All-of-the-Above Nuclear Future

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Senior Director, New Plant Licensing

World Nuclear Association Workshop
Technical and Regulatory Issues Facing Nuclear Power Plants
June 1, 2016

All-of-the-Above Nuclear Future

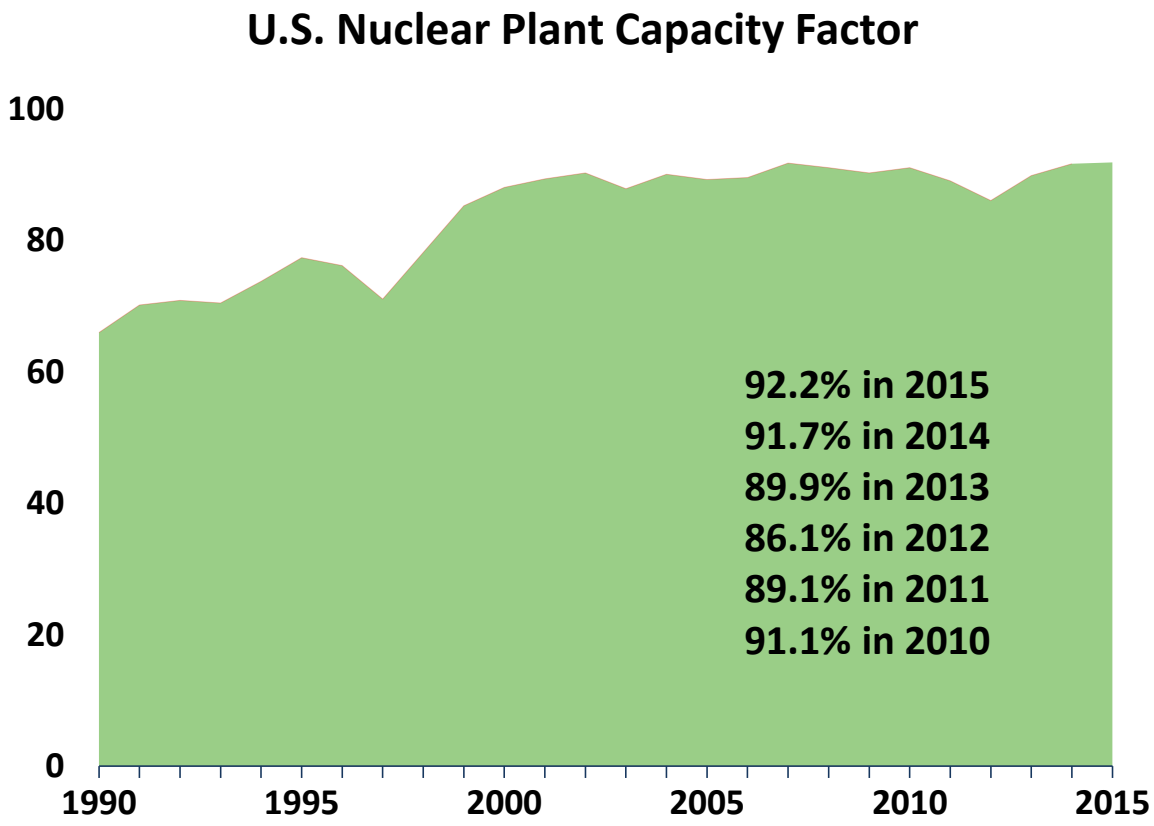
- Current fleet – Delivering the Nuclear Promise
- Second License Renewal
- New Plants
  - Large light water reactors
  - Small modular reactors
  - Advanced, non-LWRs

U.S. Energy Outlook

- By 2040, U.S. electricity demand is expected to increase 28 percent
- Increasing demands for our electricity to be clean and carbon free

Exceptional Performance in 2015

- U.S. reactors set record 92% capacity factor
- Nuclear plants generated 798 billion kWh in 2015



Source: Energy Information Administration

Premature Nuclear Plant Shutdowns

Plant	MWe	Reason	Closure Year	Latest Electricity Generated (billion kWh per year)	Latest CO2 Emissions Avoided (million tons/year)
Crystal River 3	860	Mechanical	2013	7.0	5.3
San Onofre 2 & 3	2,150	Mechanical	2013	18.1	8.8
Kewaunee	566	Market	2013	4.5	4.8
Vermont Yankee	620	Market	2014	5.1	2.7
FitzPatrick	848	Market	2016-17	5.8	3.2
Pilgrim	677	Market	By 2019	5.8	3.1
Oyster Creek	615	Policy	2019	4.9	3.9

