U.S. DEPARTMENT OF ENERGY | Nuclear Energy

Current Issues
DOE's Nuclear Energy Programs

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Nuclear Energy Advisory Committee
June 5th, 2014

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Overview

- FY15 President's Budget Request
- Vogtle Loan Guarantee Issued
- Small Modular Reactors/ Rothwell and Ganda Report
- Idaho National Lab
- Used Fuel and Waste Management
- NEAMS Reorganization
- Integrated Energy Systems
- Nuclear Energy University Programs (NEUP)

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President Obama's 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

"Today, I'm announcing a new national climate action plan, and I'm here to enlist your generation's help in keeping the United States of America a leader -- a global leader -- in the fight against climate change."
June 25, 2013, Georgetown University

"…the debate is settled. Climate change is a fact. And when our children's children look us in the eye and ask if we did all we could to leave them a safer, more stable world, with new sources of energy, I want us to be able to say yes, we did."
President Obama's 2014 State of the Union Address

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Secretary Moniz on Nuclear Energy

"The Energy Department is committed to strengthening nuclear energy's continuing important role in America's low carbon future, and new technologies like small modular reactors will help ensure our continued leadership in the safe, secure and efficient use of nuclear power worldwide."

New Investment in Innovative Small Modular Reactor, December 12, 2013

"All-of-the-above is not merely a slogan, but a clear-cut pathway to creating jobs and at the same time reducing carbon emissions, which recently stood at their lowest level in 20 years… President Obama has made clear that he sees nuclear energy as part of America's low carbon energy portfolio. And nuclear power is already an important part of the clean energy solution here in the United States."

The National Press Club, February 19, 2014

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Highlights of the Nuclear Energy FY 2015 Request

FY 2014 Request	FY 2014 Enacted	FY 2015 Request
$735M	$888M	$863M

- **Small Modular Reactors ($97M)—**Continues technical support for licensing two SMRs.
- **Reactor Concepts ($101M)—**Expands light water reactor sustainability efforts to maintain carbon free generation of the current fleet and supports development of non-water cooled reactor systems.
- **Nuclear Energy Enabling Technologies ($78M)—**Continues Energy Innovation Hub for Modeling and Simulation for second 5-year period; advanced modeling and simulation for NE R&D programs.
- **Fuel Cycle R&D ($189M)—**Expands effort to develop commercial used nuclear fuel disposal solutions; maintain schedule for 2016 selection of accident tolerant fuel candidates for further development and testing.
- **Supercritical CO2 demonstration ($28M)—**Initiates multi-program effort to accelerate commercialization of sCO2 Brayton cycle energy conversion technologies with a 10MW demonstration project.
- **Idaho National Laboratory ($290M)—**Modernization of facilities and security capabilities.

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NE FY 2015 Congressional Budget Request Summary

(Dollars in Thousands)

	FY 2014 Request	FY 2014 Enacted [a]	FY 2015 Request
Integrated University Program	0	5,500	0
SMR Licensing Technical Support	70,000	110,000	97,000
Supercritical Transformational Electric Power Generation		--	27,500
Reactor Concepts RD&D	72,500	112,822	100,540
Fuel Cycle R&D	165,100	186,205	189,100
Nuclear Energy Enabling Technologies	62,300	71,109	78,246
Radiological Facilities Management	5,000	24,968	5,000
International Nuclear Energy Cooperation	2,500	2,496	3,000
Idaho Facilities Management	181,560	196,276	185,910
Idaho Safeguards and Security	94,000	94,000	104,000
Program Direction	87,500	90,000	73,090
Adjustments [b]	-5,000	-5,000	--
Total, Nuclear Energy	**735,460**	**888,376**	**863,386**

a) Reflects application of $814,100 rescission as identified within section 317 of Public Law 113-76. Does not reflect appropriation transfer to Office of Science for SBIR/STTR of $10,844K.

b) Use of Prior Year Balances.

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Secretary Moniz Announces $6.5 Billion Vogtle Loan Guarantee

Construction of Vogtle Unit 3,
January 2014 ©Georgia Power Company

"The construction of new nuclear power facilities like this one - which will provide carbon-free electricity to well over a million American energy consumers - is not only a major milestone in the Administration's commitment to jumpstart the U.S. nuclear power industry, it is also an important part of our all-of-the-above approach to American energy as we move toward a low-carbon energy future…

The innovative technology used in this project represents a new generation of nuclear power with advanced safety features and demonstrates renewed leadership from the U.S. nuclear energy industry."

