Team Copenhagen Atomics
press@copenhagenatomics.com

Introduction to Copenhagen Atomics

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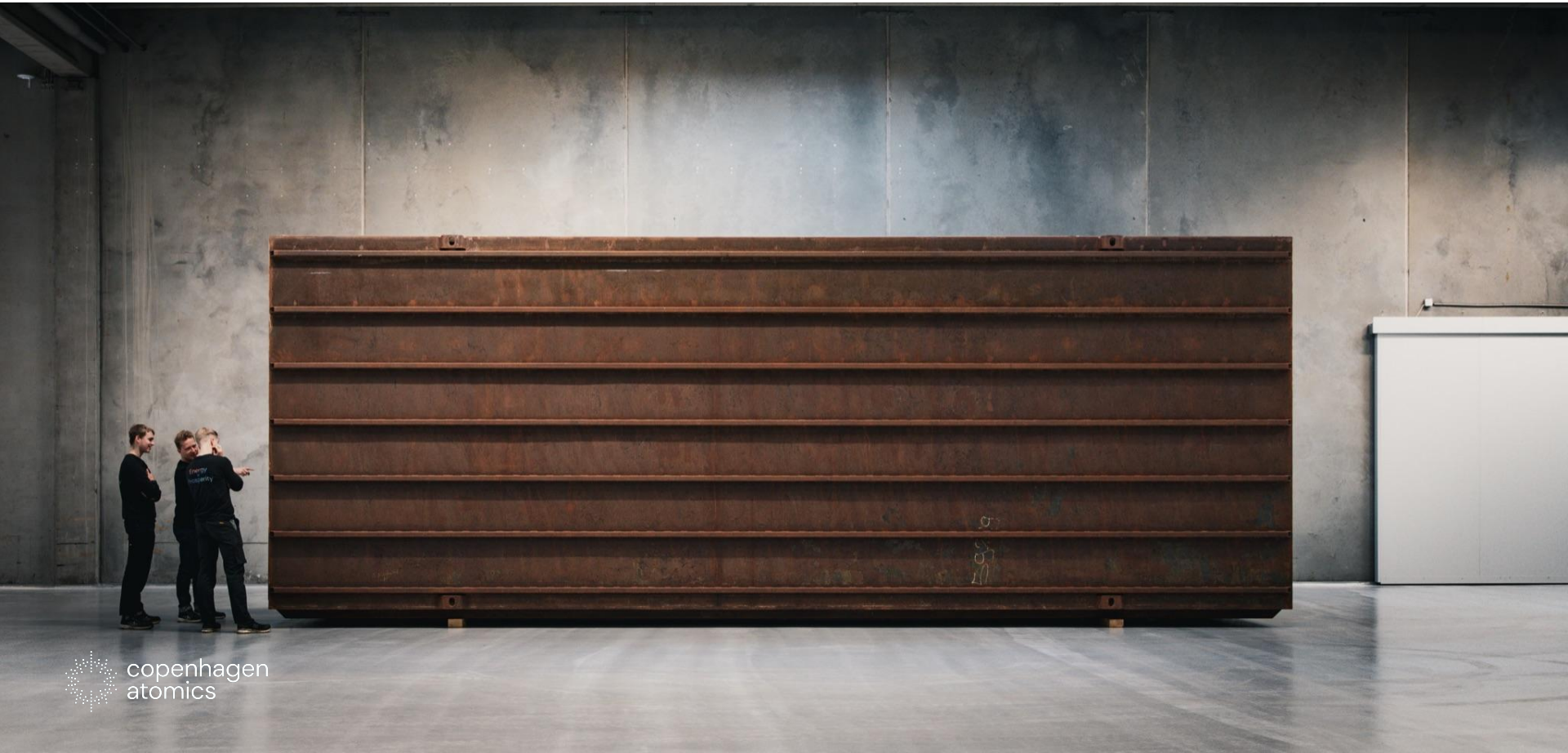
Non-fission prototype



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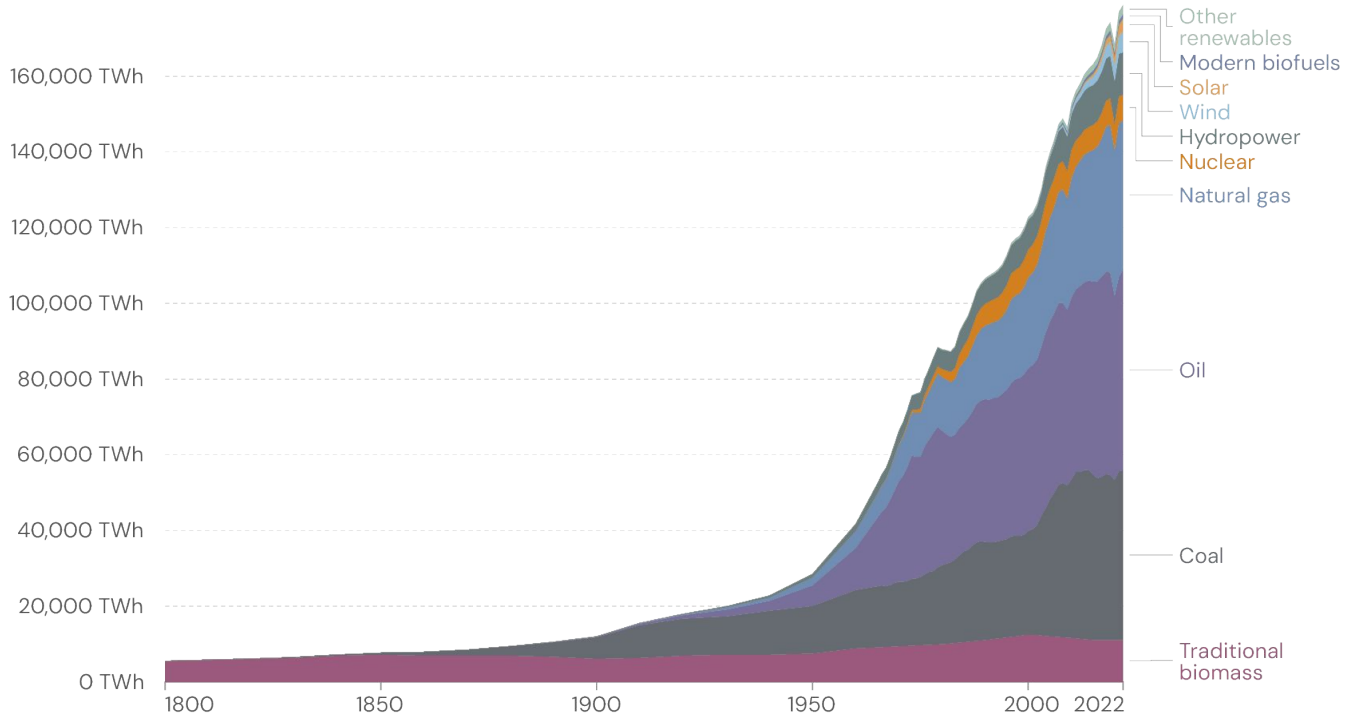
The Onion Core®

