Moderators

Commissioner Ann McCabe,

Nuclear Issues Subcommittee Chair, Illinois

James Spearman, Staff Subcommittee Chair, South Carolina

U.S. DEPARTMENT OF ENERGY | Office of Nuclear Energy

Office of Nuclear Energy

NARUC Winter Meeting Presentation

John Kotek

Assistant Secretary for Nuclear Energy, Acting

U.S. Department of Energy

February 16, 2016

Trends in Nuclear

- Recognition of importance of nuclear – today and in the future – in meeting carbon reduction/climate goals
- Concern about financial viability of some currently operating plants, yet large carbon reduction benefits from keeping them running
- Increased interest in nuclear in some domestic and international markets
  - Gen III+
  - SMR technology
- Innovators, some utilities looking at advanced “Gen IV” nuclear as a way to move nuclear beyond electricity
  - Innovators need timely, affordable access to existing and new DOE capabilities

NE Support of US Industry Research and Development

Gateway for Accelerated Innovation in Nuclear (GAIN)

- Provides the nuclear community with access to the technical, regulatory, and financial support necessary to move advanced nuclear technologies toward commercialization while ensuring continued operation of the existing nuclear fleet.
- Integrates and facilitates efforts by private industry, universities and government researchers to test, develop and demonstrate advanced nuclear technologies.

Voucher Initiative

- DOE will fund ~$2 million in vouchers to assist small business applicants including entrepreneur-led start-ups seeking access to knowledge/capabilities available from DOE national labs so GAIN can support strong interest in nuclear energy by many new companies developing advanced nuclear energy technologies.

Energy Technology Commercialization Fund

- ~$20 million allocation from DOE's applied RD&D and commercial application budget to pursue high impact commercialization activities. Established by Energy Policy Act of 2005. Provides matching funds with private partners to promote promising energy technologies for commercial purposes. (NE FY16 = $4.3M)

SBIR/STTR

- NE provides over 3.4% of its applied RD&D funding annually to support small business research addressing focused NE mission areas. (NE FY17 est. $13.6M)

Highlights of the Nuclear Energy FY 2017 Request

FY 2016 Enacted	FY 2017 Request	FY 17 vs FY16 Delta
$986M	$994M	+$8M

Nuclear Energy accelerates integrated waste management implementation with consent-based siting and invests in emerging nuclear reactor designs and advanced fuels.

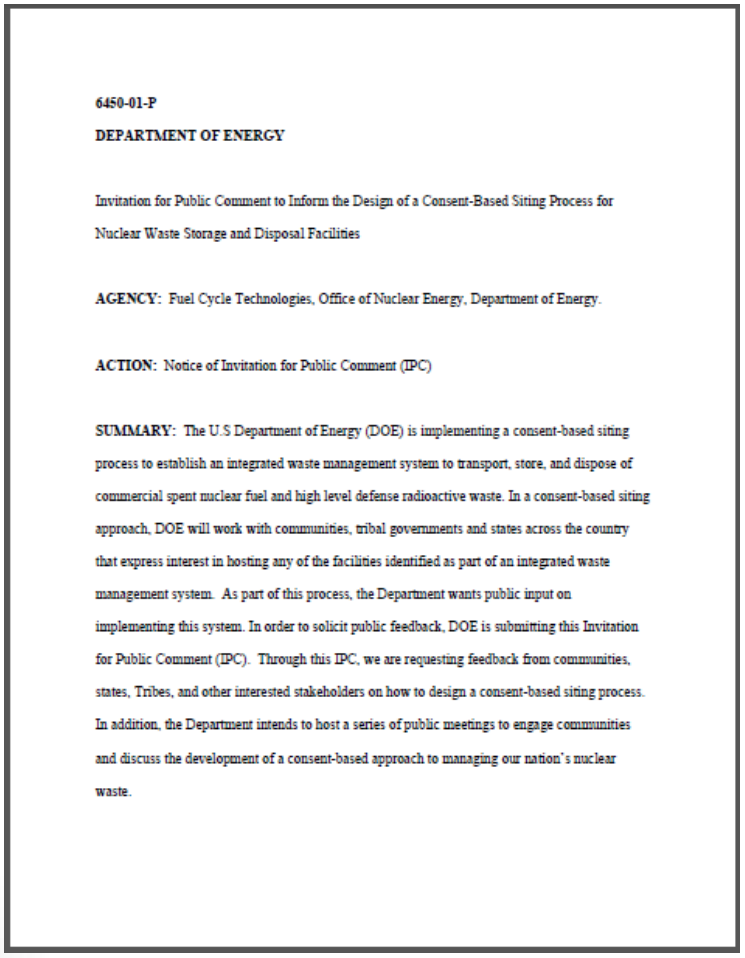
- **Small Modular Reactors ($90M)—**Complete DOE commitment for the NuScale Design Certification (DC) Project – supports NRC review of DC application, NuScale's engineering and analytical efforts to respond to NRC review issues, and work towards finalizing the SMR design.
- **Reactor Concepts ($109M)**— Continue LWRS efforts to maintain carbon free power generation by the current fleet and supports R&D of advanced reactor technologies. Consolidates sCO_2 R&D activities (STEP).
- **Fuel Cycle R&D ($250M)**—Accelerate Integrated Waste Management System storage & transportation and consent-based siting activities; initiate development and qualification phase for accident tolerant fuel to support insertion of a lead test rod or assembly in a commercial reactor by 2022; continue deep borehole field test; and continue collaboration with industry on extended storage of high-burnup used fuel.
- **Nuclear Energy Enabling Technologies ($90M)**— Supports modeling and simulation, cross-cutting technology development, nuclear user facilities, and traineeships for critical nuclear technologies.
- **Idaho National Laboratory ($356M)**—Modernization of facilities and security capabilities, including initiation of 5 year ATR reliability improvement program.
- **International Nuclear Energy Coordination ($5M)** -- Initiates development of a program for international nuclear energy education outreach to support emerging countries developing nuclear energy programs.

