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Engineering Deans Institute 2015
The Future of Nuclear Energy

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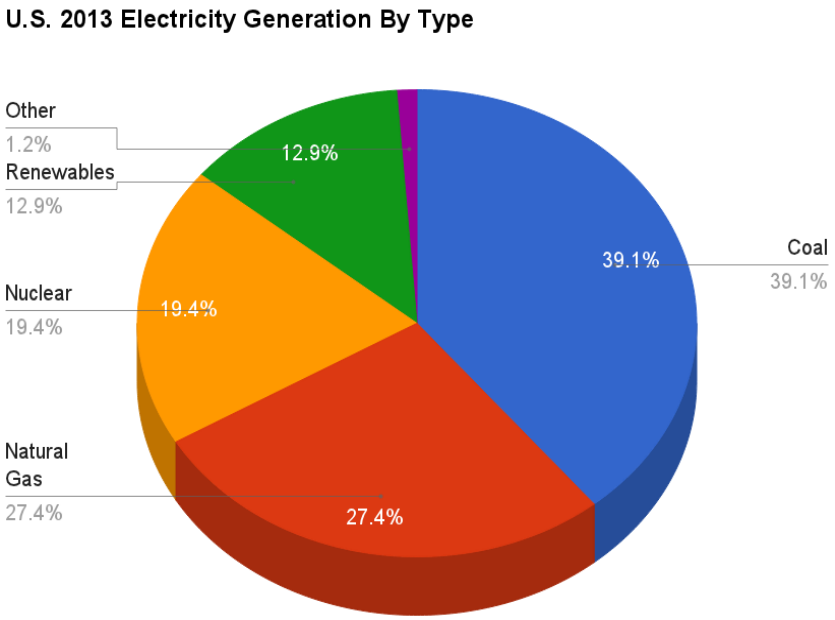
FLUOR • NEWPORT NEWS NUCLEAR • HONEYWELL

Nuclear at a Crossroads

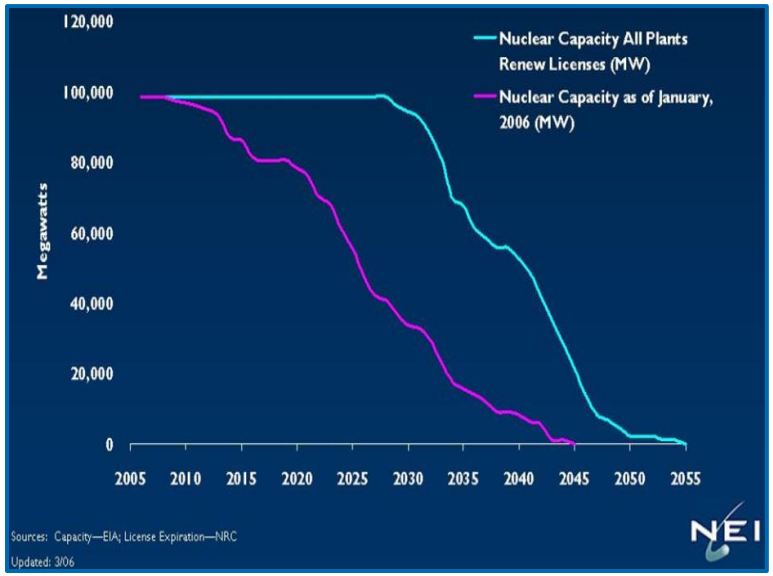
- **US nuclear produces 60% of carbon-free energy**
  - Lowers all emissions from the power sector
  - Only carbon-free baseload source
- **Part of a sustainable energy system**
  - Public support at 57% post-Fukushima
- **Energy security and climate change mitigation are allies**
  - Eliminates 650 million tons of carbon annually
  - Improves energy security by supporting fuel diversity

