technologies

Budget Summary
$ in thousands

Program Element	FY 2012 Enacted	FY 2013 Request
Crosscutting Technology Development	35,899	26,167
Energy Innovation Hub for Modeling & Simulation	24,232	24,588
National Scientific User Facility	14,539	14,563
Total:	**74,670**	**65,318**

- **Mission**
  - Develop crosscutting technologies that directly support and complement NE's R&D efforts and encourage transformative and creative solutions
- **FY 2013 Planned Accomplishments**
  - Evaluate innovative materials for use in high radiation/high temperature areas
  - Develop advanced sensors and instrumentation to control and monitor plant performance while increasing safety and efficiency of operation
  - Deliver advanced modeling and simulation capabilities to be used in support of the reactor and fuel cycle R&D programs
  - Release the Virtual Reactor Code with significantly improved capabilities
  - Conduct materials and fuel experiments and post-experiment analysis at the unique facilities within the NSUF network

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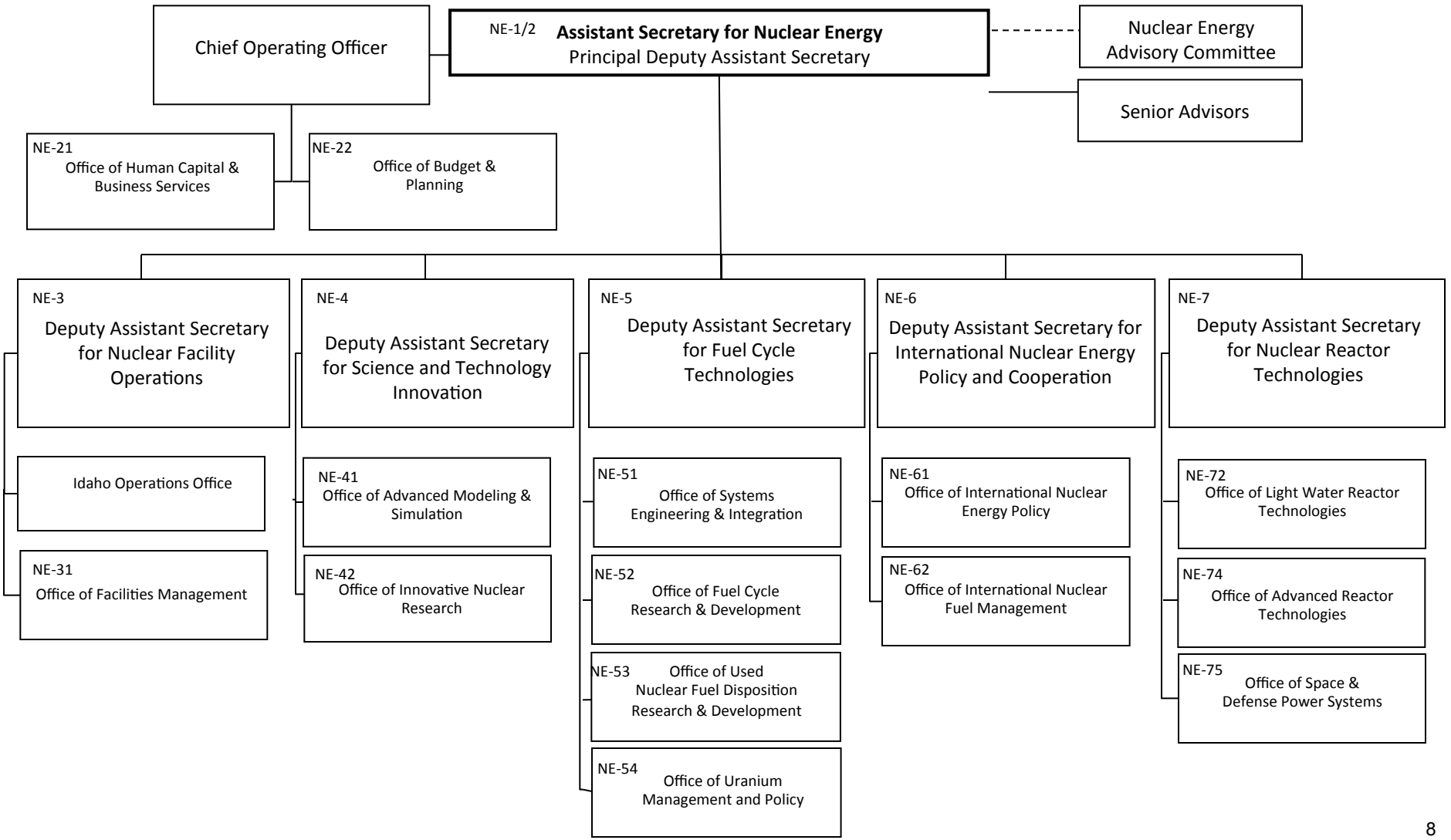
Proposed Organization



