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# TVA & Advanced Nuclear

## Clinch River Nuclear Project & New Nuclear Program

March 13, 2024

Prepared for the Central Tennessee Section of IEEE



**TVA** TENNESSEE  
VALLEY  
AUTHORITY

# Delivering on TVA's Mission – Past, Present, and Future

SERVING THE PEOPLE TO MAKE LIFE BETTER

## ENERGY

Electricity at the lowest feasible rate and highest feasible reliability

## ENVIRONMENTAL STEWARDSHIP

Stewardship of the natural resources for best use by the public

## ECONOMIC DEVELOPMENT

To attract and retain good jobs and capital investment in the Valley



1933

TVA ACT  
SIGNED



1940s

HYDRO



1950s

FOSSIL



1960s

NUCLEAR



1970s

PUMPED  
STORAGE &  
GAS



2020+

TVA'S ENERGY SYSTEM OF THE FUTURE

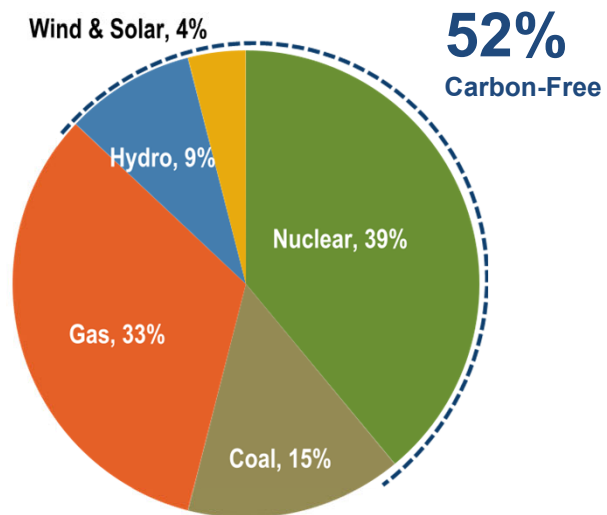
TVA has led the nation  
in energy innovation  
from our inception.

Over the next several decades,  
the energy needs of the TVA  
region could potentially  
double as our nation  
transitions toward a net-zero  
carbon economy.

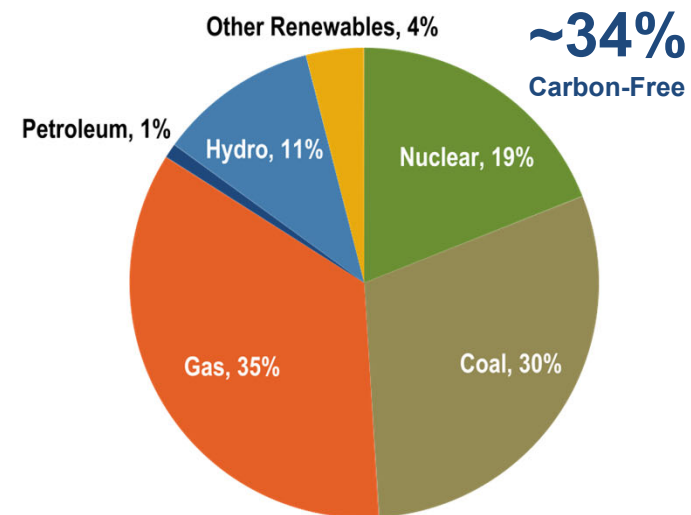
Today and in the future, the Valley needs  
affordable, reliable, resilient, and  
carbon-free energy to support and  
facilitate economy-wide decarbonization  
and for TVA to continue to lead the nation  
in energy innovation.

# The Benefits of a Cleaner and More Diverse Power System

**TVA  
Total Power Supply  
FY2022**



**National  
Average**



Data from U.S. EIA Electric Power Annual Report (2021)

Chart depicts both generated and purchased power within respective resource types. For additional information, please see Total Power Supply by Generating Source in TVA's Annual Report on Form 10-K.