- 6,336 MWe of baseload capacity
- 35.1 million short tons of CO_2 avoided
- 8.5% of Clean Power Plan's 2030 414-million-ton target
- Approximately 6,000 direct jobs

Risks and Stresses Facing Nuclear Power

Risks Beyond Our Control

- Flood of low-cost gas
- State mandates and federal subsidies for renewables
- Distributed generation
- Unexpected capital requirements

Risks Within our Control

- Industry costs
- Regulatory costs
- Market structure
- Market policies and practices
- Operational risks

U. S. Industry at a Crossroads

- Our industry is operating in electricity markets that are deluged with natural gas at historically low prices
- Nuclear industry capability factor and reliability is at extraordinary levels…but total generating costs at nuclear plants have increased 28% in the last 12 years.
- “Business as usual” approach will not successfully address the challenges of rising costs and inadequate revenue
- Must advance safety, reliability and economic performance together.

Industry's Response to the Challenge

Delivering the Nuclear Promise

3 Strategic Focus Areas

Maintain Operational Focus

- Safety remains our top priority
- Advancing safety, reliability is foundational
- Fundamental to continued operations

Increasing Value

- Generating additional revenue
- Value for unrecognized attributes
- Electricity market reform
- Clean Power Plan benefits

Improve Efficiency

- Industry-identified focus areas
- Improve efficiency of industry oversight
- Evaluating enablers for cost reductions
- Industry target: 30% cost reduction
- Companies determine pace/breadth of reductions

Chief Nuclear Officer-Led Teams

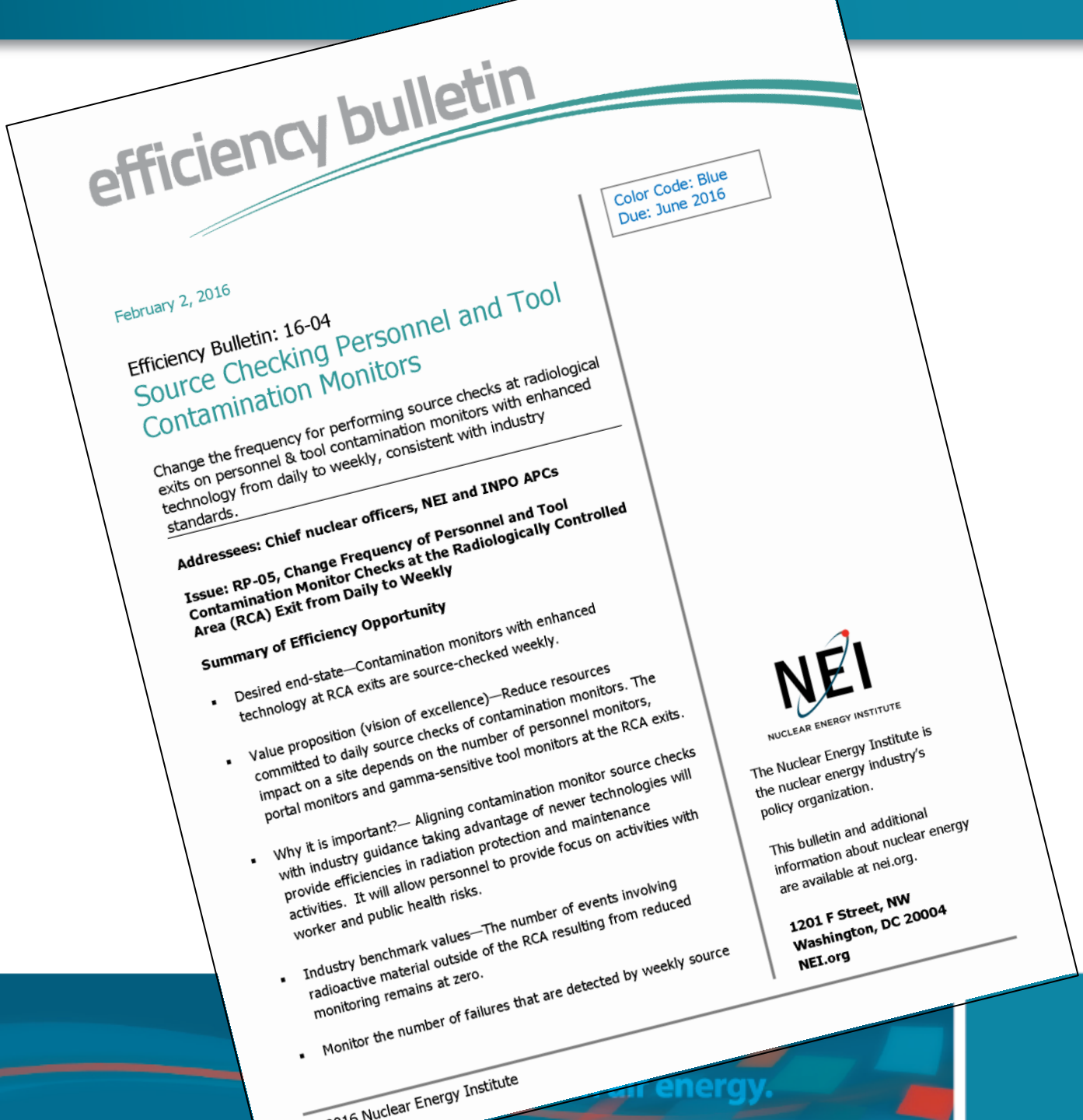
- Corrective Action Program
- Engineering (incl. Comp. Classification)
- Preventive Maintenance
- Radiation Protection
- Regulatory Efficiency
- Oversight and Assessment
- Security
- Supply Chain Efficiency
- Training
- In-Processing
- Transform Organization
- Work Management

