# Long-term Operation and License Renewal

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June 12, 2024

NUCLEAR ENERGY INSTITUTE

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**Vision:** A world powered by clean and reliable energy

**Mission:** Promote the use and growth of nuclear energy through efficient operations and effective policy

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EPCs & Suppliers

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Decommissioning

National Labs

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Advanced Reactors

Universities

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Labor Unions

NGOs & Think Tanks

# Electricity Demand Rising

- According to McKinsey's Global Energy Perspective 2022 Study, global electricity demand is expected to triple by 2050 across a range of scenarios.
  - Transportation (electric vehicles)
  - Building operations (electrified heating)
  - Industrial processes (low-carbon steelmaking)

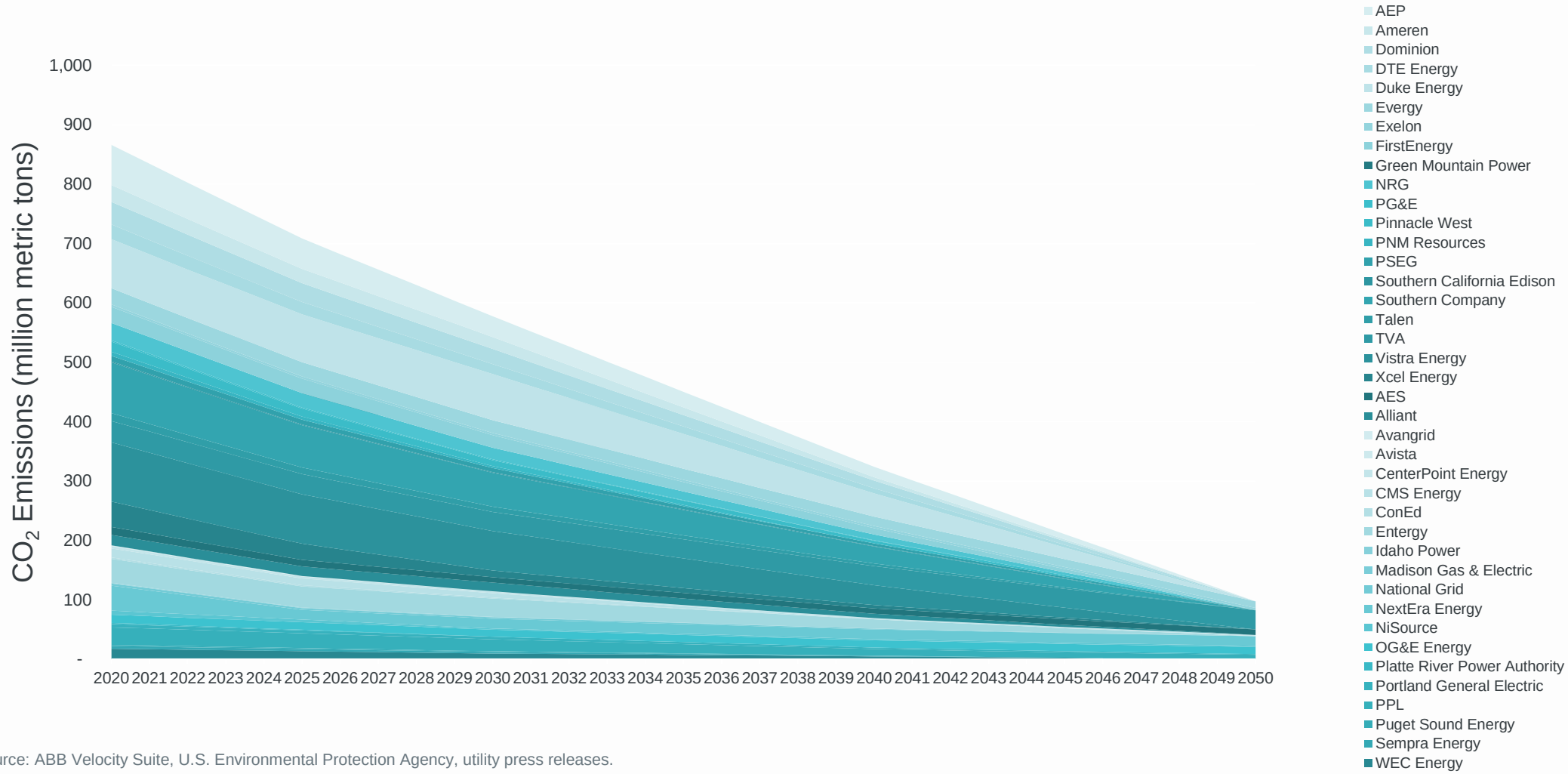
# U.S. National Climate Task Force Goals