NE FY 2017 Congressional Request
Funding Summary

(Dollars in Thousands)

	FY 2016 Enacted	FY 2017 Request
Integrated University Program	5,000	0
SMR Licensing Technical Support	62,500	89,600
STEP R&D	5,000	0
Reactor Concepts RD&D	141,718	108,760
Fuel Cycle R&D	203,800	249,938
Nuclear Energy Enabling Technologies	111,600	89,510
Radiological Facilities Management	24,800	7,000
Idaho Facilities Management	222,582	226,585
Idaho Sitewide Safeguards and Security	126,161	129,303
International Nuclear Energy Cooperation	3,000	4,500
Program Direction	80,000	88,700
Total, Nuclear Energy	**986,161**	**993,896**

Consent Based Siting of Spent Fuel Management Facilities



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DEPARTMENT OF ENERGY

Invitation for Public Comment to Inform the Design of a Consent-Based Siting Process for Nuclear Waste Storage and Disposal Facilities

AGENCY: Fuel Cycle Technologies, Office of Nuclear Energy, Department of Energy.

ACTION: Notice of Invitation for Public Comment (IPC)

SUMMARY: The U.S Department of Energy (DOE) is implementing a consent-based siting process to establish an integrated waste management system to transport, store, and dispose of commercial spent nuclear fuel and high level defense radioactive waste. In a consent-based siting approach, DOE will work with communities, tribal governments and states across the country that express interest in hosting any of the facilities identified as part of an integrated waste management system. As part of this process, the Department wants public input on implementing this system. In order to solicit public feedback, DOE is submitting this Invitation for Public Comment (IPC). Through this IPC, we are requesting feedback from communities, states, Tribes, and other interested stakeholders on how to design a consent-based siting process. In addition, the Department intends to host a series of public meetings to engage communities and discuss the development of a consent-based approach to managing our nation's nuclear waste.

- In December 2015, DOE launched a consent based siting initiative for nuclear spent fuel management facilities.
- As part of this initiative, the Department is requesting public input through an Invitation for Public Comment in the Federal Register. Feedback is requested from communities, states, Tribes, and other interested stakeholders on important considerations in designing a fair and effective process for siting.
- These actions follow Secretary Moniz's announcement in March 2015 that DOE would move forward with the development of a separate repository for defense waste.

The Future of Nuclear Power – A Regulatory Perspective

Dr. Jennifer Uhle
Director, Office of New Reactors
U.S. Nuclear Regulatory Commission

