



NRC-DOE Workshop on Advanced Non-LWRs

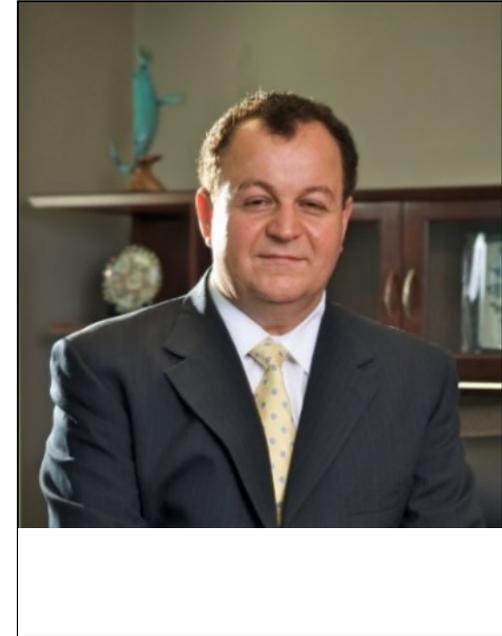
Dr. Eben Mulder

September 1, 2015



Reimagining Nuclear Energy

- X-energy was founded in 2010 to address the world's serious energy challenges and make a lasting contribution to clean energy technology
- X-energy is reimagining the promises of nuclear energy that make nuclear the go-to energy source in more locations than ever before
 - X-energy's technology is the Xe-100—a small Pebble Bed High Temperature Gas-cooled Reactor (HTGR)
- World-class senior management team with >200 years experience in high temp gas-cooled reactors, and aerospace engineering and management

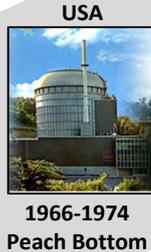
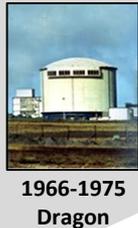


“I began X-energy because the world needs energy solutions that are clean, safe, secure, and affordable. With so much at stake, we cannot continue down the same path.”

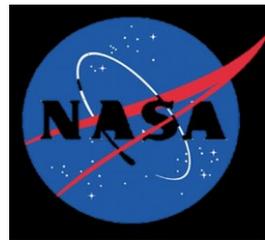
-Dr. Kam Ghaffarian, Founder & CEO

Innovating on a Proven Foundation

The **Xe-100** builds on 50 years of operating experience and leverages Department of Energy \$400+ million fuel and graphite research investment



X-energy is infusing **proven management and engineering practices** from large-scale, complex, leading edge technology projects and systems



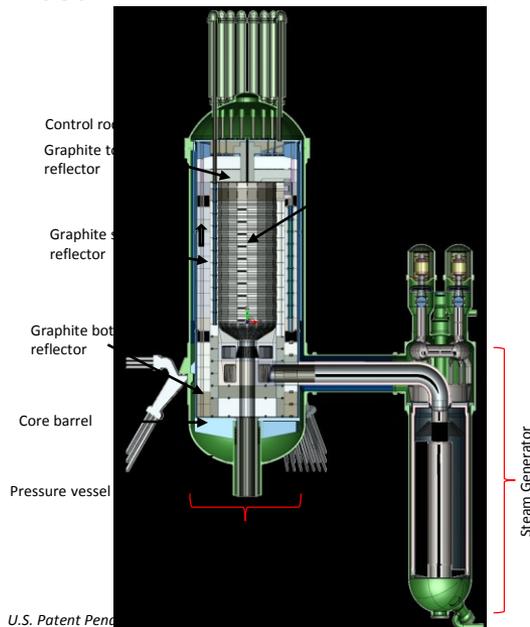
A Different Kind of Nuclear Reactor

What is an HTGR?

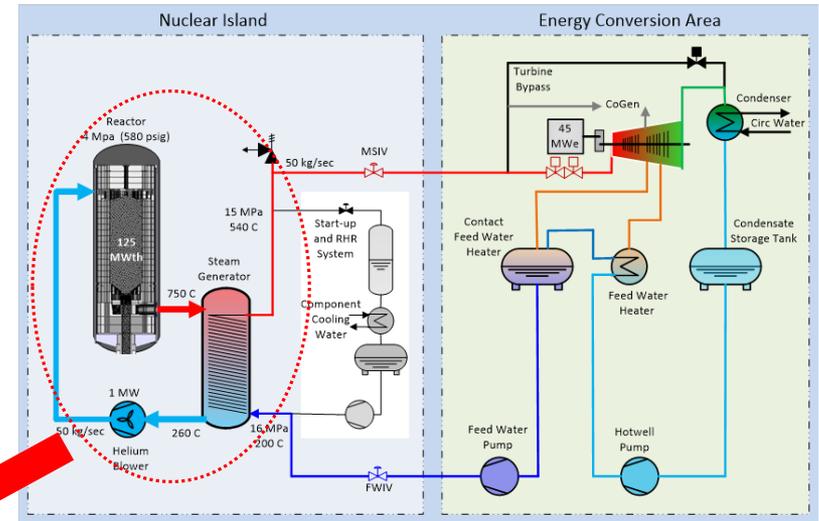
- An HTGR uses helium gas instead of water as the primary working fluid
- Graphite is the moderator rather than water

Why is it called “pebble bed”?