Improvement Opportunities Identified

- Based on analysis of costs, CNO-led teams produced over 180 ideas (Improvement Opportunities or IOs)
- These were ranked until 53 initial ideas were identified for pursuit in 2016
- 13 NEI **Efficiency Bulletins** issued so far

Completed Efficiency Bulletins

- EB 16-01: Eliminate Admin. Changes to PM Work Orders
- EB 16-02: Implement Graded Approach to Walkdowns
- EB 16-03: Align Personnel Contam. Event Resp. to Ind. Guidance
- EB 16-04: Source Checking Personnel and Tool Contam. Monitors
- EB 16-05: Non-Licensed Op/Maint and Tech Continuing Training
- EB 16-06: Implementing a Standardized Search and Seal Process
- EB 16-07: Training Task List Reviews
- EB 16-08: Eliminate Formal Margin Management Programs
- EB 16-09: Security Shift Brief and Turnover
- EB 16-10: Reduce Cumulative Impact from the CAP
- EB 16-11: Training Cumulative Impact Strategies
- EB 16-12: Graded Approach to Long-Term Dose Reduction Plan
- EB 16-13: Perform Self-Briefs for Low Radiological Risk Activities



efficiency bulletin

Color Code: Blue
Due: June 2016

February 2, 2016

Efficiency Bulletin: 16-04

Source Checking Personnel and Tool Contamination Monitors

Change the frequency for performing source checks at radiological exits on personnel & tool contamination monitors with enhanced technology from daily to weekly, consistent with industry standards.

Addressees: Chief nuclear officers, NEI and INPO APCs

Issue: RP-05, Change Frequency of Personnel and Tool Contamination Monitor Checks at the Radiologically Controlled Area (RCA) Exit from Daily to Weekly

Summary of Efficiency Opportunity

- Desired end-state—Contamination monitors with enhanced technology at RCA exits are source-checked weekly.
- Value proposition (vision of excellence)—Reduce resources committed to daily source checks of contamination monitors. The impact on a site depends on the number of personnel monitors, portal monitors and gamma-sensitive tool monitors at the RCA exits.
- Why it is important?— Aligning contamination monitor source checks with industry guidance taking advantage of newer technologies will provide efficiencies in radiation protection and maintenance activities. It will allow personnel to provide focus on activities with worker and public health risks.
- Industry benchmark values—The number of events involving radioactive material outside of the RCA resulting from reduced monitoring remains at zero.
- Monitor the number of failures that are detected by weekly source

