

Nuclear Disruption to Modernise Net-zero Industry

Copenhagen Atomics Waste Burner

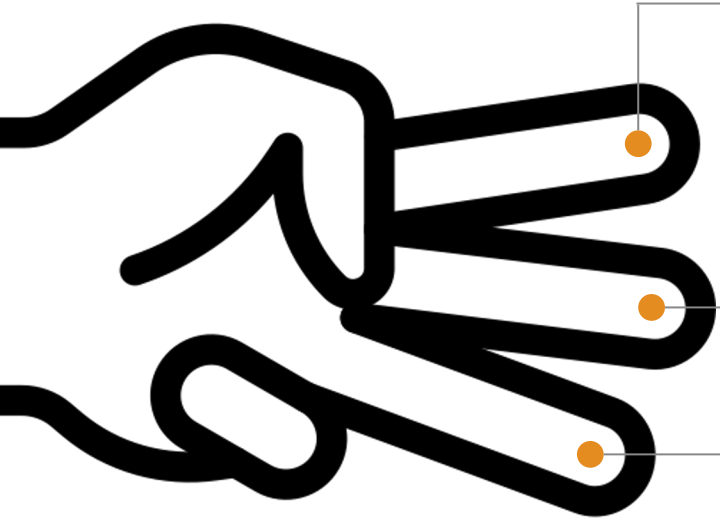
Energy
=
Prosperity

Energy
=
Prosperity



Nuclear technology paradigm shift

This is a new category of commercial nuclear energy!



Lowest cost of energy.

We can match anyone else on price!

No taxpayer investments. Copenhagen Atomics, finance, build, own and operate the nuclear power plant and we decommission it after end of life.

Copenhagen Atomics reactors are able to **burn nuclear waste** and reduce storage from 100,000 down to 300 years.

Ten times more energy can be extracted from spent nuclear fuel in CA reactors than in classic reactors first use.

The energy source of the future

A metal from the Periodic Table



Thorium

A single ball of thorium metal can supply you with all the energy you need your entire life.

\$100



12 MWh of thermal energy

1000 ton wind turbine or 70000 m2 solar park



0.5 gram of thorium
20 gram enriched uranium

=



1 ton of coal

=



480 liters oil

=



480 m3 of gas

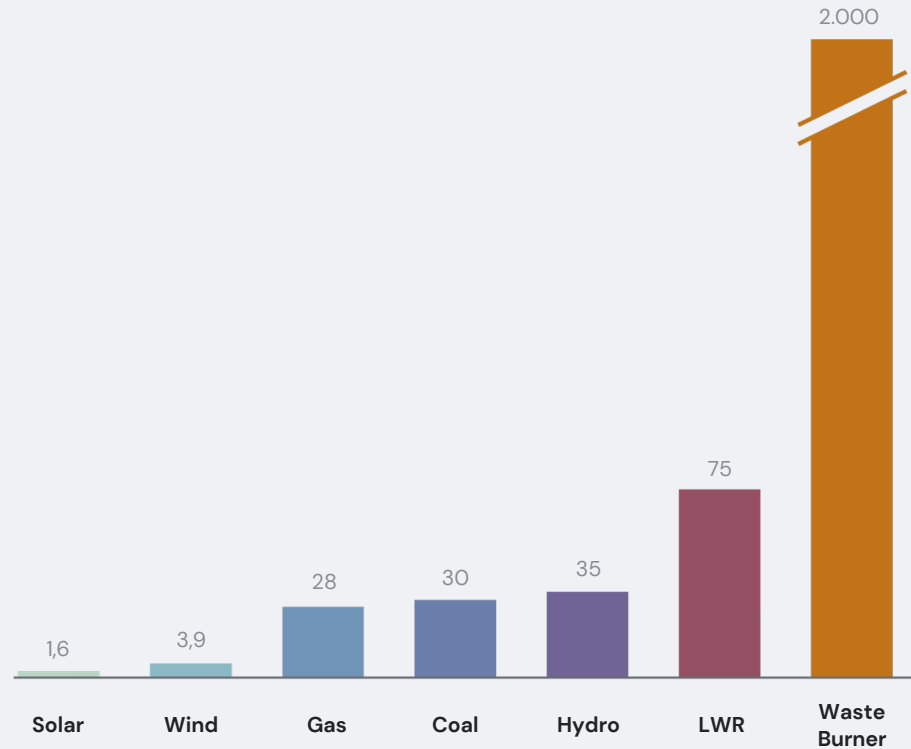
Energy input vs output

This is what disruption looks like

The Copenhagen Atomics Waste Burner is a completely new category



Copenhagen Atomics




Source: <https://www.forbes.com/sites/jamesconca/2015/02/11/eroi-a-tool-to-predict-the-best-energy-mix/>