February 16, 2016

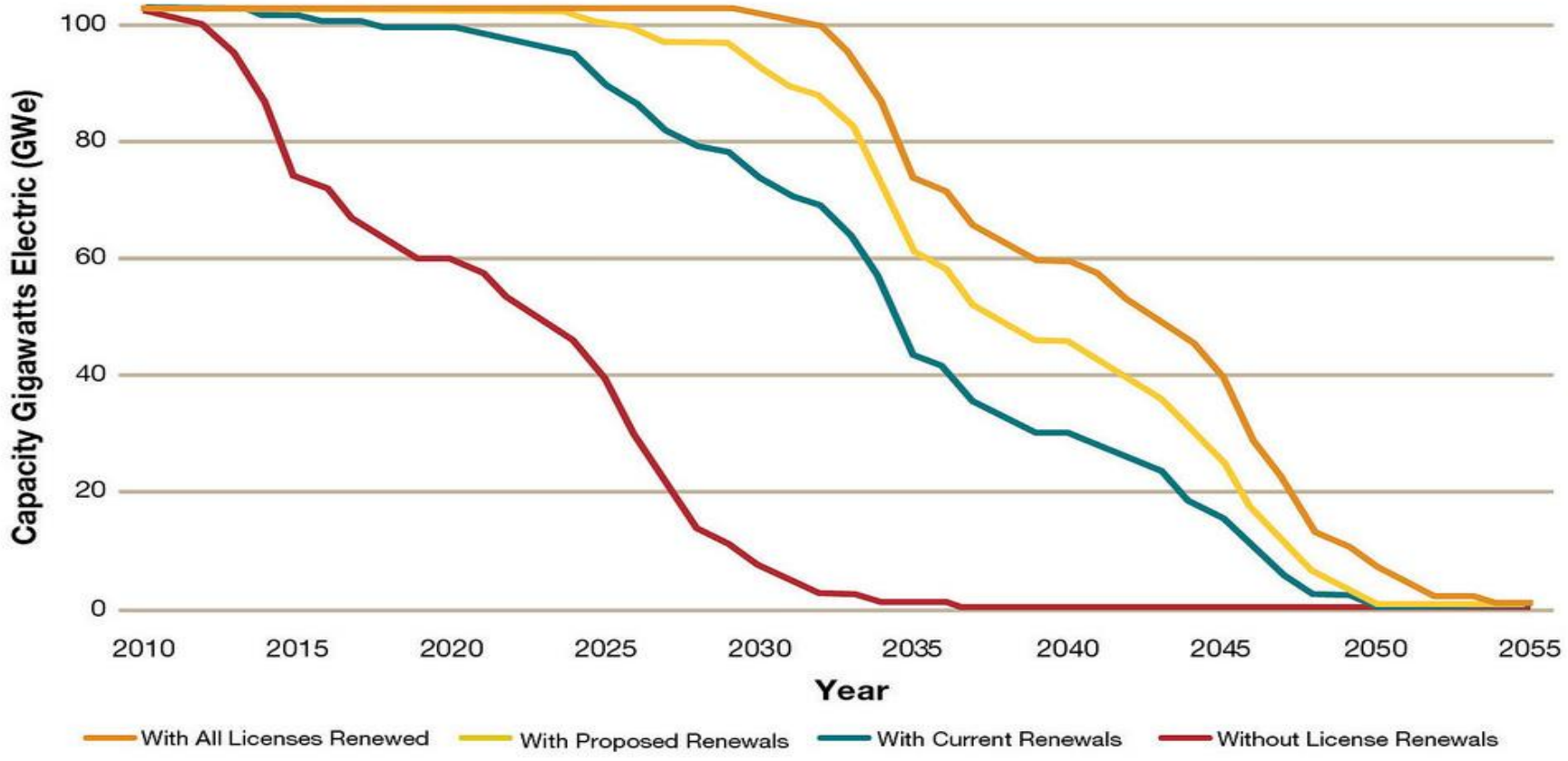
National Association of Regulatory Utility Commissioners (NARUC) Meeting