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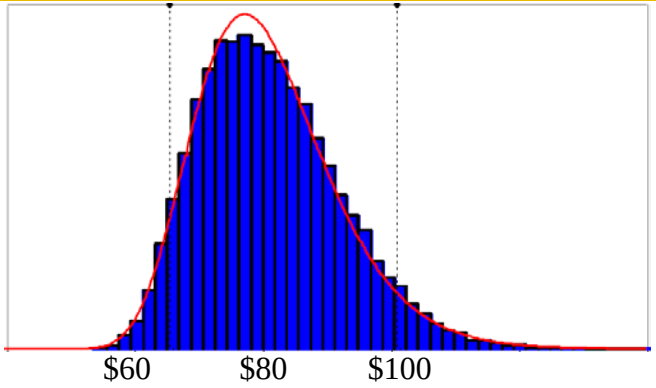
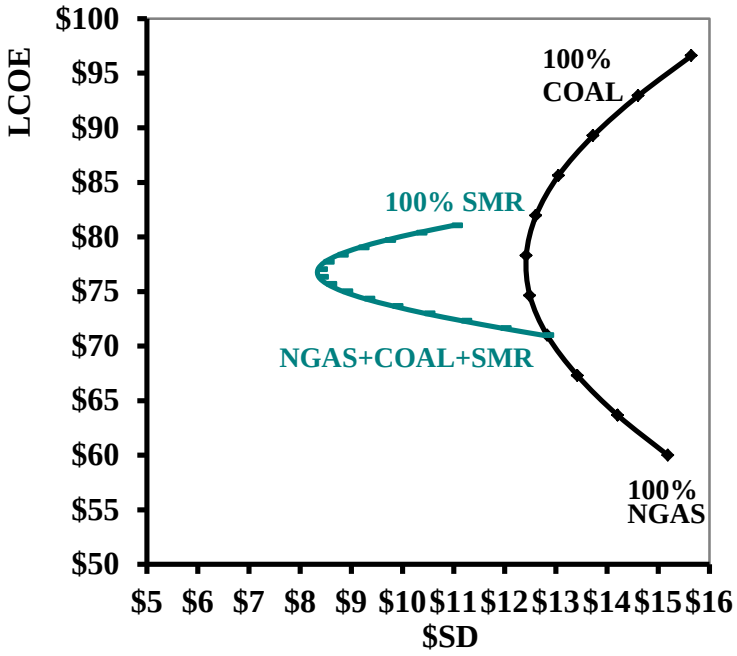
Rothwell and Ganda Report on "Electricity Generating Portfolios with Small Modular Reactors"

- **Electricity generating technologies carry different expected returns and risks**
  - Used modern portfolio theory and methods to optimize energy portfolio
  - Cost of electricity from SMRs treated as a distribution recognizing uncertainties (top)
- **Adding SMRs to a portfolio of fossil fuel generators (blue) dramatically reduces risk (horiz.) while having only a minimal impact on cost (vert.)**
- **Increasing risk aversion further encourages SMRs, but always as part of a diverse portfolio**





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Status of SMR Licensing Technical Support Program

B&W mPower America

- Cooperative Agreement established with team consisting of B&W, Bechtel, and TVA in April 2013
- Initial DOE commitment of $101 M through March 2014
- DOE is working with B&W to establish a path forward for the mPower project

NuScale Power

- Selection of NuScale announced on December 12, 2013
- Cooperative Agreement signed May 27, 2014
- DOE to fund up to $217 M for NuScale SMR development
- DCA submittal currently planned for 2nd half of 2016

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Idaho National Laboratory Contract Renewal

- On March 27, 2014, DOE exercised an option in BEA's original 10-year contract to operate INL for an additional 5 years
- The basis for exercising the option to extend is BEA's consistently strong annual performance and success in managing INL
- The contract to create INL was awarded to BEA in November 2004 and began on Feb 1, 2005. BEA will now operate INL through September 30, 2019, contingent on continued high-performance.

