Advanced Nuclear Energy

Oklahoma Senate and House Interim Study

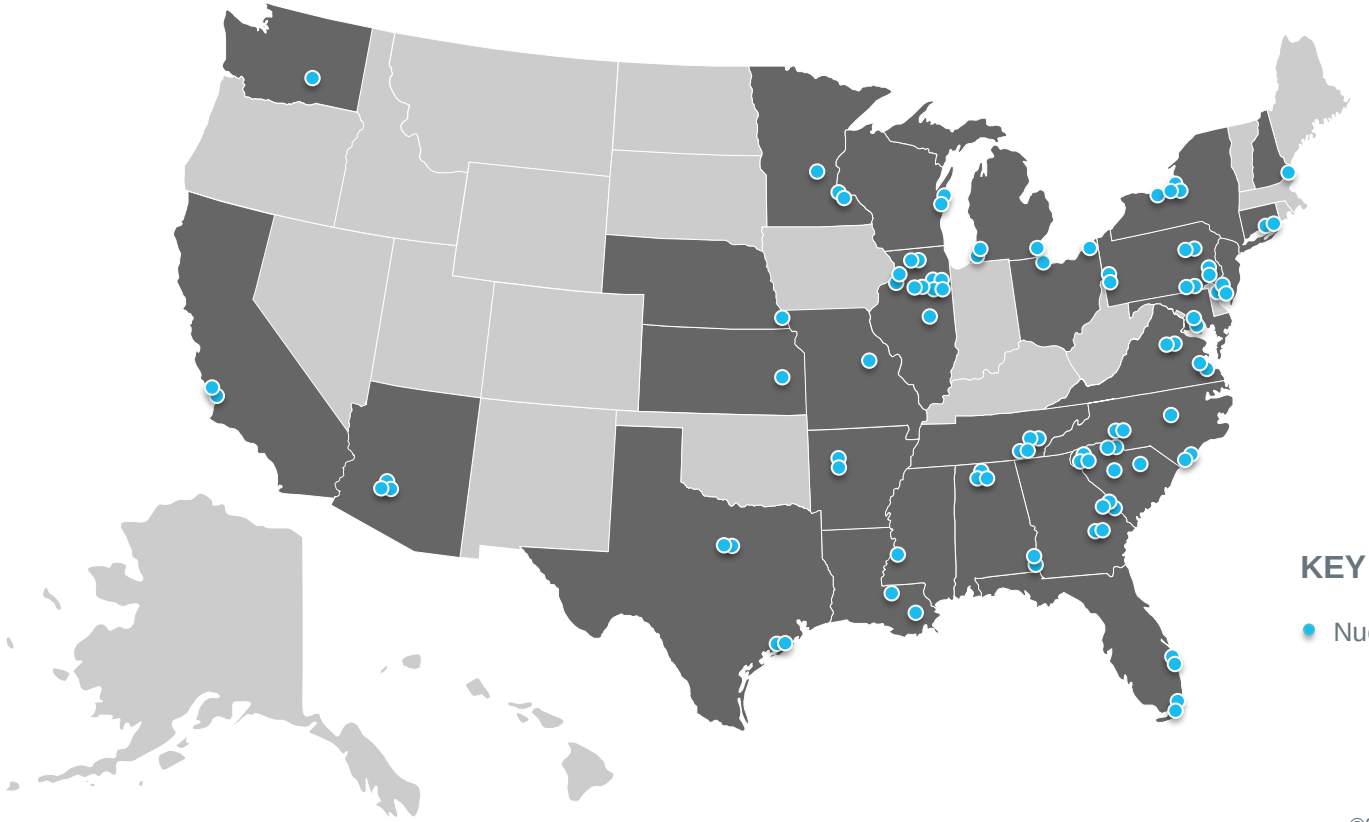
October 4, 2023

NUCLEAR ENERGY INSTITUTE

Marc Nichol
Executive Director, New Nuclear

©2022 Nuclear Energy Institute

Nuclear Provides Majority of Emissions-Free Electricity



Nuclear generated 19% of electricity in the U.S.

