Advanced Nuclear Energy: Secrets The Media and Politicians Won't Tell You

And how Australia can become an Energy Transition superpower by multiplying its renewable energy reserves with the advanced nuclear technologies that your media and politicians don't know exists!

SPEAKER INFO:

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- **www.energytransitioncrisis.org**

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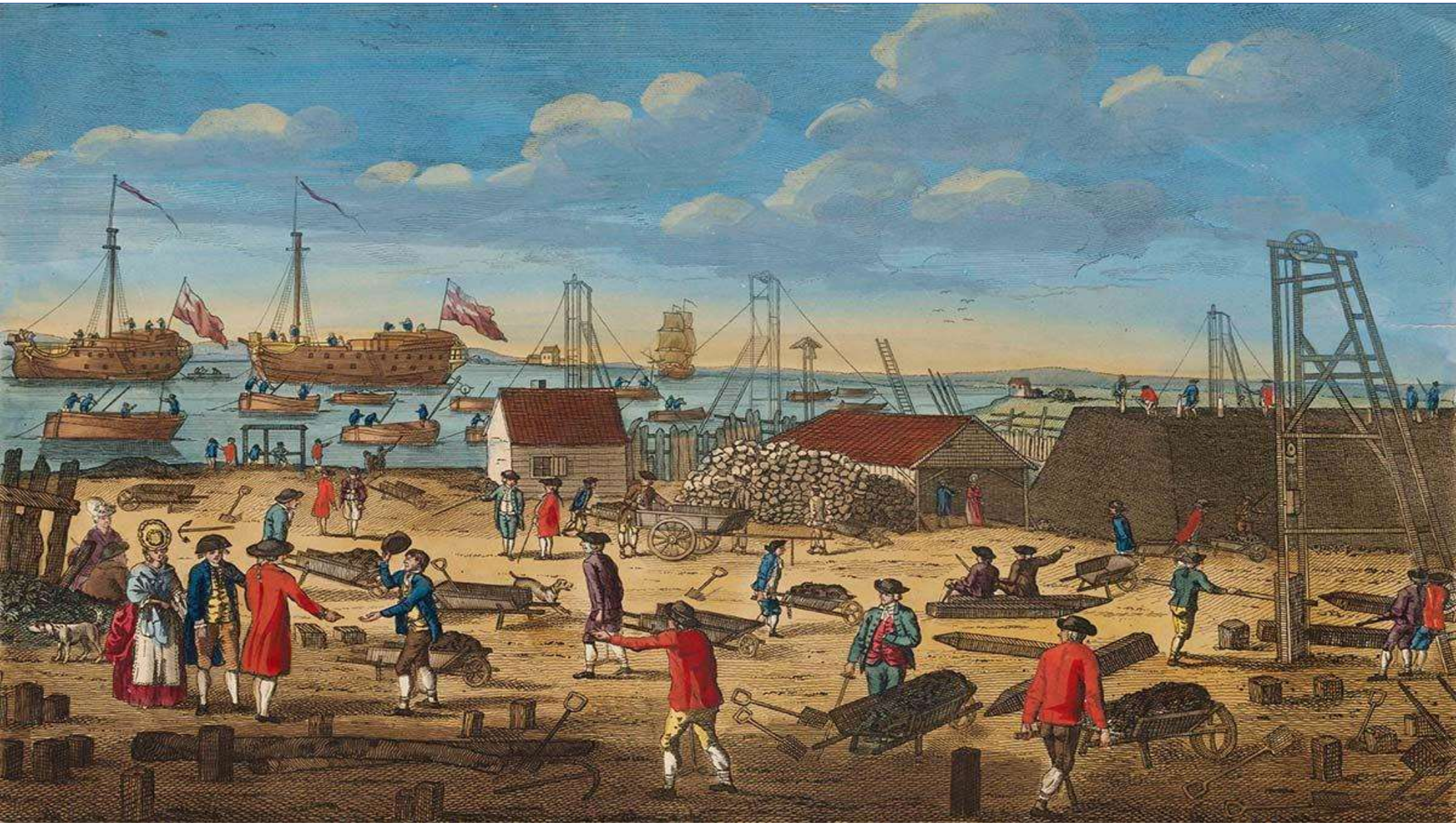
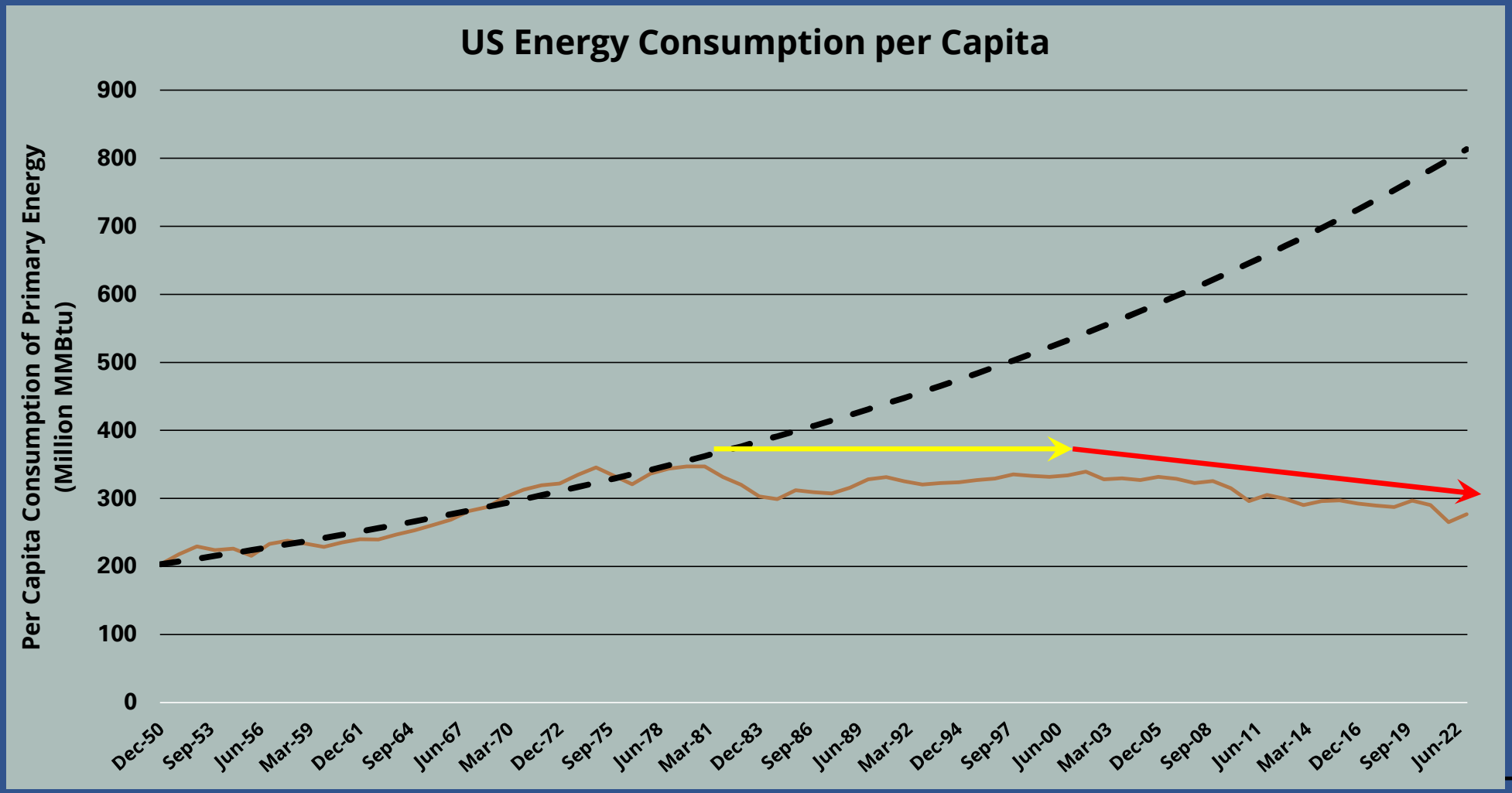
I'll give you the URL to download the Extended version of this deck.