NUCLEAR ENERGY INSTITUTE

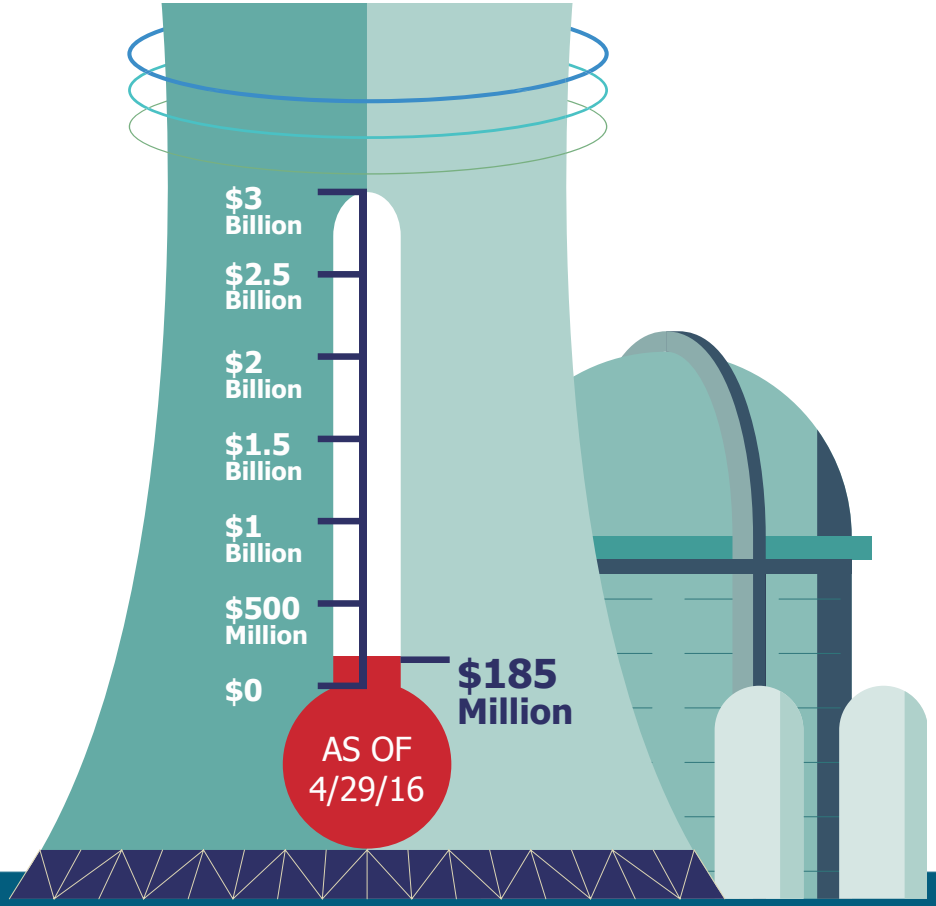
The Nuclear Energy Institute is the nuclear energy industry's policy organization.

This bulletin and additional information about nuclear energy are available at nei.org.

