

# EPRI Research to Support 60+ and 80+ Years of NPP Operation

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LTO and Aging Management Strategy

EPRI

June 10, 2026



# The Existing U.S. Nuclear Fleet:

The **fastest path to new nuclear capacity** doesn't involve breaking ground. It involves getting more from plants already operating.

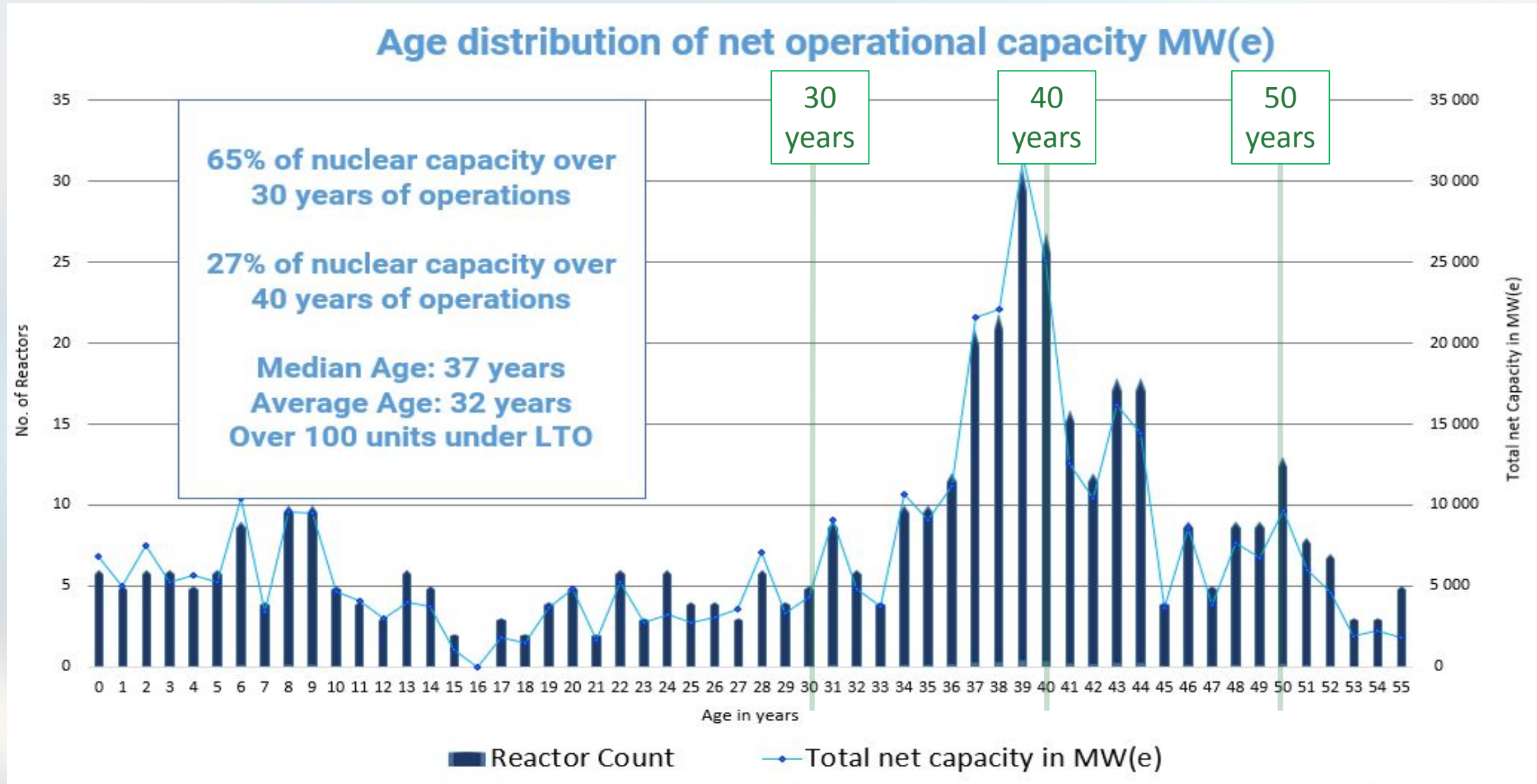
“Even with accelerated licensing, large new reactors and first-of-a-kind SMRs largely extend into the early-to-mid-2030s,” Swilley\* said. That timeline doesn't match near-term load growth. What does match it: uprates, outage optimization, long-term operation strategies, and restarts of recently shutdown plants. **“EPRI research indicates these measures could deliver the equivalent of roughly nine large reactors of additional U.S. capacity within a few years,”** Swilley added.