Thorium vs Uranium

Key selling points

The Copenhagen Atomics Waste Burner is a completely new category



 Copenhagen Atomics



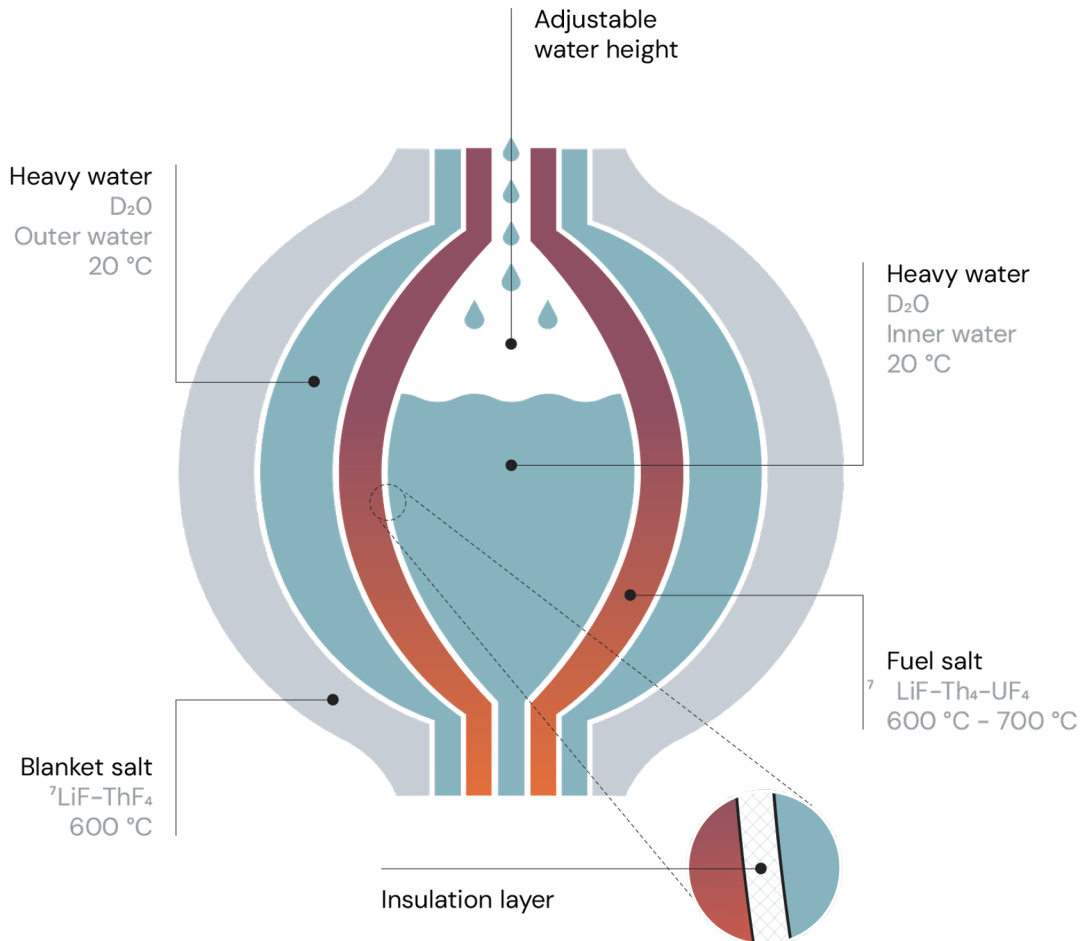
	 Waste Burner	 Advanced SMR*	 Uranium LWR
Mining	1x	50x	100x
Fuel production	No enrichment	Enrichment	Enrichment
Waste storage	300 years	100,000 years	100,000 years
Energy price	1x	2x	4x
Deployment Speed	100x	10x	1x
Max Pressure	1 bar	1 bar	200 bar

*Uranium MSR in thermal spectrum

The Onion Core®

Cross-section view

- Unpressurized room temperature heavy water moderator
- Double barrier and insulation between salt and heavy water
- segments made from metal or composite material
- Below 2% neutron leakage
- Reactivity control using heavy water level adjustment