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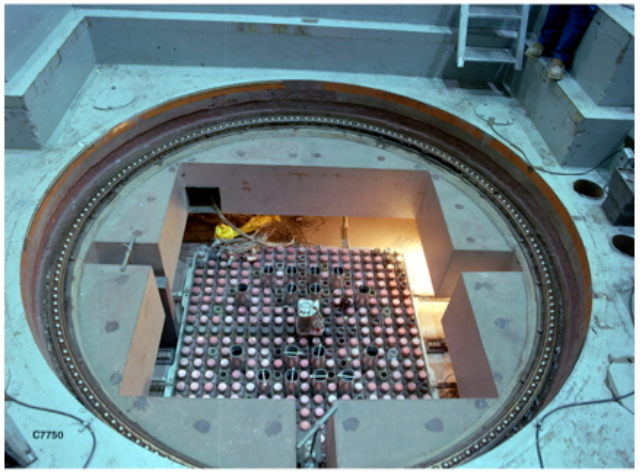
INL Facilities
Resumption of Transient Testing

- **Environmental Assessment and Finding of No Significant Impact (FONSI) was issued in February 2014 which identified TREAT at INL as the preferred alternative**

- **Goal is to resume transient testing operations by FY 2018 which supports the future testing needs of the Accident Tolerant Fuels program**

- **Preliminary assessments of the reactor fuel, the filtration/cooling system (HEPA), and the electrical distribution system have all come back positive**



- **Current efforts are focused on updating safety documentation and procedures to allow for fuel handling and movement of the control rod drives *(due 9/30/14)***

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INL Facilities
Energy Innovation Laboratory (EIL)

- LEED Platinum certified research facility
- Supporting both Office of Energy Efficiency and Renewable Energy's clean energy research, and Office of Nuclear Energy's development of new materials for advanced nuclear reactors
- EIL includes 127 laboratory modules that support research in chemical sciences, nanotechnology, water chemistry, advanced microscopy, control systems, high temperature testing, thermal hydraulics, materials testing and characterization, separations technology and advanced instrument training
- Research activities will transition with full occupancy expected by July 2014

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INL Facilities
Irradiated Materials Characterization Laboratory (IMCL)

- IMCL is designed to house post irradiation examination equipment to support a broad range of research on irradiated fuels and highly activated materials
- Equipment installation will continue on a phased approach through FY 2018
- Due to an increase in funding levels this year, current efforts are focused on accelerating the installation of the Shielded Sample Preparation Area, procurement of a Transmission Electron Microscope and cold testing three pieces of equipment by the end of FY 2014.
- Operations are expected to begin in July 2014 with the initial suite of equipment

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DOE Support for NRC on Groundwater at Yucca Mountain

- On February 28, the DOE advised the NRC that it would provide an updated version of the July 2009 Technical Report
- The updated report will provide the NRC with substantially all the technical information necessary to create a draft Groundwater SEIS

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CASL and NEAMS – Complementarity and Coordination