1201 F Street, NW
Washington, DC 20004
NEI.org

Projected Savings from First 13 Bulletins

First 13 bulletins will enable ~$185 million in savings

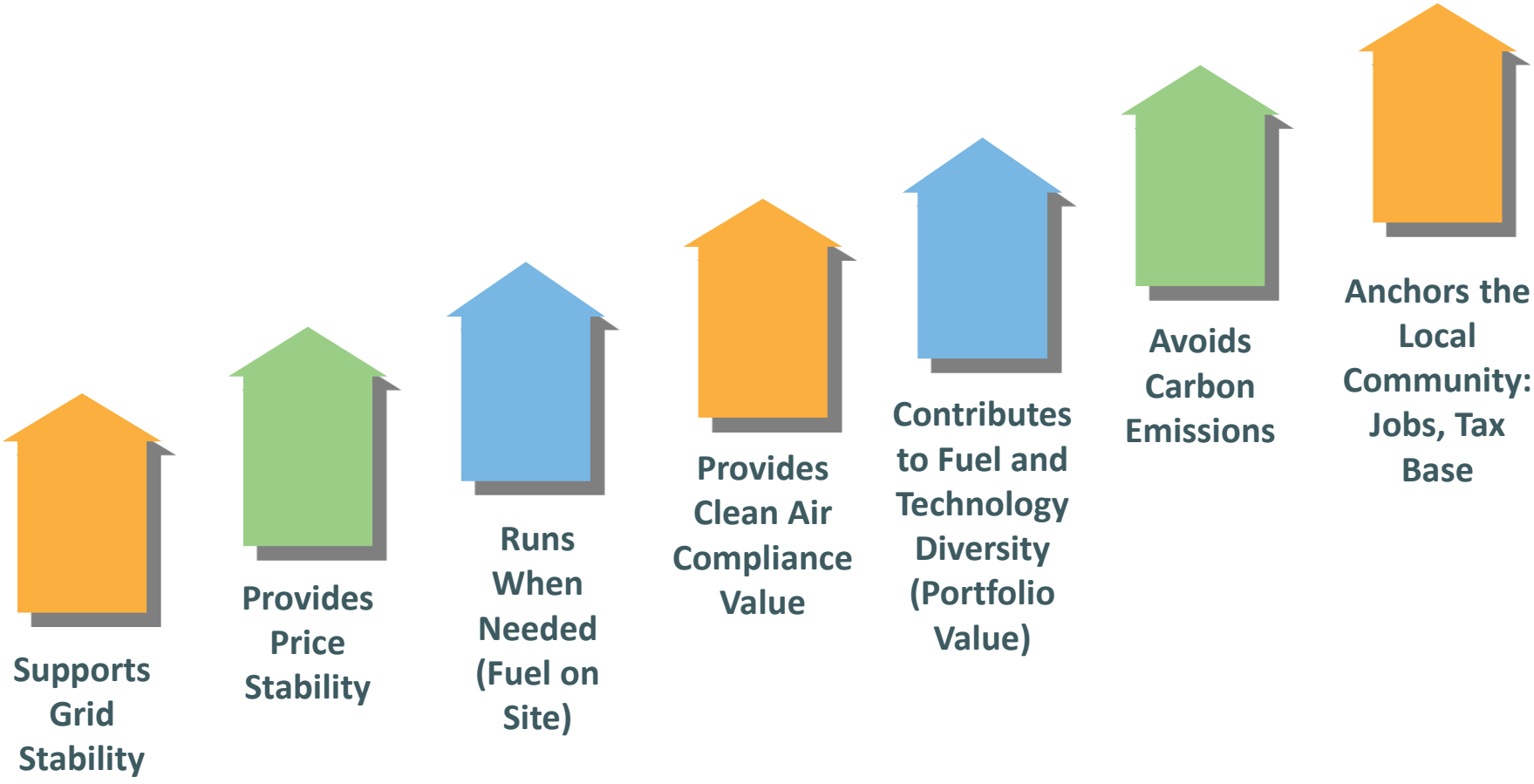


Increase Value Recognition

- Objective: Leverage federal, state policies to ensure recognition of nuclear energy's value in electricity pricing
- Encourage urgency at FERC, RTOs to address defects in competitive market practices
- Ensure Clean Power Plan and state implementation plans recognize value of nuclear power plants

Nuclear Energy's Unique Value Proposition

Safe, Reliable Electricity 24/7 Plus …



Key Promise Takeaways

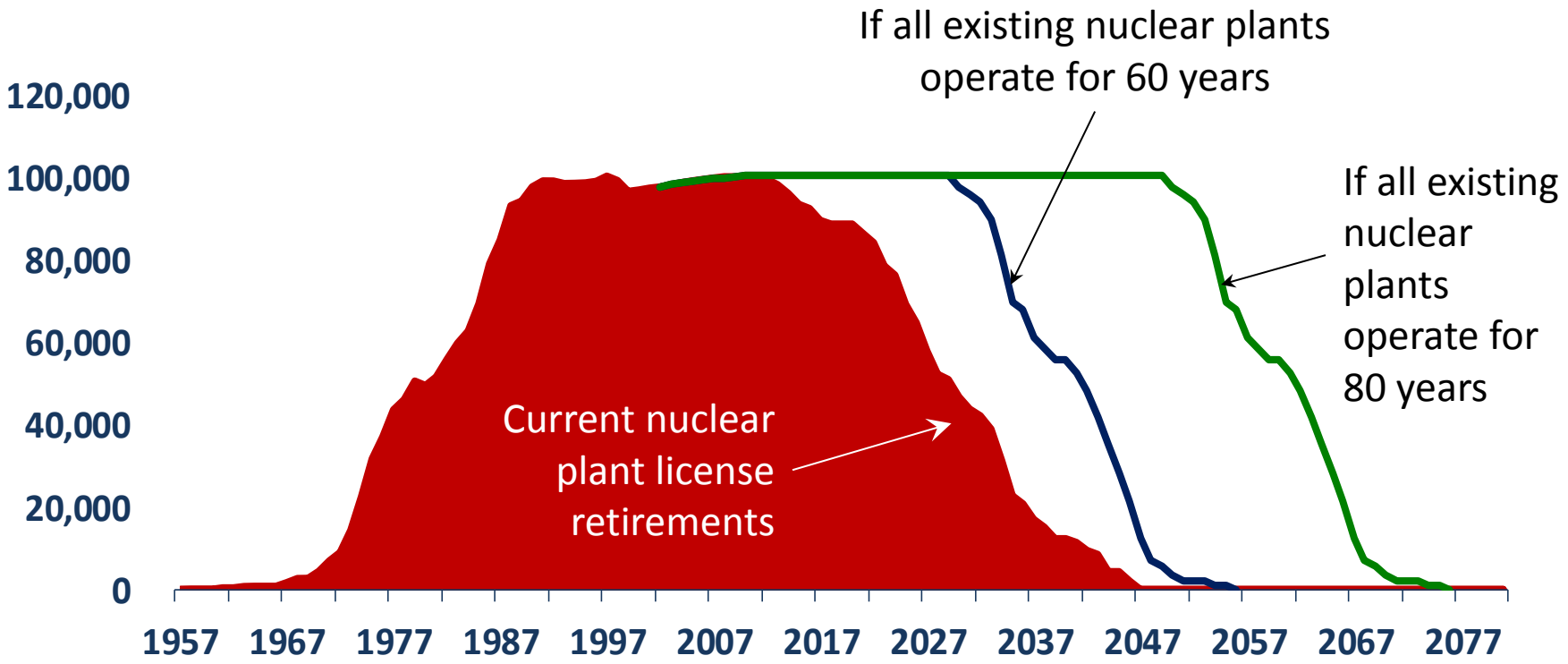
- This is a critical industrywide initiative that will make the industry more efficient and effective
- We will not sacrifice safety to reduce costs
- This initiative has three strategic goals: Maintain operational focus, increase value, improve efficiency
- Stakeholder outreach has been extensive with industry employees, unions and NRC