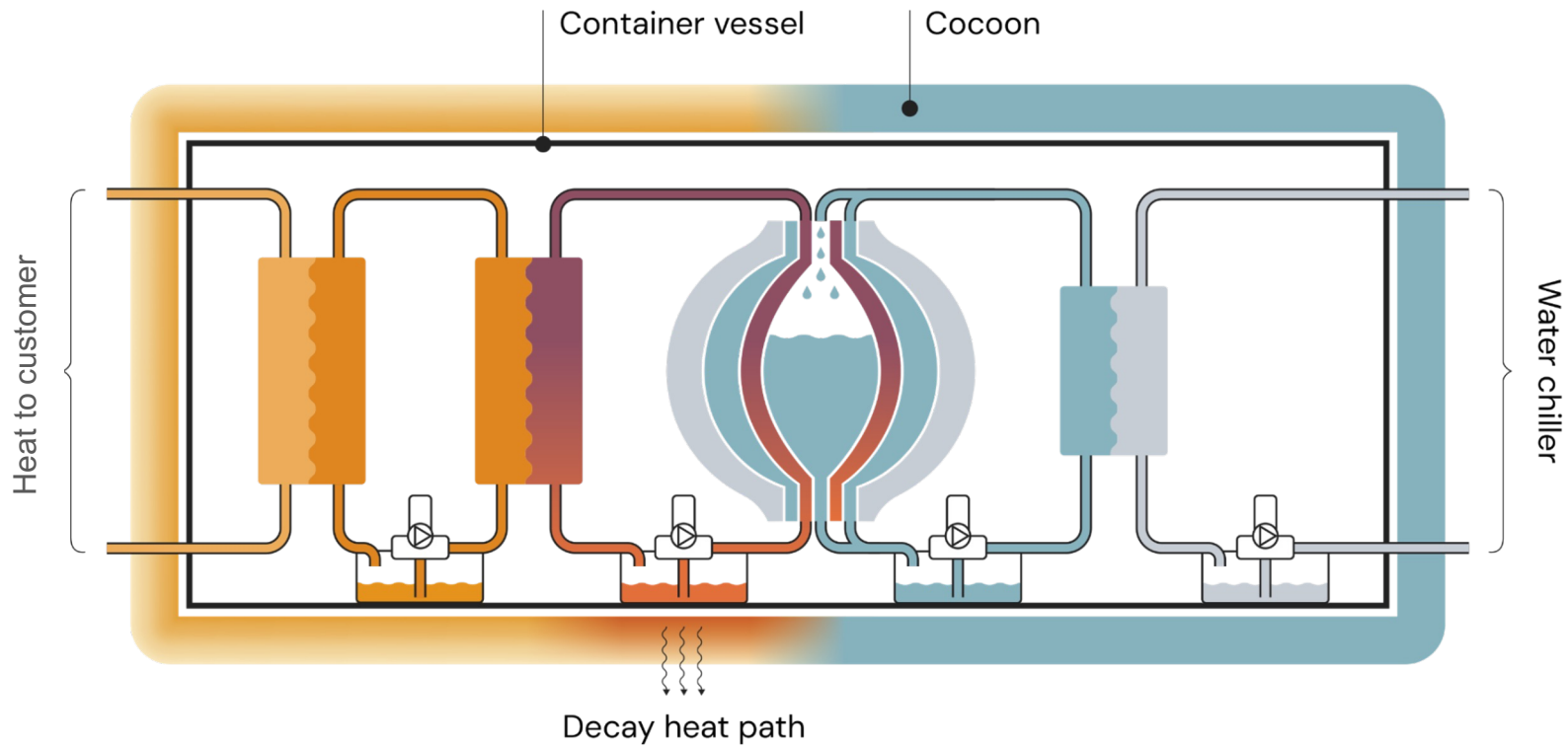
The goal

Mass manufacturing thorium reactors



The Onion Core®

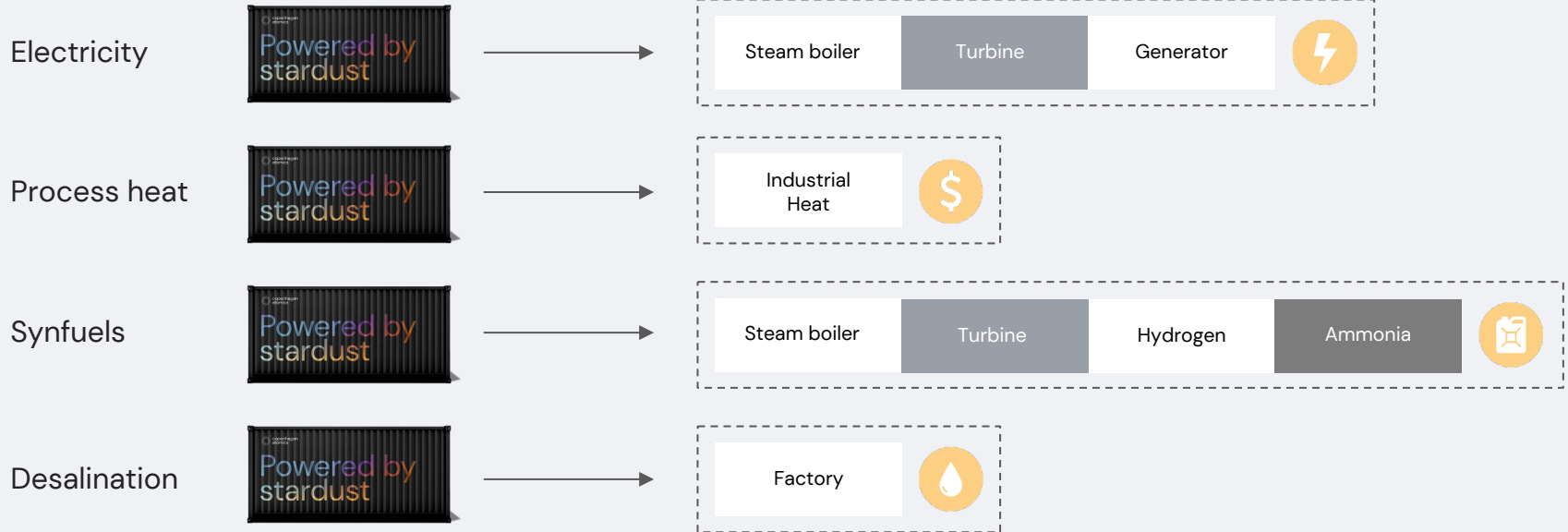
Loops and containment



Thermal energy at 560C that can be used for multiple purposes enabling ultra low carbon footprint

