# New and Advanced Reactors: Codes and Standards

BRANDON HAUGH, SR DIRECTOR MODELING AND SIMULATION

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Kairos Power's mission is to enable the world's transition to clean energy, with the ultimate goal of dramatically improving people's quality of life while protecting the environment.

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In order to achieve this mission, we must prioritize our efforts to focus on a clean energy technology that is *affordable* and *safe*.

# Overview of Kairos Power

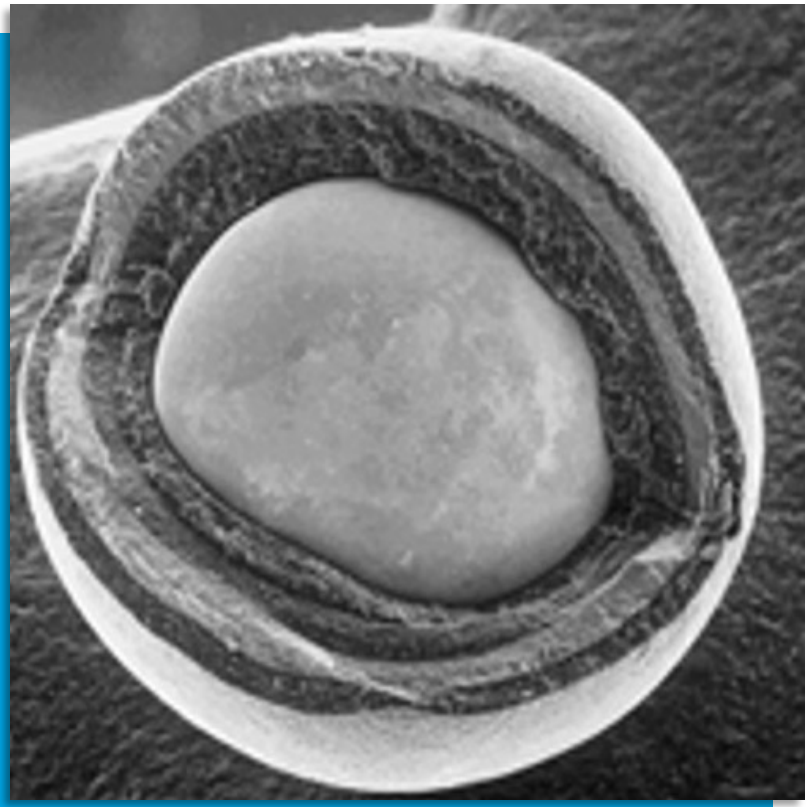
- Nuclear energy engineering, design, and manufacturing company ***singularly focused*** on the commercialization of the fluoride salt-cooled high-temperature reactor (FHR)
  - Founded in 2016
  - ~400 Employees
- Novel approach to nuclear development that includes iterative hardware demonstrations and in-house manufacturing to achieve disruptive cost reduction and provide true cost certainty
- Schedule driven by US demonstration by 2030 (***or earlier***) and rapid deployment ramp in 2030s
- Cost targets set to be competitive with natural gas in the US electricity market

