



Securing and Delivering Advanced Nuclear Projects 2023

Stephen Coates, X-energy

Thursday 9 November 2023




X-energy: advanced SMR reactor and fuel manufacturer

2009

Company Founded – 14 years of investment and development

Rockville, Maryland, USA

**Birchwood Park,
Warrington** 

**\$1.2bn Federal
Funding**

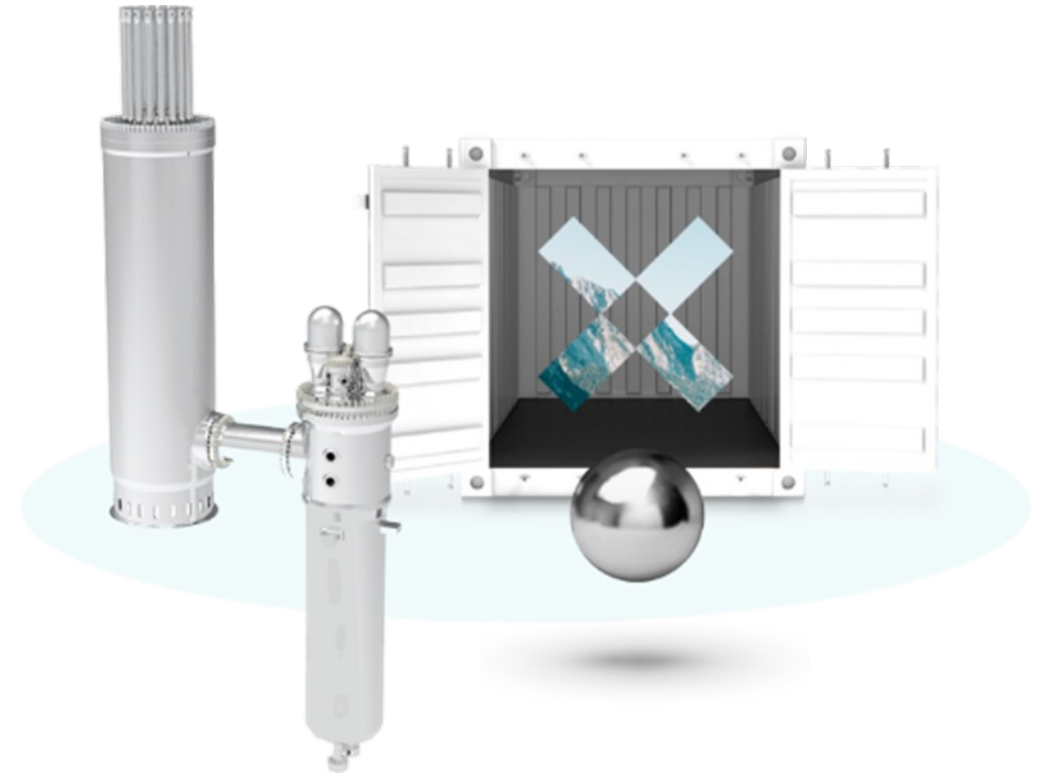
Selected for DOE's Advanced Reactor Demonstration Programme⁽²⁾

~\$580m Investment

Capital invested to date with \$120 million of committed capital⁽³⁾

>550 Employees ⁽¹⁾

Including 40+ PhDs and 40+ Masters in Engineering / Science. 1000 people working on first project