Source: US EIA, Simplify calculations

ENERGY TRANSITION REQUIREMENTS

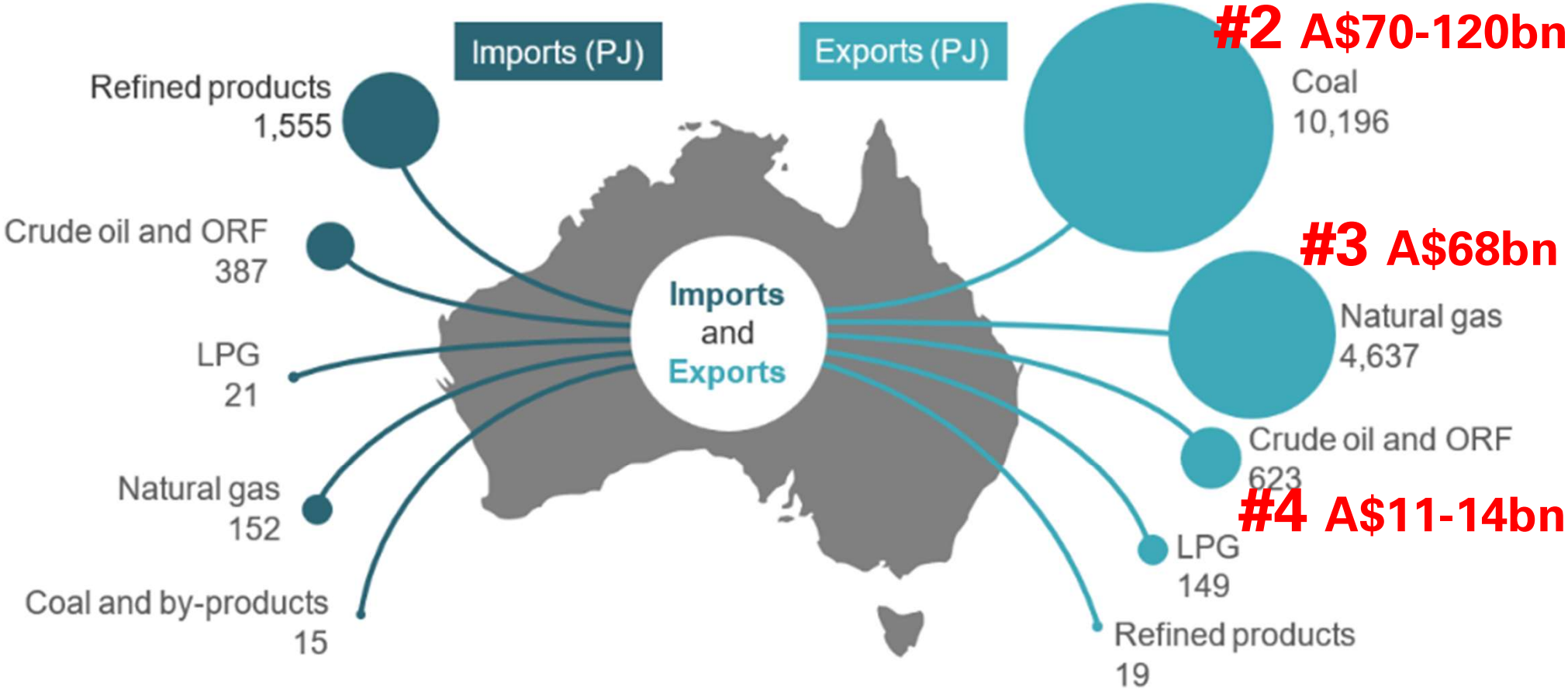
1. Eliminate dependence on finite resources (break our addiction to fossil fuels)
2. Replace FF's with CLEAN environmentally friendly energy consistent w/ Net-Zero objectives
3. Make that energy cost LESS than energy from fossil fuels or renewables costs today
4. Make energy ABUNDANT to improve Australians' standard of living