Kairos Power Headquarters

Kairos Power Team

# Fluoride Salt-Cooled High Temperature Reactor

## Technology Basis



**Coated Particle Fuel**

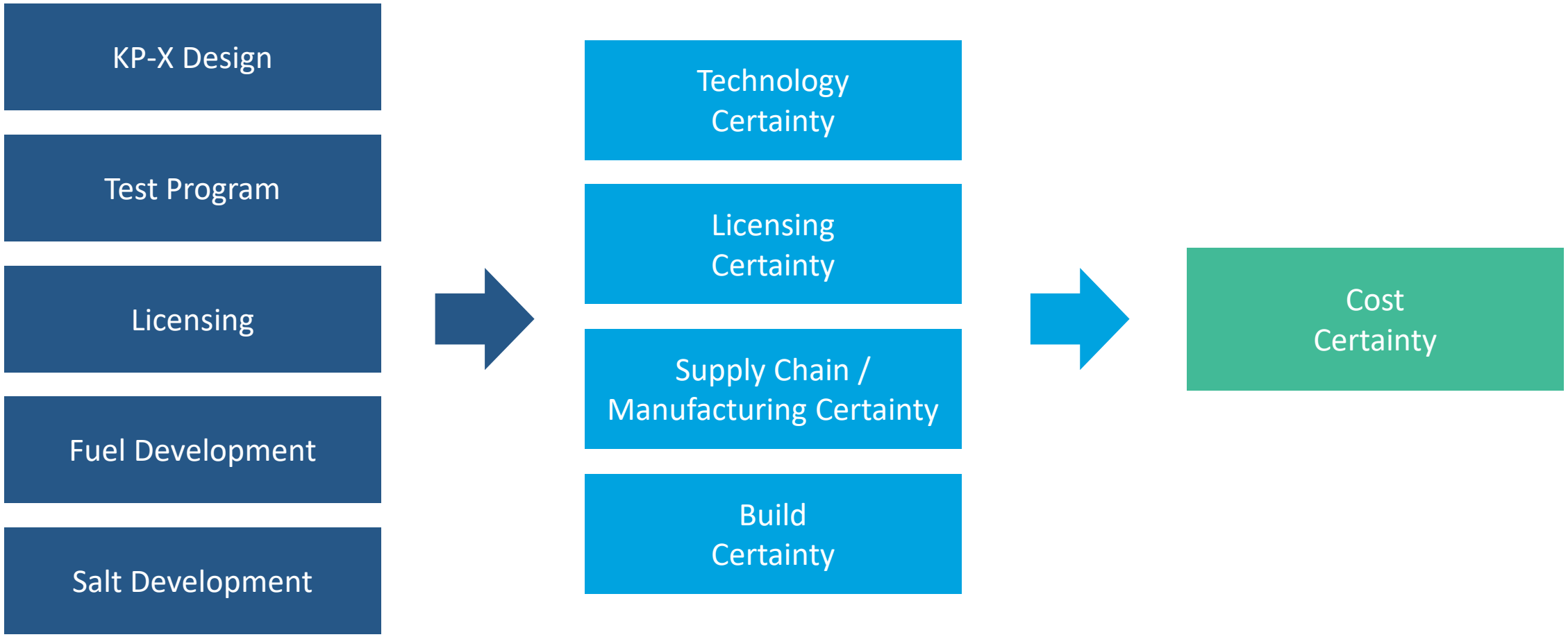
**TRISO**

**Liquid Fluoride Salt Coolant**

**Flibe ($2LiF\text{-}BeF_2$)**

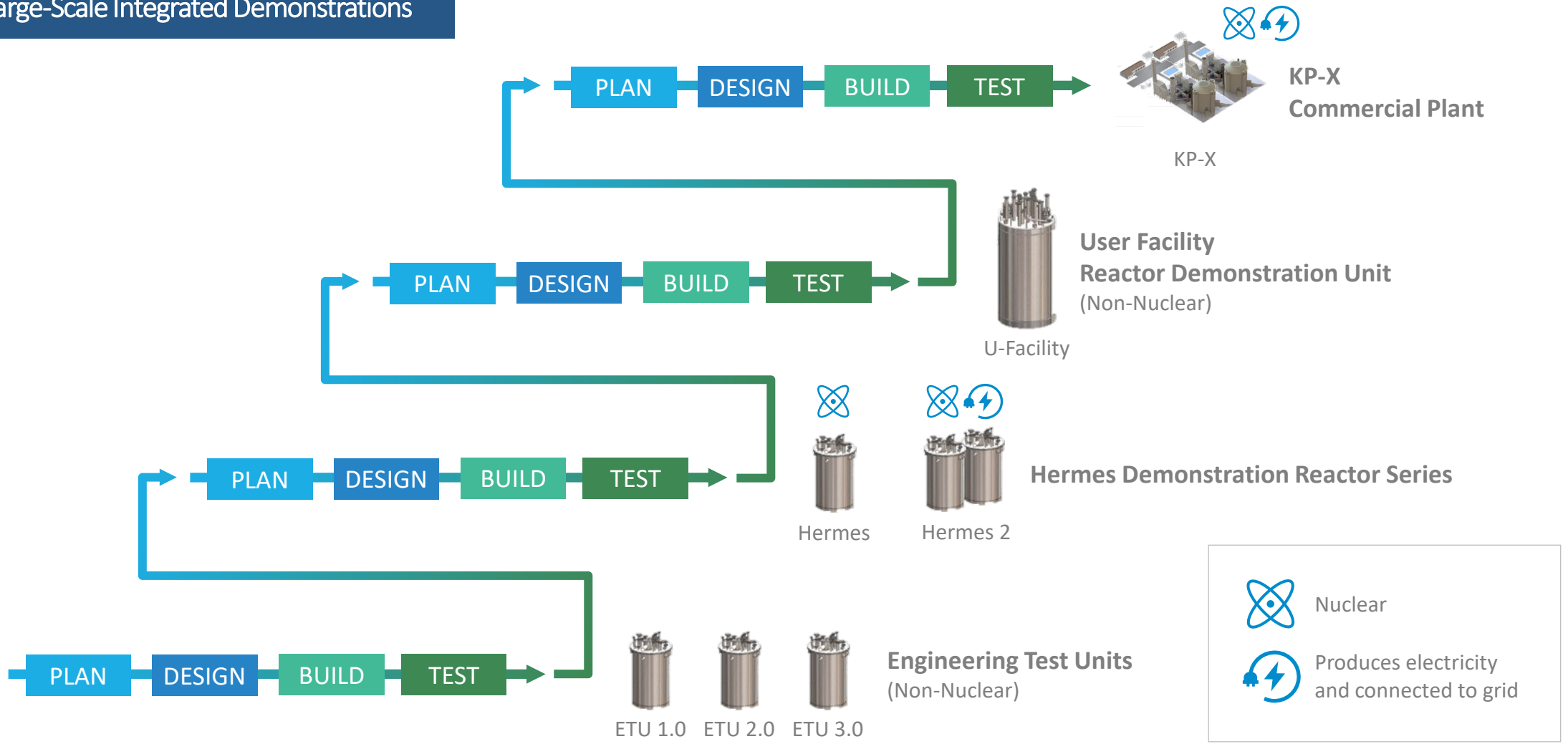