Global primary energy consumption

1800–2022



Source: Vaclav Smil (2017) and BP Statistical Review of World Energy

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Nuclear energy, grouped by fuel type

Fissile fueled

ALL NEED REPEATED REFUELING		Fuel type
CANDU PHWR MAGNOX		Natural Uranium
LWR, SMR HTGR, SFR, Gen 1, 2, 3, 4 ...		U235, Pu239

HEAVY HYDROGEN FUELED		
Gen 1 Fusion		H3, H2

Fertile fueled

ALL NEED 1 LOAD OF KICKSTARTER FUEL		Fuel type
Fast + Blanket		U238
MSR + Blanket		Th232
Fusion + Blanket		Li6, H2

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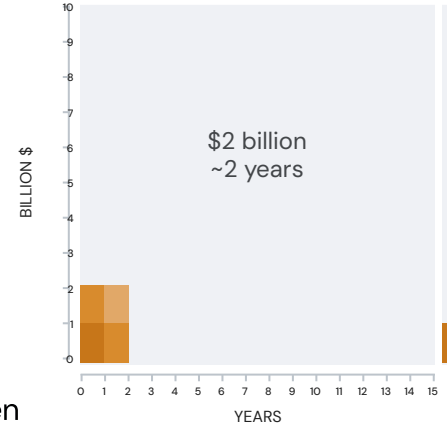
Comparing base load solutions of today to CA breeder reactor

Plant size: **1 GWe** in europe or usa

CLEAN ENERGY

CLEAN ENERGY

	Coal	Gas	Classic Nuclear	CA thorium breeder
Electricity cost	$30 - 60 / MWh	$60 - 100 / MWh	$60 - 100 / MWh	Target $20 - 40 / MWh
Raw fuel cost / year	$400 million	$600 million	$100 million	$50.000 - 300.000
OPEX / year	$50 million	$50 million	$100 million	$50 million
CAPEX & Build time	$2 billion ~2 years	$1 billion ~1 year	~$10 billion 4-15 years	$2 billion 1 year



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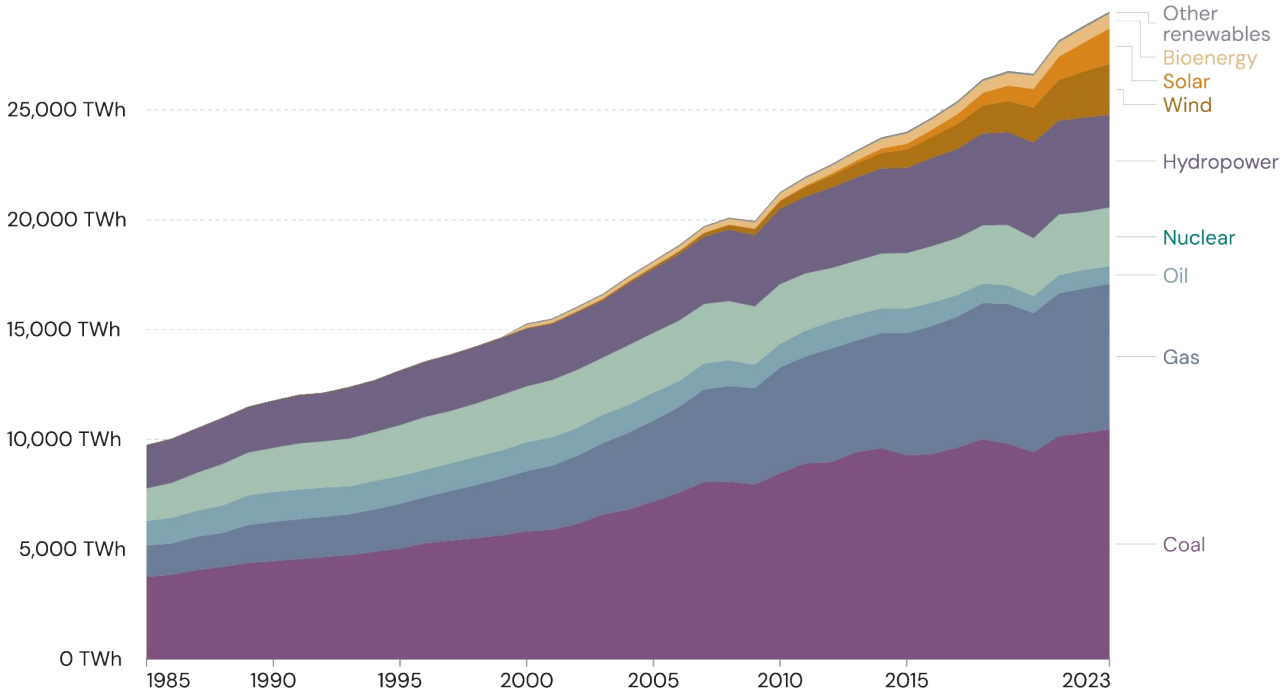
Electricity production by source, World

Measured in terawatt-hours

Growth is
~650 TWh/year
= 75 GW
= 5 CA reactors
per day



https://www.iea.org/reports/electricity-2024/executive-summary

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Electricity production by source, World

