



U.S. DEPARTMENT OF  
**ENERGY**

**Nuclear Energy**

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# **Nuclear Infrastructure Support**

presentation to  
US Energy Association Panel

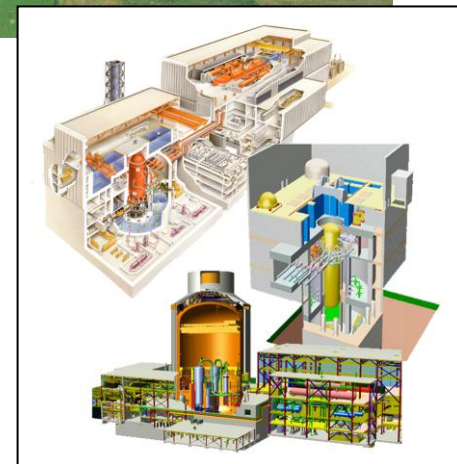
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November 9, 2010



# Activities in Infrastructure Development

- Three studies on nuclear infrastructure conducted:
  - “U.S. Job Creation Due to Nuclear Power Resurgence in the United States,” November 2004
  - “DOE NP2010 Nuclear Power Plant Construction Infrastructure Assessment,” October 2005
  - “Viability of Developing a U.S. Domestic Source for Large Forgings for Nuclear Power Plants,” March 2010
- Research support to the Nuclear Fabrication Consortium
- Advanced Methods for Manufacturing being launched
- Government Support for Nuclear Education
  - DOE Nuclear Energy University Program
  - Nuclear Regulatory Commission Education Program





# **“U.S. Job Creation Due to Nuclear Power Resurgence in the United States”**

## ■ 2004 INEEL Report on Job creation:

- Determined the potential impact on the number of manufacturing jobs in the US resulting from new construction
- Assumed the need for and additional 355 GWe of electricity by 2020 with 50 GWe coming from new nuclear generation capacity
  - Construction of the first unit was assumed to begin in 2009
- Results from the model show that approx. 610,000 jobs would be added to the U.S. economy by:
  - Repatriating 37,000 to 38,000 nuclear manufacturing jobs,
  - Adding 72,00 to 79,000 plant construction and operating jobs.
  - Adding another 181,000 to 250,000 Indirect jobs in the nuclear power industry
  - Inducing an additional 218,000 to 242,000 jobs in the non-nuclear industries throughout the country



# **“DOE NP2010 Nuclear Power Plant Construction Infrastructure Assessment”**

## **■ 2005 MPR Associates report on the adequacy of construction infrastructure concluded:**

- Manufacturing and fabrication, labor, and construction equipment infrastructure is adequate for up to 8 nuclear units through 2017
- Several areas are limited and there are some open issues related to codes and standards
  - Digital Plant Control System and Plant Simulators
  - Reactor Pressure Vessel Nuclear-Grade Large Ring Forgings
  - Qualified Personnel (boilermakers, pipefitters, electricians, and ironworkers in short supply)
- Recommended Action Plan
  - NRC should modify their procedures for design, review and approval of digital control systems
  - NSSS vendors and EPC contractors should complete plant design (ex. Routing of small bore piping, tubing and conduit)
  - EPC contractors should negotiate and sign a national labor agreement with major labor unions
  - NRC, Utilities, NSSS vendors and component and material suppliers, and EPC contractors should ensure that appropriate QA and QC program are in place
  - Nuclear Power Operators should recruit and train health physicists, operators, and maintenance technicians at current plants to serve as replacements at future plants



## **“Viability of Developing a U.S. Domestic Source for Large Forgings for Nuclear Power Plants – A Cost/Benefit Study”**

### ■ Published in March 2010, the MPR study found:

- Including Japan Steel Works, there are several forging facilities internationally (France, Russia, China, and Korea)
- Their combined capability exceeds demand even under best case conditions through 2030
- US demand ranges from 10 to 50 reactors by 2030
- Excess capacity in 2030 is projected at 4 to 16 reactor vessel sets
- No evidence of real plans by any major suppliers or NSSS vendors to establish an ultra-large forging facility in the US.
  - Cost for new facility is about \$2 billion
  - Would take about 7 years to build
- Some interest by existing small-scale forging suppliers (Elwood City, Jorgensen, Forging, Lehigh Heavy Forge and ArcelorMittal Steel) but they would need substantial government support.