# Kairos Power Workstreams

## Reduce risk and build cost certainty



# Kairos Power Path to Commercialization

## Successive Large-Scale Integrated Demonstrations

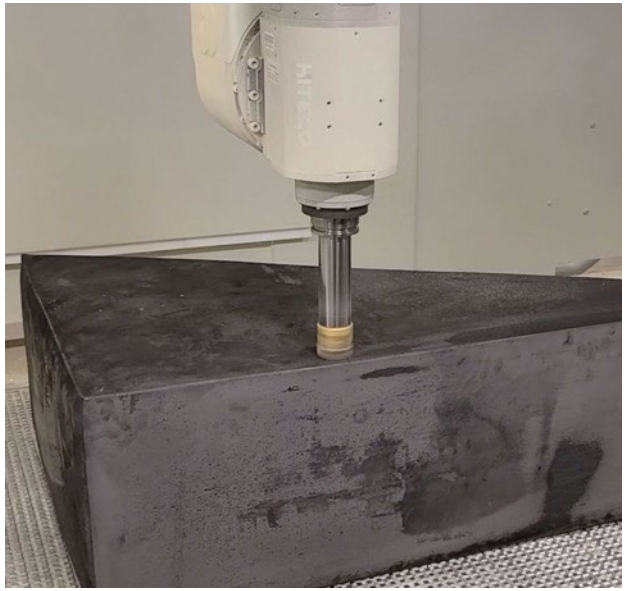


# Manufacturing

## Vertical Integration

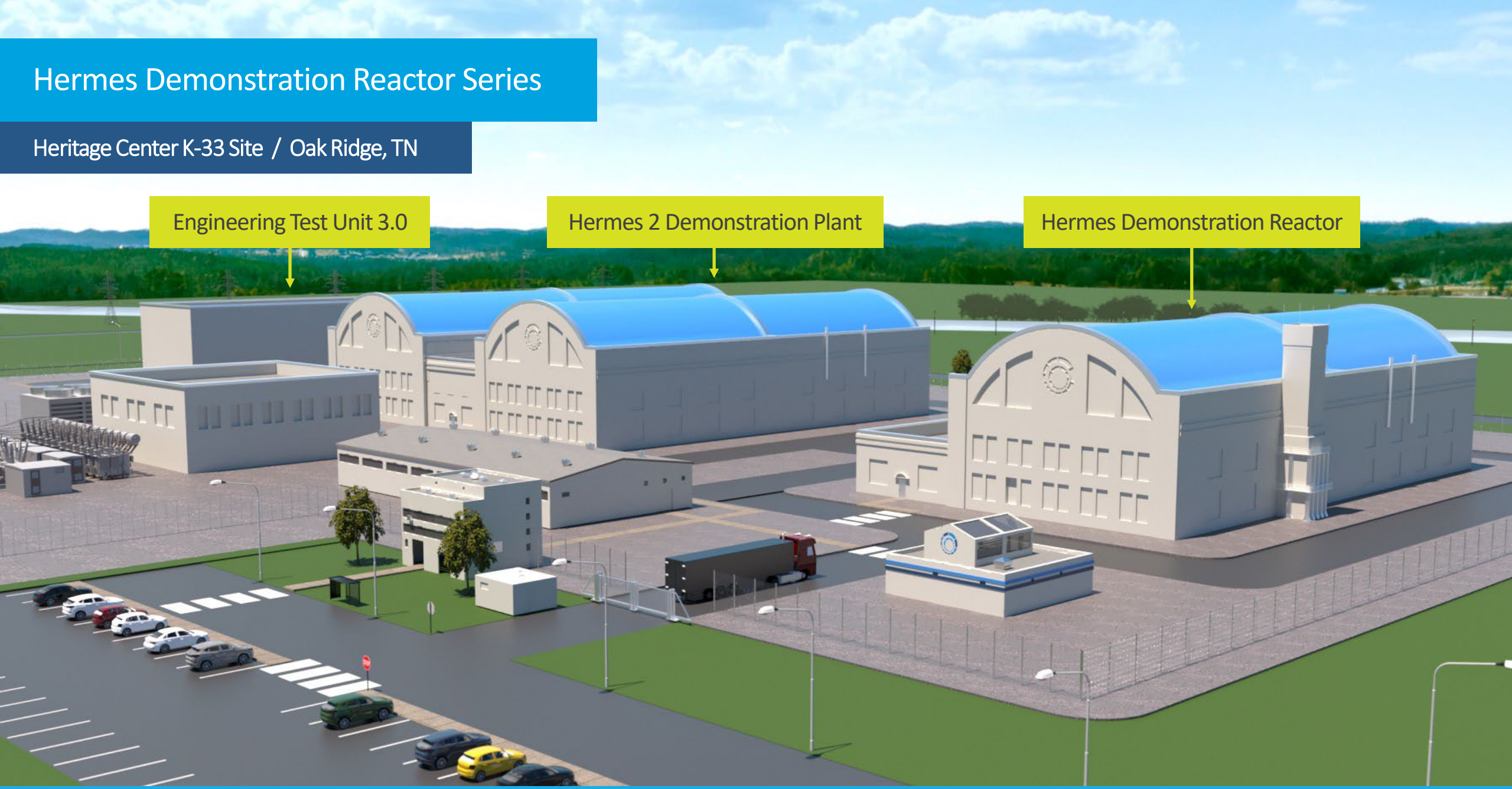
**KP Southwest Manufacturing Floor**
*Albuquerque, NM*