# Browns Ferry Nuclear Plant Overview

- Located about 30 miles southwest of Huntsville, AL, near Athens, AL
- Three General Electric BWR Units, generating more than 3,400 MWe
- Largest BWR facility in the U.S.
- Supplies electricity to more than 1.8 million homes
- Supports about 1,400 full-time jobs
- ~20 percent of TVA's total net generation
- ~45 percent of TVA's nuclear net generation
- One of the top two nuclear generating stations in the United States – only Palo Verde, a three-unit site in Arizona, generates more electricity.



# Sequoyah Nuclear Plant Overview

- Located 18 miles northeast of Chattanooga, TN
- Two Westinghouse PWR Units, generating about 2,400 MWe
- Supplies electricity to approximately 1.3 million homes
- Supports about 1,000 full-time jobs



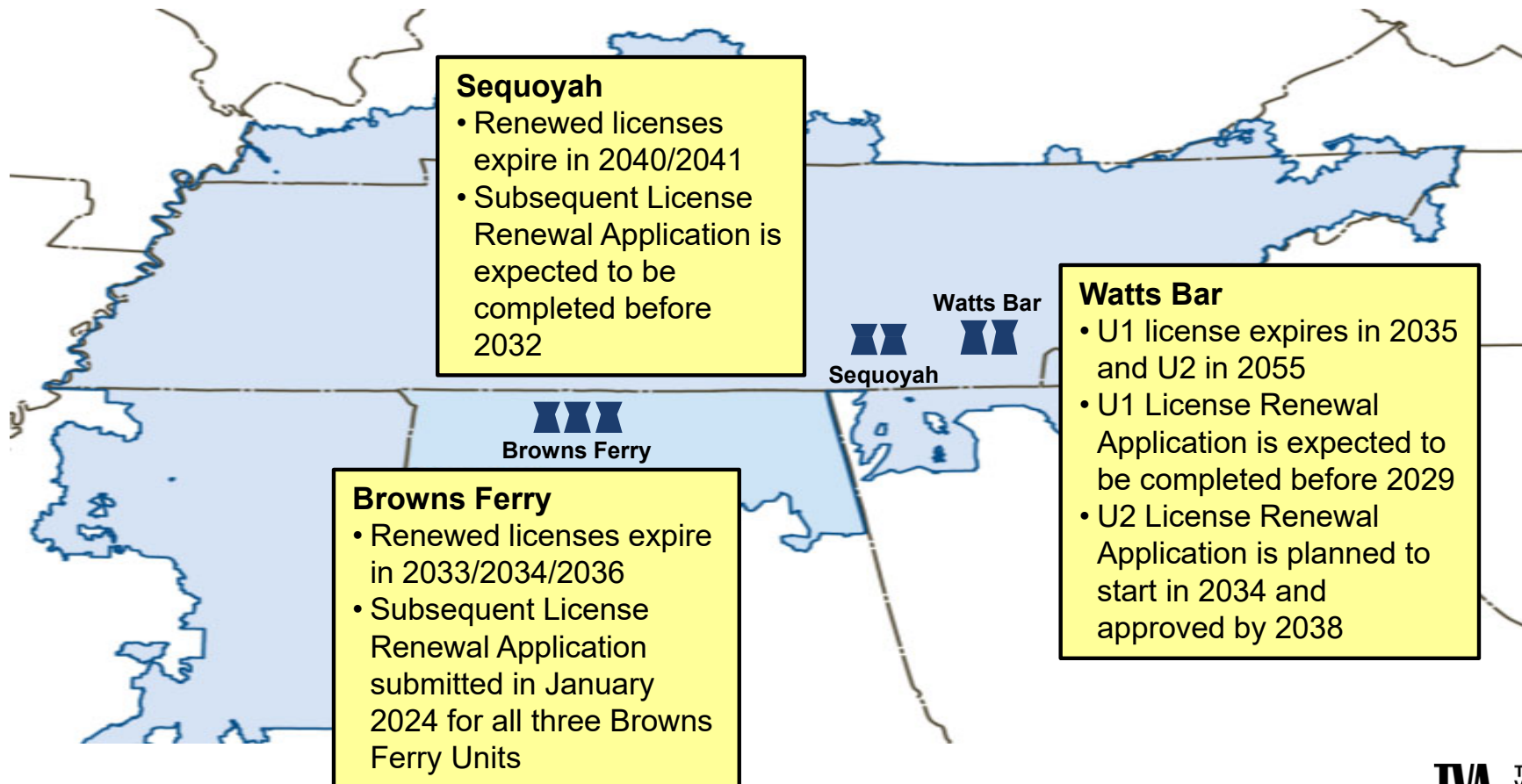


# Watts Bar Nuclear Plant Overview

- Located about half-way between Knoxville and Chattanooga, near Spring City, TN
- Two Westinghouse PWR Units, generating about 2,400 MWe
- Supplies electricity to approximately 1.3 million homes
- Supports about 1,000 full-time jobs
- Unit 2 began operation in October 2016