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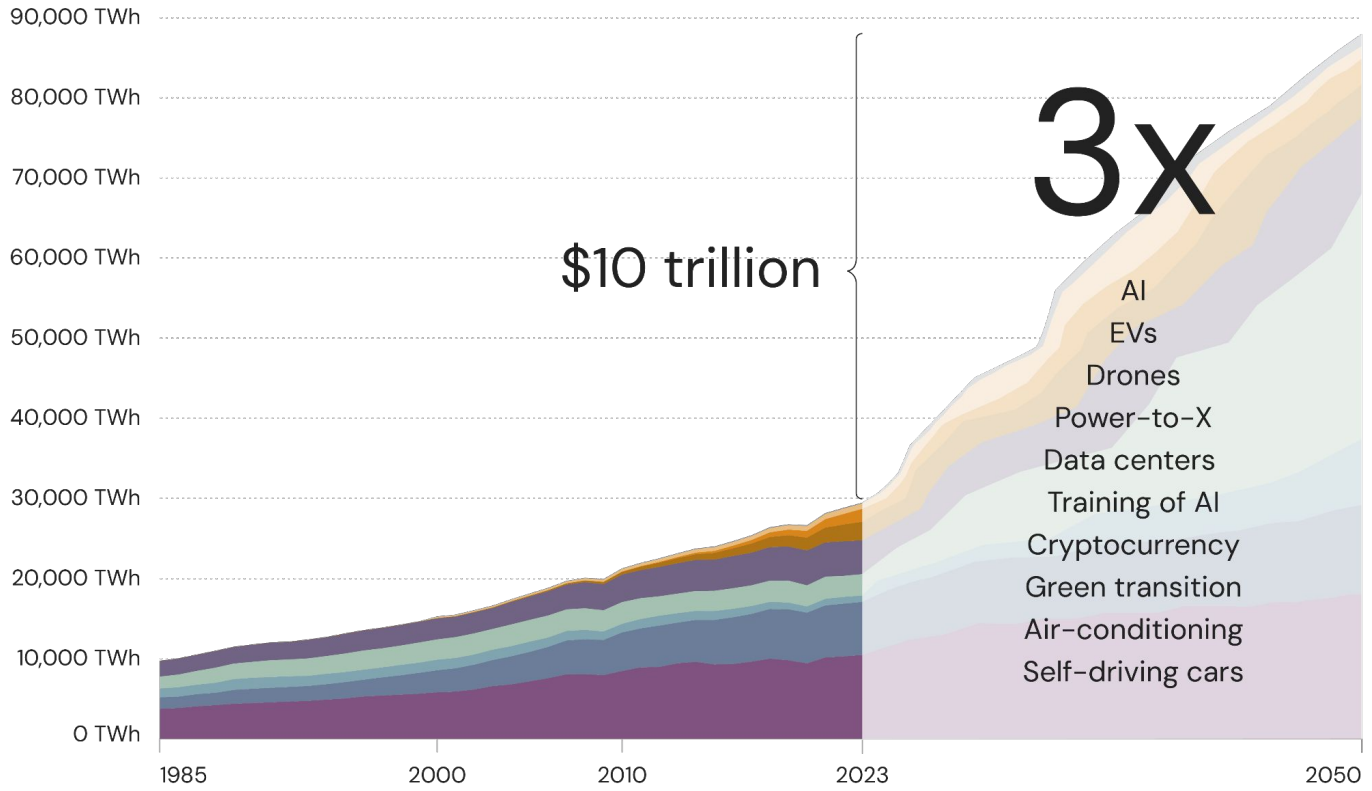

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Technology

The energy source of the future - A metal from the Periodic Table

Th 90 Thorium

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

$100

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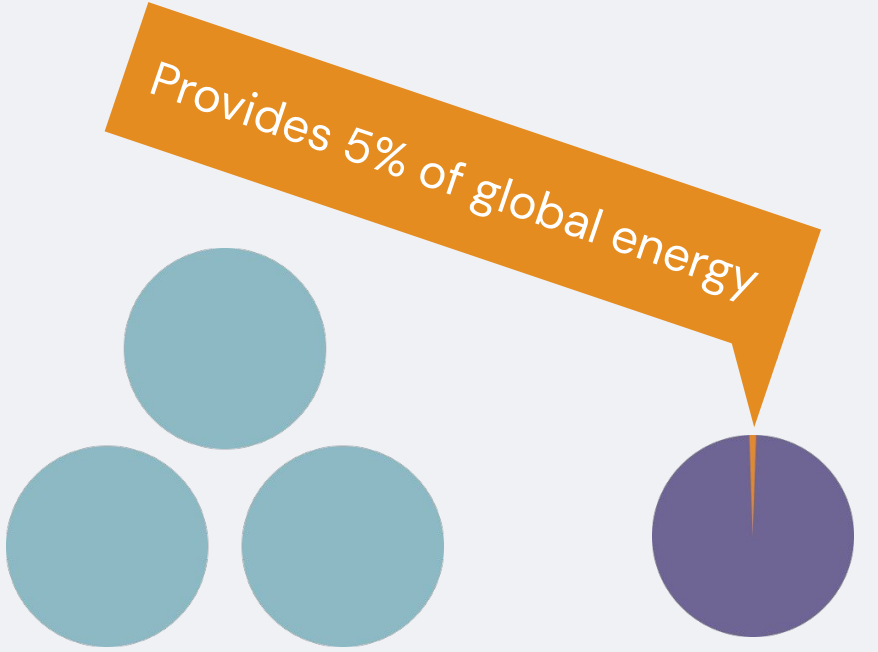
We will never run out

Thorium is more abundant than uranium

Classic nuclear uses U235 and we may run out of it in 200 years time. Therefore it is not considered a renewable energy source.

However thorium can make a breeder reactor and we will run out of materials to build wind and solar before we run out of thorium and the materials needed to build Copenhagen Atomics power plants. Therefore CA reactors are considered über-renewable energy.



Natural Thorium
100% thorium-232

Natural Uranium
99.3% uranium-238
0.7% uranium-235

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100 MW heat = 42 MW electric

The goal

Mass manufacturing thorium reactors

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Visualisation of a 1 GW power plant