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Recent Key Events

- Fukushima Dai-ichi
- Blue Ribbon Commission on America's Nuclear Future- Final Report Issued January 26, 2012
- Small Modular Reactor Program Approved
- AP 1000 Design Certification and Combined Construction and Operating License (COL) Issued
- Nuclear Energy University Programs Awards

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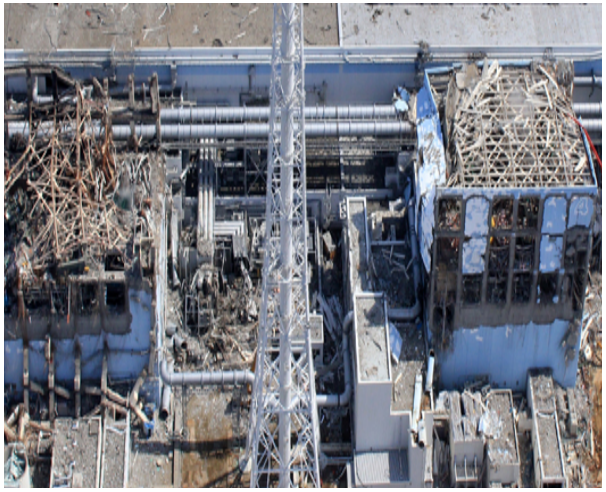
Fukushima Dai-ichi – U.S. Responses



- President Obama asked the NRC to *"do a comprehensive review of the safety of our domestic nuclear plants in light of the natural disaster that unfolded in Japan"*
- Secretary Chu stated, *"the Administration is committed to learning from Japan's experience as we work to continue to strengthen America's nuclear industry"*
- Marvin Fertel, President & CEO Nuclear Energy Institute: "T*he industry's highest priority is the safe operation of the 104 reactors in 31 states and we will incorporate lessons learned from this accident at American nuclear energy facilities"*

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DOE/NE Research Impacts: Post - Fukushima

- **Reducing the need for Operator Actions in Accident Response enhances overall safety**
  - Passive Systems enhance safety
    - AP1000, ESBWR, SMRs, HTGRs
  - Better understanding of dry cask storage systems.
- **Re-engineering barriers can reduce complications**
  - SiC cladding
  - Enhanced fuel properties
- **Re-evaluation of potential natural phenomena**
  - Re-evaluation of U.S. seismic criteria
- **Targeted use of Modeling and Simulation**
  - Improved modeling of operating reactors
  - Enlistment of the University Community.

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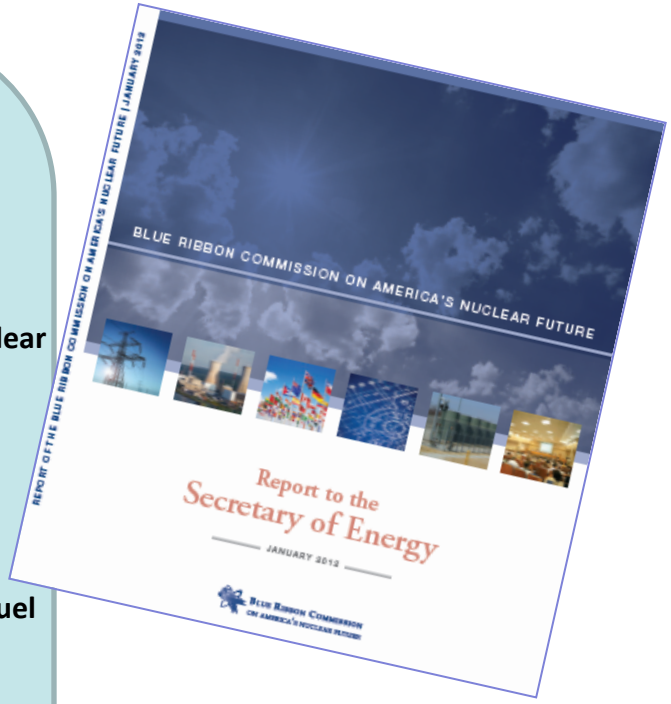
Blue Ribbon Commission Recommendations