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

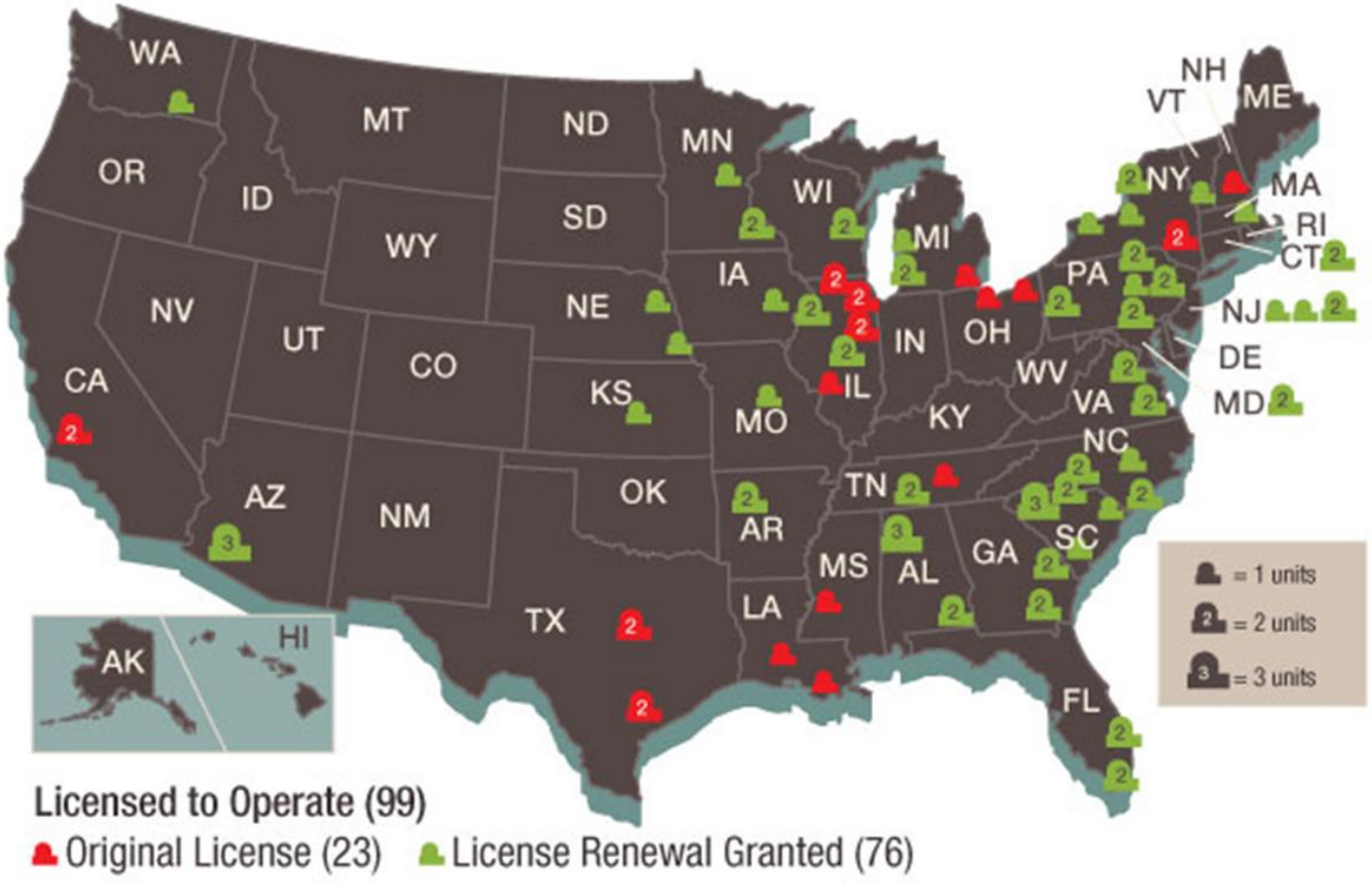
Overview: New reactor designs are vying to replace current light water reactors

- Future nuclear power in the U.S.
- Small Modular Reactors (SMRs) may bring incremental additions of capacity, enhanced safety, lower costs
- Advanced, non-light water reactors are not new in the U.S.
- NRC preparation progress continues but more is needed
- Industry's deployment target timelines
- Non-light water reactor (LWR) preparation challenges
- Future nuclear power capacity options

Projected electric capacity dependent on license renewals



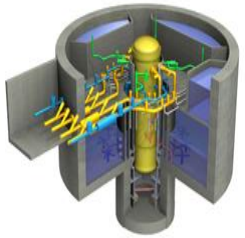
Majority of operating nuclear power reactor licenses renewed



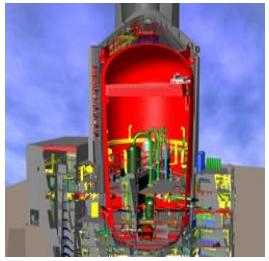
Updated 10/2015

Nuclear designs with enhanced safety features are available today for new construction