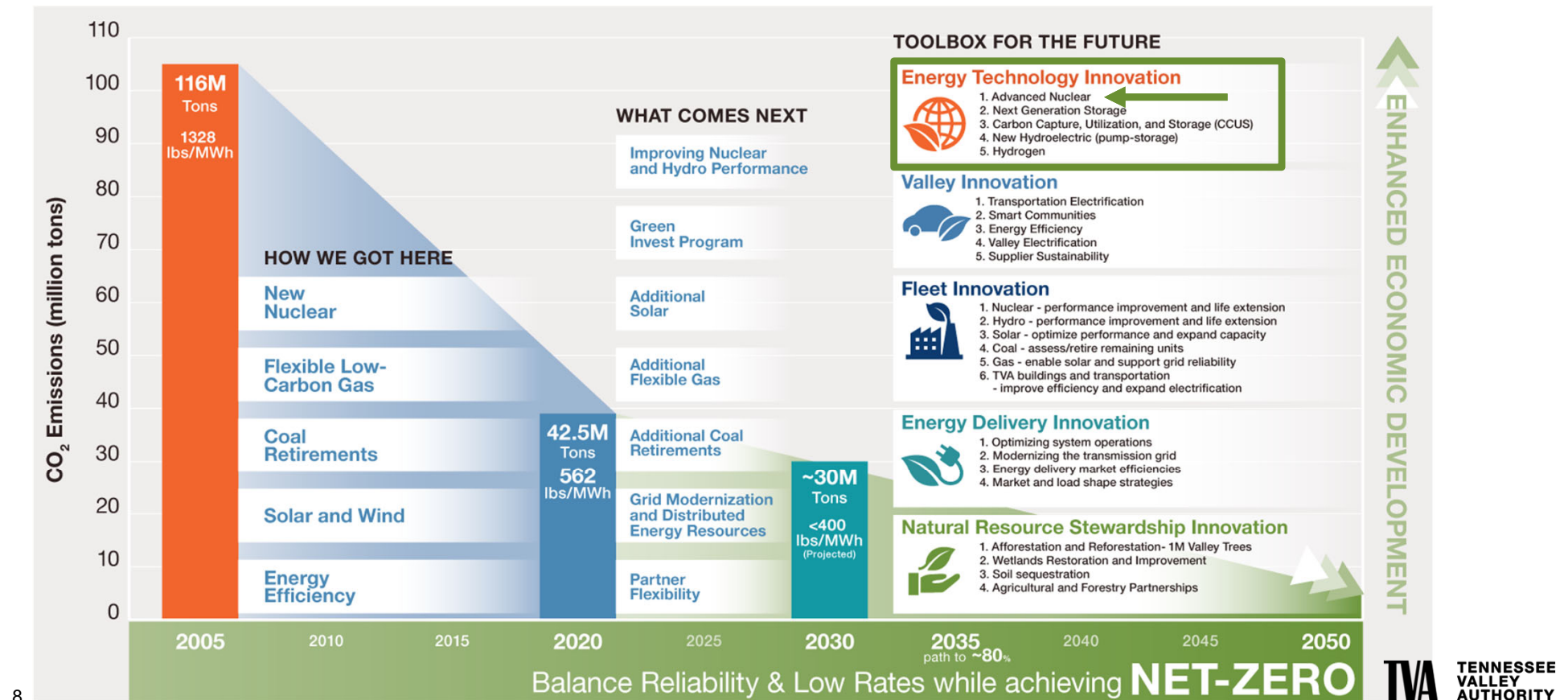


# Fleet Nuclear Asset



# TVA's Clean Energy Leadership

ENERGY TECHNOLOGY INNOVATION THAT CAN SUPPORT CARBON GOALS





# TVA & New Nuclear Technology

FEBRUARY 2022 TVA BOARD DIRECTION

Approved funding up to \$200 million for a program to:

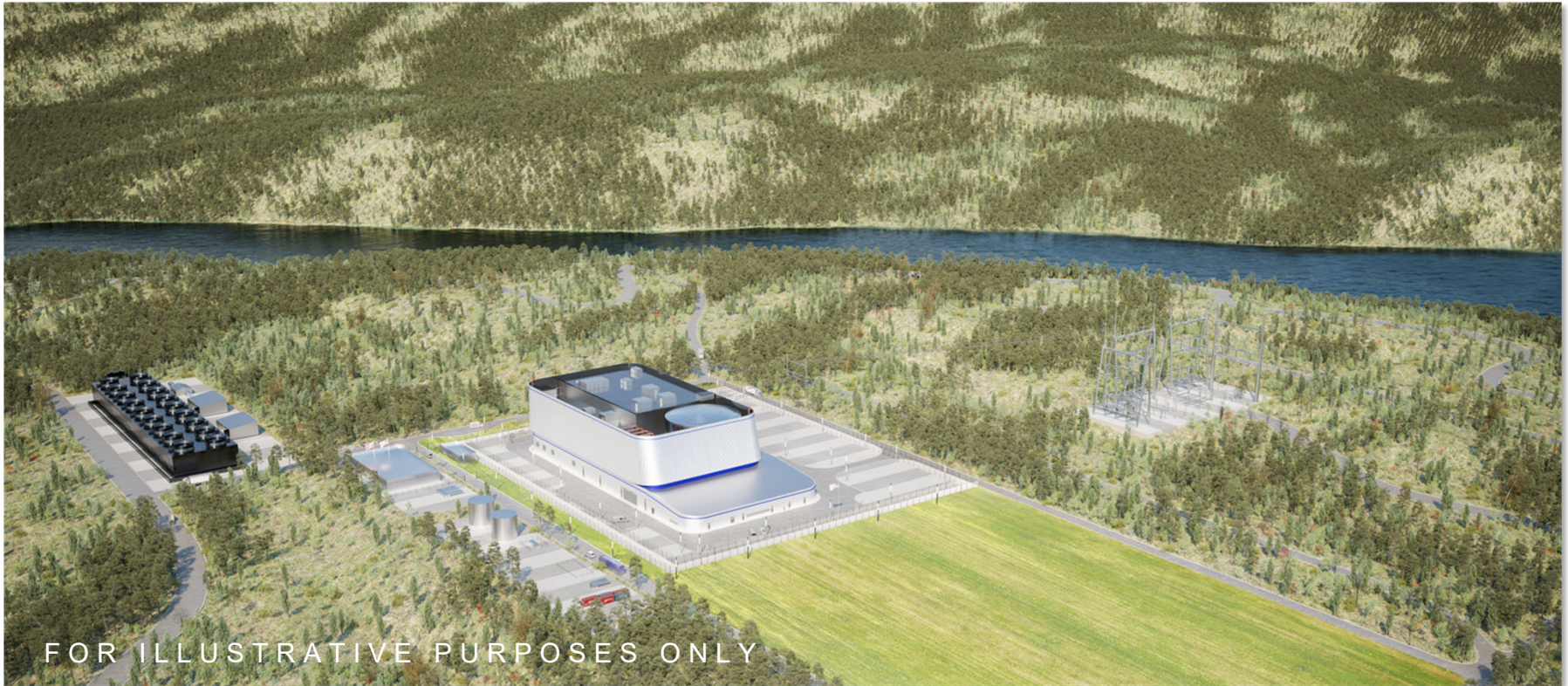
1. Perform design engineering, scoping, estimating, and planning associated with potential future deployment of an advanced reactor at Clinch River
2. Develop new nuclear license applications
3. Continue to study potential, future advanced reactor technologies
4. Study potential for advanced nuclear deployments at other sites