Reducing U.S. greenhouse gas emissions 50-52% below 2005 levels in 2030

Reaching 100% carbon pollution-free electricity by 2035

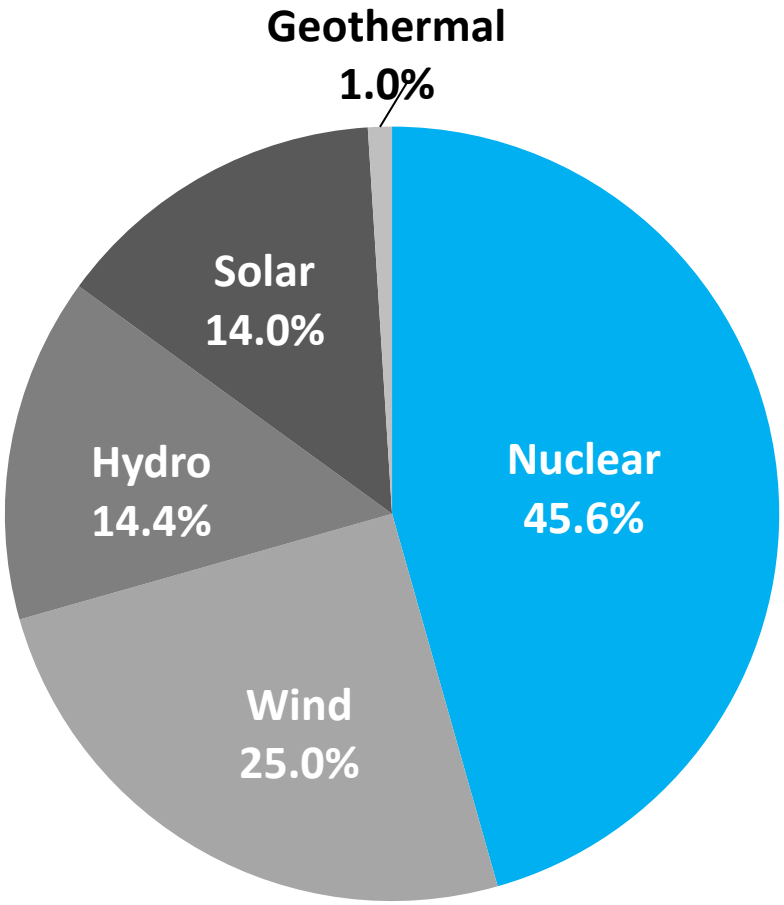
Achieving a net-zero emissions economy by 2050

# Utility Carbon Emission Pledges




Source: ABB Velocity Suite, U.S. Environmental Protection Agency, utility press releases.

# Nuclear continued to be the **largest source of carbon-free generation** in 2023




Notes: Includes small-scale solar.
Source: U.S. Energy Information Administration
Updated: February 2024