Australia's Dual Nuclear Agenda

1 **How can Australia best leverage export of its Nuclear fuel resources?**

2 **Is Nuclear Energy right for use in Australia?**

Iron Ore - #1 A$102-131bn



#2 A$70-120bn

#3 A$68bn

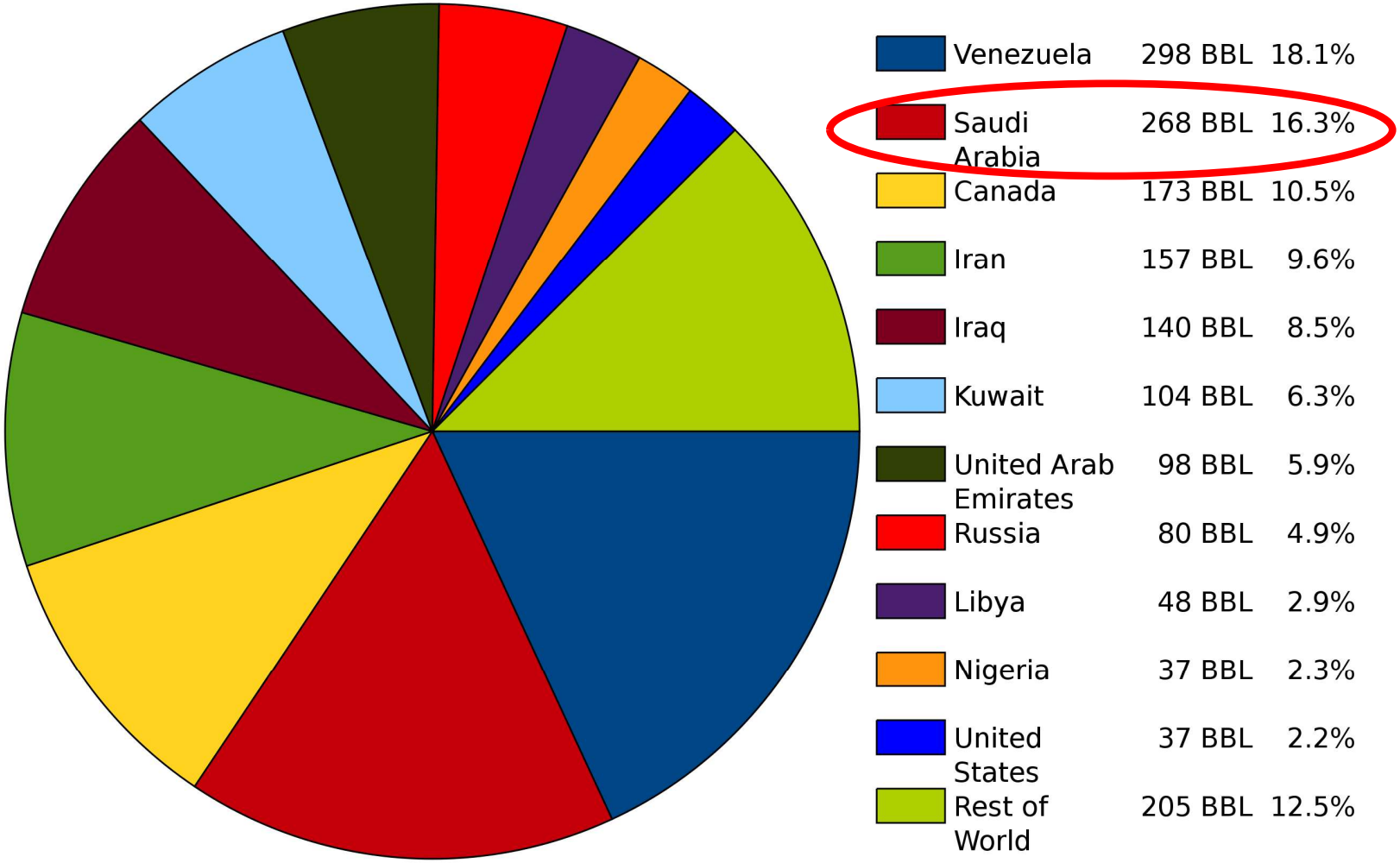
