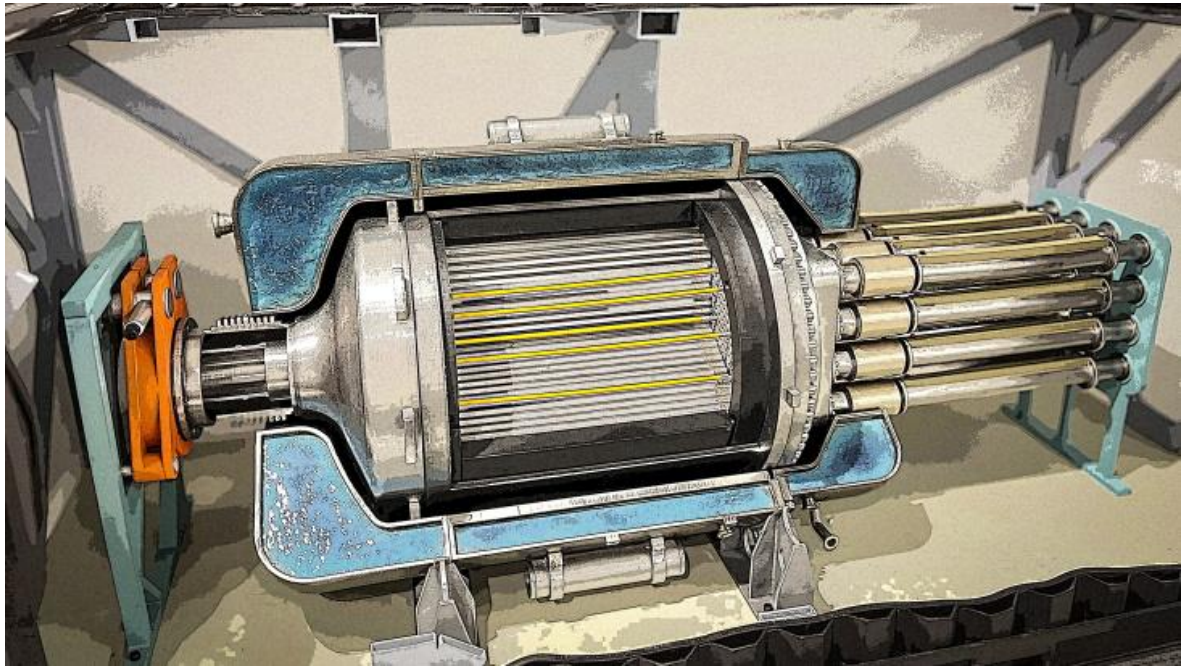
# The Case for Microreactors in Australia




