



# Development and Qualification of Advanced Fuel Designs for the Sodium<sup>TM</sup>\* and Molten Chloride Fast Reactor Designs

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\*A TerraPower & GE-Hitachi Technology

SUBJECT TO DOE COOPERATIVE AGREEMENT NO. DE-NE0008924  
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# Fuel Development and Qualification Efforts

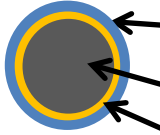
- Since our inception in 2008 TerraPower has actively been working on advancing fuel designs including metallic fuels for the Traveling Wave Reactor (TWR®) and Sodium reactor designs and molten salt fuels for the Molten Chloride Fast Reactor (MCFR) designs
- Active engagement with the NRC to advance our fuel qualification strategies
- Advanced Fuel Qualification Methodology effort was funded by the Department of Energy through a regulatory assistance grant to help TerraPower refine our approach for metallic fuel qualification by supporting early engagement with the NRC (ML20209A155, ML20316A038, ML21057A008)
- Four total documents prepared as part of this effort:
  - 1) Overall fuel qualification methodology, 2) Fuel Assembly Qualification Plan, 3) Type 1 Fuel Pin Qualification Plan (host fuel), and 4) *Type 1B Fuel Pin Qualification Plan (advanced fuel)*

# Advancing Metallic Fuel Designs

## Fuel Pin Cross-Sections


U-10Zr 75% Smear Density

EBR-II\*  
(Mk IV)  
5.84mm




Cladding  
Fuel  
Bond Sodium

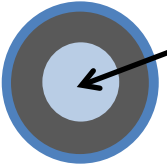
FFTF\*  
(MFF)  
6.86mm



Host Fuel  
(Type 1)  
>6.86mm



Commercial  
Advanced  
Fuel (Type 1B)



He-filled  
Central Pore  
Fuel-Cladding  
Chemical  
Interaction Barrier

## Pins Arranged in Hexagonal Assembly Surrounded by a Duct

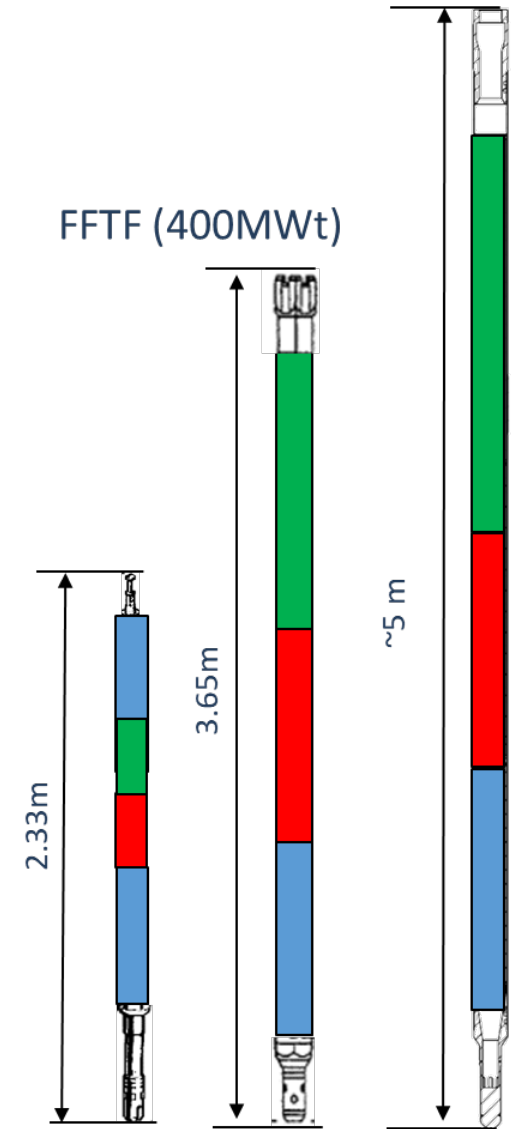


\*EBR-II: Experimental Breeder Reactor II

\*FFTF: Fast-Flux Test Facility

Sodium Type 1 (840MWt)

FFTF (400MWt)