From 93 reactors at 53 plant sites across the country

KEY

- Nuclear power reactor

Updated: May 2023

©2023 Nuclear Energy Institute

Expanding Versatility through Advanced Technology

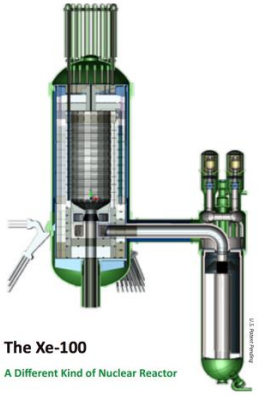
Micro Reactors (< 20MW)

Oklo (shown)
Approximately a dozen in development

LWR SMRs <300MW

NuScale (shown)
GEH X-300
Holtec SMR-160

High Temp Gas Reactors

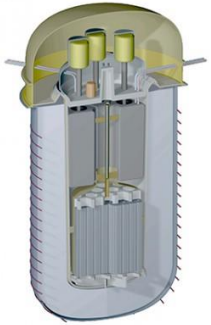


X-energy (shown)
Several in development

Liquid Metal Reactors

TerraPower Natrium (shown)
Several in development

Molten Salt Reactors



Terrestrial (shown)
Several in development

Non-Water Cooled
Most <300MW, some as large as 1,000 MW

NIA Technology Primer: https://nuclearinnovationalliance.org/sites/default/files/2022-07/ANRT-APrimer-July2022.pdf

©2022 Nuclear Energy Institute

System Benefits of Advanced Reactors

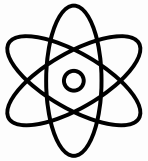
Long term price stability	• Low fuel and operating costs
Reliable dispatchable generation	• 24/7, 365 days per year, years between refueling (Capacity factors >92%)
Integration with renewables and storage	• Paired with heat storage and able to quickly change power
Efficient use of transmission	• Land utilization <0.1 acre/TWh (Wind =1,125 acre/TWh; Solar 144 acre/TWh)
Environmentally friendly	• Zero-carbon emissions, one of lowest total carbon footprints • Many SMRs are being designed with ability for dry air cooling
Black-start and operate independent from the grid	• Resilience for mission critical activities • Protect against natural phenomena, cyber threats and EMP

Source: SMR Start, *SMRs in Integrated Resource Planning*

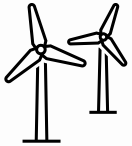
©2022 Nuclear Energy Institute

Lowest System Cost Achieved by Enabling Large Scale New Nuclear Deployment

Lowest Cost System

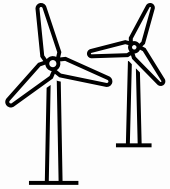


Nuclear is 43% of generation (>300 GW of new nuclear)

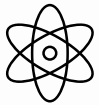


Wind and solar are 50%

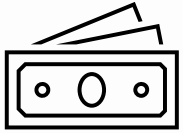
Energy System with Nuclear Constrained



Wind and Solar are 77% of generation



Nuclear is 13% (>60 GW of new nuclear)



Increased cost to customers of $449 Billion

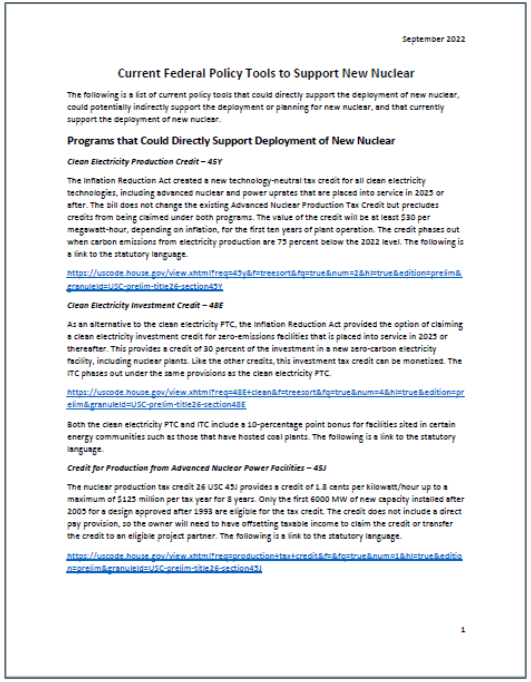
Both scenarios are successful in reducing electricity grid GHG emissions by over 95% by 2050 and reducing the economy-wide GHG emissions by over 60%