ANA 2025 Tony Irwin, SMR Nuclear Technology Pty Ltd

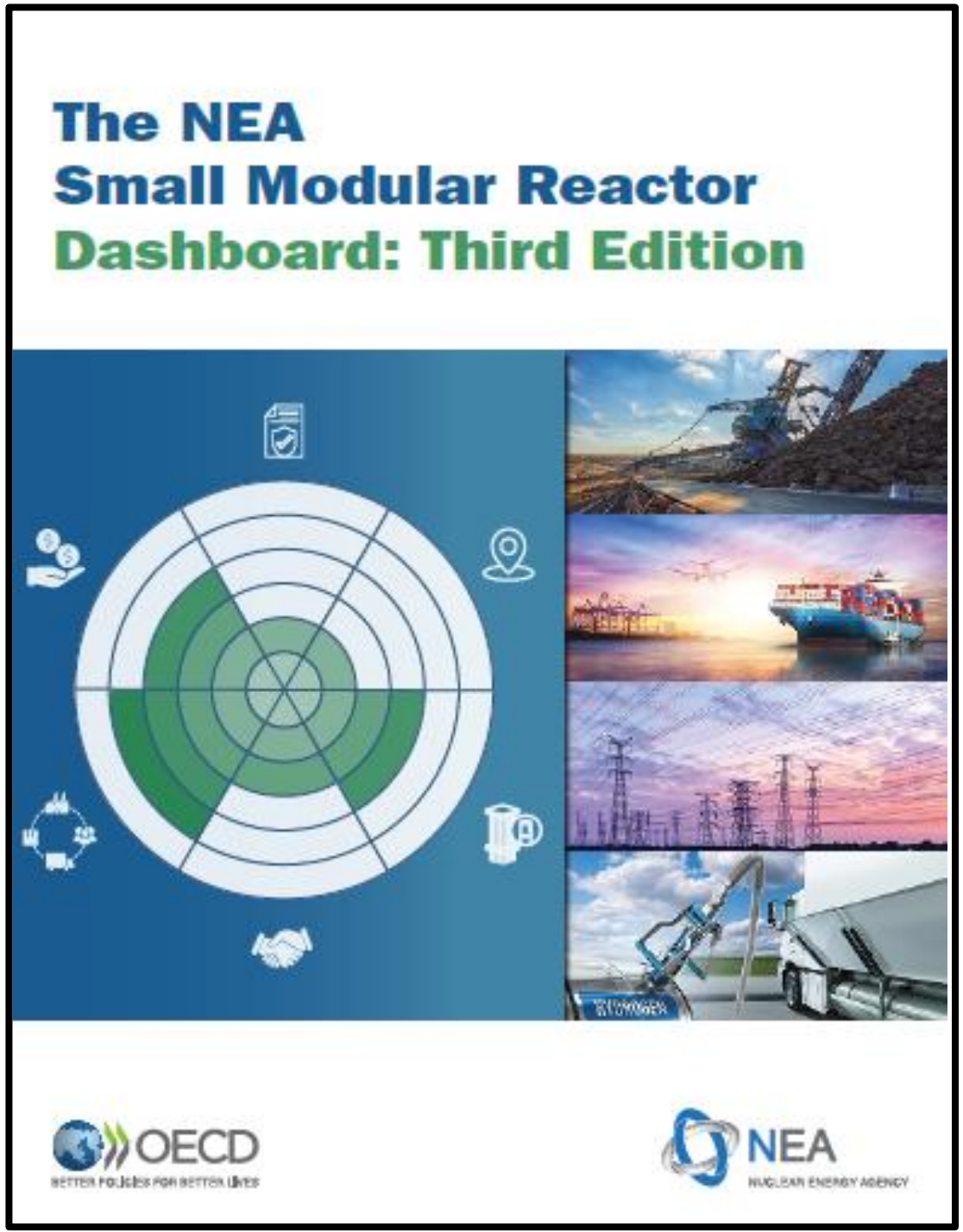
SMR NUCLEAR TECHNOLOGY

# Micro Modular Reactors (MMR)

- Increasing interest in very small reactors, typically < 10 MWe power capacity known as Micro Modular Reactors or simply microreactors
- Provide reliable, low emissions power, independent of the weather.
- Suitable for many deployments including off-grid remote locations, microgrids, mining operations, critical infrastructure, strategic military installations, data centres and disaster recovery
- Multipurpose – electricity + heat + desalination, scalable
- Load following capabilities, work with renewable energies in a microgrid
- Factory built, very compact, transport in shipping containers, can redeploy on another site
- Quick, on-site installation – months/weeks instead of years

- Over 1,000 islanded electricity systems and microgrids across Australia serving a population of 450,000 (Australian Energy Council 2015)

*In Canada, Governments of Ontario, New Brunswick, Saskatchewan and Alberta February 2023 Strategic Plan for deployment of MMR designed primarily to replace the use of diesel in remote communities and mines.*