A conceptual visualization of a 1GW Power plant


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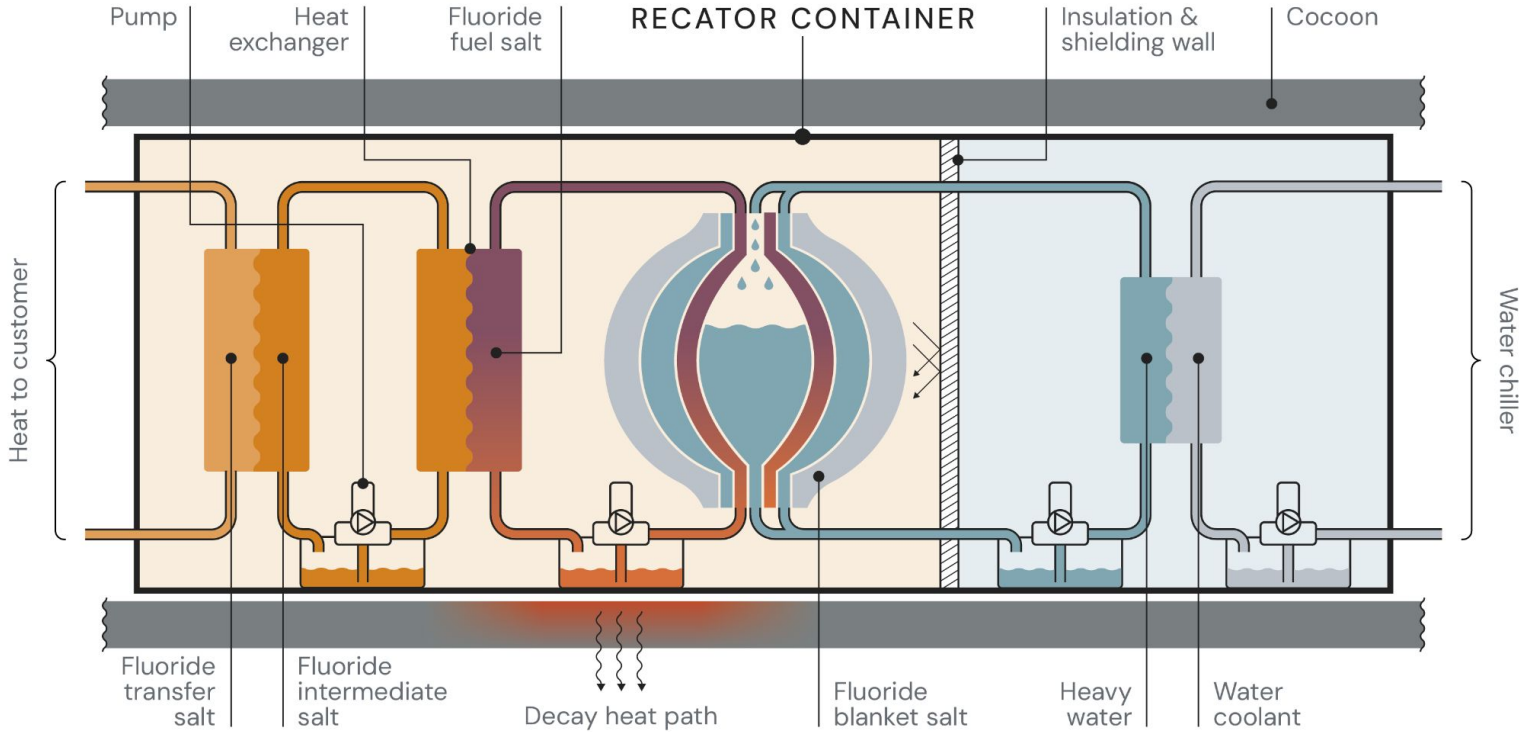
Simplified schematics of reactor container



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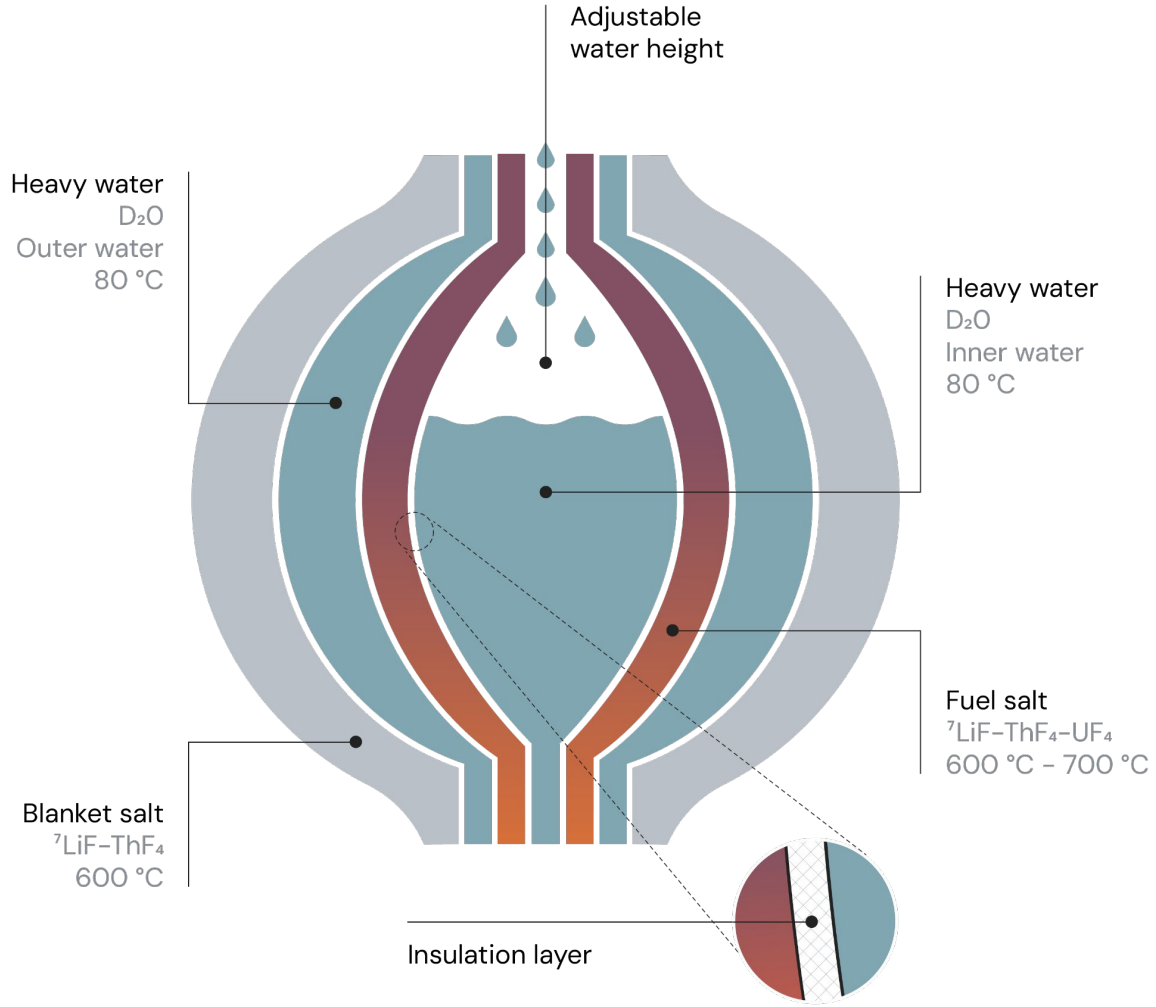
The Onion Core®

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



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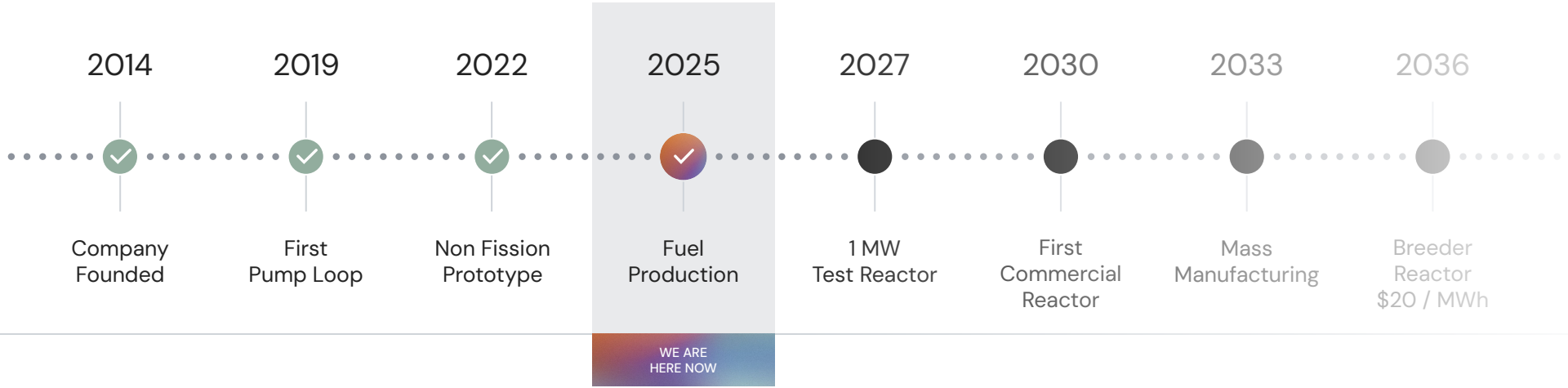
Development timeline