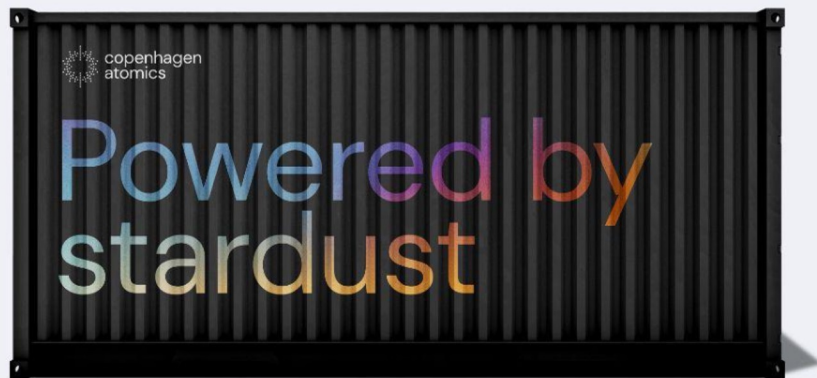
UKA will deliver energy-as-a-service

3rd parties will convert the thermal heat energy for numerous purposes



Introduction

The format provides significant benefits



A visualization of the Copenhagen Atomics Waste Burner

Visualisation of a 1 GW power plant



Storage for used reactors

Remote controlled crane

Cooling

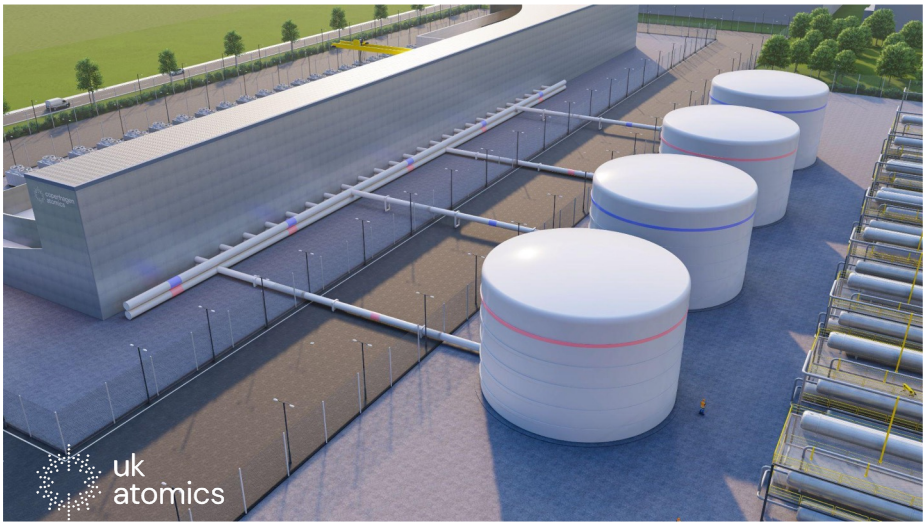
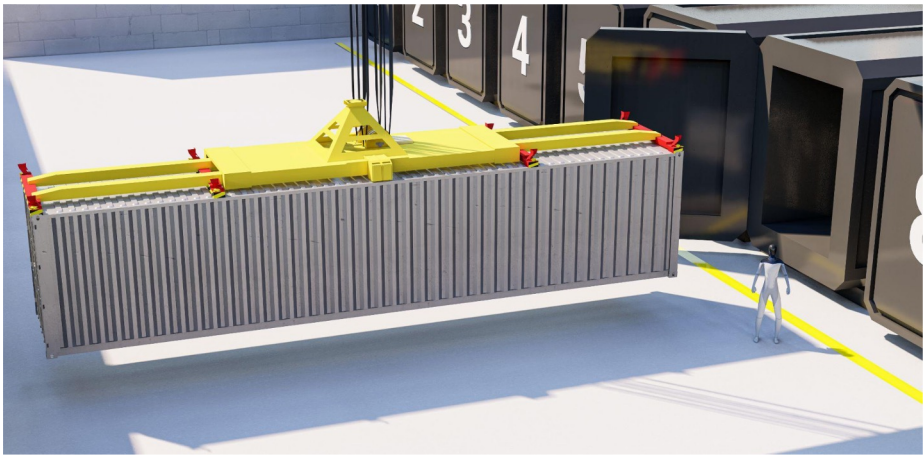
Each tube holds 2x 40 foot containers

Double lock

1x reactor being delivered by truck



A conceptual visualization of a 1GW Power plant



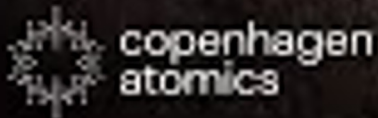


copenhagen
atomica



uk
atomica

Energy of the Future: Thorium Molten Salt Reactors



+ 1 Million Test Hours!