Source: Vibrant Clean Energy: https://www.vibrantcleanenergy.com/media/reports/

©2022 Nuclear Energy Institute

Strong Federal Support for Advanced Reactors

- DOE funding 12 different designs, >$5B over 7 years
- Infrastructure Bill
  - $2.5B funding for two demonstration projects
- Inflation Reduction Act
  - PTC: At least $30/MWh for 10 years
  - ITC: 30% of investment
  - Both can be monetized, include 10% bonus for siting in certain energy communities
  - Loan Guarantees – up to $40B in expanded authority
  - HALEU Fuel - $700M
- CHIPS Act
  - Financial assistance to States, Tribes, local governments and Universities



September 2022

Current Federal Policy Tools to Support New Nuclear

The following is a list of current policy tools that could directly support the deployment of new nuclear, could potentially indirectly support the deployment or planning for new nuclear, and that currently support the deployment of new nuclear.

Programs that Could Directly Support Deployment of New Nuclear

Clean Electricity Production Credit – 45Y

The Inflation Reduction Act created a new technology-neutral tax credit for all clean electricity technologies, including advanced nuclear and power uprates that are placed into service in 2025 or after. The bill does not change the existing Advanced Nuclear Production Tax Credit but precludes credits from being claimed under both programs. The value of the credit will be at least $30 per megawatt-hour, depending on inflation, for the first ten years of plant operation. The credit phases out when carbon emissions from electricity production are 75 percent below the 2022 level. The following is a link to the statutory language.

https://uscode.house.gov/view.xhtml?req=45y&f=treesort&fq=true&num=2&hl=true&edition=prelim&granuleId=USC-prelim-title26-section45Y

Clean Electricity Investment Credit – 48E

As an alternative to the clean electricity PTC, the Inflation Reduction Act provided the option of claiming a clean electricity investment credit for zero-emissions facilities that is placed into service in 2025 or thereafter. This provides a credit of 30 percent of the investment in a new zero-carbon electricity facility, including nuclear plants. Like the other credits, this investment tax credit can be monetized. The ITC phases out under the same provisions as the clean electricity PTC.

https://uscode.house.gov/view.xhtml?req=48E+clean&f=treesort&fq=true&num=4&hl=true&edition=prelim&granuleId=USC-prelim-title26-section48E

Both the clean electricity PTC and ITC include a 10-percentage point bonus for facilities sited in certain energy communities such as those that have hosted coal plants. The following is a link to the statutory language.

Credit for Production from Advanced Nuclear Power Facilities – 45J

The nuclear production tax credit 26 USC 45J provides a credit of 1.8 cents per kilowatt/hour up to a maximum of $125 million per tax year for 8 years. Only the first 6000 MW of new capacity installed after 2005 for a design approved after 1993 are eligible for the tax credit. The credit does not include a direct pay provision, so the owner will need to have offsetting taxable income to claim the credit or transfer the credit to an eligible project partner. The following is a link to the statutory language.

https://uscode.house.gov/view.xhtml?req=production+tax+credit&f=treesort&fq=true&num=1&hl=true&edition=prelim&granuleId=USC-prelim-title26-section45J