Second License Renewal

- By 2030:
  - First US nuclear plants will reach 60 years
- By 2040:
  - Half of the nation's nuclear power plants will reach 60 years

Projected U.S. Nuclear Power Capacity

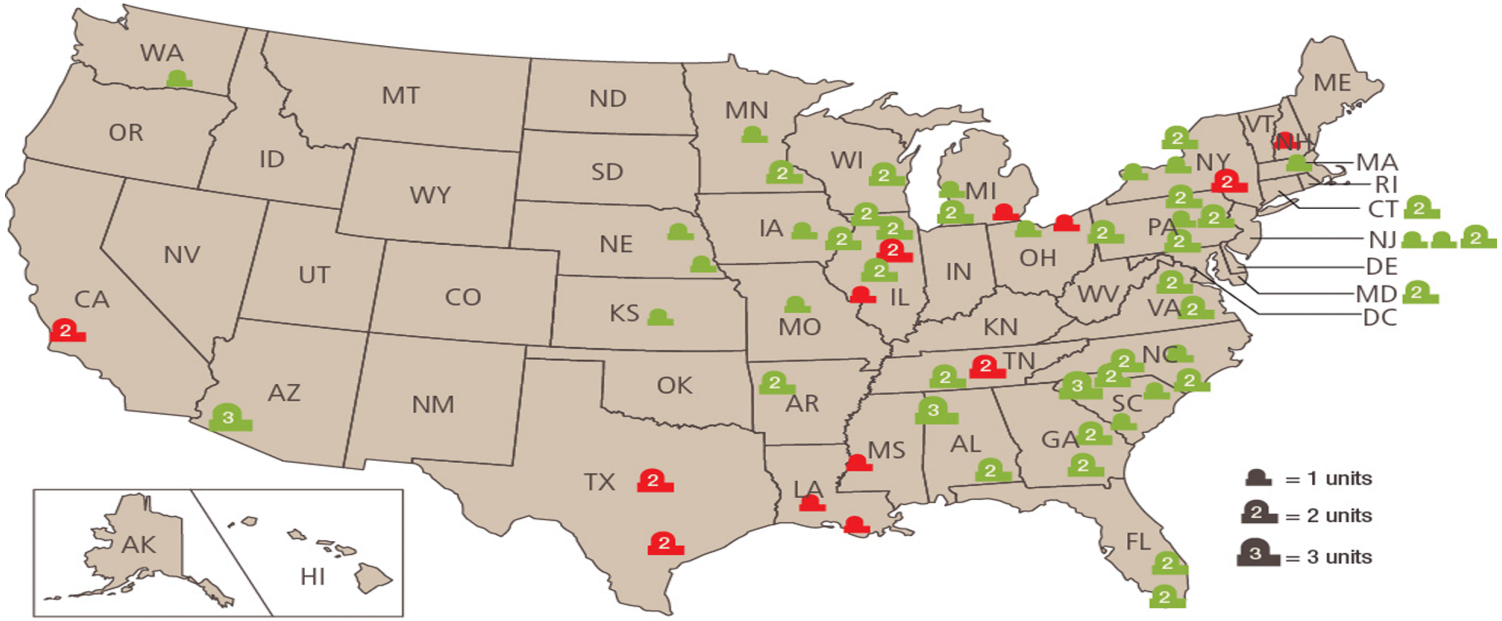
Megawatts



Sources: Energy Information Administration, Nuclear Regulatory Commission

Status of License Renewal

License Renewals Granted for Operating Nuclear Power Reactors



Licensed to Operate (100)

Original License (19) License Renewal Granted (81*)