## **“Viability of Developing a U.S. Domestic Source for Large Forgings for Nuclear Power Plants” *Continued...***

### ■ Report Conclusions

- No favorable benefit to support industry at this time as international suppliers would take market share before a US facility is completed
- Targeting smaller forging market is consistent with potential shift in US nuclear power design focus
- Encourage industry to focus on forging special materials like stainless steels, special corrosion resistant alloys for non-water coolants, and high strength or high temperature alloys





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# Nuclear Fabrication Consortium R&D with Edison Welding Institute

- Help stimulate advanced fabrication approaches/technology
- Focus on advanced welding, inspection methods, modularization, and fabrication
  - Advanced non-destructive examination technology
  - Advanced welding processes
    - Laser Beam Welding
    - Electric Beam Welding
    - Hybrid Laser Arc Welding
  - Modularization and fabrication techniques
    - Ultrasonic machining
  - Real-time weld quality inspection
  - Field demonstration of advanced welding processes





## **Advanced Methods for Manufacturing (AMM)**

- Under Cross-cutting Technologies within the newly requested Nuclear Energy Enabling Technologies
- Focuses on fostering advanced manufacturing and fabrication technologies and the enhancement of construction methods and management techniques
  - Draws upon successful practices in the aircraft, and shipbuilding industries that could accelerate nuclear plant construction
  - Employs the modeling and simulation capabilities of the National Labs to validate and optimize new technologies.
  - Technologies or techniques pursued are independent of reactor type and are broadly applicable to the industry





# Advanced Methods for Manufacturing Planned Accomplishments

## Improving the quality and economics of equipment and component modules fabrication and manufacturing

### ■ FY 2011 Planned Achievements

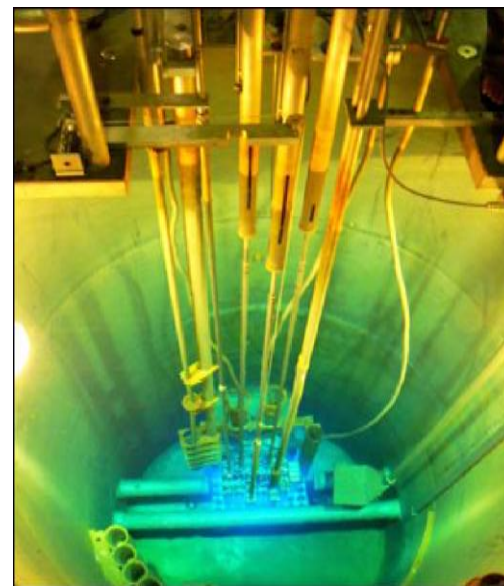
- Initiate a detailed research roadmap effort that crosscuts key DOE programs and addresses technology risks associated with this program area
- Initiate competitively selected, peer-reviewed, high-potential R&D projects with universities, industry, and laboratories across a variety of manufacturing and fabrication technologies





# Nuclear Energy University Program Mission and Program Objectives

- IUP Mission – Provide scholarship and fellowship grants to support training of engineers and scientists in nuclear engineering, nonproliferation, nuclear forensics, and nuclear safeguards missions.
- IUP Objectives – Sustain future workforce for nuclear renaissance and NE Research and Development (R&D) mission via collaboration between the Office of Nuclear Energy (NE), the National Nuclear Security Administration (NNSA), and the Nuclear Regulatory Commission (NRC). Avoid duplication of effort.
- NEUP Mission - As part of NE R&D mission, engage U.S. university community to provide resources to conduct Program Directed, Program Supporting, and Mission Supporting R&D, related infrastructure improvements, and student fellowship/scholarship grants supporting university-based nuclear science and engineering research.
- NEUP Objectives – Support the NE R&D Roadmap objectives while bolstering university R&D infrastructure, especially research reactors.





## NE Funding for Universities

- More than 20% of the NE R&D budget will be used to support university-based activities
- Up to 20% of the NE R&D budget is allocated to the peer-reviewed NEUP
  - Support for infrastructure, students, and research and development are all components of the NEUP scope
  - All on-going and new University-supported activities directly funded by DOE-NE will be included in NEUP (M and S Hub program is the one exception)
- Other NE University Investments Outside NEUP
  - NE funds fuel management support for University-based Research Reactors
  - National Laboratories use NE R&D funds to support specific R&D or support efforts at universities



## NRC Education Grant Programs

### ■ Curriculum Development (\$5M)

- Supports courses, studies, training, curricula, and disciplines pertaining to nuclear safety, nuclear security, nuclear environmental protection, and other fields that the Commission determines to be critical to NRC's regulatory mission
- ~\$200,000 over 2 years

### ■ Other Programs (\$15M)

- Scholarships – 2 years, \$10,000 per student per year, awarded to institution (\$200,000)
- Fellowships – 4 years, \$50,000 per student per year, awarded to institution (\$400,000)
- Faculty Development – 3 years, \$150,000 per year plus institution match (\$450,000 + \$150,000)
- Trade schools/community colleges – 1 year, \$10,000 per student (\$150,000)