1

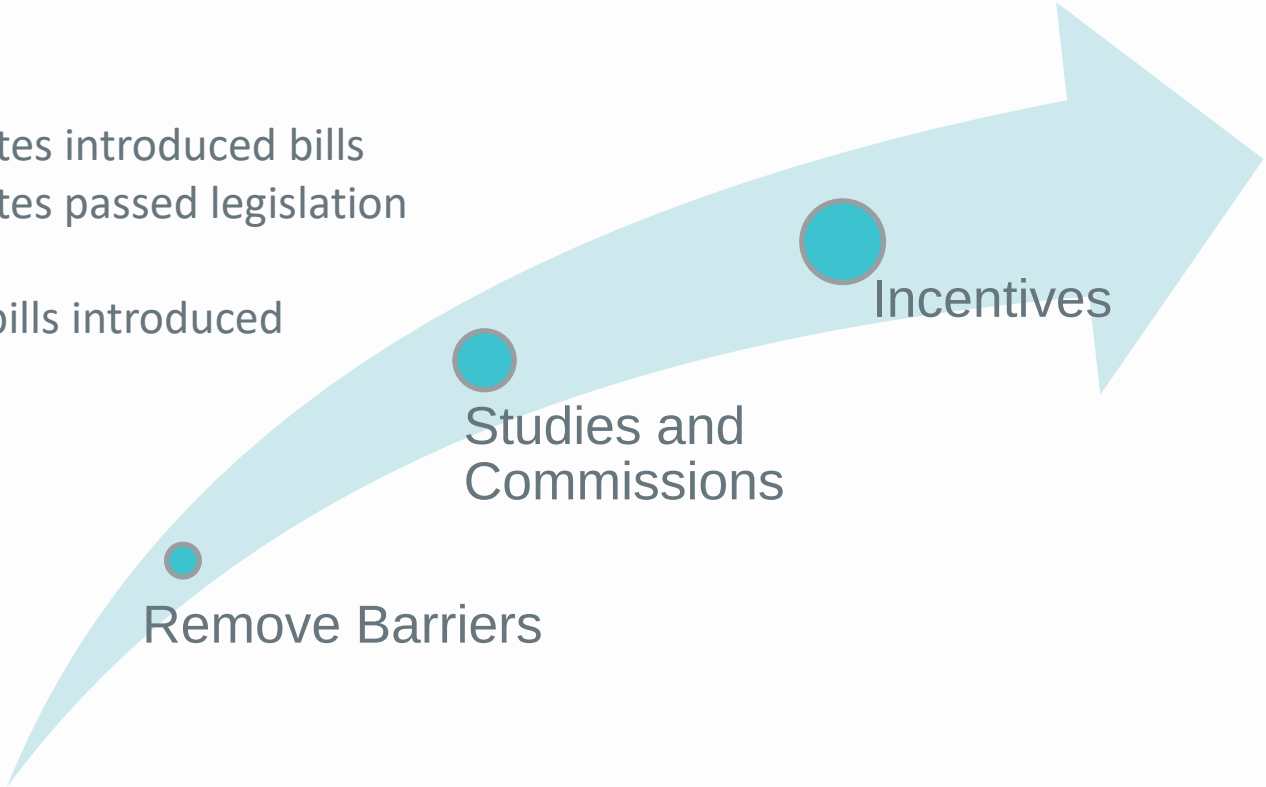
Current Federal Policies: https://www.nei.org/CorporateSite/media/filefolder/advantages/Current-Policy-Tools-to-Support-New-Nuclear.pdf

©2022 Nuclear Energy Institute

State Action for Advance Reactors

2022
- 19 States introduced bills
- 11 States passed legislation

2023
- 200+ bills introduced



State Policy Options: https://www.nei.org/resources/reports-briefs/policy-options-for-states-to-support-new-nuclear

©2022 Nuclear Energy Institute

2023 State Actions for Nuclear Energy

CES and Defining Clean
- Minnesota, Idaho, Tennessee, North Carolina

Workforce Development
- Virginia, West Virginia

SMR Incentive
- Indiana

SMR Study
- North and South Dakotas

Moratorium Repeal
- Illinois

Energy Study
- Colorado

Hydrogen/Nuclear
- Nebraska

Nuclear Working Group or Authority
- Kentucky, Connecticut, Ohio

Coal to Nuclear
- Texas

Fuel Recycling
- Arkansas

Interim SMR Study
- Oklahoma, West Virginia

Nuclear Energy Caucus
- Washington, Texas, Michigan

©2022 Nuclear Energy Institute

2023 Governor Actions

- Tennessee's Governor Lee's $50 Million for Incentives and Nuclear Energy Advisory Council
- Michigan's Governor Whitmer $150 Million for re-activating Palisades in state budget
- Governor Abbott directing the PUCT to create a working group to develop rules for advanced nuclear

©2022 Nuclear Energy Institute

Updated 9/1/2023

Advanced Reactor Licensing Progress

Approved

1. NuScale Power

Under Review

1. Abiline Christian University
2. Kairos Power
3. NuScale (power uprate)

Pre-Application

1. GEH BWR X-300
2. General Atomics
3. Holtec SMR-160
4. Kairos Power
5. Oklo
6. TerraPower Natrium
7. TerraPower MCFR
8. Terrestrial
9. Univ. of Illinois U-C
10. X-energy
11. Westinghouse