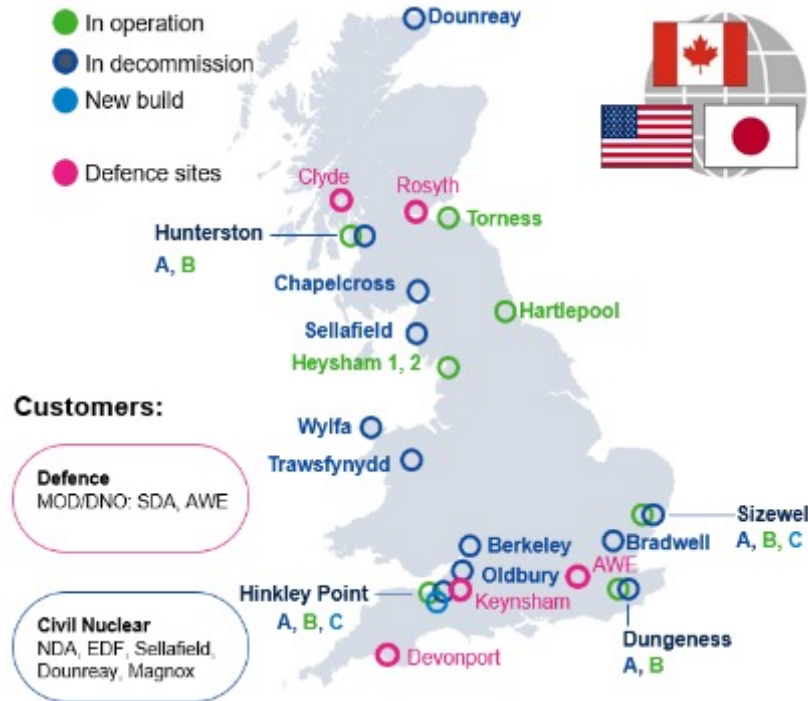


- 1) As of July 2023
- 2) Awarded in December 2020
- 3) As of December 2022, includes \$210mm of government funding, \$75mm committed capital of Series C-2 financing,
- 4) including a \$30mm commitment from Ares Management and \$45mm PIPE commitment from Ares Management

Partnering in UK with Cavendish Nuclear – Part of Babcock International Group

Creating a safe and secure world, together

Cavendish helped design, manufacture and build the UK existing fleet of nuclear power stations. Today it supports their operation and has key roles building the next generation of nuclear power stations.



At a Glance

- Access to 5,000 nuclear SQEP personnel
- Strategic partner supporting nuclear companies in the lifetime extensions of their fleet
- 60+** years of industry heritage
- Supporting delivery of the UK's first new nuclear power station in a generation
- Experienced operator of nuclear sites
- Delivery of large-scale engineering projects across the UK nuclear estate



Commercial advanced nuclear power... in 2029

DOW energy

“Our advanced nuclear project is another example of Dow leading the way and showing industry the path toward a lower carbon future.”

Jim Fitterling, Dow chairman and CEO

The map shows Texas and Mexico with a red pin on the Texas Gulf Coast. Major cities like Houston, San Antonio, Austin, and Corpus Christi are labeled. The Gulf of Mexico is also labeled.

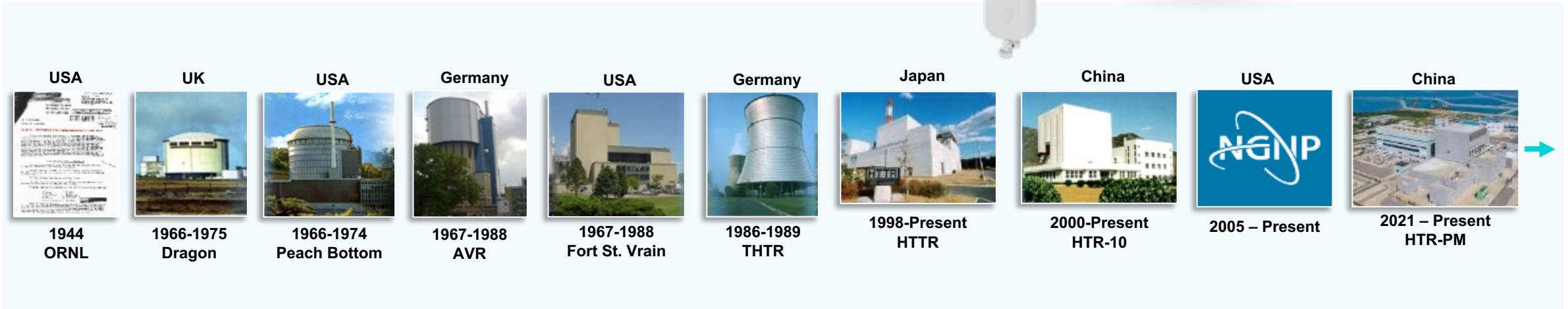
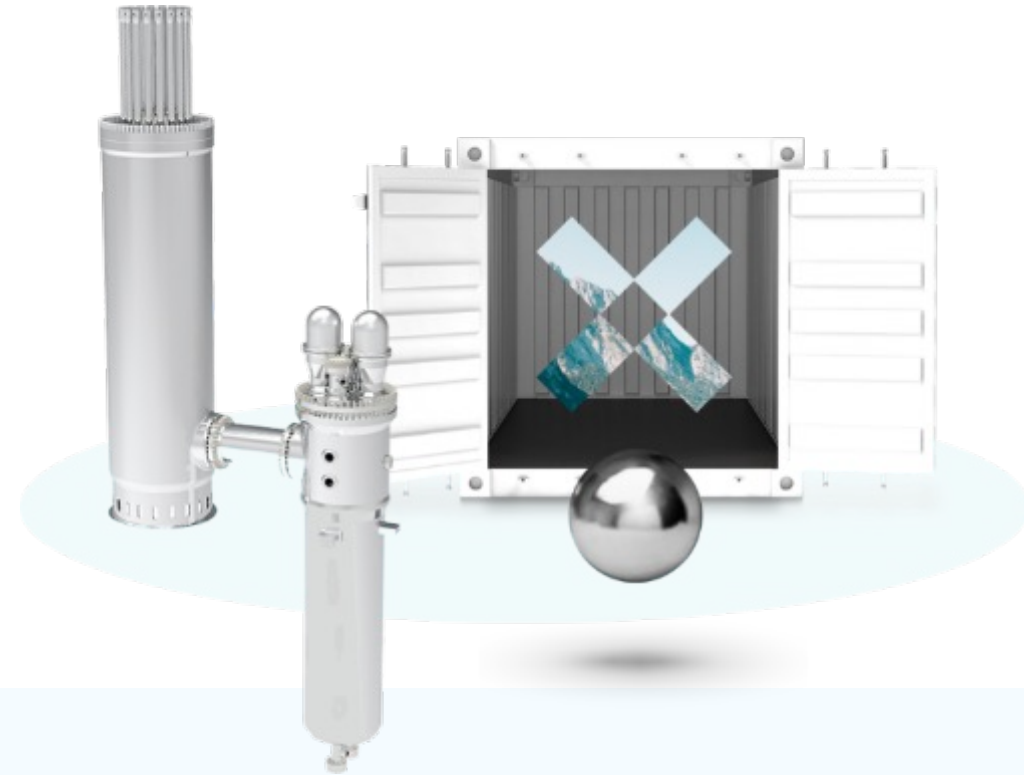