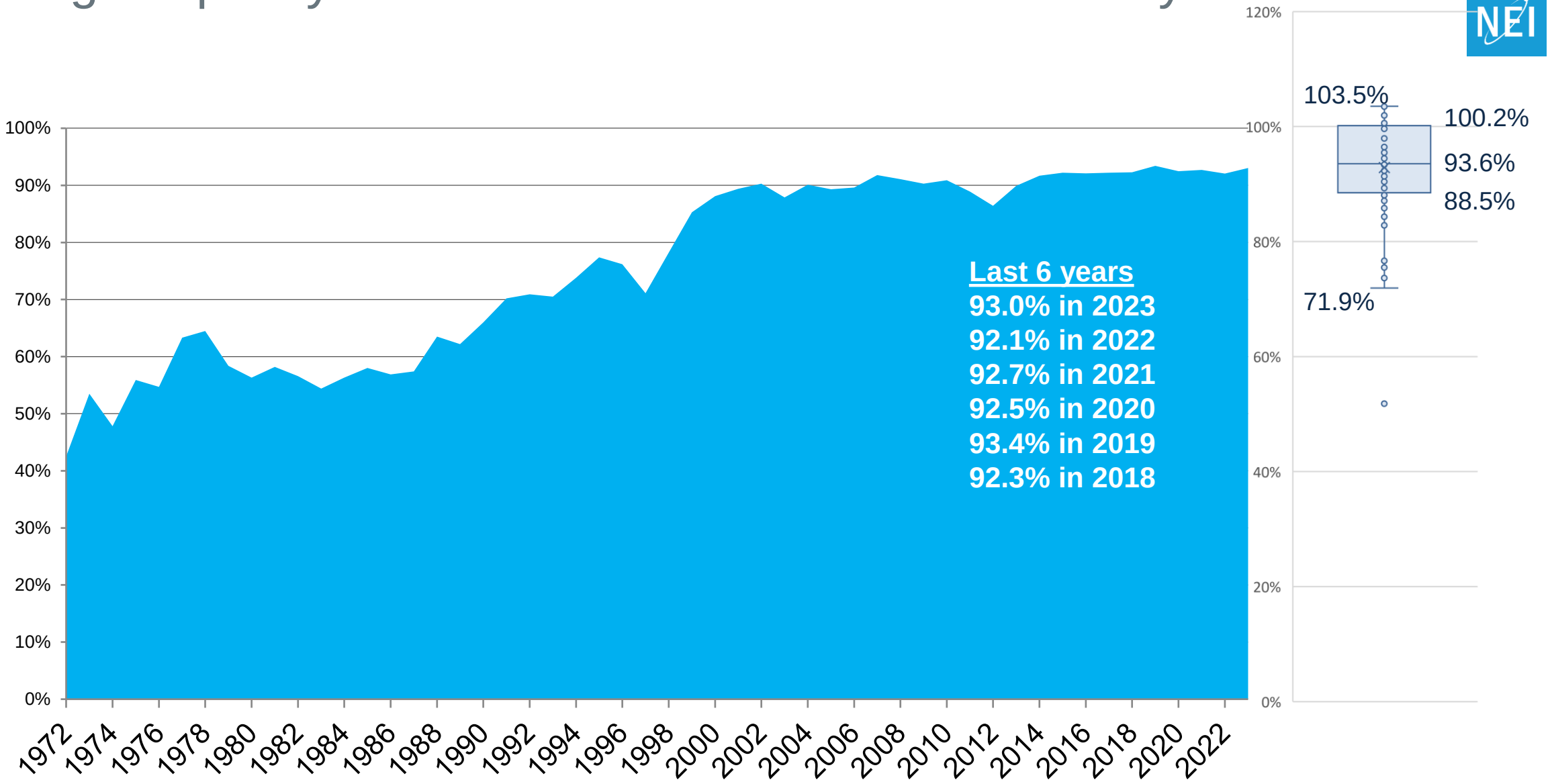
 

# Plants continued strong performance in 2023

- **775.3 million MWh of electricity generated**
- **93.0% capacity factor**

Source: U.S. Energy Information Administration
Updated: February 2024

# Average capacity factor above 90% for more than 20 years

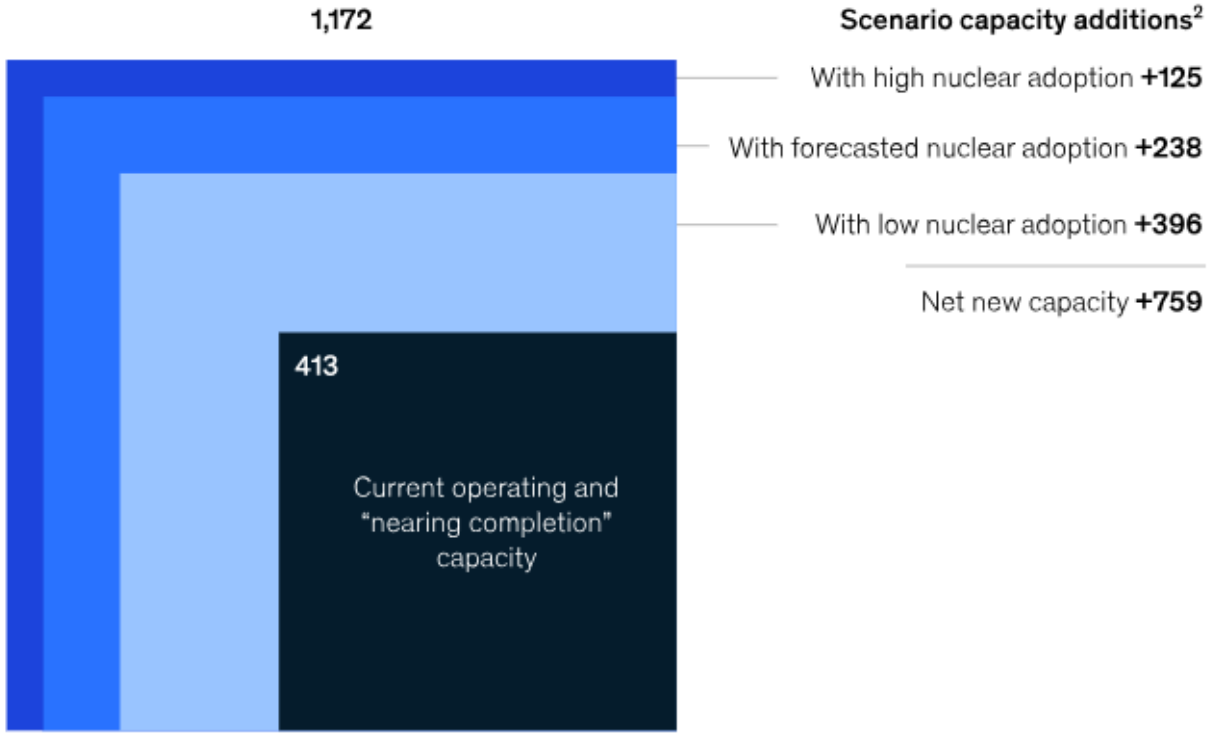



Source: U.S. Energy Information Administration
Updated: February 2024

# Operating Plants Are Essential

**Demand for nuclear power is projected to double or even triple by 2050 based on today's capacity.**

**2050 global nuclear generating capacity required for net-zero emissions with US uptake sensitivities,**[1] gigawatts (GW)




*Net-zero global and domestic composite modeling shows a doubling to tripling of installed nuclear generating capacity by 2050*

[1]US required build-out modeling has explored nuclear sensitivities in more depth and shows that required capacity is highly sensitive to the build-out of renewables, transmission and distribution constraints, and the development of competing firming technologies, most notably carbon capture and underground storage.
[2]When accounting for the age of the current global fleet, an additional ~100 to ~250 GW of new builds could be required to replace retiring capacity, depending on plant life extensions.