Complementarity - differences

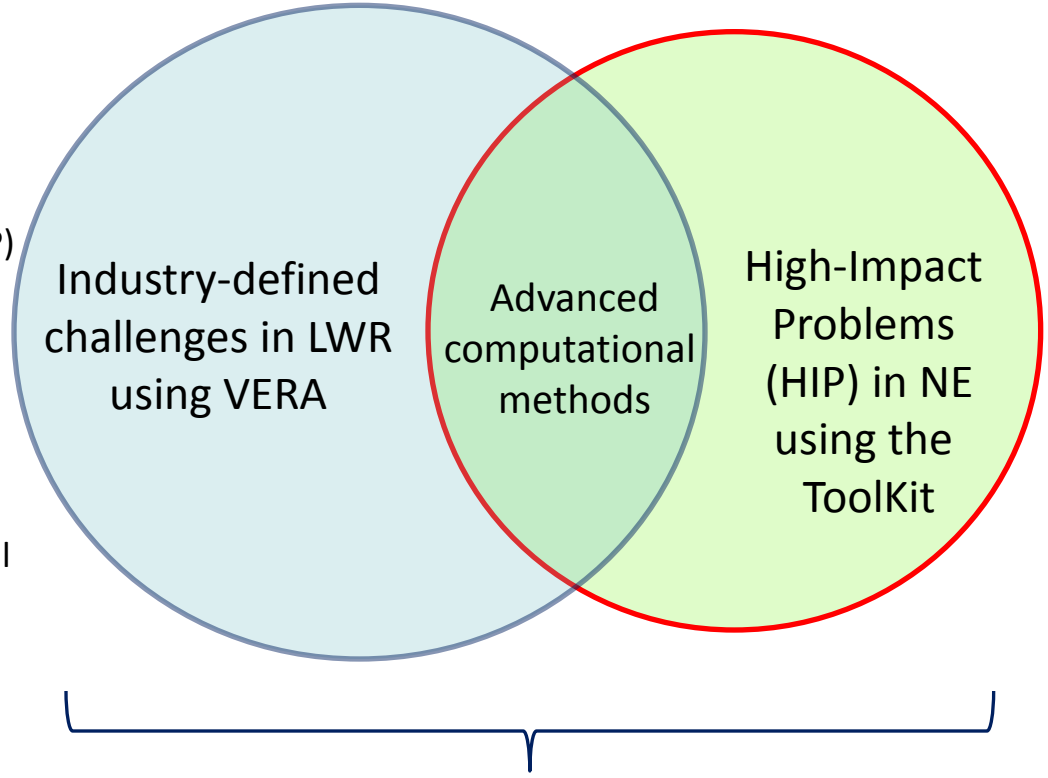
- CASL
  - Delivers solutions to industry-defined challenges in LWR technology
  - Develops "virtual reactor" software, VERA
  - Provides strength to the program
- NEAMS
  - Delivers solutions to high-impact problems (HIP) in various NE technologies
  - Develops a ToolKit of computational tools
  - Provides flexibility to the program

Coordination – common goals

- Improve advanced, multi-physics computational methods
- Accelerate Innovation in NE technology
- CASL and NEAMS coordinate activities to avoid duplication of efforts

CASL Consortium for Advanced Simulation of LWRs

NEAMS NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM



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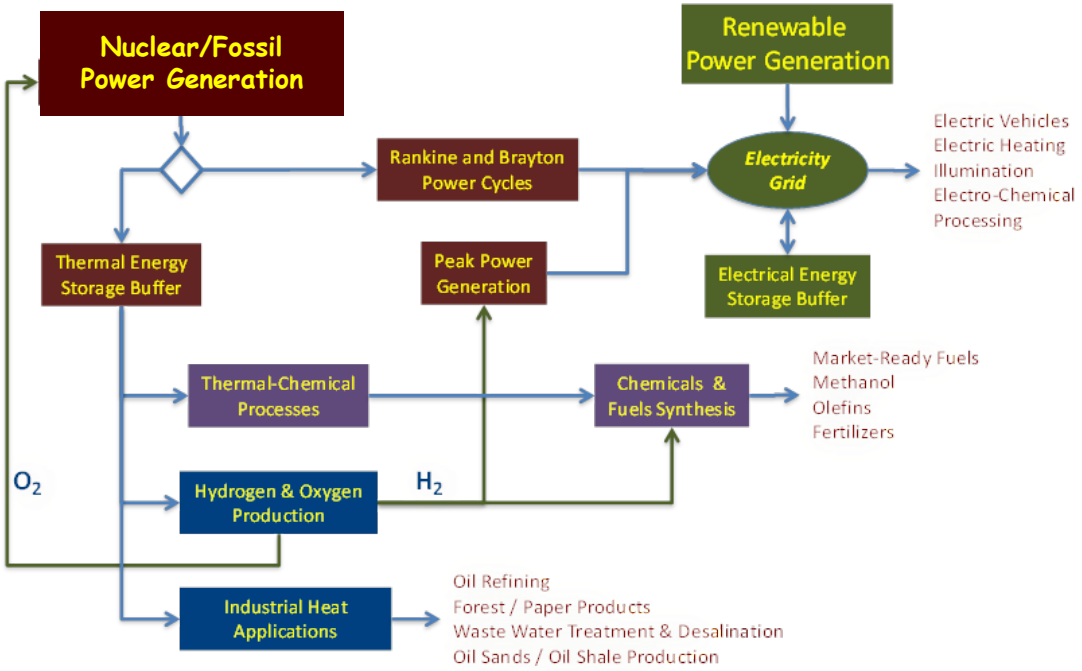
Hybrid Energy Systems Study

- The Offices of Nuclear Energy and Energy Efficiency and Renewable Energy have agreed to sponsor a study of Hybrid Energy Systems. Study will examine optimizing clean energy sources (intermittent and baseload) to produce clean energy products



- Kickoff workshop will occur July 8 through July 10 at Idaho National Laboratory. Academia, industry, and international participants are invited.