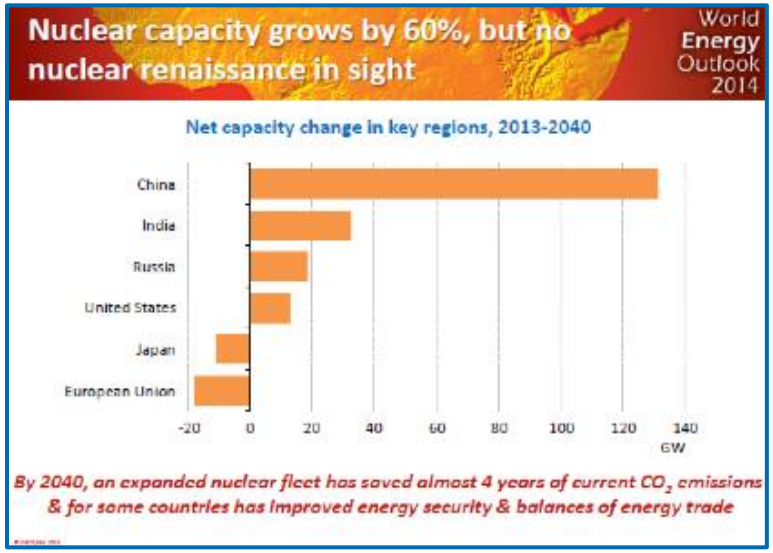



Vogtle Electric Generating Plant

Challenges to a Nuclear Future

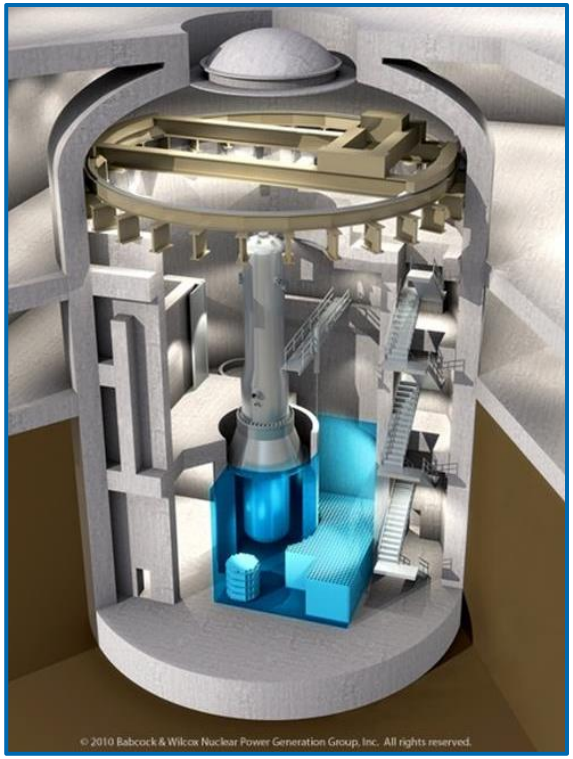
- **US operating fleet reaches end of life**
  - Loss of 100 gigawatts of carbon-free power by mid-century
  - Only 5 new builds
  - Only 11 of 24 new license applications active
- **Economics**
  - 5 US reactors shut down – can't compete with natural gas boom
  - Large investments; long build times
  - Cost pressure in unregulated markets
  - Government subsidies for other renewables
- **Approximately 60% increase forecast in 25 years worldwide**
  - Barely maintains world market share at 12%
  - 72 reactors under construction

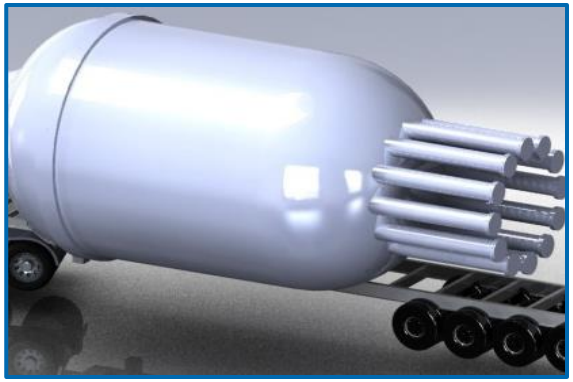




Potential of Small Modular Reactors (SMR)

- **SMRs to lower financing barriers**
  - Standardized units; factory built
  - Less than 300 Mwe
  - Standard design reduces risk
  - Right size to replace aging coal-fired plants
  - Developing countries or islands
- **Challenge is to demonstrate a business plan**
  - Complete design & licensing
  - Demonstrate first-of-a-kind deployment
  - Meet pricing targets and minimum order goals
  - Build infrastructure/supply chain





Artist renderings of SMR

DOE Supports R&D in All Energy Sectors

- **$9.8B for energy and research programs including:**
  - Electricity Delivery and Energy Reliability $180M
  - Energy Efficiency and Renewable Energy $2.3B
  - Fossil Energy $711M
  - Nuclear Energy $863M
  - Science $5.1B
  - Advanced Research Projects Agency—Energy $325M
- **Funds research at 300 universities**

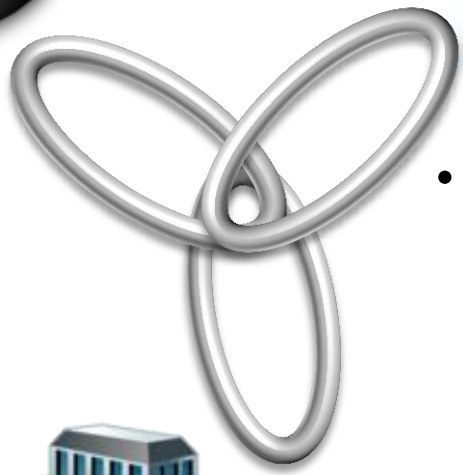
DOE Launching Energy Crosscut Teams

- **Grid Tech Team**
  - Significant scale-up of clean energy
  - Universal access to consumer participation and choice
  - Holistic design
  - Two-way flows of energy and information
  - Reliable, secure (cyber and physical), and resilient
- **Water Energy Tech Team**
- **Subsurface Tech Team**
- **Advanced Computing Tech Team**
- **Supercritical CO_2 Tech Team**
- **Clean Energy Manufacturing Tech Team**

Clemson University Wind Turbine Drivetrain Test Facility

Working Together on the Future of Energy

- **Academia**
  - Creates talent pipeline
    - Technical/science degrees
    - Finance and business
    - Policy and government
  - Supports ongoing R&D
    - Develops advanced concepts



- **National Labs**
  - Brings teams together to evaluate options
  - Provides opportunities for students/post-docs
  - Integrates R&D with academia, government and industry
  - Provides user facilities

- **Industry**
  - Defines problems
  - Supports R&D
  - Validates options
  - Deploys solutions