©2022 Nuclear Energy Institute

Regulatory Enhancements

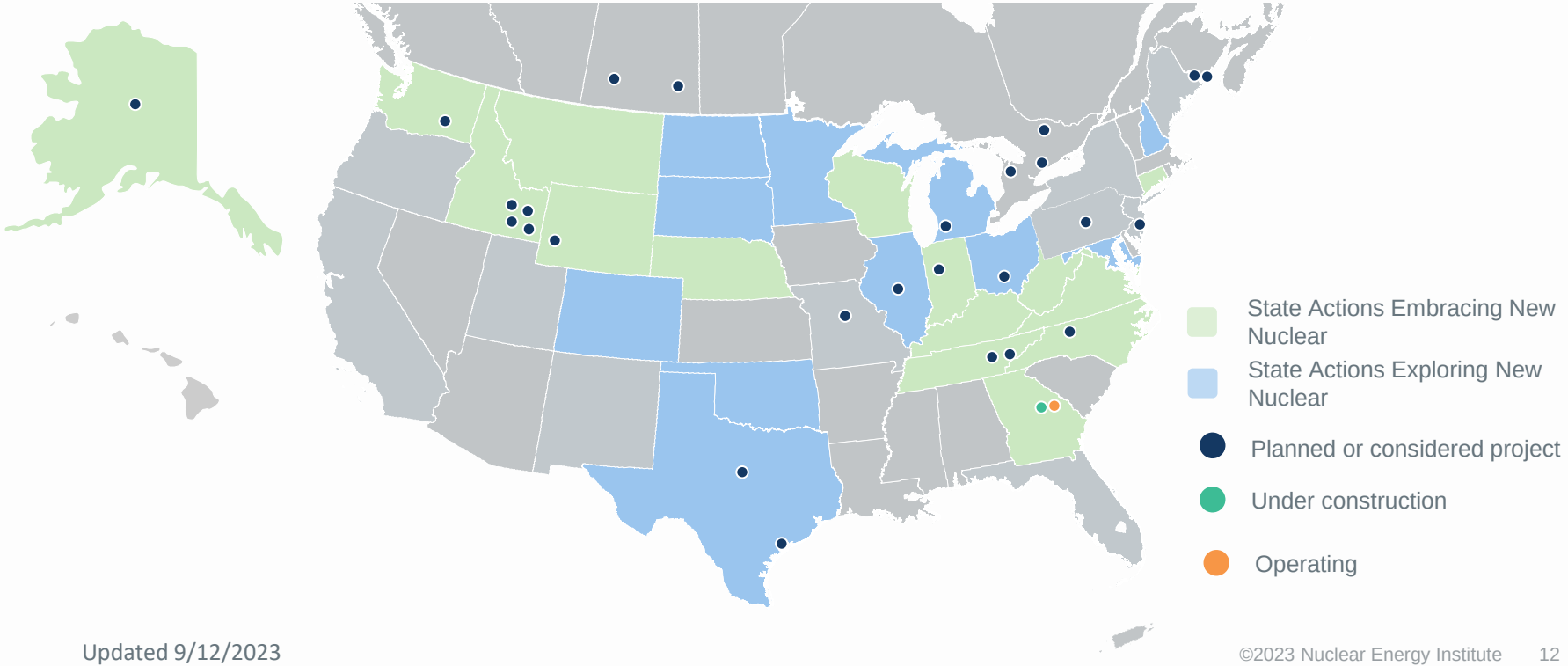
- Streamlining of regulatory processes
  - Review efficiency and timeliness
  - Application review experience
  - Technology Inclusive Content of Application
- Resolution of key generic technical or policy topics
  - Emergency Planning Zone
  - Physical Security
  - Siting
- Modernize the regulations
  - Generic Environmental Impact Statement
  - Part 50/52 lessons learned
  - Part 53

Source: NEI Letter to NRC, Input on Regulatory Priorities, June 7, 2022

©2023 Nuclear Energy Institute

Advanced Nuclear Deployment Plans

Projects in planning or under consideration in U.S. and Canada >20; Globally >30



Updated 9/12/2023

©2023 Nuclear Energy Institute

QUESTIONS?

By Third Way, GENSLER