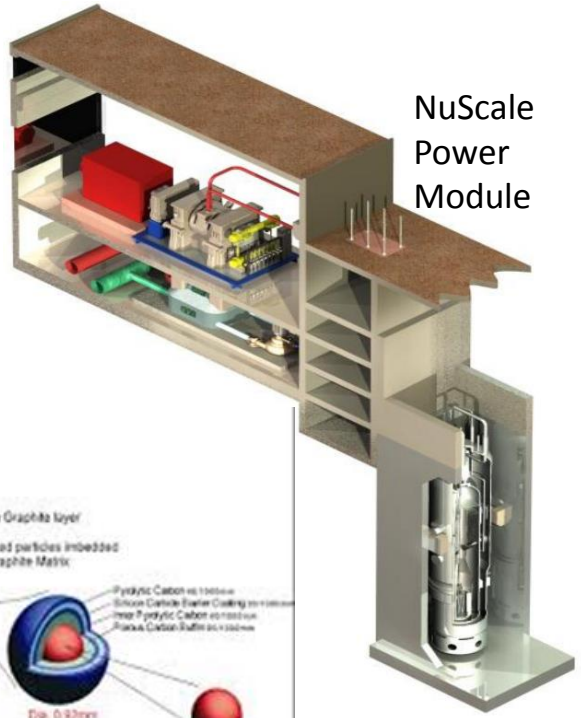
** The NRC has issued a total of 83 License Renewals, two of these units have permanently shut down.*

As of January 2016

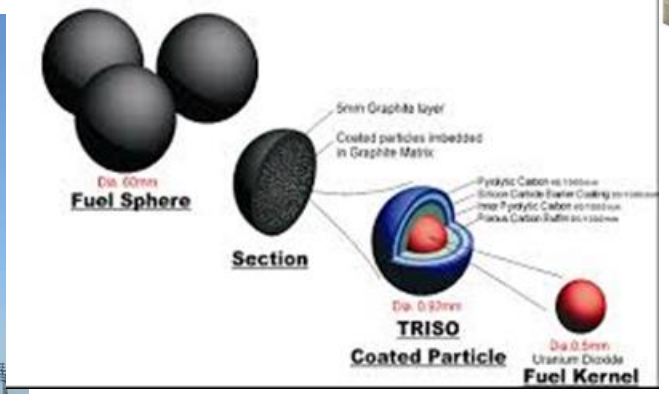
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Expanding the U.S. Nuclear Fleet