\* Steve Swilley, EPRI V.P., Nuclear and CNO

**Nine Reactors' Worth of Untapped Capacity**

*1/14/2026 POWER Magazine*

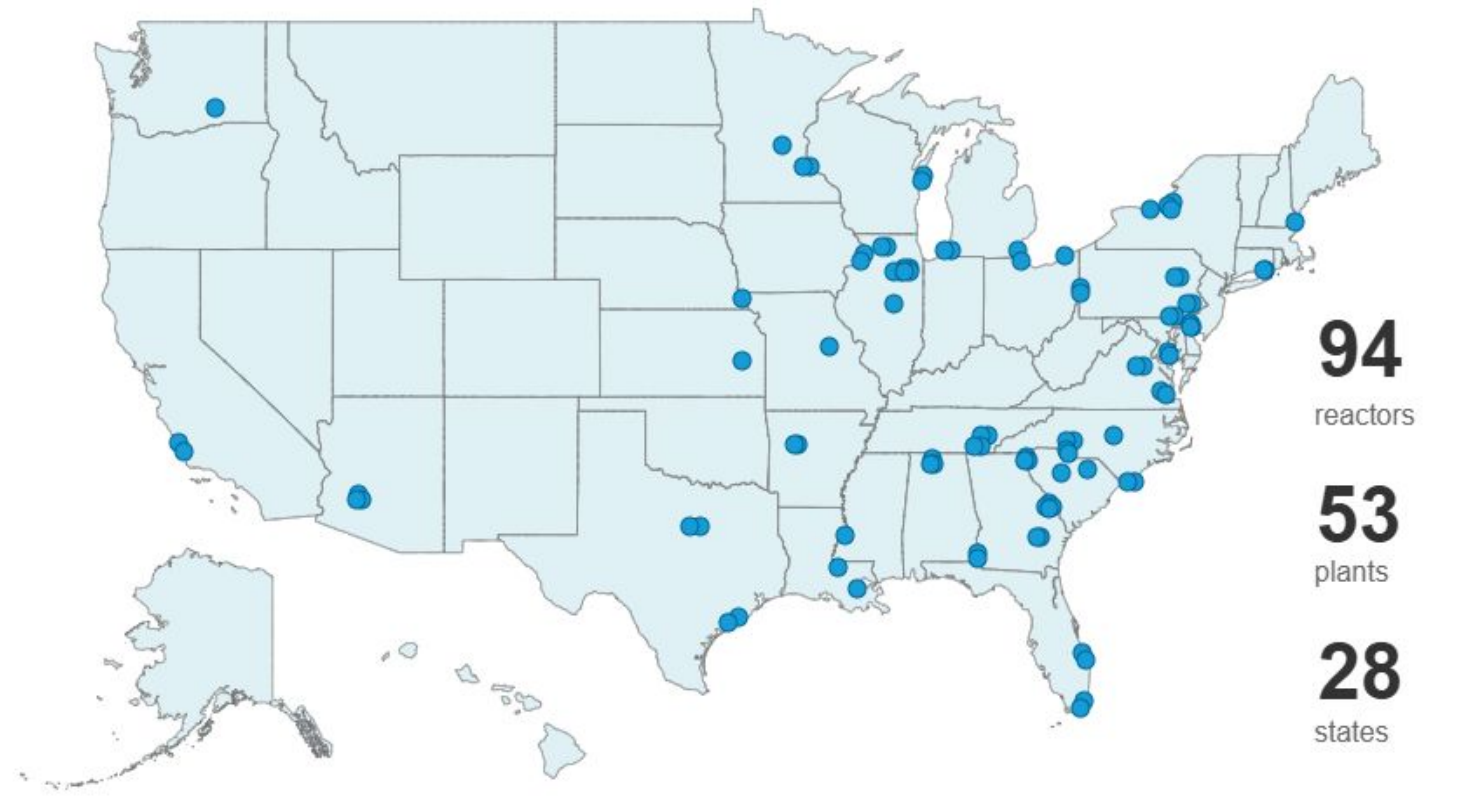
# What is the Status of LTO Worldwide?



\*IAEA PRIS database, as of February 2025

# Can plants operate safely for more than 80 years?

## NUCLEAR POWER ACROSS THE U.S.



Based on NRC Website information – [www.nrc.gov](http://www.nrc.gov)

- Recent NRC approvals (in 2026)
  - Diablo Canyon (2) – April 2026 (LR)
  - H.B. Robinson (1) – April 2026 (SLR)
  - St. Lucie (2) – April 2026 (SLR)
- 67 reactors have 60-year licenses
- **23 reactors have 80-year licenses**

**More than 95% of U.S. reactors are approved for LTO**

A pair of hands is shown holding a glowing globe. The globe is covered in intricate circuitry patterns, suggesting a focus on technology or research. The background is a teal color with soft, glowing light rays emanating from behind the globe, creating a sense of depth and focus. The overall image conveys a message of global research and technological advancement.