1. A new, consent-based approach to siting future nuclear waste management facilities.
2. A new organization dedicated solely to implementing the waste management program and empowered with the authority and resources to succeed.
3. Access to the funds nuclear utility ratepayers are providing for the purpose of nuclear waste management.
4. Prompt efforts to develop one or more geologic disposal facilities.
5. Prompt efforts to develop one or more consolidated storage facilities.
6. Prompt efforts to prepare for the eventual large-scale transport of spent nuclear fuel and high-level waste to consolidated storage and disposal facilities when such facilities become available.
7. Support for continued U.S. innovation in nuclear energy technology and for workforce development.
8. Active U.S. leadership in international efforts to address safety, waste management, non-proliferation, and security concerns.



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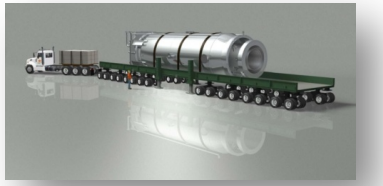
SMR Licensing Technical Support Program

Modeled After Nuclear Power 2010 Program

- **$1.4B Joint government-industry program to overcome barriers to new reactor deployment**
  - 50-50 cost-share between government and industry
- **Results:**
  - Three Early Site Permits (North Anna, Grand Gulf, Clinton)
  - Two Construction and Operating License applications (Vogtle, Fermi)
  - Two Design Certification applications (AP1000 received, ESBWR 2012)

Current Program:



- **Goal is design certification of 2 SMR designs**
- **Supports first phase for deployment**
- **Facilitates and accelerates commercial development and deployment of near term U.S. SMR designs at domestic locations**
- **$452 M in cost-share program over 5 years**
  - FY12 funding is $67M and FY13 request is $65M

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AP1000 Construction Sanmen, Vogtle, and Summer

Sanmen- January 2012

Summer - May 2012

Vogtle – March 2012

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NEUP Supports the NE Mission

- **NEUP Mission** - The Nuclear Energy University Programs mission is to engage the U.S. university community to conduct program directed, program supporting, and mission supporting research and development, related infrastructure improvements, and student education support to build world class nuclear energy and workforce capability as an integral component of the Office of Nuclear Energy.

- **NEUP Objectives** – Support the NE R&D Roadmap and associated implementation plan objectives while bolstering university R&D infrastructure, especially research reactors. Sustain future workforce for nuclear renaissance and NE R&D mission.

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NEUP FY 2012 R&D Awards

- **In May 2012, NEUP announced awards amounting to $37 million for 48 projects, which leverage the R&D capabilities of U.S. universities and colleges**
- **These awards were made to 32 American universities in 22 states and the District of Columbia**
- **"We must invest in the next generation of American scientists and engineers in order to fulfill our commitment to restarting America's nuclear industry and making sure that America stays competitive in the 21st century." – Secretary Chu**
- **The projects will focus on:**
  - Fuel Cycle Research and Development
  - Reactor Concepts Research, Development and Demonstration
  - Nuclear Energy Advanced Modeling and Simulation
  - Transformative Research