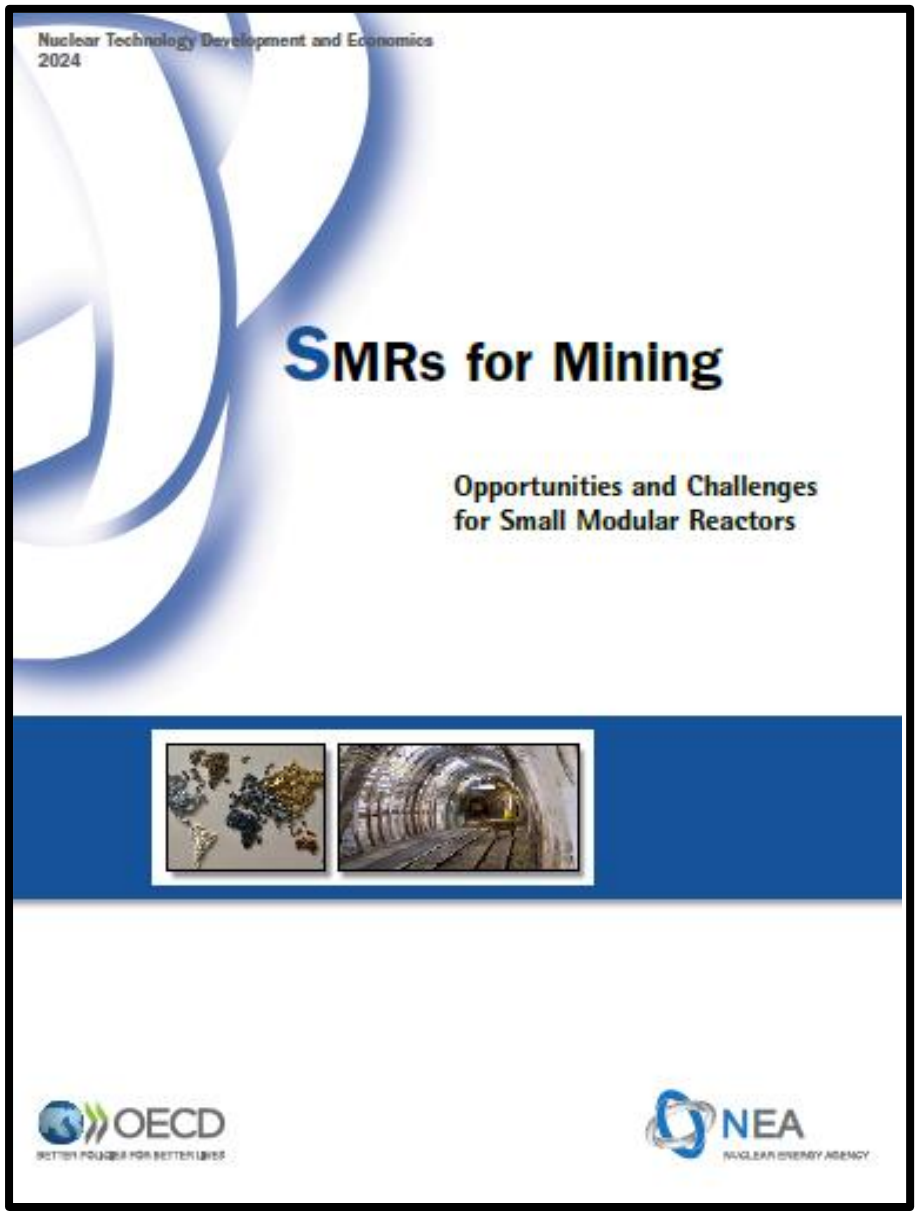

**Third Edition July 2025**
Includes microreactors.

Assesses against:

- Licensing readiness
- Siting
- Finance
- Supply chain
- Engagement
- Fuel

https://www.oecd-nea.org/jcms/pl_73678/nea-small-modular-reactor-smr-dashboard

# OECD-NEA "SMRs for Mining – Opportunities and Challenges"



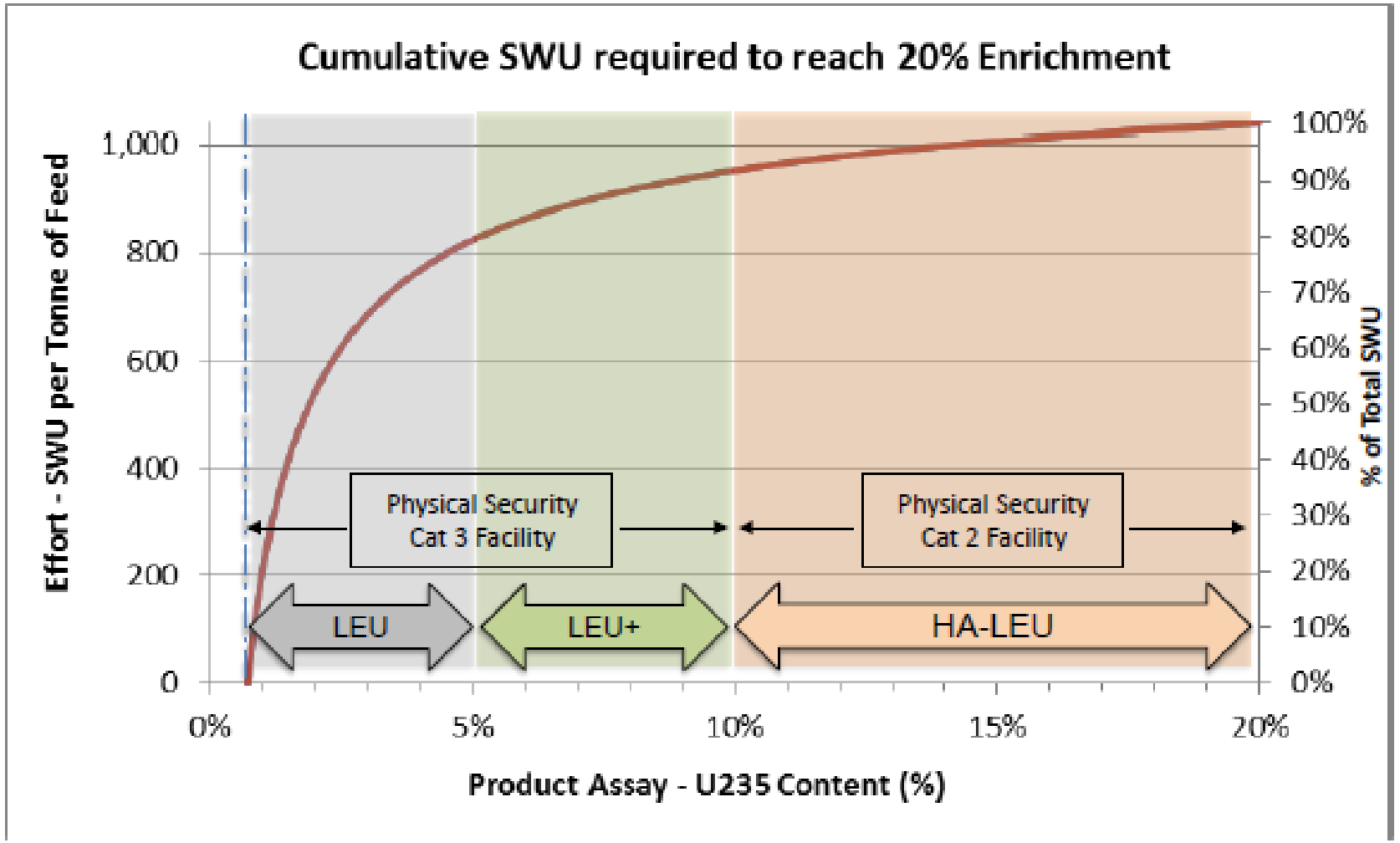

- Off-grid mining is expensive, mainly due to the high costs of generating electricity in a remote area (>20km from a grid supply).
- 16% of mineral deposits were found in remote areas, only 5% of existing mining operations operate in remote areas.
- Increased demand for critical minerals required for the clean energy transition. Some critical minerals, such as rare earth elements, niobium, lithium and cobalt, are more commonly found in these remote areas.
- NEA found that predicted costs of MMR's appear to be competitive with existing diesel generation in remote areas.

# TRISO (TRI-structural ISOtropic) Fuel

**TRISO fuel**:
0.5 mm diameter uranium fuel kernel coated typically with 92 µm porous carbon buffer + 38 µm inner pyrolytic carbon + 33 µm silicon carbide barrier + 41 µm outer pyrolytic carbon to give a <1mm diameter coated particle