# EPRI Research Supporting LTO

# EPRI Approach to LTO – “Connecting Nuclear Generations”

## On-Going Activities – 60+

Continue existing materials (MRP, BWRVIP, IMR, SGMP, etc.), chemistry (primary, secondary, etc.), NDE, welding (WRTC), balance of plant, electrical/cable, civil & structural, and other on-going EPRI research

## New Activities – 80+

Coordinate with EPRI members to collect input on potential gaps, challenges, or additional research needs for operation beyond 80 years via EPRI supplemental project “LTO – Life Beyond 80” and adjust EPRI research plans as needed

## Coordination

Work with NRC, DOE/LWRS, IAEA, OECD/NEA, and other domestic and international organizations to compare and coordinate needed research to maximize use of valuable resources to “connect nuclear generations”

# Potential Challenges for 80+ Years of Operation

Research Area	Research Topics (examples)
<b>Reactor Pressure Vessel (RPV) and RPV Internals (RPVI)</b>	<ul style="list-style-type: none"><li>• Update to MDM and IMT's based on 80+ changes and new data</li><li>• MRP and BWRVIP changes to address new OE and update guidelines</li><li>• Embrittlement mitigation and possible annealing options</li><li>• Surveillance/monitoring programs – high-fluence data and need for additional surveillance capsules</li><li>• Welding/repair of highly irradiated materials</li><li>• Mitigation of SCC, IASCC, etc.</li><li>• Advanced NDE, repair, and mitigation of aging effects options</li></ul>
<b>Reactor Coolant Pressure Boundary (RCPB) Components</b>	<ul style="list-style-type: none"><li>• Mitigation of PWSCC and other degradation mechanisms</li><li>• Mechanical/thermal fatigue</li><li>• DMW and defect repair on RCPB components</li><li>• Water chemistry and corrosion mitigation options</li><li>• Advanced NDE, repair, and mitigation of aging effects options</li><li>• SGMP changes to address new OE and update guidelines</li></ul>

# Potential Challenges for 80+ Years of Operation

Research Area	Research Topics (examples)
<b>Balance of Plant (BOP) and Secondary Side Components</b>	<ul style="list-style-type: none"><li>• Water chemistry and corrosion mitigation options</li><li>• Flow accelerated and erosion corrosion management</li><li>• Advanced NDE, repair, and mitigation of aging effects options</li><li>• Advanced materials for buried/underground piping repair/replacement (e.g., SIPP, CIPP, CFRP, etc.)</li><li>• Long term effects of climate change on plant operation</li></ul>
<b>Cables and Electrical</b>	<ul style="list-style-type: none"><li>• EQ and condition monitoring options for extending qualified life</li><li>• Advanced NDE, repair, and mitigation of aging effects options for cables and electrical components</li></ul>
<b>Civil Structures, Concrete, and Components</b>	<ul style="list-style-type: none"><li>• Effects of radiation on concrete supports &amp; structural supports</li><li>• Advanced NDE, repair, and mitigation of aging effects options for concrete and structural components</li><li>• Containment liner and containment post-tension aging effects</li><li>• Long term effects of climate change on structures</li></ul>

# EPRI Nuclear Sector – Long Term Operations

Research Area	Programs
<b>Materials Management</b>	<ul style="list-style-type: none"> <li>▲ Steam Generator Management Program</li> <li>▲ Materials Reliability Program</li> <li>▲ BWR Vessel and Integrity Program</li> <li>▲ International Materials Research</li> </ul>
<b>Plant Support</b>	<ul style="list-style-type: none"> <li>▲ Welding and Repair Technology Center</li> <li>▲ Nondestructive Evaluation</li> </ul>
<b>Fuels and Chemistry</b>	<ul style="list-style-type: none"> <li>• Fuel Reliability Program<sup>✦</sup></li> <li>▲ Nuclear Fuel and Performance Research</li> <li>▲ Used Fuel Management</li> <li>▲ Chemistry and Radiation Safety</li> <li>• Decommissioning</li> <li>▲ Used Fuel and High-Level Waste<sup>^</sup></li> </ul>

✦ 2027 name change to Nuclear Fuel and Performance Research  
 ▲ 2027 name change to Used Fuel Management  
 ▲ Programs with research to support Long Term Operations.