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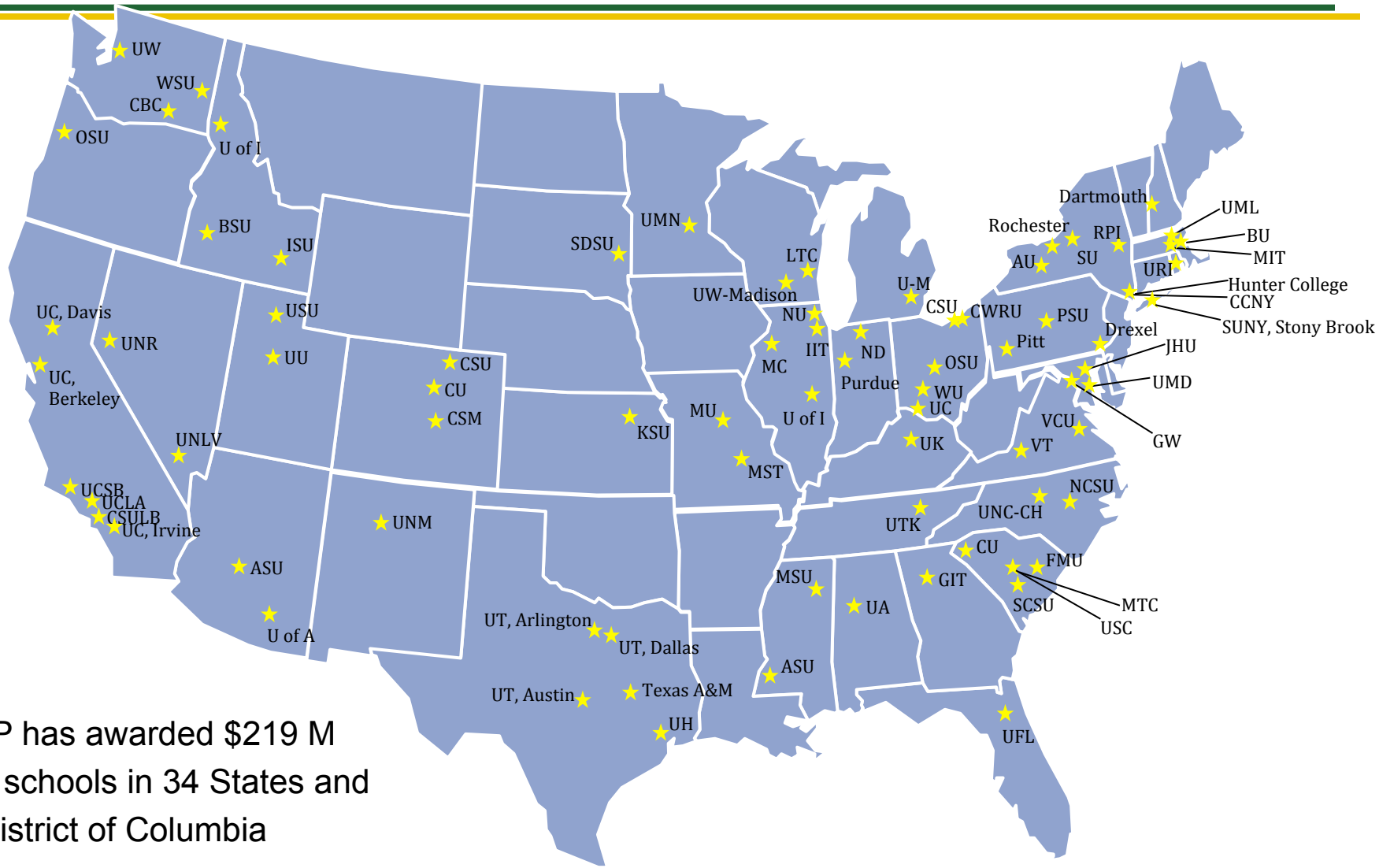
NEUP Award Recipients FY 2009 – May 2012



NEUP has awarded $219 M to 81 schools in 34 States and the District of Columbia

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Issues Potentially Impacting University Awards in FY 2013

- Integrated University Program (student fellowships and scholarships) not included in the NE FY 2013 budget request, but is included in HEWD Report.

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NEUP Program Support in FY 2013: Program Areas

- Fuel Cycle Technologies (FC R&D)
- Nuclear Reactor Technologies (RC RD&D)
- Science and Technology Innovation - Nuclear Energy Advanced Modeling and Simulation (NEAMS)

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Continued Support for Universities

- **NE plans to continue its significant investment in university-based R&D and supporting activities through NEUP and other programs**

- **Up to 20% of R&D budget is allocated to the peer-reviewed NEUP**
  - Support for R&D and related infrastructure remain components of NEUP scope
  - Energy Policy Act of 2005 requirement for university cost-share waived for NEUP

- **NE University Investments Outside of NEUP Solicitations**
  - Potential for competitively-awarded solicitations to universities, national labs, and industry under NEET
  - NE-funded fuel management support for university research reactors
  - National labs apply NE R&D funds to support specific R&D or support efforts at universities