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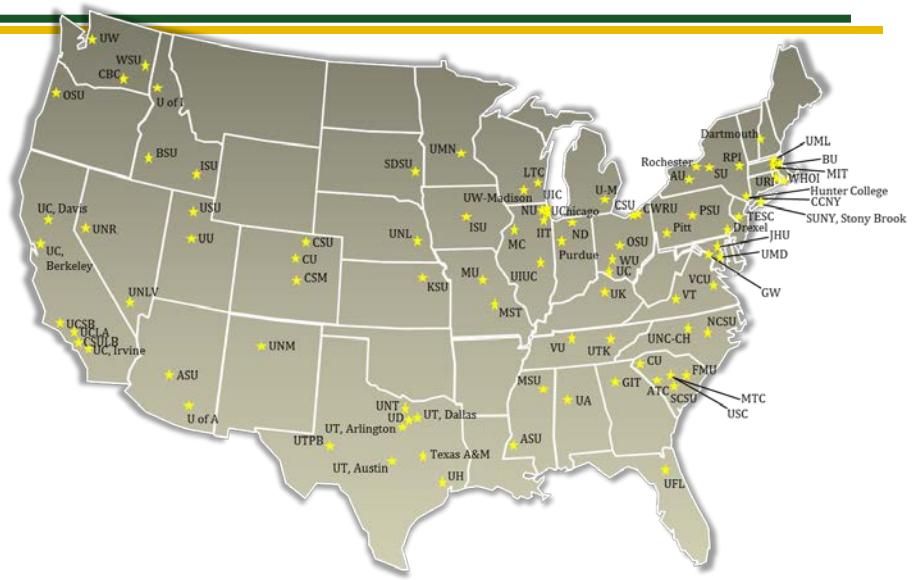
Nuclear Energy University Programs (NEUP)
Integrated University Program (IUP)

- **NEUP and IUP have well-established, competitive processes for awarding R&D and infrastructure projects and scholarship/fellowship grants.**
  - FY 2014 IUP awards: 42 scholarships and 33 fellowships, totaling $5.3M announced on May 9, 2014
  - FY 2014 NEUP awards will be announced in late July, totaling an estimated $50M for IRP, R&D and Infrastructure projects



Since FY 2009, NE has awarded $295M to 92 schools in 37 States and the District of Columbia.

- **The NE R&D Programs are the cognizant technical managers of these competitive R&D awards and therefore play in integral role in the success of each project.**
  - Universities, national laboratories, industry, and international research partners are strongly encouraged to actively engage and collaborate with the NE R&D programs.

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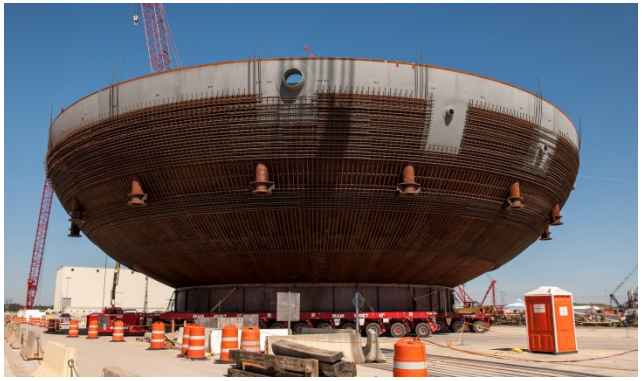
Global Demand for Nuclear Energy Continues

Sanmen – April 2014

Source: SNPTC

Summer – June 2014

Source: SCE&G



Vogtle – May 2014

Source: Georgia Power Co.

Haiyang – December 2013

Source: State Nuclear Power Engineering Feng Qingyi Wang Jinjie.