Image: X-Energy

# URENCO : LEU, LEU+, HALEU




U235 Enrichment Levels

Feed 0.711% Natural Uranium

LEU <5% Civil Nuclear Reactors

LEU+ 5% - 10% Extended Fuel Cycles & ATFs

HA-LEU 10% - 20% Test, Research and Gen IV Reactors

# Heat Pipe Operation

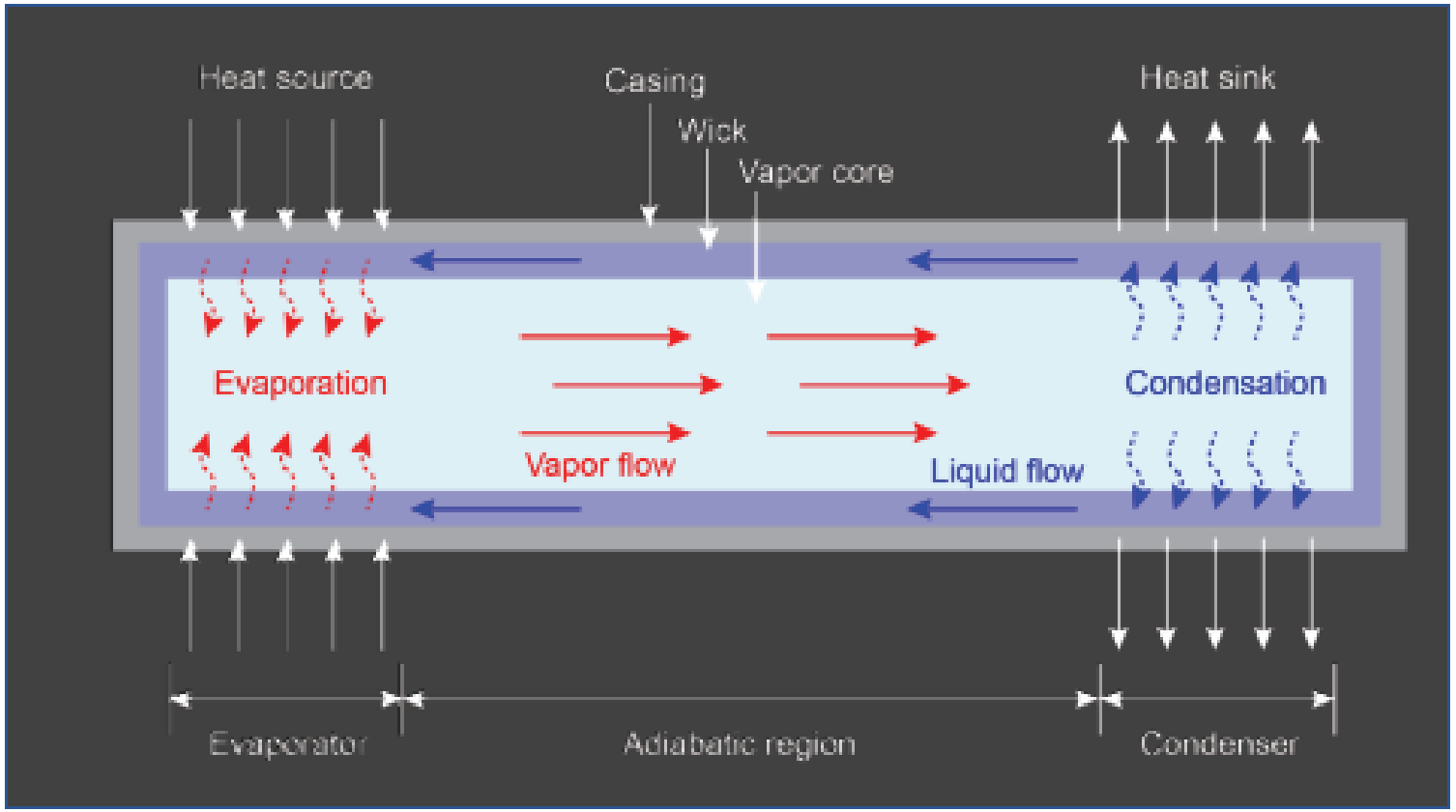



Image: OKLO

Combines thermal conductivity and phase transition.
Heat pipe filled with sodium/potassium and sealed.
Hot vapour pressure > cold vapour pressure – pressure difference drives gas to cold end. Wick transfers liquid by capillary action back to hot end.

# Demonstration of Microreactor Experiments (DOME)

The Experimental Breeder Reactor II (EBR II) operated on the INL site 1964-1994. Although the reactor has been decommissioned, the large concrete and steel containment dome has been retained – 24m diameter, 14m high.
Containment now repurposed as the DOME test bed.
DOME will hold a shipping container sized microreactor.

# Demonstration of Microreactor Experiments (DOME)

- US DOE, Idaho National Labs (INL) and the National Reactor Innovation Centre (NRIC) are enabling developers by providing technical resources, capabilities and a demonstration site.

- May 2025 – INL received priority rating authorization by the federal government to expediate the construction of the DOME test bed – reduces the time to secure components and services

- July 2025 – the DOE made conditional selections for Westinghouse and Radiant to perform the first tests in DOME

# USA DOE Pilot Program

- June 2025 – US DOE announced new pilot program to expediate testing of advanced reactor designs under DOE authority outside of the national laboratories (under the Atomic Energy Act). DOE issued Request for Application