Source: *Examining supply-side options to achieve 100% clean electricity by 2035*, National Renewable Energy Laboratory, Aug 2022; World Energy Outlook 2021, IEA; Net-Zero America Project, Princeton; McKinsey analysis

McKinsey & Company

# Operating Plants Are Essential

"When accounting for the age of the current global fleet, an additional ***~100 to ~250 GW*** of new builds could be required to replace retiring capacity, ***depending on plant life extensions.***" <emphasis added>

# Key Federal Policy Developments

## Bipartisan Infrastructure Law

**Civil Nuclear Credit Program**
$6B to support financially challenged plants

**ARDP Funding**
$2.5B funding for two projects

**Nuclear Hydrogen Hub**
$8B total in the bill

## Inflation Reduction Act

**Production Tax Credit (PTC) for Operating Plants**
Up to $15 per MWh

**Technology-Inclusive PTC for Clean Electricity**
$30 per MWh

**Technology-Inclusive Investment Tax Credit (ITC) for Clean Electricity**
30% + 10% in energy communities + 10% using U.S. components

**Clean Hydrogen Credit**
$3 per kilogram

# Survey of NEI's U.S. Utilities

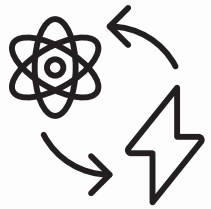
Nuclear power's potential role in meeting decarbonization goals:

## SLR




**>90%** of fleet expects to operate to at least **80 years**

## GW



**100 GW** of new nuclear opportunity by **2050s**

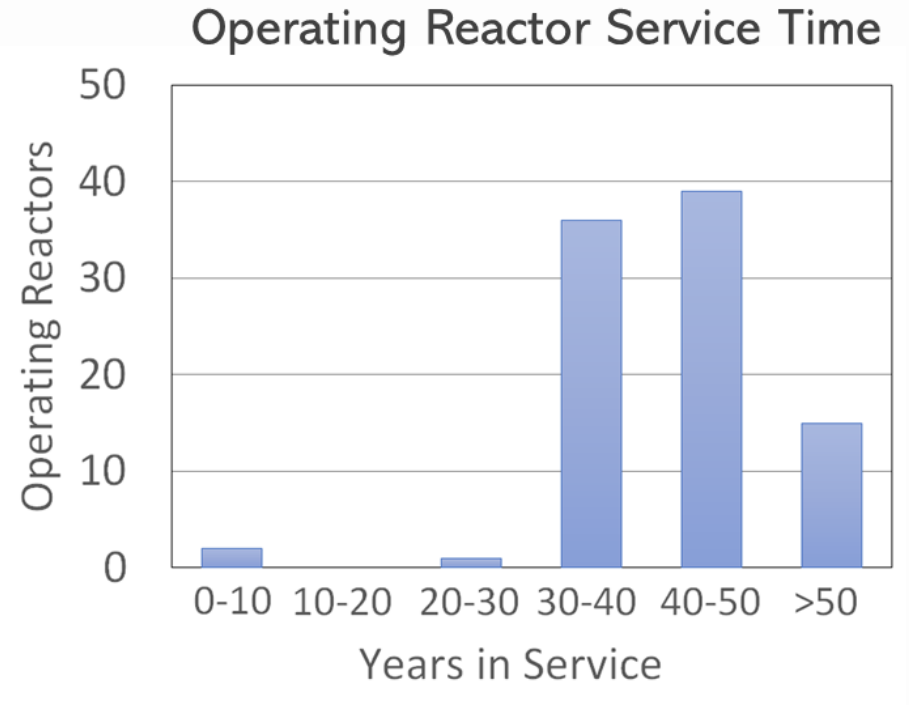
## SMRs

Translates to more than **300 SMR-scale plants**

* NEI utility member companies produce nearly half of all US electricity

# The U.S. Operating Fleet

- 94 operating power reactors
  - 10 with original licenses (40 years)
  - 78 renewed (60 years)
  - 6 subsequently renewed (80 years)
- 54 operating reactors have exceeded 40 years of service **(longest operation at 55 years)**
- 9 additional reactors exceeded 40 years, but have been shut down
- 100 licenses have been renewed
  - 94 for 60 years and 6 for 80 years
- More than 450 reactor-years of operation beyond the initial 40-year licenses



# Second License Renewals ensure reliable carbon-free electricity well into the 2050s

**6**
**Reactors Approved**

**31**
**Reactors' Renewed Licenses Expire by 2035**

**14**
**Reactors Under Review**

**2**
**Reactors Under Acceptance Review**

**16**
**Future Applications Announced**

**34**
**More Reactors' Renewed Licenses Expire by 2045**

Source: U.S. Nuclear Regulatory Commission
Updated: March 2024

# Operating Licenses

- NRC's may grant 40-year licenses for commercial power reactors
  - Atomic Energy Act of 1954 (as amended)
  - License duration instituted for economic antitrust reasons, not technical or material degradation concerns
  - 40-year license influenced service life considerations for component selection
  - The AEA also allows the NRC to renew licenses for 20 years per renewal

# Regulatory Review - Safety

- 10 CFR Part 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants*
  - Governs the issuance of renewed operating licenses
  - Describes submittal of applications and NRC's review of applications

# License Renewal Scoping

## *10 CFR 54.4(a)*

### Systems, structures, components

- Safety-related
- Nonsafety-related whose failure could prevent accomplishment of safety-related functions
- Relied on for compliance with NRC regulations (fire protection, station blackout, etc.)

### Safety-related functions

- Integrity of the reactor coolant pressure boundary
- Shut down the reactor and maintain it in a safe shutdown condition
- Prevent or mitigate consequences of accidents which could result in potential offsite exposures

# License Renewal Screening

## *10 CFR 54.21(a)(1)*

- "In-scope" SSCs are screened to determine which structures and components require aging management review

- Structures that are "passive" and "long-lived" are screened in
  - ***Passive*** is defined as performing the intended function without moving parts or a change in configuration

  - ***Long-lived*** is defined as not subject to replacement based on a qualified life or specified time

# Aging Management Review

- Demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained in accordance with the Current Licensing Basis through the period of extended operation
    - Identify aging effects that could prevent the intended functions (e.g., cracking, loss of material)
    - Identify aging management programs to manage the effects of aging

# Regulatory Finding

- 10 CFR 54.29(a)
  - ". . . there is *reasonable assurance* that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB . . ."
  - "managing the effects of aging during the period of extended operation on the *functionality of structures and components* that have been identified to require review…"

# Regulatory Review - Environmental

- 10 CFR Part 51, *Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*
  - National Environmental Policy Act
  - Assess the environmental impacts that could be associated with nuclear power plant license renewal and an additional 20 years of operation

# Generic Environmental Impact Statement

- Summarizes findings from a detailed inquiry into the environmental impacts of license renewal and continued operations during the renewal term
- Identifies and evaluates generic impacts (same or similar) at all power plants, or a subset of power plants
- Identifies plant-specific impacts that need to be addressed in supplements to the license renewal GEIS

# Conclusion

- Long-term operation of the existing fleet is essential to meeting energy demand and global decarbonization goals.
- The US nuclear industry is responding to the incentives and demand signal set forth by Congress.
- A predictable, stable, and efficient regulatory review structure is key to the timely approval of the forecasted wave of license renewal applications over the next 20 years.

# Questions/Comments