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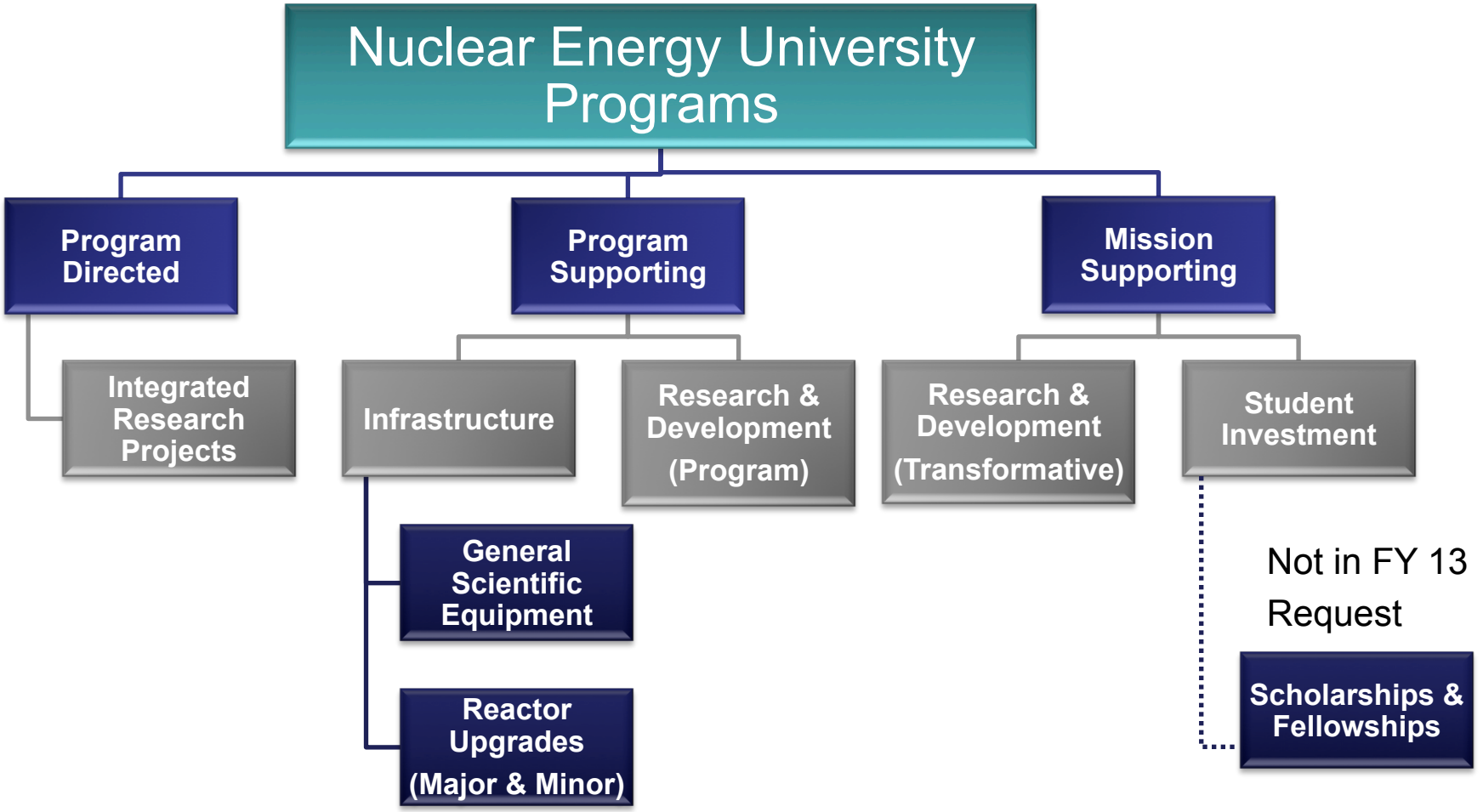
FY 2013 NEUP Structure



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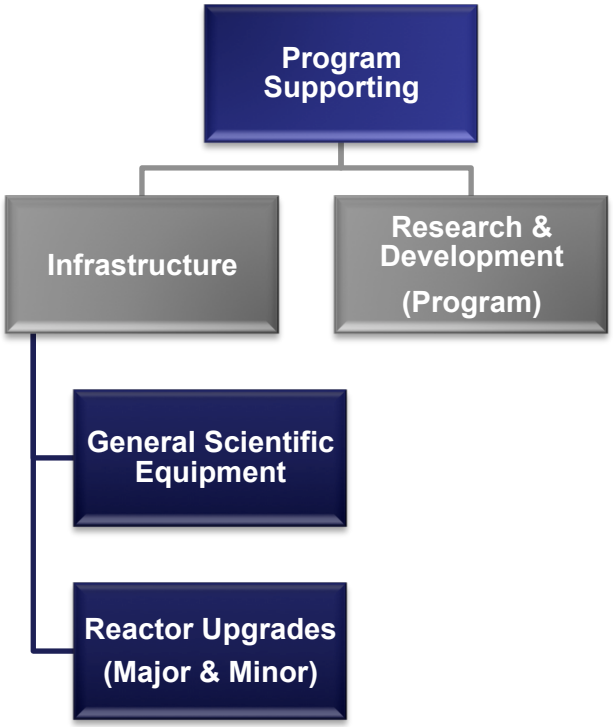
Program-Directed Component