CLINCH RIVER  
NUCLEAR PROJECT  
INFORMS POTENTIAL  
FLEET DEPLOYMENTS

NEW NUCLEAR  
PROGRAM  
PLANNING FOR  
POTENTIAL  
FLEET  
DEPLOYMENT

# Clinch River Nuclear Project

TVA'S POTENTIAL FIRST ADVANCED NUCLEAR SMALL MODULAR REACTOR\*



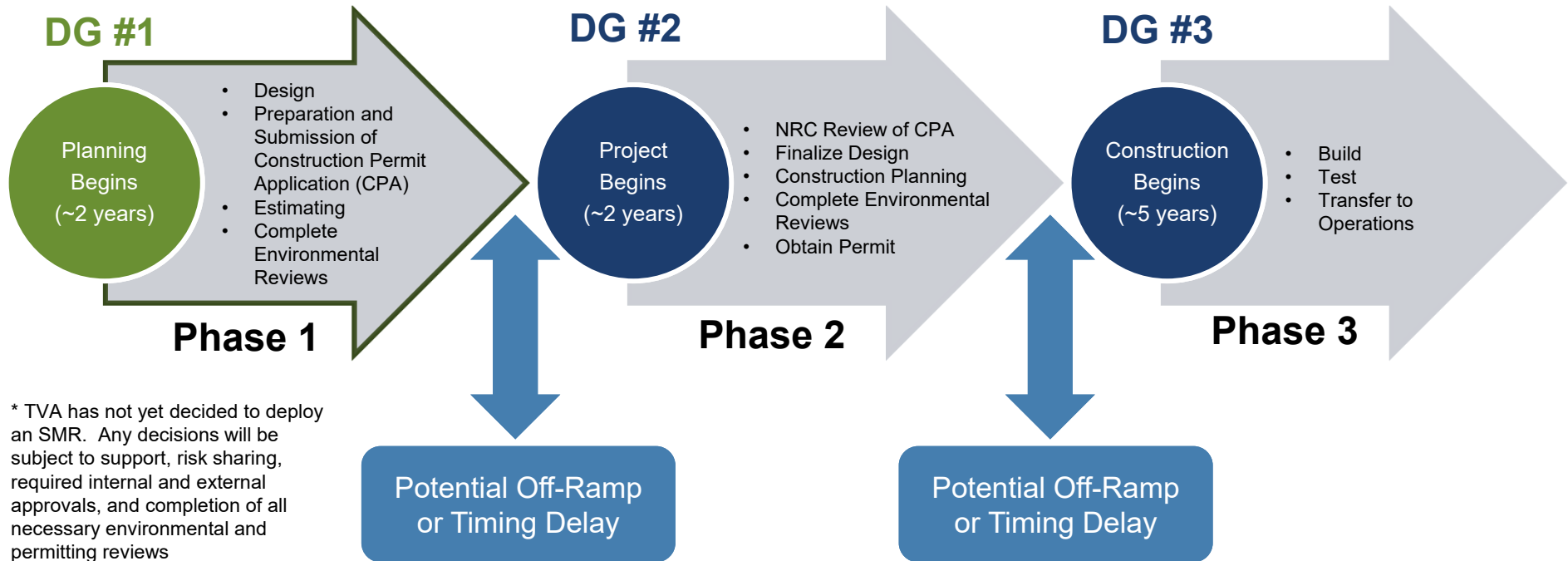
\* TVA has not yet decided to deploy an SMR. Any decisions will be subject to support, risk sharing, required internal and external approvals, and completion of all necessary environmental and permitting reviews.