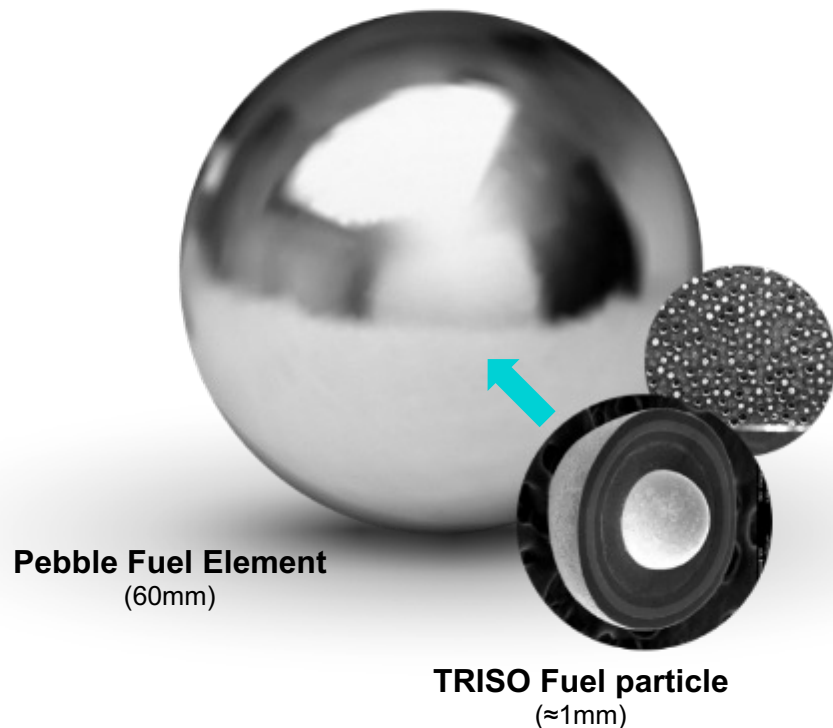
Four-unit Xe-100 plant providing 320MWe and 800MWth to Dow’s Seadrift facility on Texas Gulf Coast



Capitalising on decades of learning & best practices in High Temperature Gas-cooled Reactor design.

On approval track in both US and Canada





TRISO-X

Snooker ball-sized fuel pebbles with microscopic kernels of uranium wrapped in indestructible layers of carbon.

Retains waste and fission products during all conditions and cannot melt.