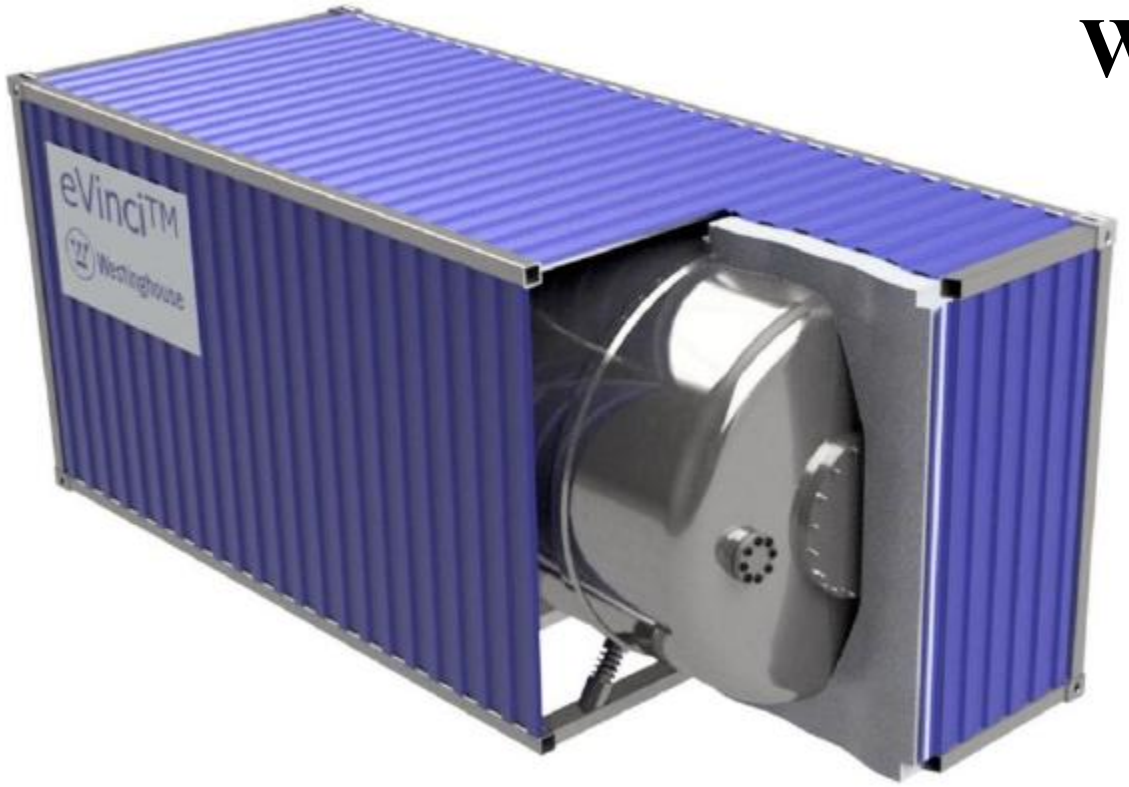
- Streamline nuclear reactor testing and ensure three reactors achieve criticality by 4 July, 2026. Initial applications closed on 21 July 2025

- 12 August 2025 - Initial selections: Aalo Atomics; Antares Nuclear Inc; Atomic Alchemy Inc; Deep Fission Inc; Last Energy Inc; Oklo Inc (two projects); Natura Resources LLC; Radiant Industries; Terrestrial Energy Inc; Valar Atomics Inc

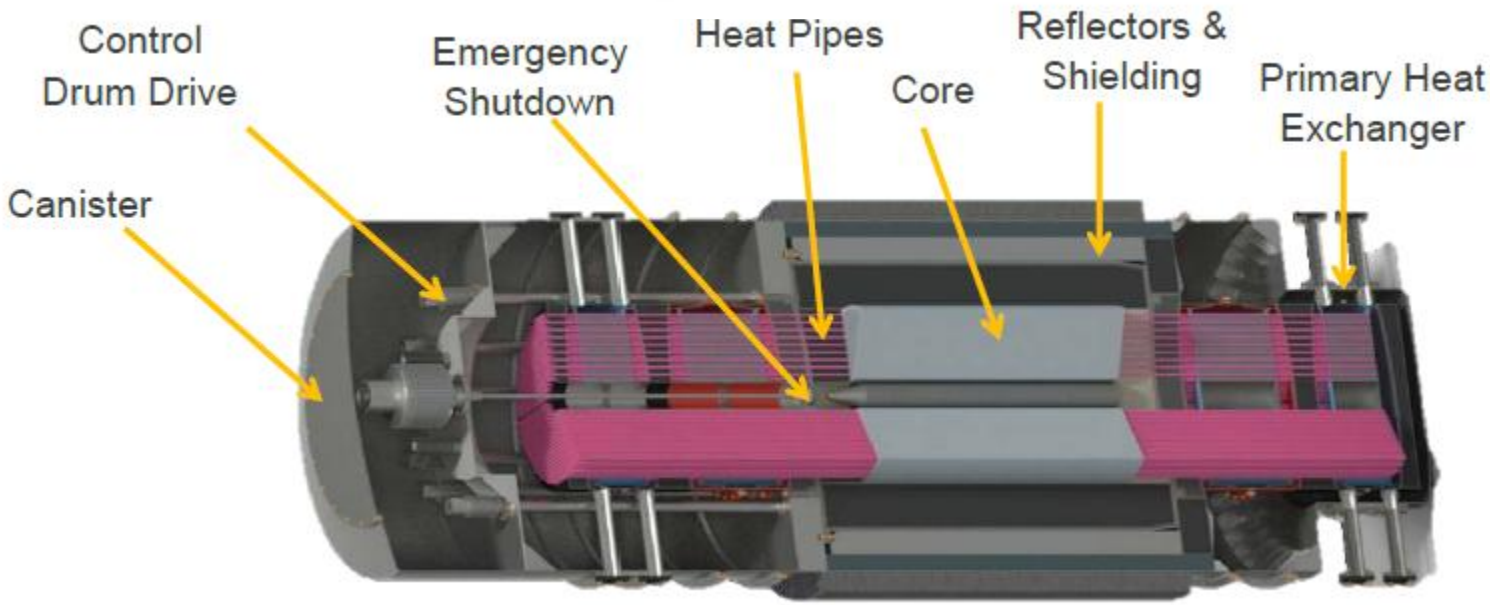
- Each company will be responsible for all costs associated with designing, manufacturing, constructing, operating and decommissioning their test reactors.