- Large light water reactors
- Light water SMRs
- Non-light water reactors



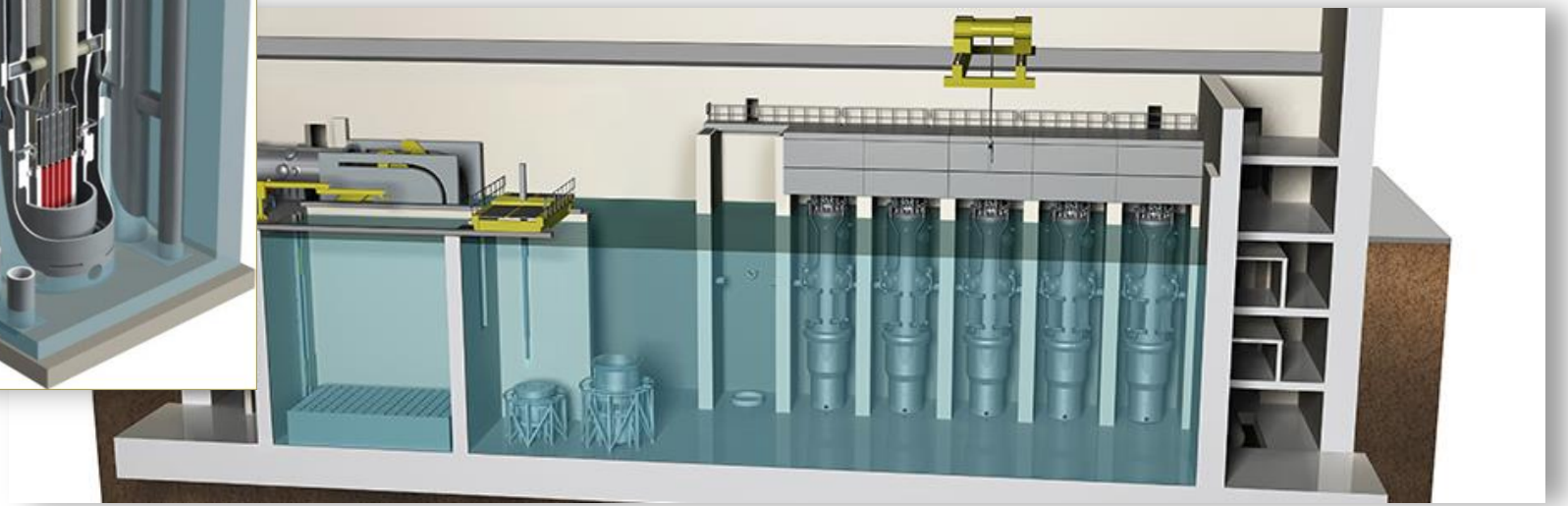
NuScale Power Module




SCE&G Places
CA01 Module in
VC Summer Unit 2

Small Modular Reactors

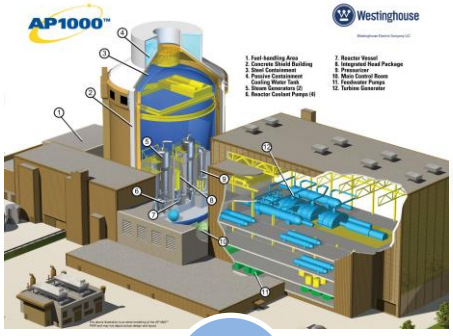
- NuScale Power expects to file design certification for its small modular reactor in 4th quarter
- UAMPS preparing COLA for 2018
  - Utah Associated Municipal Power Systems

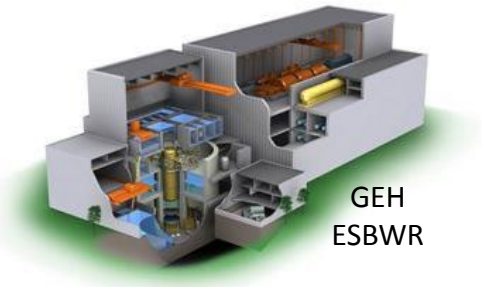


Additional SMR Activities

- Right-sizing NRC requirements
  - Emergency Planning, Security, Control Room Staffing
- Mechanistic source term
- TVA Clinch River early site permit application
  - May 2016
- DOE Licensing Technical Support Program
- SMR Start formed to advocate conditions for SMR commercialization

Continuum of Innovation





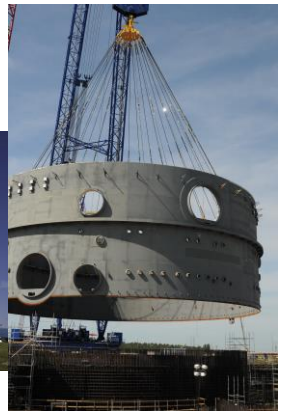
GEH
ESBWR

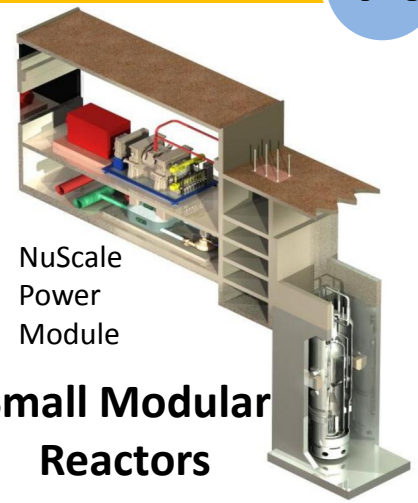
Large LWRs

Advanced Non-LWRs

- Hi-temp gas
- Liquid metal
- Molten salt

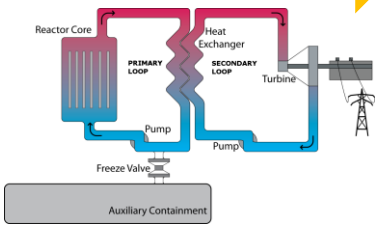
2015 2020 2025

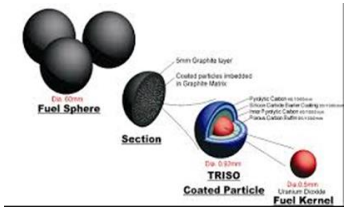




NuScale
Power
Module

Small Modular Reactors






THE U.S. NUCLEAR ENERGY INDUSTRY'S
Strategic Plan for
Small Modular Reactor
Development and Deployment
March 2016
NEI
NUCLEAR ENERGY INSTITUTE
1201 F Street NW
Suite 1100
Washington DC 20004
nei.org
DRAFT
THE U.S. NUCLEAR ENERGY INDUSTRY'S
Strategic Plan for
Advanced Non-Light Water Reactor
Development and Commercialization
Draft 2016
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Providing technology options
Reducing time-to-market
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nuclear. clean air energy.

Non-LWR Advanced Reactors Face Special Challenges

- Energy Policy & Financial
- Technology
- Regulatory

- Policy issues/gaps
- Staged design approval process
- Technology-inclusive regulatory framework
- Licensing process for non-commercial demo reactors

Industry Imperatives

- Delivering the Nuclear Promise
- Second License Renewal
- All-of-the-Above Nuclear Future