- Graphite “pebbles” contain thousands of ceramic-coated fuel particles
- Thousands of “pebbles” fill the reactor core, forming a “bed”



U.S. Patent Pending



What is the Xe-100?

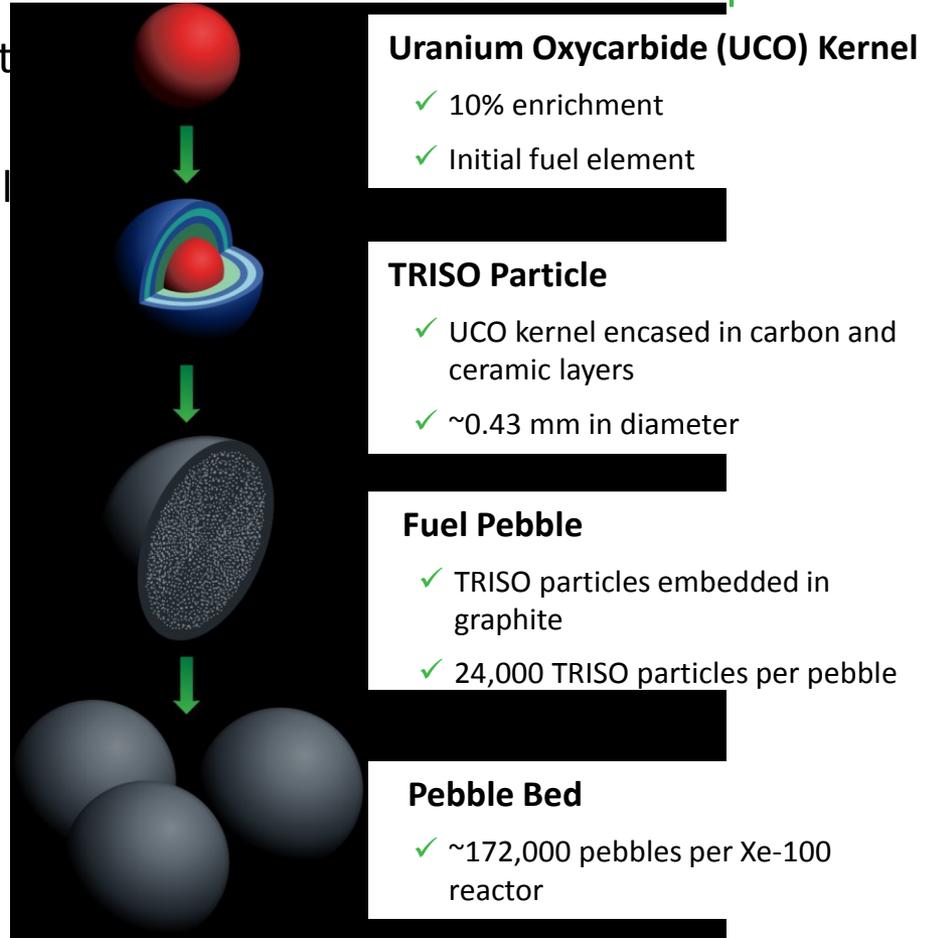
- 125MWt (~45MWe); Rankine cycle
- Standard Xe-100 power plant will consist of 4 reactor modules producing 200MW of electricity
- The plant is also capable of co-generation (Combined Heat and Power (CHP))

Fuel is Key to Unsurpassed Safety

Pebble Fuel Inherent Safety Benefits

- Carbon and ceramic layers prevent release of radioactivity
- TRISO particles maintain individual integrity independent of other particles
- Graphite surrounding the TRISO particles moderates the reaction

Pebble Fuel Components



Regulatory Uncertainty

- Current licensing framework is LWR-centric, lengthy, and expensive
 - Not conducive to progressing Gen IV advanced reactors in the U.S.
- Key issues remain unresolved after 20 years
 - Licensing Basis Event Selection
 - Mechanistic Source Terms
 - Functional Containment Performance
 - Emergency Preparedness
- Other generic regulatory issues identified by industry not fully addressed (e.g., fees/reactor)
- NRC's current priority basis continues to postpone addressing all of the above



Industry View for Regulatory Progress

- Realign priorities and resources to *enable* efficient, timely, and cost-effective advance reactor licensing
- Reduce financial burden for early phase NRC engagements – a *barrier to entry* for any new reactor design
- Obtain closure on outstanding issues – DOE and NRC
- NRC staff and ACRS need to become familiar with non-LWR technologies and challenging licensing topics
 - Expeditious licensing process is needed to make industry cost and risk predictable

A paradigm shift in regulatory approach and government support is needed now for the U.S. to continue as the world leader of nuclear power generation.