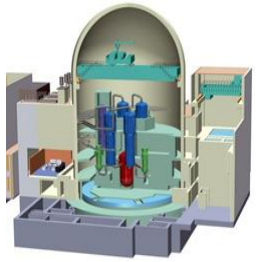
ABWR – 1,300 MWe



ESBWR – 1,500 MWe



AP1000 – 1,110 MWe



US APWR – 1,700 MWe

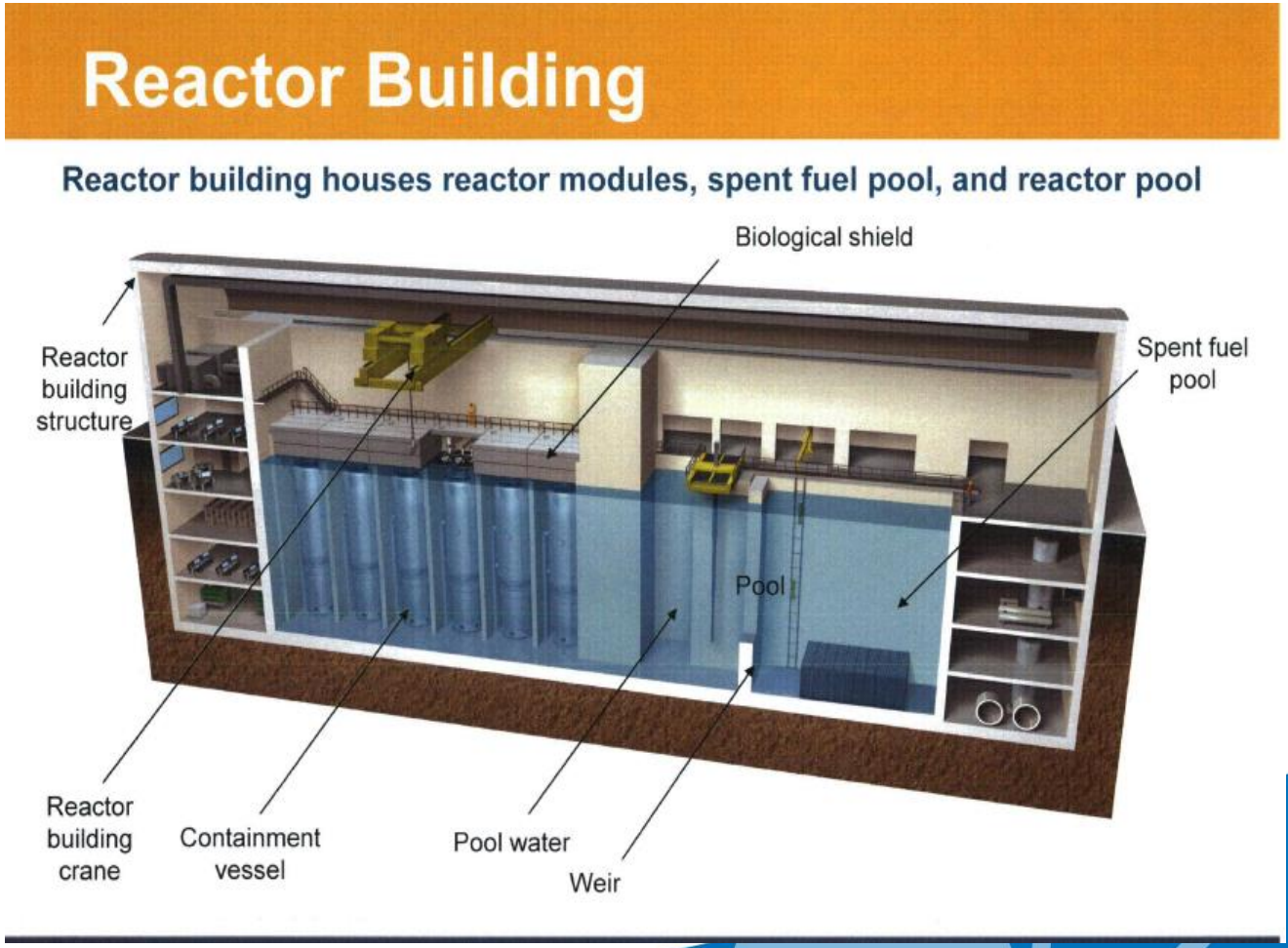
APR1400 – 1450 MWe
***NRC is reviewing this design**

SMRs (light water) may bring incremental additions of capacity increases flexibility in uncertain market

Applicant	Application	Timing
TVA Clinch River	Early Site Permit	May 2016
NuScale	Design Certification	November-December 2016
UAMPS	Combined License	Late 2017/Early 2018
TVA Clinch River	Combined License	Mid-2018

NuScale is a modular design with passive features

- 50 MWe net power/module
- Each module installed in own isolated bay – up to 12 modules
- Natural circulation for normal operations and post- accident