## Comparison of Fuel Assembly Heights

# Natrium Fuel Qualification Path

## Type 1/Host Fuel Activities

Qualification of  
Existing EBR-II Fuel  
Data

Post-Irradiation Exams  
on Historic FFTF/MFF  
Pins

Irradiation Test  
Comparing Historic  
and New Na-Bonded  
Fuels

Transient Testing of  
Irradiated FFTF/MFF  
Pins

Natrium Reactor

## Type 1B/Advanced Fuel Activities

Advanced Test Reactor  
(ATR) Tests of Type 1B  
Fuel

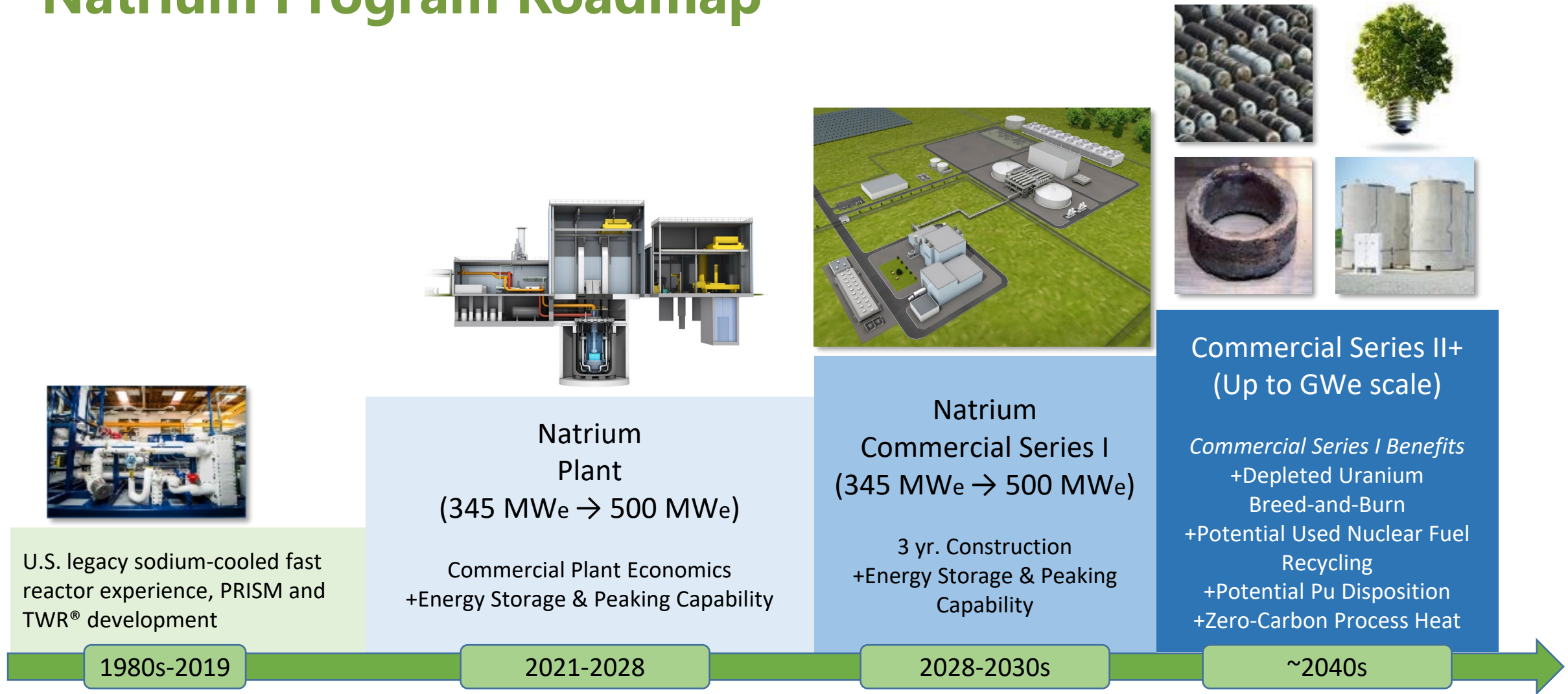
Transient Testing of Fresh  
and Irradiated Advanced  
Fuel Pins

Lead Test Assembly  
Testing of Advanced Fuels  
in Natrium Reactor

Commercial Natrium  
Reactors



**Host and Advanced Fuel Testing Activities Being Performed in Parallel**

# Sodium Program Roadmap





# MCFR Technology Development Roadmap

 = non-nuclear facility  
 = nuclear reactor/facility