- **Anticipate Three IRPs in FY 2013**
  - One funded and scoped by RC RD&D
  - Two funded and scoped by FC R&D
  - Initial planning estimate is $1.5M per year per IRP for 3 years ($12.5M total)
- **Evaluation criteria weighting will be 50% program relevance and 50% technical quality**
  - Peer review team evaluates technical quality
  - Federal Program staff evaluates relevance
  - If technical quality is evaluated as “not recommended”, or if evaluated as “not relevant”, project will not be funded

Program-Supporting Component



- **R&D Element:**
  - Anticipate continuing the maximum of $900k for three years (~$300k/yr)
  - Pre-applications and full proposals will continue to undergo peer review and relevancy review
- **Evaluation criteria weighting will be 35% program relevance and 65% technical quality**
- **Includes Infrastructure support (reactor upgrades and equipment).**

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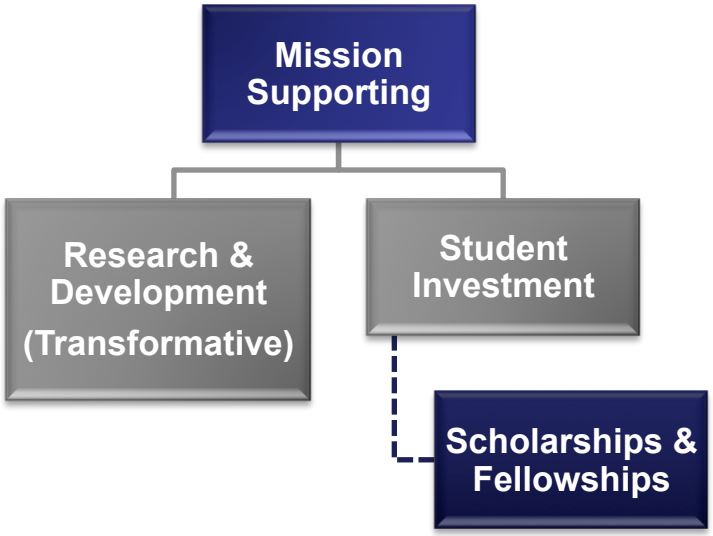
Mission-Supporting Component



- **R&D Component:**
  - Anticipate continuing maximum of $450K for three year projects (~$150k/yr)
  - Pre-applications and full proposals continue to undergo peer and relevancy review
- **Evaluation criteria weighting will be 20% program relevance and 80% technical quality**
- **Student investment not in FY 2013 request, but in HEWD Report**

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Improvements and Considerations Initiated in FY 2012 will Continue

- **International Collaborations**
- **Develop and implement performance metrics**
  - Demonstrate program effectiveness
  - Help justify program funds
  - Build support (Congress, GAO, public)
- **Expand and improve the peer review database**
- **Employ communication enhancements**
  - Social media and web-based/videoconferencing
- **We Need Your Feedback and Your Support Throughout the Upcoming Year!**

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Renewed Interest in Nuclear Energy

- **Early Site Permits**: 4 early site permits approved for Clinton, Grand Gulf, North Anna sites, and Vogtle; additional permit applications filed.
- **License Applications:** 18 Construction and Operating License applications for 28 new reactors have been submitted for NRC review; Areva and USEC enrichment licenses filed; 73 reactor license renewals approved.
- **Reactor Design Certifications:** Four designs have been certified; three new designs (APWR, EPR, and ESBWR) are under review; ESBWR through ACRS; **AP1000 certified**.
- **New Plant Orders:** 4 plant construction contracts initiated; 9 power companies have placed large component forging orders.
- **Plant Construction:** TVA construction activities at Watts Bar 2, and reinstated construction permits for Bellefonte 1 and 2. LES enrichment plant operating. **Vogtle and Summer COL issued.**
- **Financial Incentives:** Conditional loan guarantees approved for Vogtle and Eagle Rock.
- **Small Modular Reactor Program**: Administration support for multiyear SMR Licensing and Deployment Program. $65M requested in FY13. Issued FOA April 22, 2012.

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Global Demand for Nuclear Energy Continues

- **Key Drivers:**
  - Long-term energy supply/energy security
  - Clean, base-load source of energy
  - Significant source of jobs and economic benefit