Major milestones



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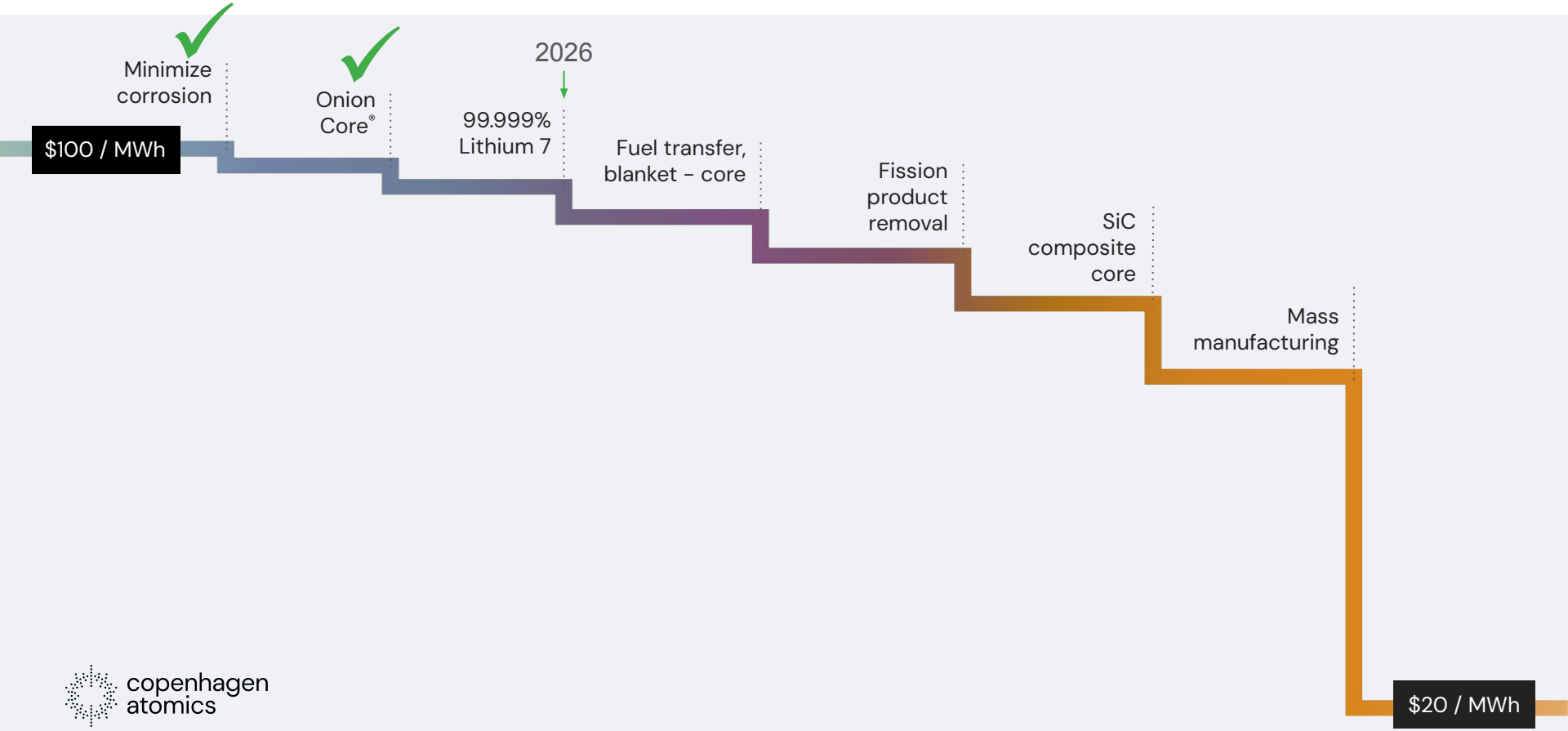
Essential steps towards $20 / MWh



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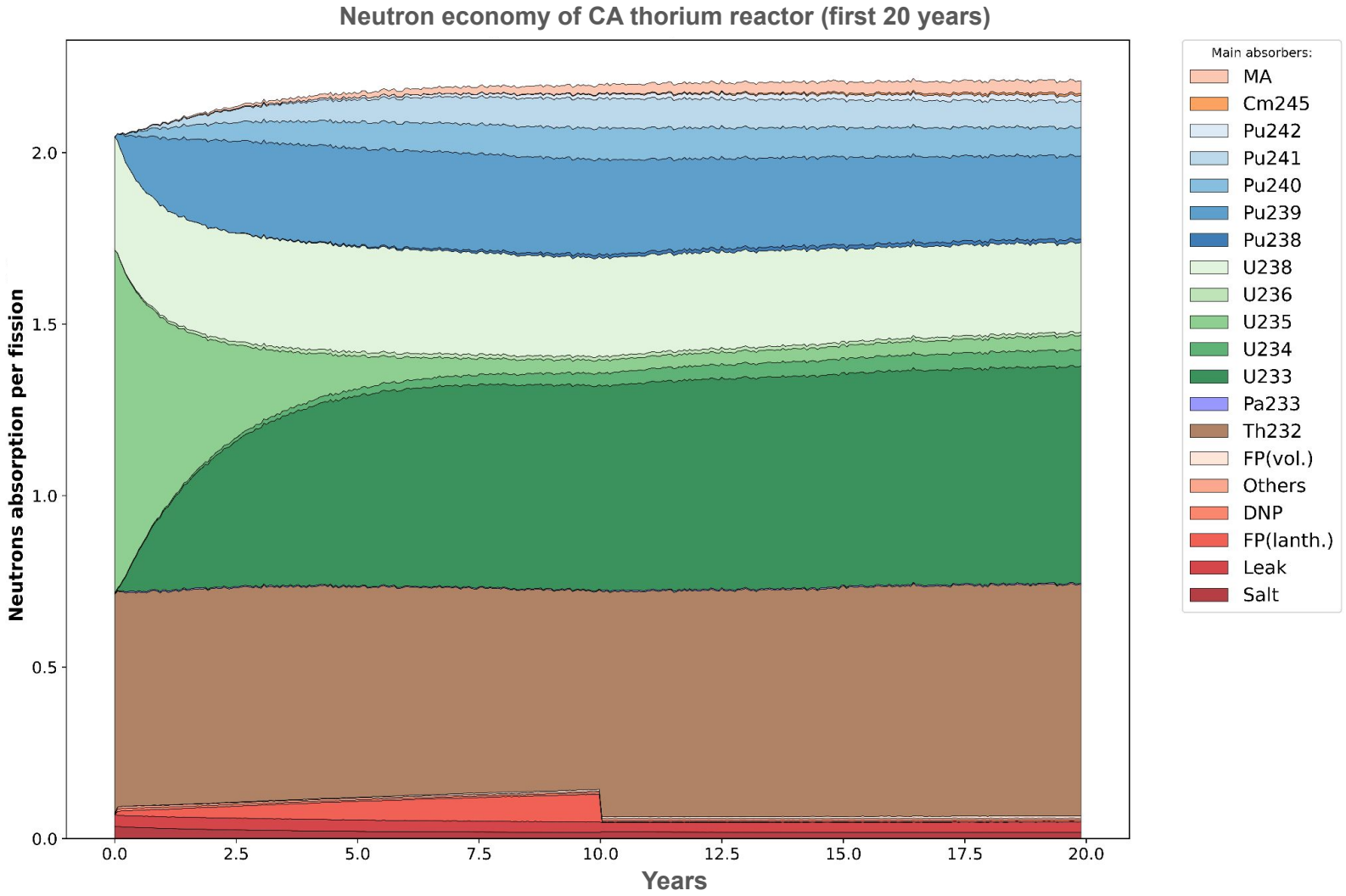