https://www.energy.gov/ne/us-department-energy-reactor-pilot-program

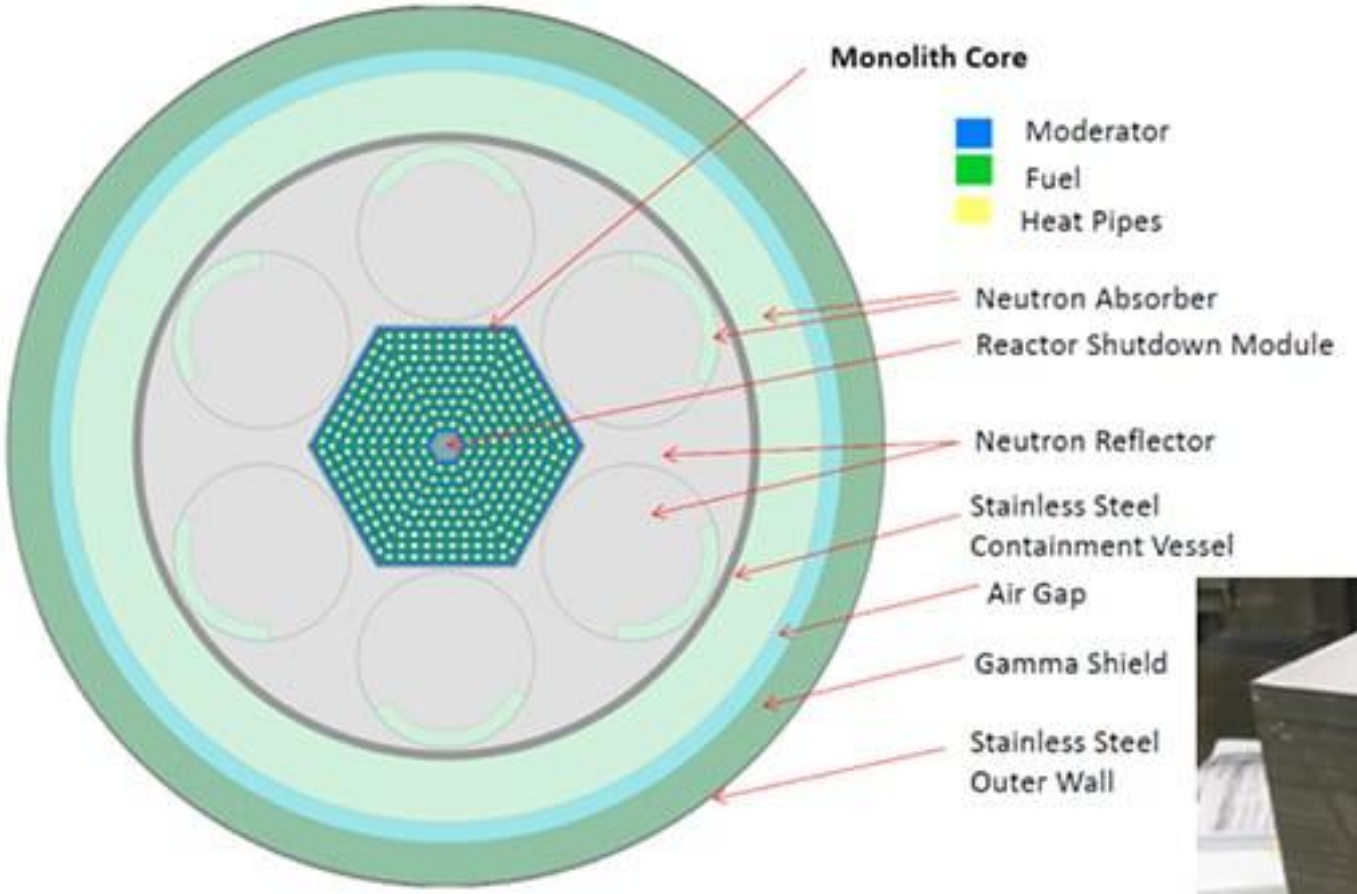
# Westinghouse eVinci Micro-Reactor 1MWe – 5MWe