Research Area	Programs
<b>Plant Performance</b>	<ul style="list-style-type: none"> <li>▲ Plant Reliability and Resilience</li> <li>▲ Risk and Safety Management</li> <li>▲ Operating Plant Initiatives</li> </ul>
<b>Strategic Initiatives</b>	<ul style="list-style-type: none"> <li>• Advanced Nuclear Technology</li> <li>• Fusion</li> <li>• Nuclear Beyond Electricity</li> </ul>
<b>Training</b>	<ul style="list-style-type: none"> <li>▲ Common Initial Training (CIT)</li> <li>▲ Streamlined Training for Engineering Proficiency (STEP)</li> <li>▲ Standardized Task Evaluation (STE)</li> </ul>



# EPRI Research Supporting LTO – Power Uprate



A person's hands are shown holding a glowing globe. The globe is covered in intricate circuitry patterns, symbolizing technology and energy. The background is a teal color with a subtle starry space pattern, suggesting a global or futuristic theme. The text is centered over the image.

# EPRI Research Supporting LTO – Beyond Electricity

# EPRI's Nuclear Beyond Electricity



Data Centers



Process Manufacturing



Low Carbon Fuels



Energy Storage



Water & Wastewater



Medical Isotopes



District Energy



Maritime

## GOAL

Enable **existing** and **future** nuclear plants to **participate in energy markets beyond the practice of generating baseload electricity.**

Product 3002034069

# Key Business Case Considerations for LTO

EPRI

## Key Business Case Considerations for Long-Term Operation of Nuclear Power Plants

3002034069

Technical Update, November 2025

EPRI Project Manager  
M. Hurley

All or a portion of the requirements of  
the EPRI Nuclear Quality Assurance  
Program apply to this product.



EPRI

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# Business Case Considerations for Extended Operation

## Long-Term Cost Considerations

- Consider only the regulatory costs necessary to extend the operating term
- Consider both the initial regulatory costs and the long-term generation costs through the extended asset life

## Long-Term Operation Benefit Considerations

- Monetary
  - Power revenue
  - Lock in Power Purchase Agreements (PPAs)
- Non-Monetary
  - Low-carbon goals
  - Grid reliability
  - Generation reliability
  - Diversity of supply

## Strategic Initiative Considerations

- Return on investments
- Combine with power uprates
- Combine with longer fuel cycles

A pair of hands is shown holding a globe of the Earth. The background is a teal color with a subtle pattern of stars and light trails, suggesting a space or technology theme. The text is overlaid on the center of the image.

**Product 3002032385**

**LTO Wiki – [LTO.EPRI.COM](http://LTO.EPRI.COM)**

# Long-Term Operations Wiki – LTO.EPRI.COM

- Designed as an overview of the process to apply for LTO both in the US and Internationally and the steps that are involved both prior to PEO and after PEO to maintain the aging management programs.
- Publicly available with links to specific information that may require a login to access.

**EPRI** Page  Read

## Nuclear Power Plant Long-Term Operations (LTO)

**LTO Acronyms and Descriptions**

This wiki is intended to provide a structured framework for presenting information relevant to extending the life of nuclear plants beyond their initial authorized or designed period both in the United States (US) and internationally.

**Long-Term**  can be defined as operation, justified by a comprehensive safety assessment, that goes beyond a previously established time frame corresponding to initial design assumptions (typically referred to as "original design lifetime" and usually 30-40 years depending on the design). These initial assumptions, however, do not represent a technical constraint inhibiting longer operating time periods and should not be confounded with the remaining, useful life of the facility, which is periodically re-evaluated, taking into account the actual plant conditions and the latest available knowledge.

The International Atomic Energy Agency (IAEA) defined the term long-term operation as "the operation beyond an established period defined by the license term, the original plant design, relevant standards, or national regulations" ([Specific Safety Guide SSG-48, "Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants \(2\)"](#)).

**Navigation Menu:**

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**Diagram: NUCLEAR POWER PLANT LIFETIME**

The diagram illustrates the nuclear power plant lifetime with the following components:

- NUCLEAR POWER PLANT LIFETIME:** Represented by a large yellow double-headed arrow at the top.
- USEFUL LIFE:** Represented by a blue double-headed arrow below the lifetime arrow.
- DESIGN LIFE/LICENSED TERM:** Represented by a blue double-headed arrow below the useful life arrow.
- LTO:** Represented by a blue double-headed arrow below the design life arrow, extending to the right.
- Licensee: Preparation of the LTO documentation and technical studies:** Represented by a red double-headed arrow below the LTO arrow, spanning the end of the design life and the beginning of the LTO period.
- Regulator: LTO review process:** Represented by a red double-headed arrow below the LTO arrow, spanning the end of the design life and the beginning of the LTO period.

# EPRI LTO Contact Information

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