https://youtu.be/HUue5-QjT_o?feature=shared



Product Led Development

Copenhagen Atomics Waste Burner

Factory facility
9000 m²

Office & lab space
2000 m²

Customers
11

Team size
+70

Employees from
15 countries

Sub suppliers
+200

Accumulated component testing
+100 years





Reactor
Production
Facility



11.000
m²



Copenhagen,
Denmark



70+
Employees

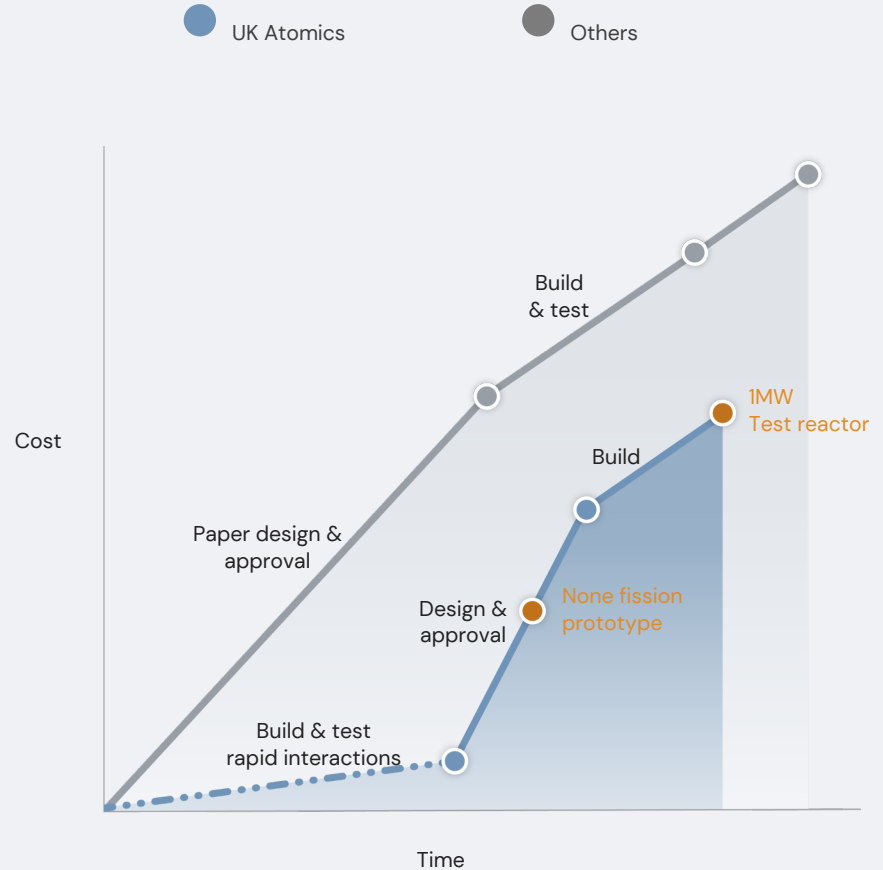


Development philosophy

Build & test hardware

Copenhagen Atomics has built and tested more than any other advanced reactor company.

Running a 30 days reactor experiment is likely 10x less expensive than approval of a commercial reactor.



How we work at UK Atomics

Embracing the maker culture among our employees and creating a technology birthplace

The fastest and cheapest way to a commercial thorium molten salt reactor



Rapid iterations

Design, build, test, repeat – with rapid iterations issues are quickly discovered and resolved

This mitigates costly design errors and increases the pace of development



Partnerships

Establishing the MSR industry is of utmost importance

Once the industry is established, there will be plenty of room for different players and variations of the technology

Hence, partnerships and knowledge sharing is a key part of Copenhagen Atomics' strategy



Flexible and mass manufacturing

Designing the reactor for manufacturing at scale is necessary in order to address the green transition in a serious way

If the reactor is not widely available and economically viable, it will have no measurable impact on global CO₂ emissions

Access to cheap and abundant energy is crucial, especially for third world countries, to achieve the ambitions for a global green energy transition

Our vision, mission and culture

Vision

Provide cheap green abundant energy to fuel prosperity

Mission

Build shipping container sized thorium molten salt reactors on assembly lines to reduce cost and nuclear waste problems

Culture

Copenhagen Atomics reduces the number of meetings by using voice and short messaging apps. They embrace the maker culture among the employees and 95% of the team are STEM¹ people. Copenhagen Atomics is a technology birthplace that actively try to avoid HR and meaningless marketing lingo

UK Atomics': product led approach = £20/MWh LCOE

Technology is ready to go requires a site for test & demonstration



A conceptual visualization of a 1GW Power plant



Image: Technology tested, patented and commercialised globally

UK Atomics': product led approach = technology at pace

Technology is ready to go requires a site for test & demonstration



Image: Prototype reactor under testing in Copenhagen

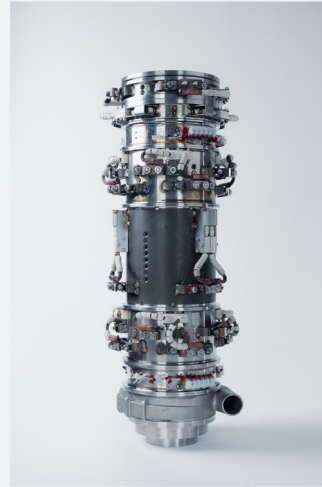


Image: Technology tested, patented and commercialised globally

The Molten Salt Reactor design

Simple, efficient & inherently safe

The reactor design has three barriers between radioactive salts and nature.

The system is not pressurized.

If the pump is stopped the salt drains in the dump tank by gravity and the chain reaction stops within seconds.

Heavy water is used as the moderator and this helps the Onion Core® to outperform any other reactor design.

The energy is transferred through heat exchangers and delivers heat via molten salt at 560C to the customer.

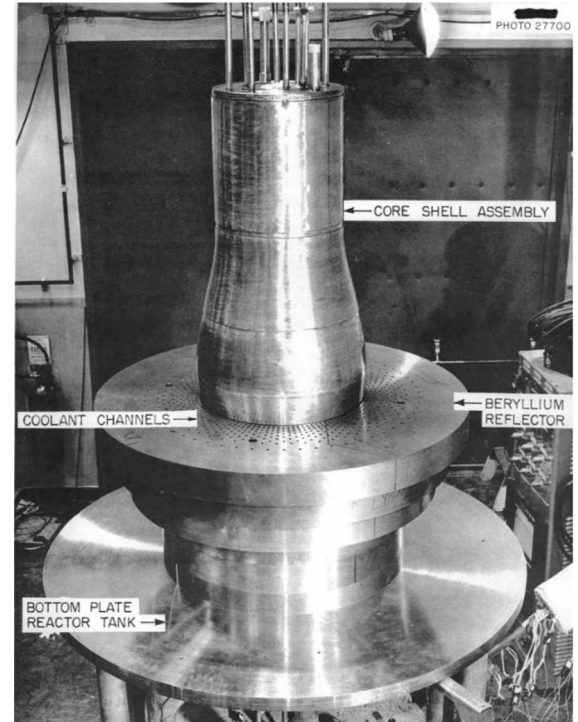
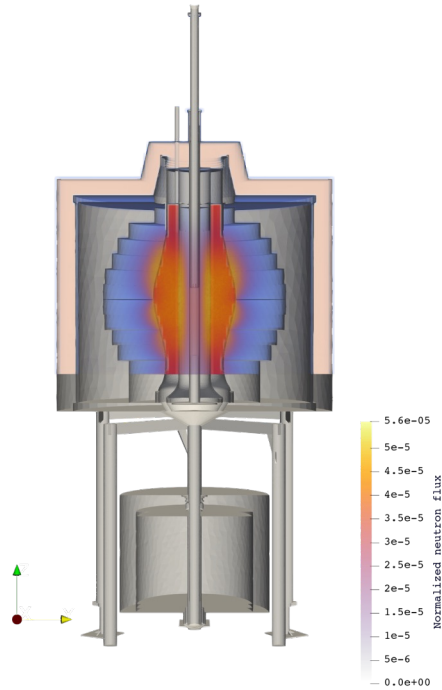