Sodium filled heat pipes, no moving parts.
Power conversion – Brayton cycle



# Westinghouse eVinci




10 years without refuelling.
19.75% enrichment

Image: Westinghouse

# BWX Technologies (USA) Microreactor

## US DOD Project Pele
## Mobile, reliable, sustainable, resilient power source


*Transportable microreactors can deliver clean, zero-carbon energy where and when it is needed in a variety of austere conditions (Image: BWXT)*

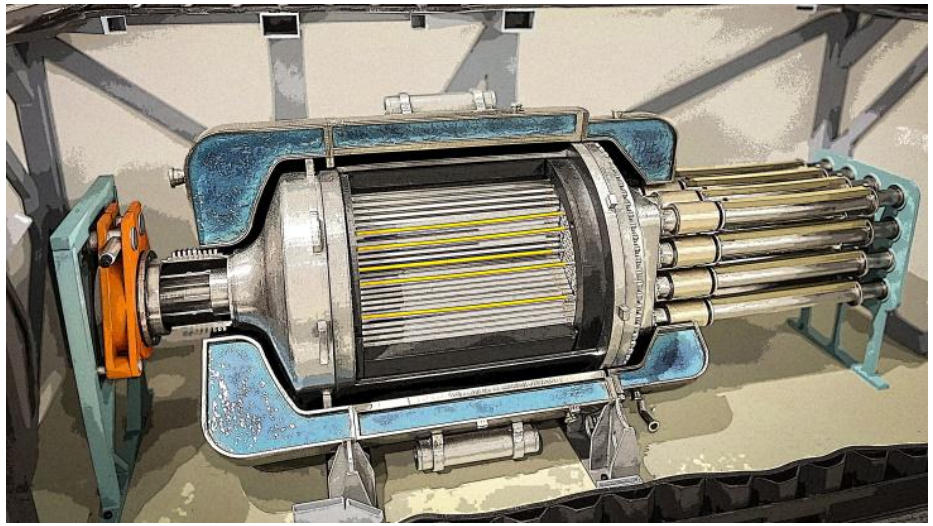


Image:BWXT

BWXT TRISO fuelled High Temperature Gas Reactor (HTGR) generates 1-5 MWe.
Transportable in 4 x 20-feet long ISO-compliant CONEX shipping containers. Operational within 72 hours of arriving on site.
June 2022 US DOD contract to BWXT to deliver prototype full scale microreactor. September 2024 site preparation at INL, testing 2026.

# Radiant Industries Kaleidos 1.2 MWe HTGR


Company founded in 2019 by former Space X engineers. TRISO fuel, helium coolant, graphite moderator, Packed in single shipping container. Ship back for refuelling every 5 years. June 2024 US DOE approved safety design strategy for testing at INL's DOME facility, starting 2026. https://www.radiantnuclear.com/

# Nano Nuclear Energy KRONOS MMR


HTGR
10-45 MWt, 3.3 – 15 MWe
TRISO fuel in prismatic graphite blocks
Helium coolant

Planned deployment as a research reactor at University of Illinois

KRONOS design acquired by Nano in January 2025 following the bankruptcy of USNC. The nuclear plant supplies 45MWt of process heat to an adjacent non-nuclear plant by an intermediate molten salt heat. The heat can be used as process heat and to generate electricity

# Aurora Powerhouse – Oklo USA

4 MWt / 1.5 MWe micro fast reactor, based on EBR II pool type sodium fast reactor.
Up to 10 years before refuelling.

(now up to 75 MWe)

Image: Oklo

Dec 2019 - US DOE granted permit for a demonstration plant at INL
Sept 2025 – Oklo broke ground at INL site
June 2025 – US Department of Air Force notice of intent to award contract to deploy an Aurora Powerhouse for Eielson Air Force base, Alaska

# Summary

In addition to the advantages of all nuclear reactors in providing reliable, low emissions power, independent of the weather:

- Microreactors are suitable for many deployments including off-grid remote locations, microgrids, mining operations, critical infrastructure, strategic military installations, data centres and disaster recovery.

- Multipurpose - electricity and process heat can be provided.

- Compact, factory assembled transportable plant in shipping containers makes for quick installation and re-deployment.