# Clinch River Nuclear Decision Gate Process\*

PHASED DECISION APPROACH TO REDUCE RISK AND COSTS



**Board Authorization required to proceed beyond Decision Gate (DG) for each phase.  
Enterprise evaluation criteria to support recommendation to the CEO and Board.**



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# GE-Hitachi BWRX-300


BUILT ON EXISTING TECHNOLOGY


TVA identified GEH's innovative BWRX-300\* reactor design as the most promising for near-term deployment.


**BENEFITS OF THIS DESIGN INCLUDE**

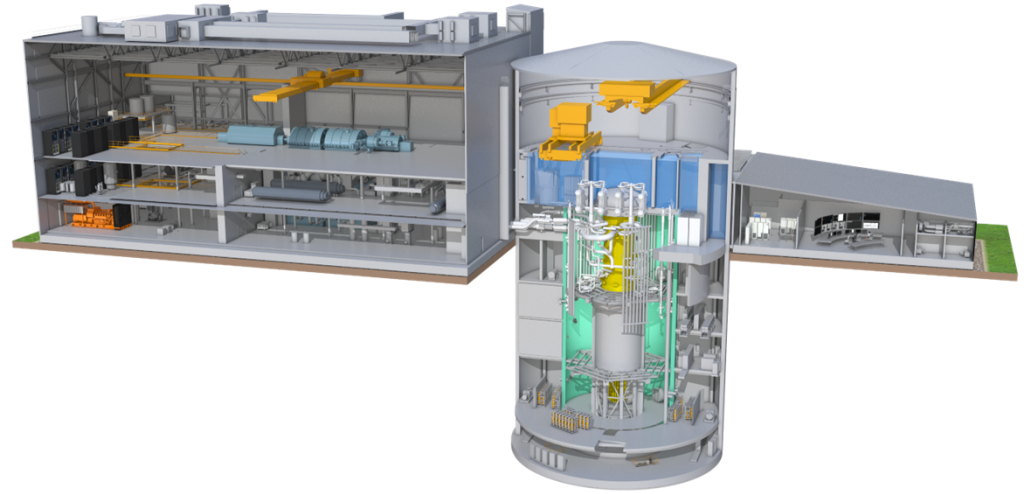
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**10** GENERATIONS OF DESIGN HISTORY 

 EXISTING SUPPLY CHAINS

 AMERICAN FUEL

 NRC LICENSING PATHWAY



This provides confidence the technology can be **deployed** on a **predictable schedule** with **acceptable risk**.

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# Technology Collaboration Agreement

COLLABORATION | COST SHARING | STANDARDIZATION | O&M SUPPORT

**ONTARIOPOWER**  
GENERATION

Participating in the BWRX-300 SMR design for deployment in Canada. Two years ahead of TVA proposed deployment timeframe.\*

**TVA**

Participating in the BWRX-300 SMR design being evaluated for deployment in the Valley.

**OSGE**  
ORLEN SYNTHOS GREEN ENERGY

Participating in the BWRX-300 SMR design being evaluated for deployment in Poland.



**HITACHI**

Developer of the BWRX-300 design being evaluated for deployment.