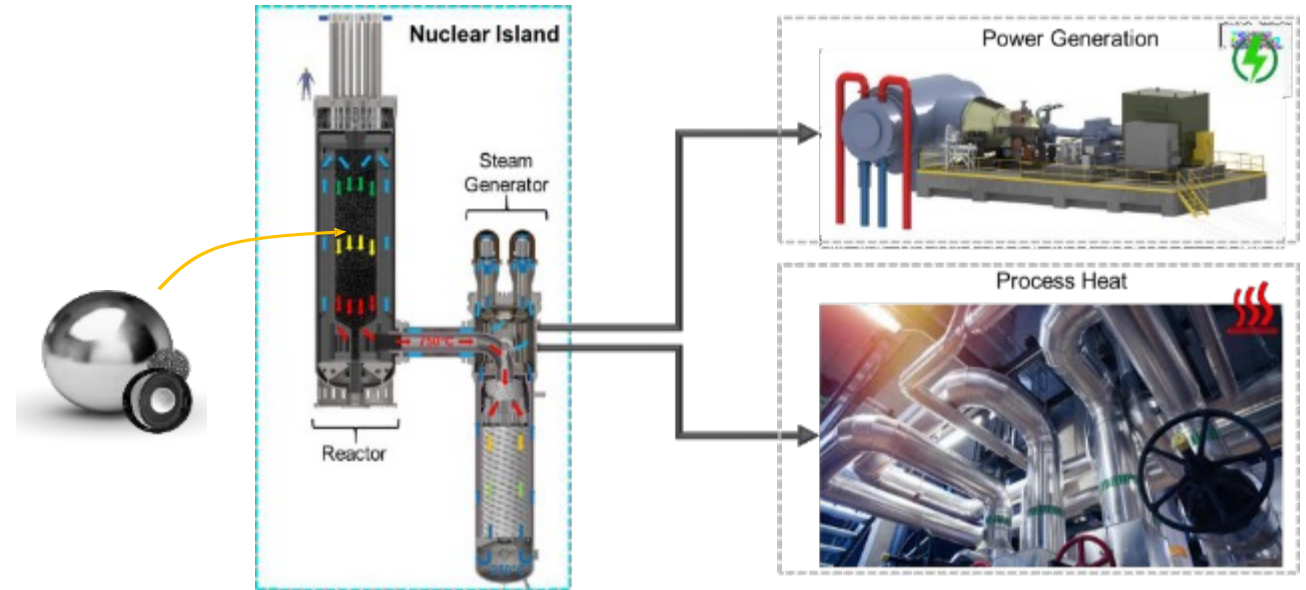
- Because TRISO-X Fuel IS the containment vessel we will have no more expensive, gigantic concrete & steel structures to build, maintain, and decommission.
- Low reactor power density and self-regulating core design (i.e., if cooling stops, the core shuts down).



Xe-100

200MWth / 80MWe Small Modular Reactor (“SMR”) that can be scaled into a ‘four-pack’ 320 MWe power plant, or larger.

- The inherent safety and simplified design drastically decrease the plant footprint and emergency planning zone.
- More locations & applications than traditional nuclear reactors.



Power and heat

- Nuclear island designed to be independent of the end use making our solution deployable for electricity and many other process heat applications:
- The Xe-100 can do both simultaneously or switch between applications.

X-energy is targeting end-markets beyond just conventional power generation to satisfy diverse decarbonisation needs



**Conventional
Power
Generation**



**High-Temperature
Steam for
Industrial Use**



**Synthetic fuels
production**



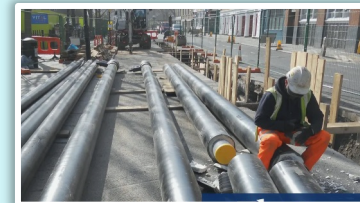
Desalination



**Clean
Hydrogen
Production**



**24/7 Data Centre
Power**



District heating



**Load Following to
Complement
Renewables**

Our vision for the UK



FLEET DEPLOYMENT

> 3.2GWe
> 8GWth



c£1.5- £2bn

UK FOAK SITE

(4 reactors) 320MWe



>£20bn Value
to UK Economy



BY 2030....

FIRST XE-100 PLANTS ONLINE
Flexible design allows wide
deployment potential e.g.
Power, heat & hydrogen

- Contributes to levelling up the UK
- Leverages UK AGR knowledge and experience
- Fast Follower of the U.S. ARDP programme
- Accelerating the hydrogen economy with low cost zero carbon hydrogen
- Accelerates the decarbonisation of UK heat market.