Open source

open msr modeling tools

OpenMC development

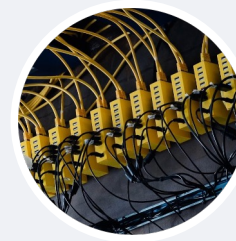
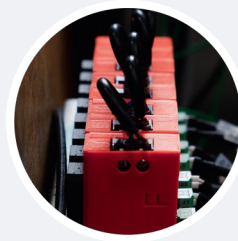
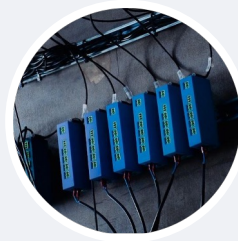
- ARE, ZPRE, & MSRE CAD benchmark models
- Open source CAD meshing tool
- Continuous and batch-wise burn-up.
- Geometry modifications for burn-up criticality search
- Transient coupling to NekRS



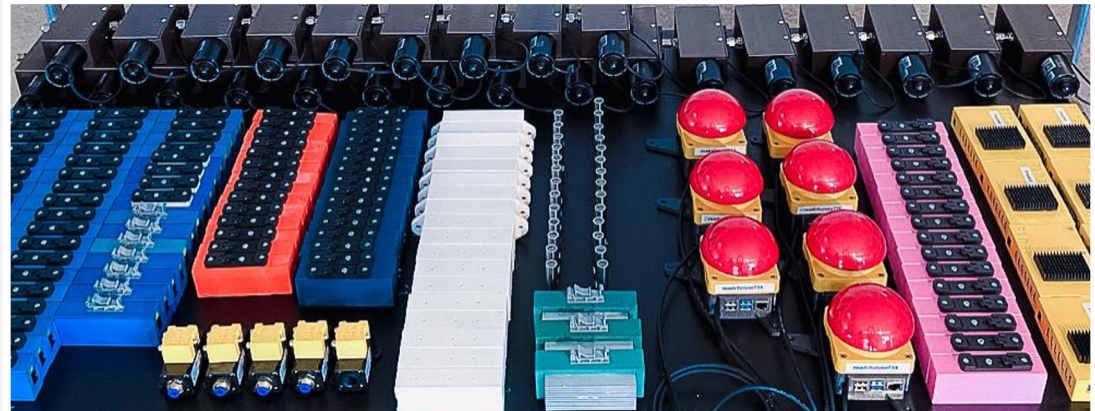
Copenhagen Atomics

Electronics production

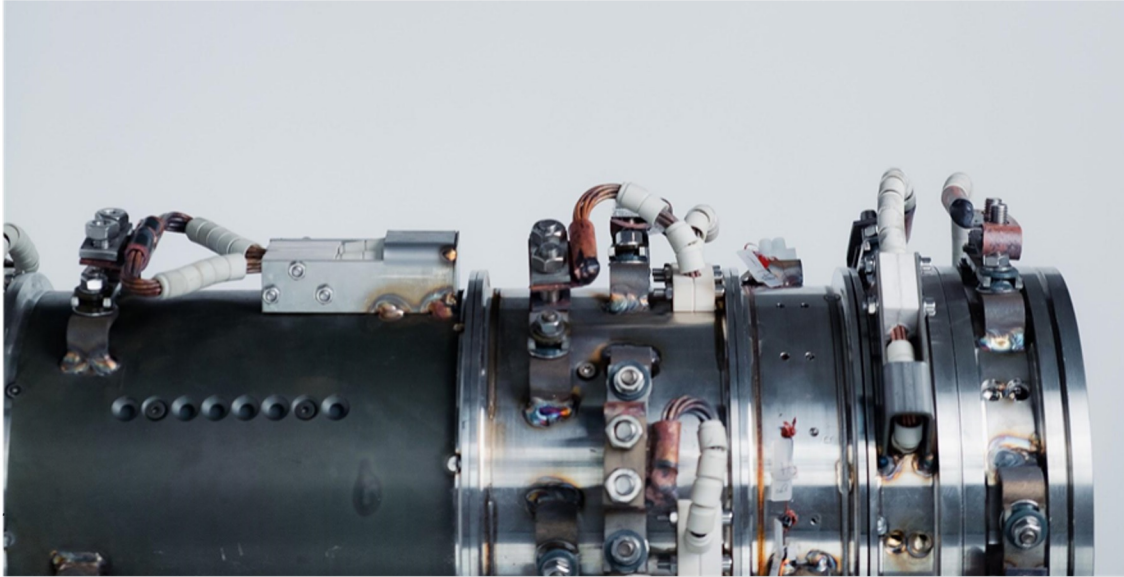
30+ different sensor and electronic products, designed in-house, enhanced or customized by supplier.