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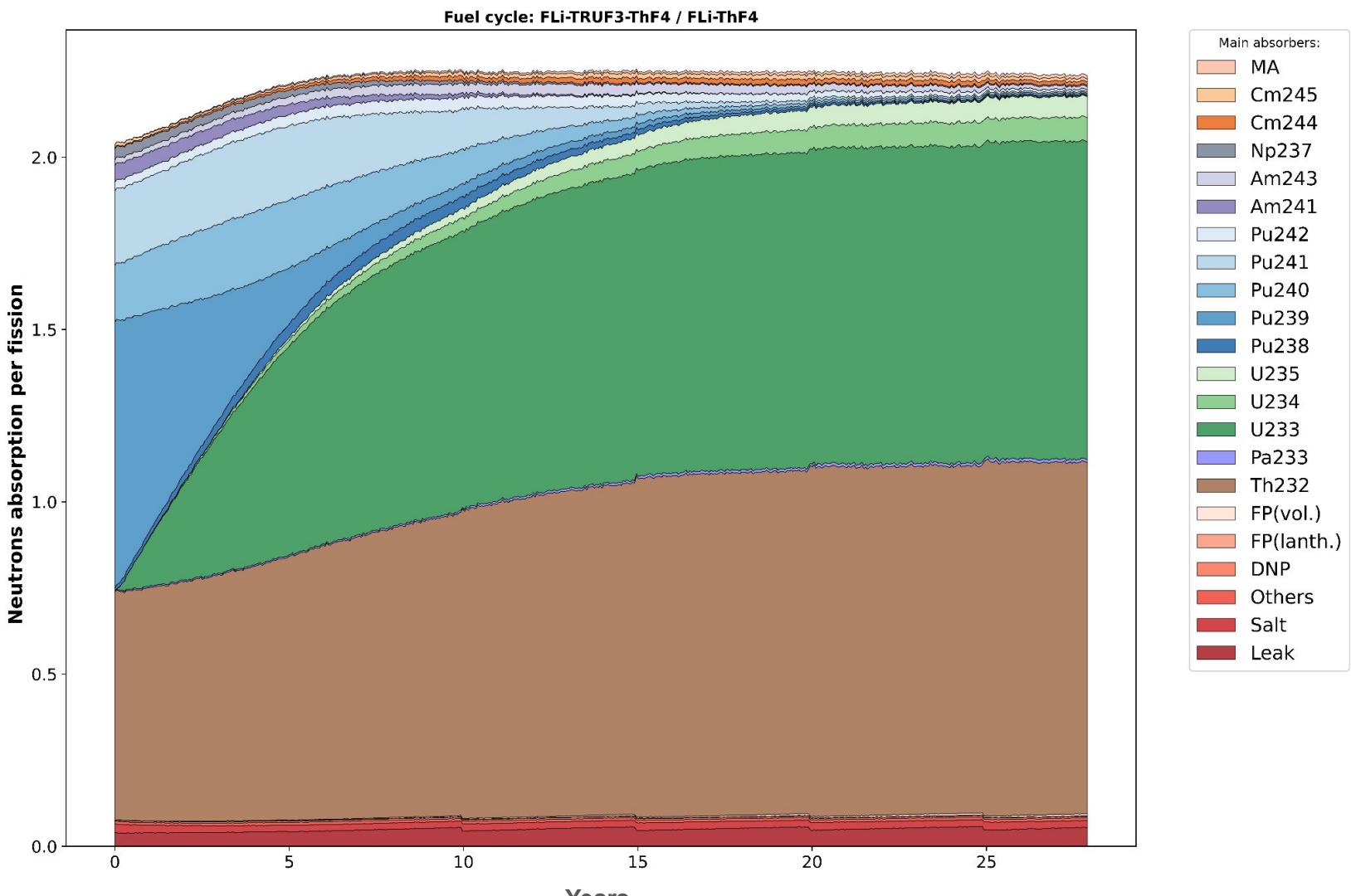
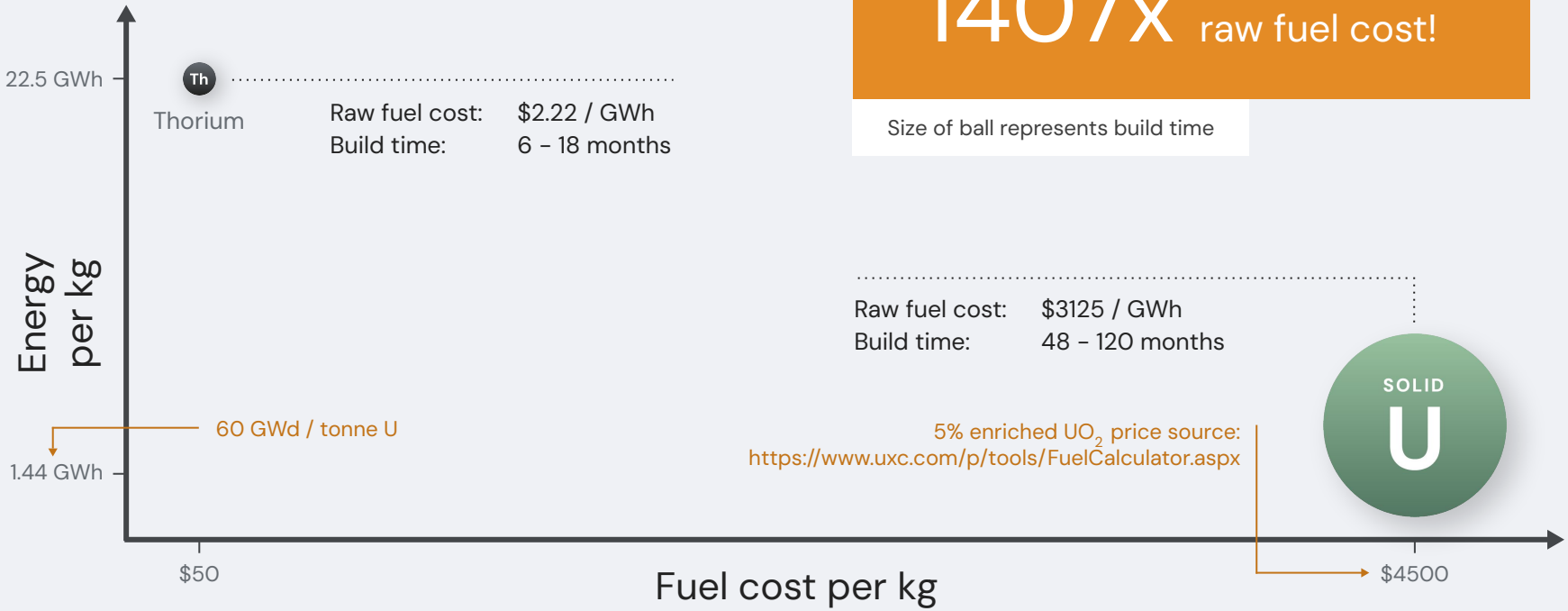