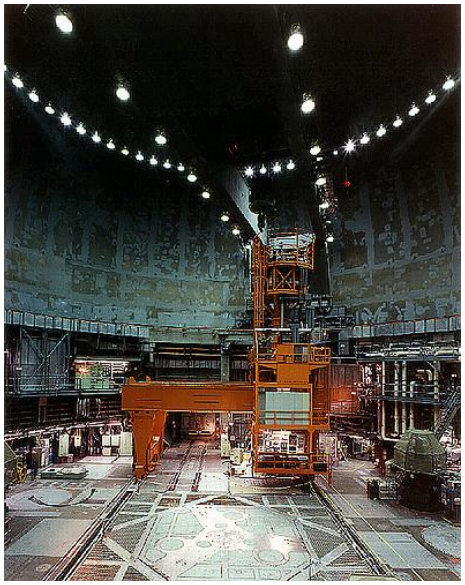


Non-LWRs have been and can be licensed in the U.S. under the current regulatory framework

- Examples include mHTGRs and SFRs

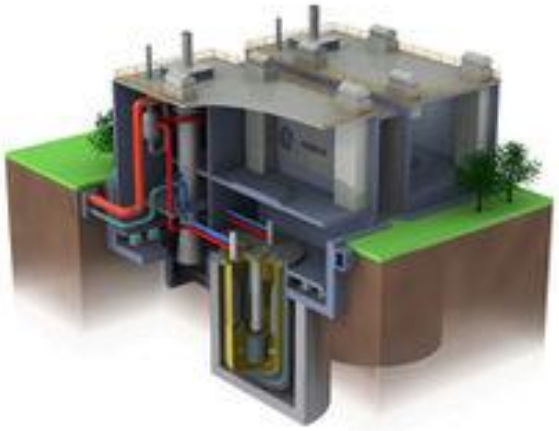
Fort St. Vrain in Colorado 1974 - 1989

EBR- 1 at Argonne National Lab 1951 - 1964



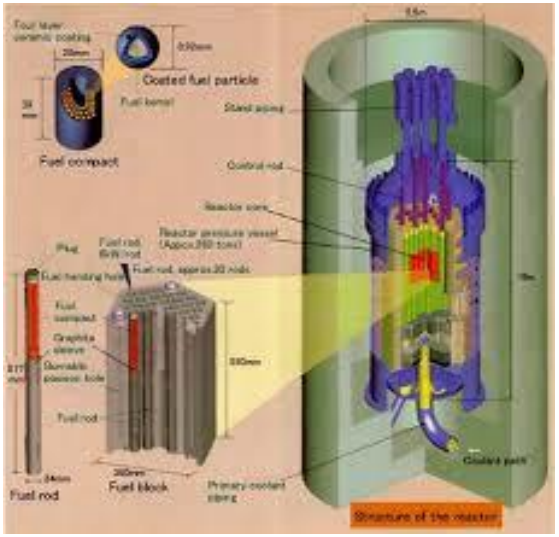
Fast Flux Facility at Hanford 1980 - 1993

New designs that build on existing or previously reviewed technology supports the safety case