Selected electronic products installed in our reactor.



Overview of electronic products.

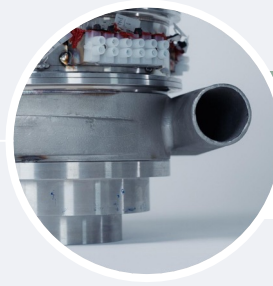




Canned active magnetic bearings keeps the rotor levitation during operation, removing wear and tare.



Canned motor spins the rotor assembly while submerged in molten salt for years without need of maintenance or leakage.



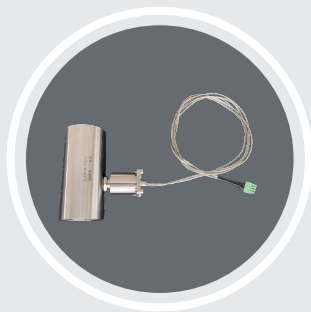
Centrifugal pump which is passively open allowing the salt to quickly drain backwards into storage tanks when the motor shuts down.









Other products in beta

Salt leak detection sensor, Salt pressure sensor & voltammetry sensor



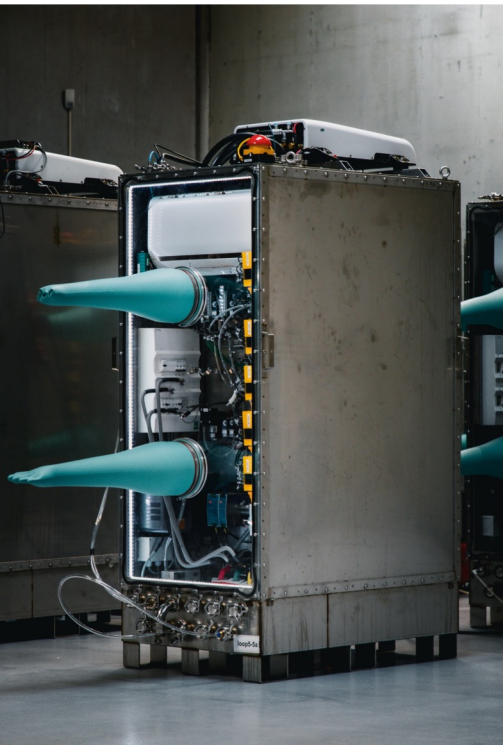
Corrosion in molten salt

2000 hours in purified and unpurified FLiNaK salt at 600C

	Raw unpurified salt	Purified salt	
Before			
After			Very low corrosion rate ←

Pumped portable molten salt loop

Autonomous operation with up to 700C flowing molten salt



Specs

- Pump
- Valve
- Flow meter
- Pressure sensor
- Salt leak sensor

Available for purchase
with 1000h warranty

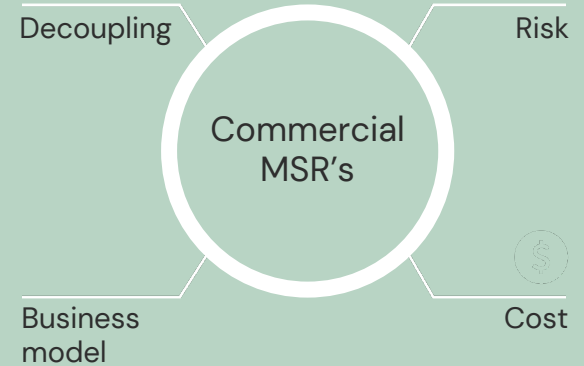
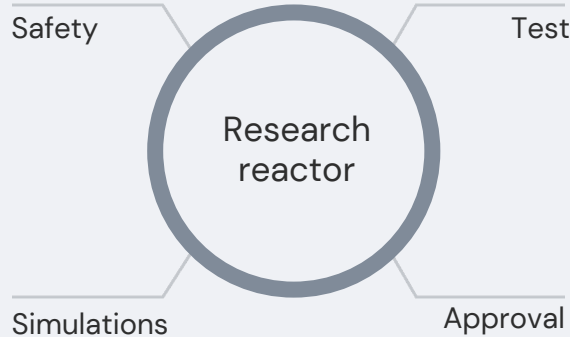
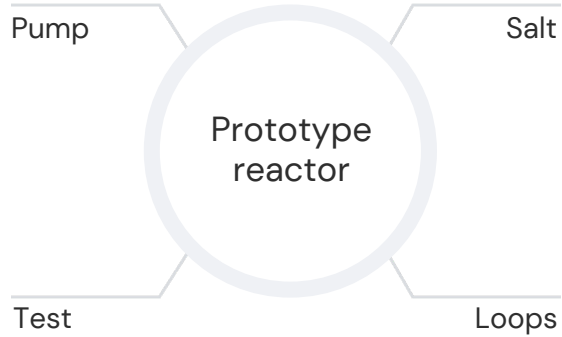
Upcoming

Online salt chemistry
monitoring



Roadmap

A clear path for the deployment



Tech Development

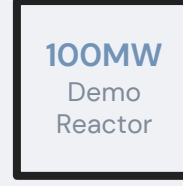
The UK is already supporting Molten salt development generating **Molten Salt Capabilities** in the UK.