**First U-Stamped Vessel**
*December 2022*



# Hermes Demonstration Reactor Series

## Heritage Center K-33 Site / Oak Ridge, TN



# Hermes Demonstration Reactor Series

## Leading the Way in Advanced Reactor Licensing

- The U.S. Nuclear Regulatory Commission issued a construction permit for the **Hermes demonstration reactor** in 2023 following an accelerated application review enabled by robust pre-application engagement
- Kairos Power submitted a construction permit application (CPA) for the **Hermes 2 demonstration plant** in July 2023, which builds upon the successful Hermes CPA
- **Major licensing accomplishments to date:**
  - ✓ **11 of 11 topical reports supporting KP-FHR licensing approved**
  - ✓ **Hermes Construction Permit Issued by NRC in Dec. 2023**
  - ✓ **First CP for a non-water-cooled reactor in over 50 years**
  - ✓ **Hermes 2 CPA accepted for review in Sept. 2023**

*Kairos Power completed its mandatory hearing for the Hermes CPA and received its construction permit in Q4 2023*

# Advanced Reactor Demonstration Program (ARDP)

## Novel Performance-Based, Fixed-Price Funding Agreement

- Kairos Power and DOE signed a Technology Investment Agreement in Feb 2024 to implement an ARDP risk reduction funding award that will provide up to **$303 million** to support the design, construction, and commissioning of the **Hermes demonstration reactor**
- Under the agreement, Kairos Power will receive fixed payments from DOE upon demonstrating the achievement of significant project milestones
- This investment by DOE will supplement Kairos Power's substantial private investment in the Hermes project and supporting infrastructure

# Codes and Standards to Enable a Path to Commercialization

- Current support from ASME and ANS are helpful.
  - ASME is working to remove legacy LWR specific terms, regulatory and other requirements for BPVC and supporting quality standards
    - Section III Div5
    - QME
    - OM-2
    - Etc
  - ANS is working on both technology agnostic and technology specific standards.
    - Kairos participated in the development of reactor startup testing needs for FHR plants
    - ANS-19.13, Initial Fuel Loading and Startup Tests for FOAK Advanced Reactors
- There is focused effort by ASME's staff and Working Group's leadership efforts to accelerate the review and approval of code cases and code changes.
  - Right now, code cases / changes are being slowed down by lack of consensus within WGs.
  - ASME's leadership is trying to streamline the process via the creation of Task Groups and push for more documentation.
- We think more work could be done specifically to support new technologies like the KP-FHR
- Update Section 3 to allow for alternate QA programs to NQA-1
  - For example as we iterate through our demonstration facilities the QA program endorsed by the USNRC is not NQA-1 but ANSI-15.8.
  - Yet we cannot stamp a Section III vessel without and NQA-1 program and associated qualified suppliers of the raw materials.
  - This is likely critical to having a robust supply chain vs a very limited to nonexistent.
- For new materials qualification efforts we have seen progress around different grades.
  - It takes significant testing to achieve the lifetime durations to create the rules sets for each material.
  - We see a key partner in DOE supporting this time of sustained testing program.
  - It is often challenging for developers to do this all ahead of time and then share with competitors.
- The community could benefit from a faster USNRC endorsement process. (for example the last endorsed version of Section III.5 was 2017)