Fuel cycle: FLi-TRUF3-ThF4 / FLi-ThF4
Neutrons absorption per fission
0.0
0.5
1.0
1.5
2.0
0
5
10
15
20
25
Years
Main absorbers:
MA
Cm245
Cm244
Np237
Am243
Am241
Pu242
Pu241
Pu240
Pu239
Pu238
U235
U234
U233
Pa233
Th232
FP(vol.)
FP(lanth.)
DNP
Others
Salt
Leak

Uranium solid fuel reactors vs CA thorium breeder reactor

Fuel cost, energy per kg & build time

1407x difference in raw fuel cost!

Size of ball represents build time



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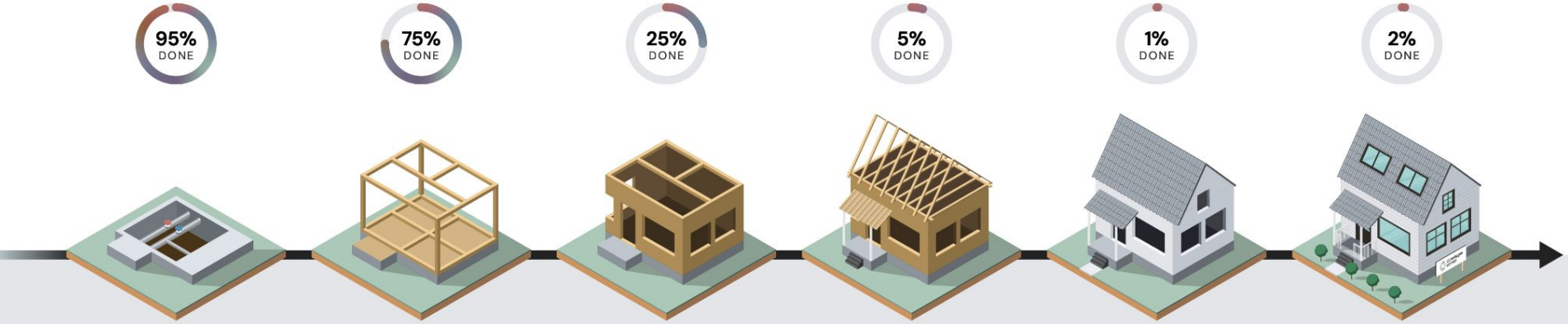
CURRENT STATUS
DECEMBER 2023



2015-2026	2020-2024	2023-2026	2025-2029	2029-2035	2032-2035
Technology foundation	Non-radioactive prototype reactor	1 MW Nuclear Test Reactor	First commercial reactor	Assembly line reactor production	Waster Burner Breeder Reactor

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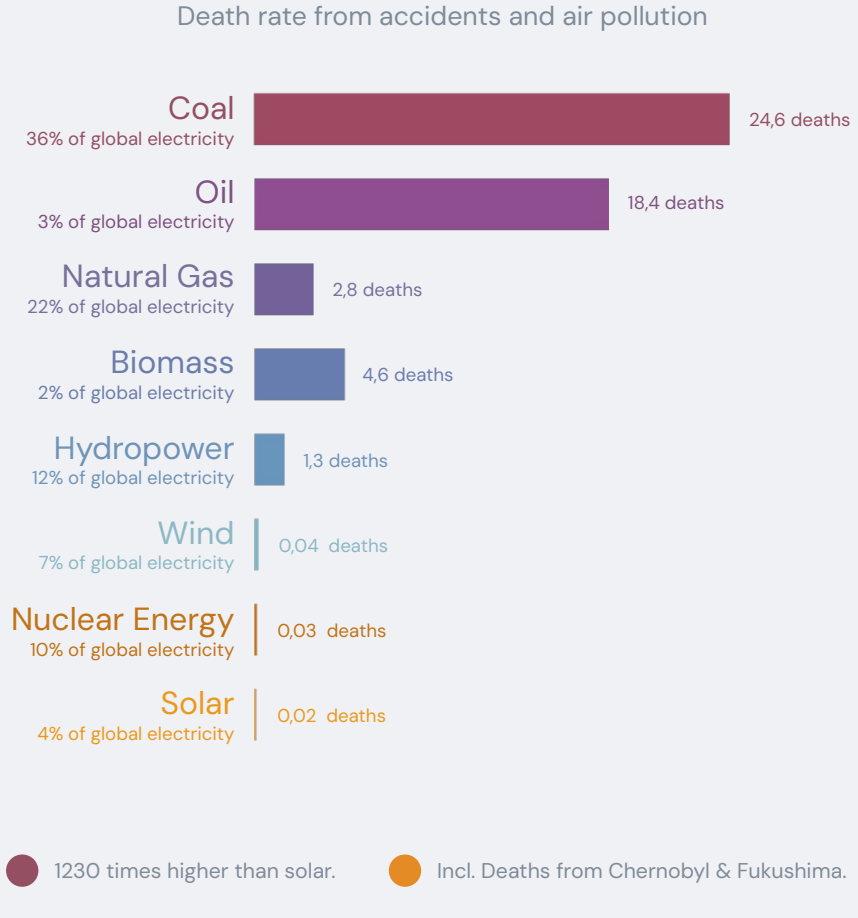
What are the safest energy sources?