Demo Reactors

Criticality Test and Demo nuclear superpower and world leading for MSR technology.

Commercial

1 GWe equals **£1 billion inward investment** per plant + **£1 billion UK opportunity** for power generation supply.



UK Suppliers and Academia engaged in developing technology for MSR loops, pumps, components and systems

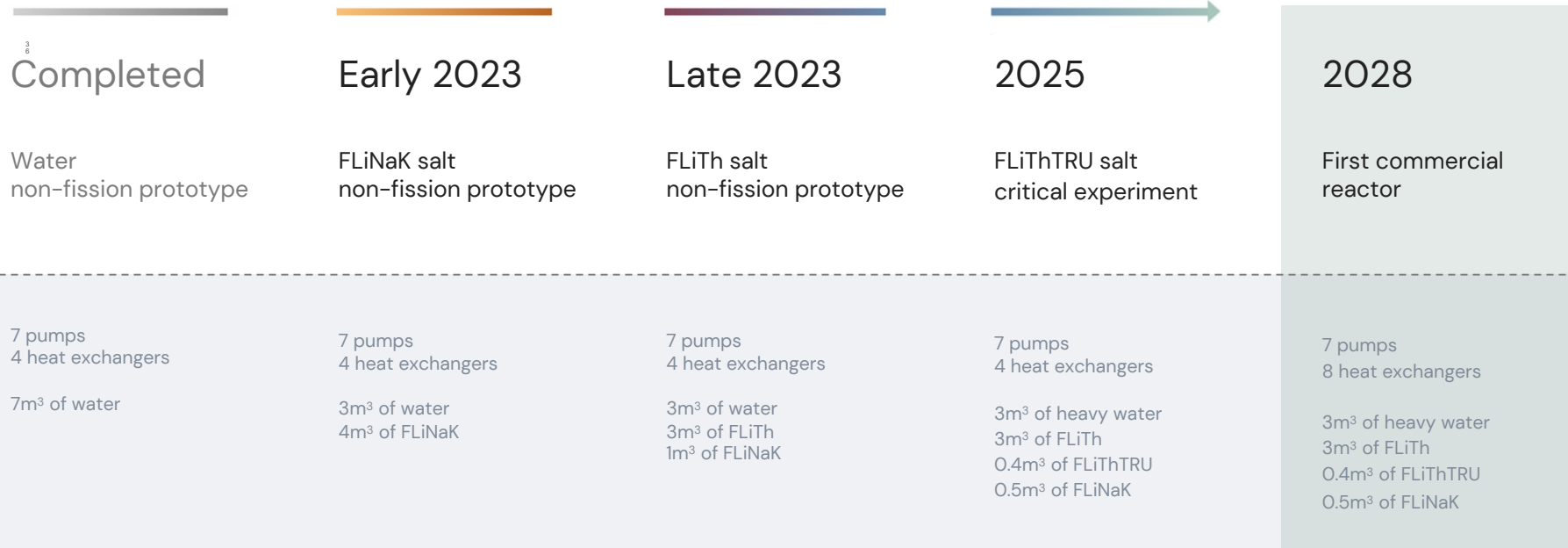
UK can be world leader in operating and running MSR technology by 2025 and supplying MSR fuel.

UK Security of supply for both grid electricity and heat to decarbonise industry by 2028 for technology readiness

Seeking UK Site for testing in 2025

Upcoming milestones

2022-2028









Green electricity at prices below any other energy technology

Our waste burner can get x10 more energy out of discarded fuel from classic reactors

We build, own and operate reactors (energy-as-a-service)

We are already building the first prototype reactor in Copenhagen

Long term goal:
Green energy to 1 billion people



THORIUM: World's CHEAPEST Energy! [Science Unveiled]

340K views · 1 month ago



Energy's FUTURE! 9 Years of THORIUM Molten Salt Reactor Advancements

14K views · 2 months ago



The FUTURE Of Green Ammonia: Is THORIUM The Answer?

6.1K views · 2 months ago



Energy Future Unveiled! THORIUM Molten Salt Reactors

480K views · 4 months ago



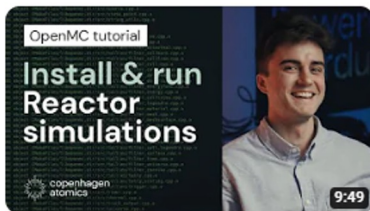
The POWER of Product-First: Advancing Thorium Molten Salt Tech

18K views · 5 months ago



Innovating nuclear technology with the world's most advanced molten salt test...

2.8K views · 5 months ago



OpenMC Tutorial | Build, install & run nuclear simulations

3.7K views · 6 months ago



Thorium Talks: Physics Teachers Union (Talk in Danish)

3.5K views · 11 months ago



Thorium Energy Alliance Conference 2022

925 views · 11 months ago



Simulating the Zero Power Reactor Experiment (ZPRE) in OpenMC

3K views · 1 year ago



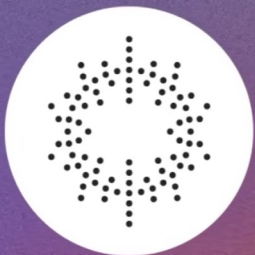
Thorium Energy Alliance conference 2022

17K views · 1 year ago



Copenhagen Atomics first reactor images

107K views · 1 year ago



Subscribe



Subscribe at: youtube.com/@CopenhagenAtoms?sub_confirmation=1