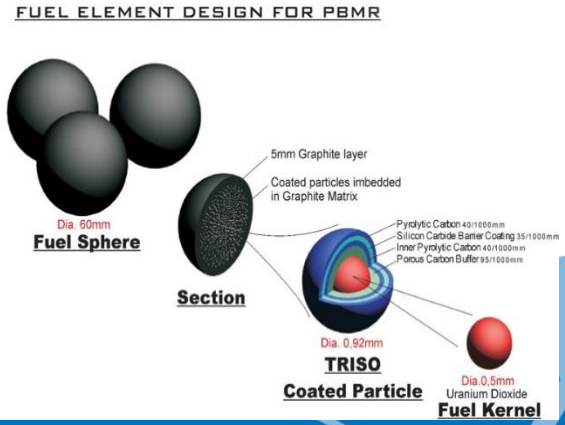


General Electric-Hitachi PRISM is a SFR that builds on EBR II

TRISO particle fuel for a pebble bed mHTGR



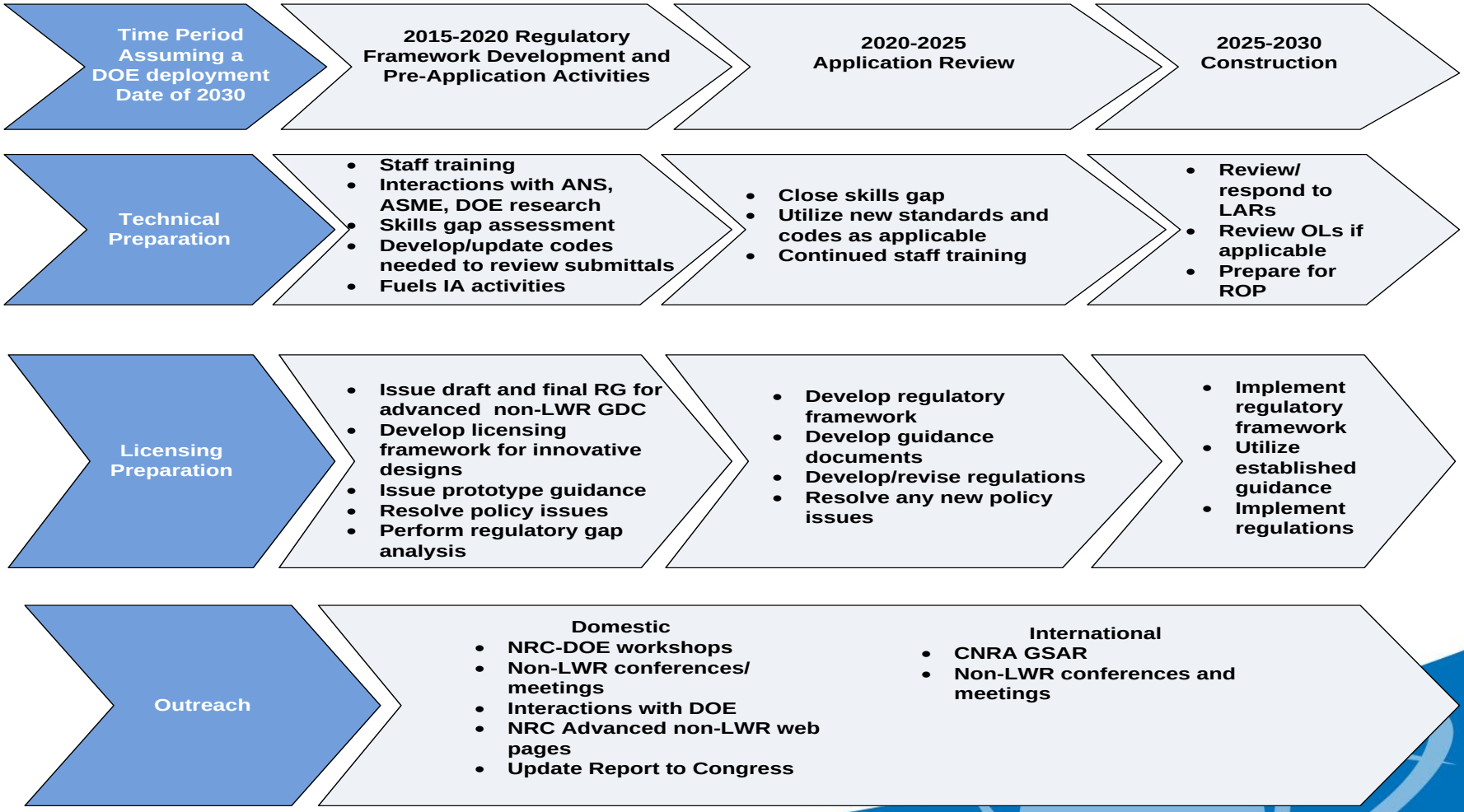
mHTGR



NRC preparation progress continues and more is planned

- Improvements to or creation of guidance and/or regulations to address technical issues specific to non-LWR technologies
- New consensus standards for materials and environments
- Confirmatory research addressing critical topics such as analysis tools, design criteria, and materials performance
- Hire or train staff for non-LWR technologies