Measured as deaths per terawatt-hour of electricity production.

1 terawatt-hour is the annual electricity consumption of 150.000 people in the EU.



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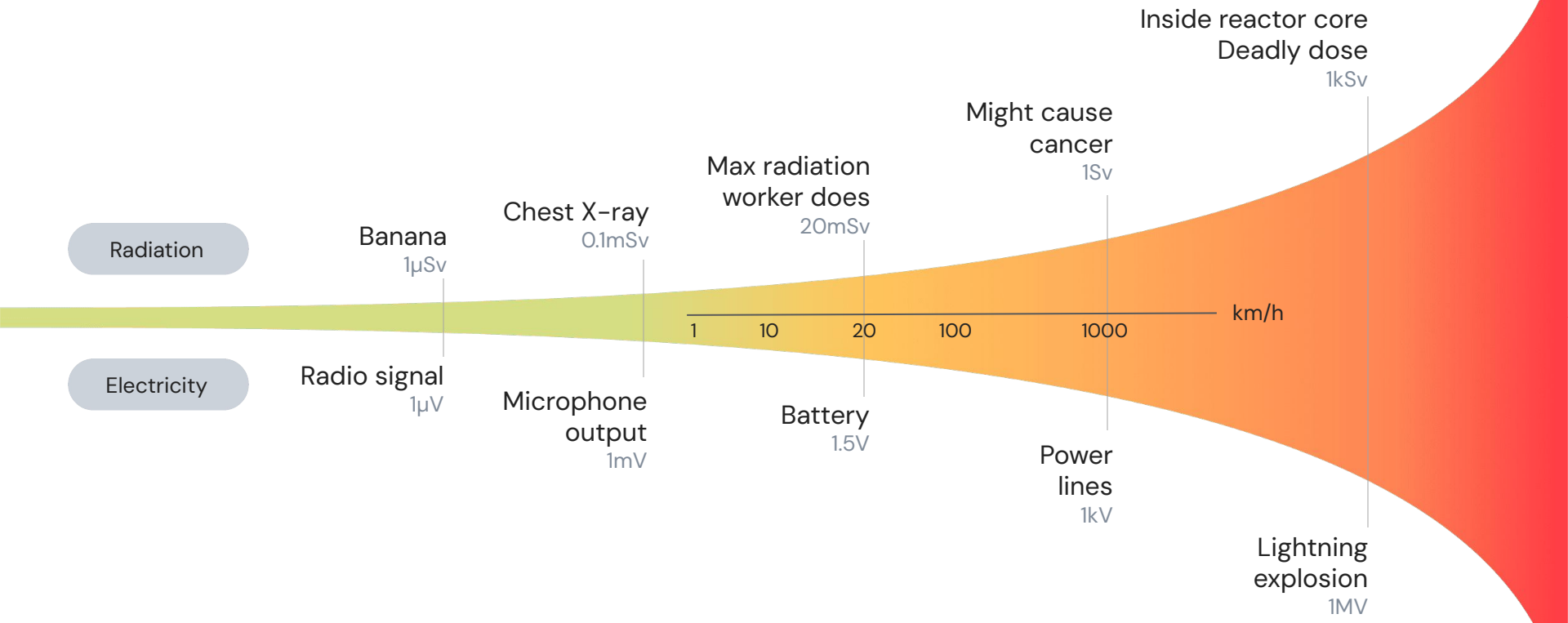
Understanding radiation

Compared to electricity



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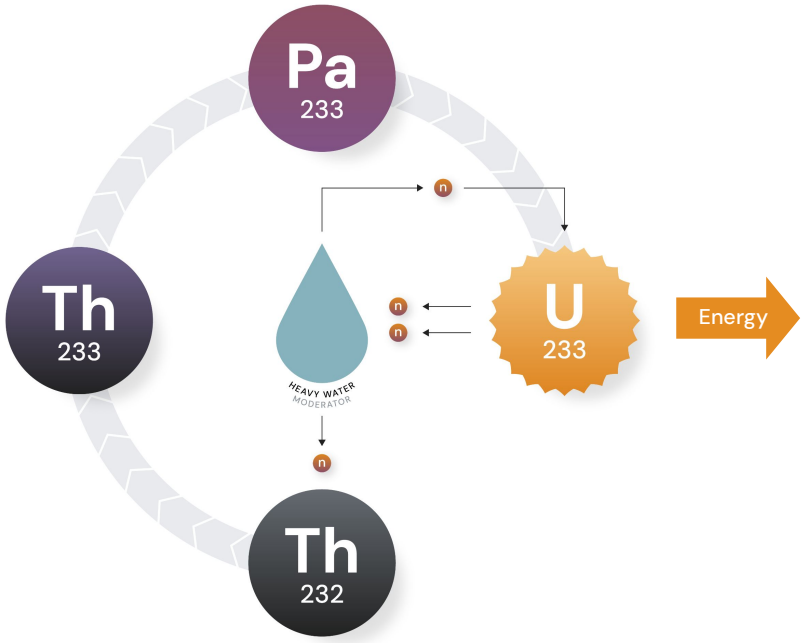
Thorium

Fuel cycle



1 kg of thorium gives you 22.5 GWh of thermal energy

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6 o'clock: Natural thorium will convert to Th-233, when hit by a slow neutron, which then quickly convert, through radioactive decay to Pa-233 at 12 o'clock.

Pa-233 converts to U-233 through radioactive decay with a 30 days half life.

U-233 is not found in nature, but it is the best nuclear fuel you can get.

When you hit U-233 with a slow neutron it fissions with a high probability and give off 2.35 neutrons on average, which make a chain reaction possible.

Copenhagen Atomics will use heavy water as the moderator.

Reactor Production Facility

11.000 m^2

Copenhagen, Denmark

65+ Employees

Factory facility
9.000 m²

Office & lab space
2.000 m²

Customers
25

Team size
+65

Employees from
12 countries

Sub suppliers
+200

Accumulated component testing
+100 years

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Loops

Specs

Pump
Valve
Flow meter
Pressure sensor
Salt leak sensor

1000h warranty

Upcoming

Online salt chemistry monitoring

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Worlds largest molten salt test facility

Thank you

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