ENERGY SECURITY

UK Fuel Manufacturing (TRISO)



COST COMPETITIVE WITH NUCLEAR & RENEWABLE TECHNOLOGIES



HIGH UK CONTENT
>80%

- Modular manufacturing and construction – including RPV in the UK
- Significant export potential (X-energy targeting >100 sites internationally)
- Creates long term well paid and high technology jobs
- Opportunities for UK TRISO fuel production facilities.

Hartlepool Heat Hub location – indicative layout



EDF has established a 'heat hub' concept in which high temperature gas reactors could deliver process heat and steam to nearby industrial facilities as well as electricity.

X-energy is developing this concept with further analysis to assess the commercial and technical opportunities.

*note: this is EDF's indicative example. X-energy would propose to deliver 3 four-reactor plants of 320MWe each on a commercial basis, with no need for a smaller demonstrator.

Key

- Existing Pipe Corridors
- Existing Tunnels
- Existing CO₂ Exports
- Ports

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Exwold Technologies
Speciality Chemicals

Millfield Composites

EDF Energy
Nuclear Power Station

ConocoPhillips
Crude Oil Storage

Venator
Tiioxide

ConocoPhillips
Crude Oil Processing

Frutarom
Flavours & Ingredients

Seal Sands / North Tees Chemical Sites

Redcar Bulk Terminal
Logistics

TEESWORKS

CATS
Importer of Gas

Victrex
BDF / Composites

Exolum
Chemical Storage

Net Zero Teesside
Power/CCS

APS Growers
Greenhouses
Waste heat / CO₂ to grow tomatoes

PX
Teesside Gas Processing Plant

Greenergy
Biodiesel

Bran Sands
Effluent Treatment

FUJIFILM Diosynth
Bio Pharmaceuticals

Frutarom
Flavours & Ingredients

Marlow Foods
Quorn

SABIC
Underground Chemical & Hydrogen Storage

Lianhetech
Fine Chemicals

Navigator Terminals
Chemical Storage

British Steel
Steel / Beams / Manufacturer

SNF
Speciality Chemicals

KD Pharma
Pharmaceuticals

Teesport

Kemira
Speciality Chemicals

Nova Pangaea Technologies
Biochemicals and Biofuels

Johnson Matthey
Catalyst

N&P Group
Refuse Derived Fuel

BOC
Air Separation Unit

Anglo American
Mineral Processing

CF Industries
Nitrogen Fertilisers

SITA
Waste to Energy

Wilton Group
Engineering

BOC
Steam Methane Reformer

SeAH Wind
OSW

MGT
Biomass Power

Huntsman
Polyurethanes

SABIC
Ethylene (Cracker) / Polythene

Billingham Chemical Site

TWI
The Welding Institute

Stobart Biomass
Engineering

SABIC
Ethane Import Facility

Sembcorp Biomass Power Station
Power / Utilities

Wilton International

CPI
Manufacturing Catapult

Sequens
Fine Chemicals

Mitsubishi Chemicals
Acrylics

Mitsubishi Chemicals
Li-ion Battery / Electrolyte

Port of Middlesbrough
Logistics

SABIC
Ethane Import Facility

Sembcorp EFW Power Station
Power / Utilities

RWE
OSW Grid Connection

Calysta
Protein Manufacturer

Applied Graphene

Poseidon Plastics
Polymer Recycling

Micropore Technologies

2M
Chemical Blending

ENVA
Wood Recycling

Biffa
Polymer Recycling

Materials

ReNew ELP



UK Opportunity – Benefits to Suppliers

- Our goal is for more than 80% of the value of the Xe-100 to flow to UK companies, providing significant manufacturing and construction opportunities.
- X-energy and Cavendish are looking for suppliers to provide a wide range of components such as:



- Pumps
- Valves
- MV/LV Motors
- Steam Turbines
- Heat Exchangers
- Fabricated Pipe
- Fabricated Steel
- Fabricated Tanks
- Cable
- Cable Tray
- Flowable Concrete
- Formed Concrete
- Instrumentation
- Diesel Generators
- MV/LV Gear
- Transformers
- Cooling Towers
- Air Cooled Condensers
- Graphite
- Helium Circulators



- Opportunities could be available to support deployment of the Xe-100 US, Canada, EU, and worldwide



UK success factors

1. First site secured and path to fleet deployment
2. Confirm project delivery model
3. Generic Design Assessment
4. Place for deployable AMRs in nuclear roadmap, facilitating progress on the above.
5. Move at pace to capitalise on synergies with existing fleet





Thank you

09 November 2023