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# Nuclear Support in Tennessee

VISION TO MAKE THE STATE A NATIONAL LEADER IN ADVANCED NUCLEAR

- Governor Bill Lee & US Representative Chuck Fleischmann visited the CRN site in March 2023 and discussed Tennessee's leadership role in the development and deployment of new nuclear power generation
- Later that month, the State of Tennessee committed \$50 million to a nuclear energy fund
- In May, Governor Lee signed an executive order to create the Tennessee Nuclear Energy Advisory Council
- TVA is actively working to engage in these opportunities to support the efforts of the Clinch River Nuclear Project & New Nuclear Program



# Federal Interest in the Clinch River Project

VISION FOR THE US TO LEAD IN ADVANCED NUCLEAR

- TVA hosted Secretary of Energy, Jennifer Granholm, at the Clinch River Nuclear site on December 5.
- The discussion focused on TVA's leadership and the need to bring down the cost of first-of-a-kind reactors.
- “TVA is leading on small modular reactors with this site. Everybody's looking to TVA to make sure that this can actually happen.” – Jennifer Granholm



# Advanced Nuclear Technology Evaluation

## LIGHT WATER VS. NONLIGHT WATER

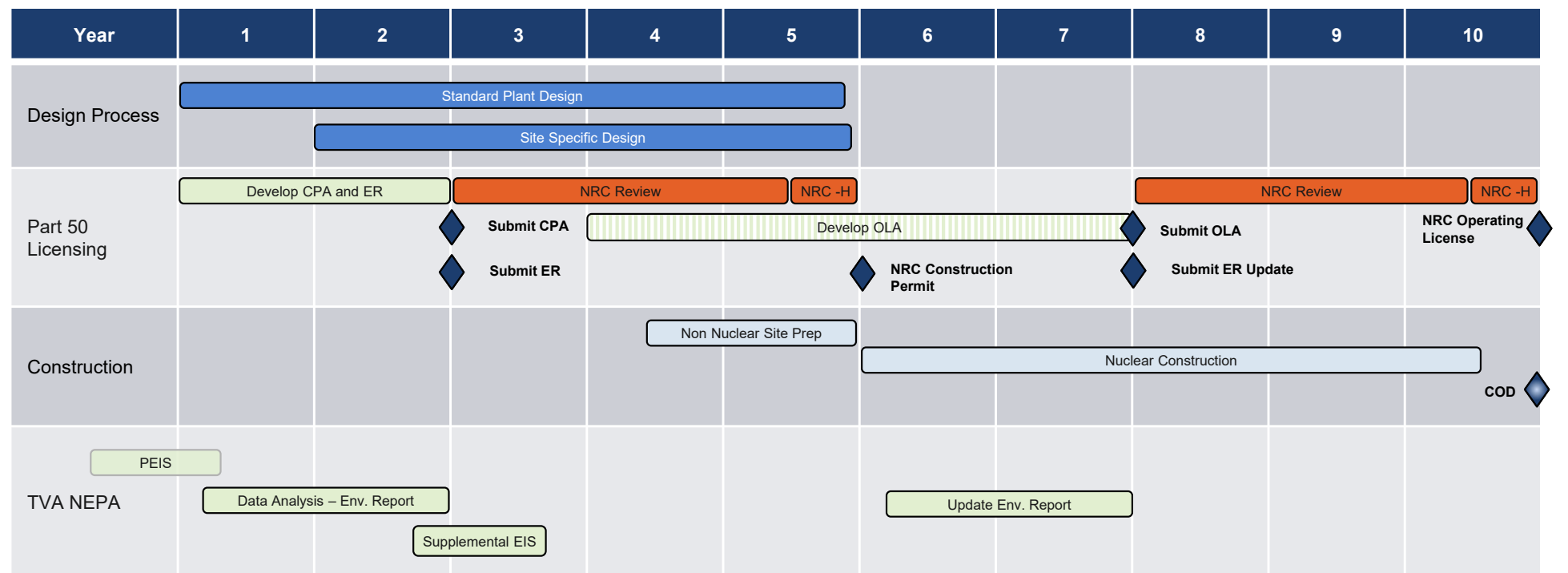
Technologies and their potential for commercial scale deployment were assessed:

- ✓ Technology – evaluates subsystem development / maturity
- ✓ Licensing – progress towards and probability of regulatory approval
- ✓ Economic – estimated levelized cost of electricity (LCOE)
- ✓ Manufacturing – maturity and viability of fabricating the plant / subsystems / major components
- ✓ Risk – combination of safety, implementation and operability risks

	Light Water Reactors	Nonlight Water Reactor – Gen IV (sodium, gas, salt coolants)
Nuclear Fuel	Same as operating nuclear fleet	Need supply chain, testing, and licensing
Supply Chain	Ready; quickly scalable	Need suppliers and component testing
Operational Characteristics	High availability; compatible with renewables	Unproven availability; compatible with renewables; industrial process heat capable, improved efficiency
Timeframes	First commercial deployments by 2028 (OPG)	First commercial deployments from late 2030s to early 2040s

# CRN1\* Design, Licensing, and Environmental

SCHEDULE FOR ILLUSTRATION ONLY



CPA Construction Permit Application  
 COD Commercial Operation Date  
 ER Environmental Report

NEPA National Environmental Protection Act  
 NRC Nuclear Regulatory Commission  
 NRC- H Nuclear Regulatory Commission Hearing Process

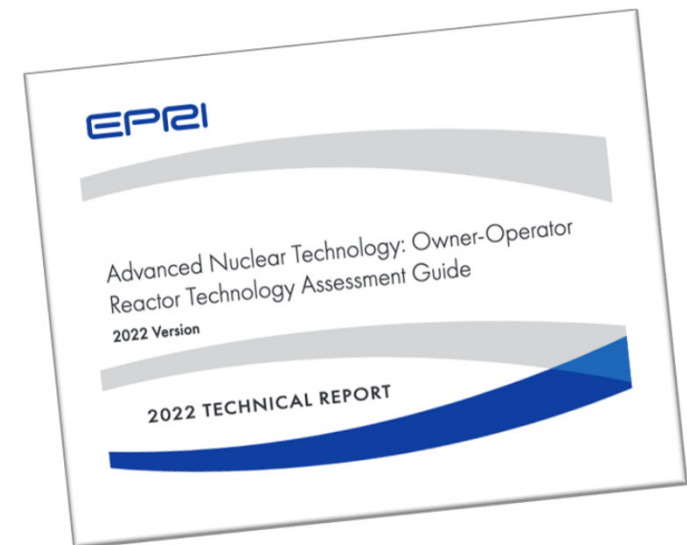
OLA Operating License Application  
 PEIS Programmatic Environmental Impact Statement (NEPA), CRN ROD issued 9/22  
 ROD Record Of Decision (NEPA)

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# Planning For Potential Future SMR Deployments

## SCREENING OF EXISTING TVA PROPERTIES FOR POTENTIAL SMR USE

- EPRI Advanced Nuclear Siting Guideline methodology
- TVA properties with at least 75 acres
- Conducted with available site information
  - Seismic
  - Flooding
  - Water Access
  - Generation Needs
  - Transmission Favorability
  - Energy Communities
  - Population Density
  - Rail Access
  - Barge Access
  - Highway Access
  - Emergency Planning
  - Environmental Considerations





# TVA Vision for Advanced Nuclear

STRATEGIC PATH FORWARD FOR THE PEOPLE OF THE VALLEY

## Leadership



TVA's leadership in technology innovation provides a pathway to net-zero carbon emissions.

## Experience



TVA has the nuclear and construction experience and talent to support small modular reactor (SMR) development and deployment.

## Approved Site



The Nuclear Regulatory Commission approved an Early Site Permit for TVA's Clinch River site, meaning that it is suitable for SMRs.

## Strategic Approach



TVA's Decision Gates will ensure the timing of deployment is right.

## Future-Looking



TVA's New Nuclear Program will inform future SMR decisions and potential deployment locations across the Tennessee Valley.