Ambitious deployment timelines - NRC targets industry needs

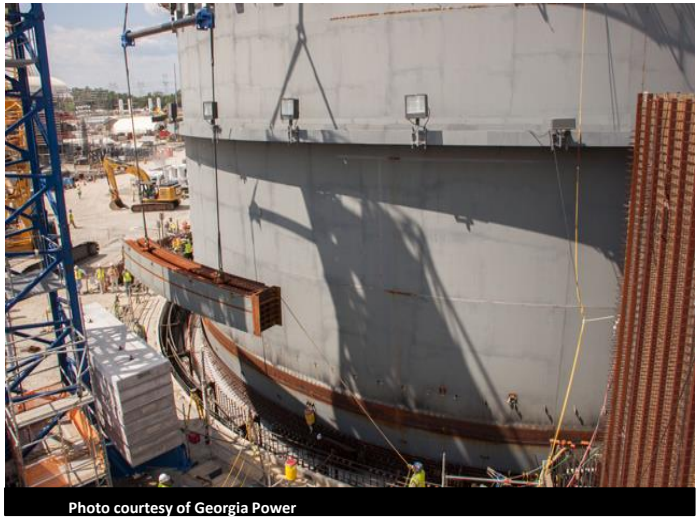


NRC Non-LWR preparation challenges exist

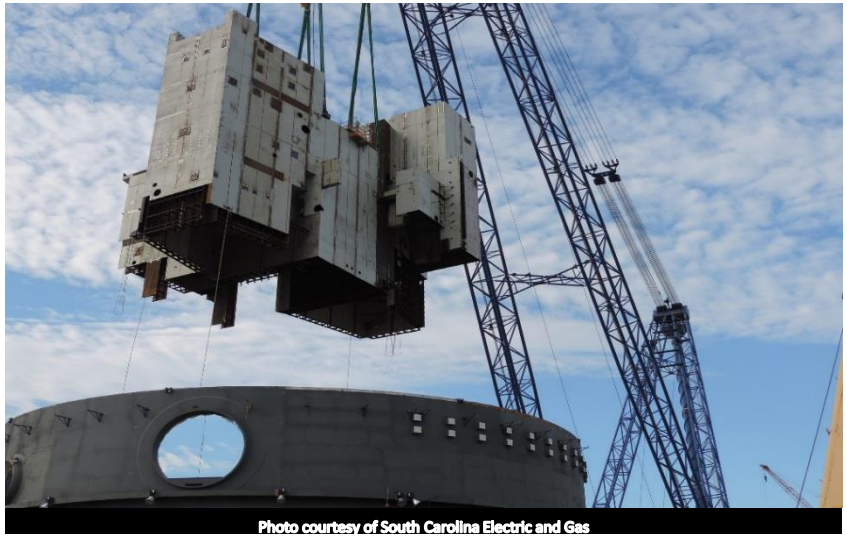
- **NRC is faced with several challenges in preparing for the non-LWR applications**
  - Lack of specificity in the technology/designs that will ultimately be submitted to NRC for review
  - Lack of maturity in designs
  - Technical skills gap
- **Lessons learned from reviews of large light water reactors**
  - Evolving areas of technology
  - Design completeness affects NRC review timeline
  - Increase in NRC timeliness while maintaining safety effectiveness

Future nuclear power capacity options

- Current nuclear power plant fleet
- New LWR Construction
- Subsequent License Renewals (60+)



Vogtle Unit 3 Shield Building Panel Installation (August 2015)



V.C. Summer – Steam Generator & Refueling Canal Module Placement

- New Combined Licenses
- Small Modular Reactors
- Advanced non-light water reactors

Conclusions

- Industry is taking a multi-phased approach to maintain nuclear in the electricity market
  - License renewal and subsequent license renewal
  - New LLWR designs with enhanced safety features
  - SMRs (LWRs)
  - Advanced non-LWR designs of varying size
- NRC has made recent progress in strategically preparing for review of non-LWR applications. There is still much work to do in a relatively short period of time
- NRC's role is to ensure safety and no undue risk to the public in the licensing, construction and operation of nuclear power plants, while not placing unnecessary regulatory burden

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United States Nuclear Regulatory Commission
Protecting People and the Environment

When an advanced reactor design is ready for licensing, the NRC will be ready.

Acronyms

- ABWR – Advanced Boiling Water Reactor
- AP1000 – Advanced Passive 1000
- APR1400 – Advanced Power Reactor 1400
- APWR - Advanced Pressurized Water Reactor
- COL – Combined License
- EBR – Experimental Breeder Reactor
- ESBWR – Economic Simplified BWR
- FFTF – Fast Flux Test Facility
- LWR – Light Water Reactor
- mHTGR – modular High Temperature Gas-cooled Reactor
- MWe – Mega-watts electric
- MWt – Mega-watts thermal
- Non-LWR – Non-Light Water Reactor
- NRC – Nuclear Regulatory Commission
- PRISM - Power Reactor Innovative Small Module
- SFR – Sodium-cooled Fast Reactor
- SMR – Small Modular Reactor
- TVA – Tennessee Valley Authority
- TRISO - Tristructural-isotropic
- UAMPS – Utah Associated Municipal Power Systems
- USAPWR – US Advanced Pressurized Water Reactor