#4 A$11-14bn

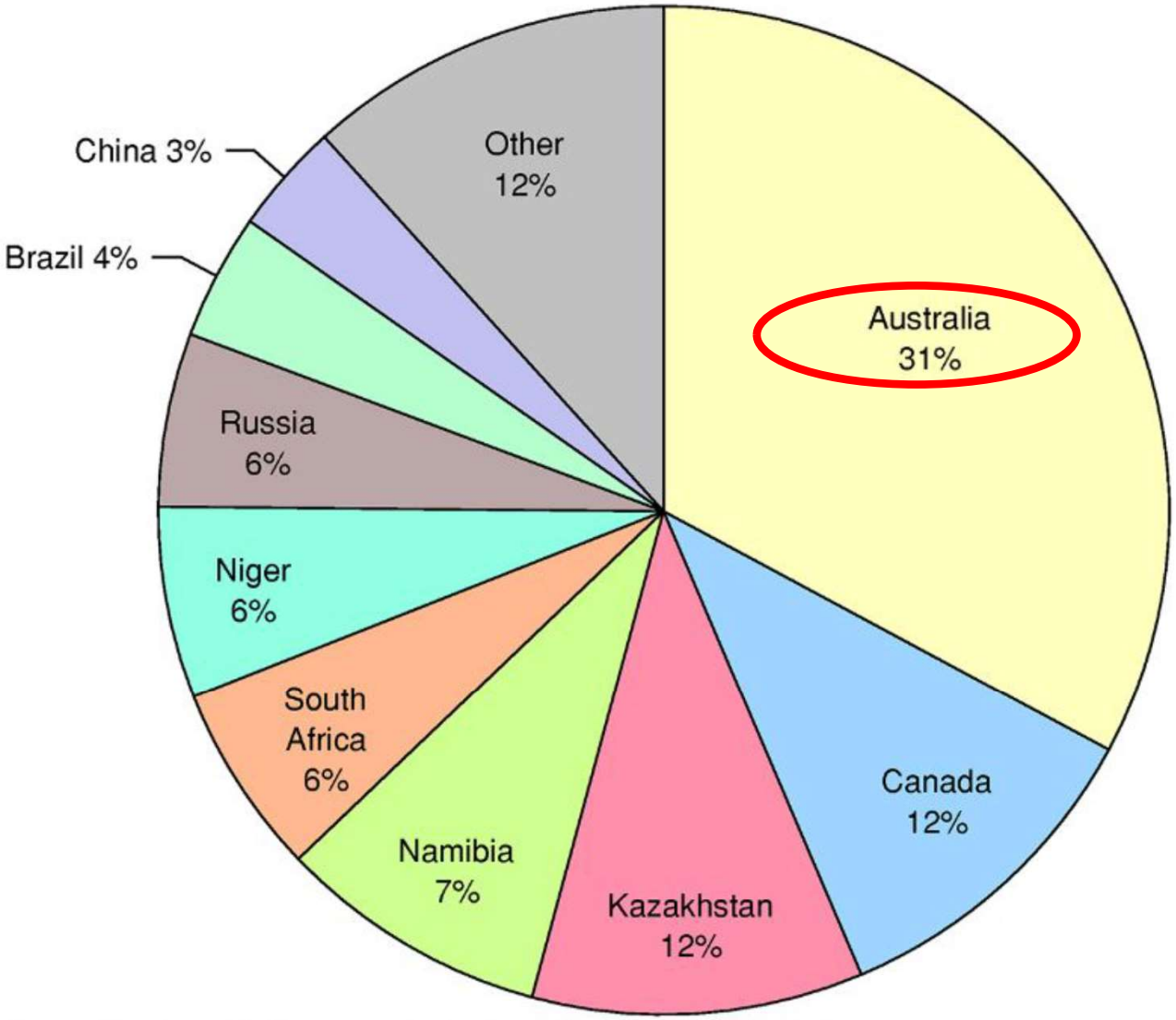
Total Fossil Fuel Export Revenue (approx.): A$149-202bn (11-15% GDP)

Revenue Data source: https://www.industry.gov.au/publications/resources-and-energy-quarterly-december-2023


1937

World Oil Reserves

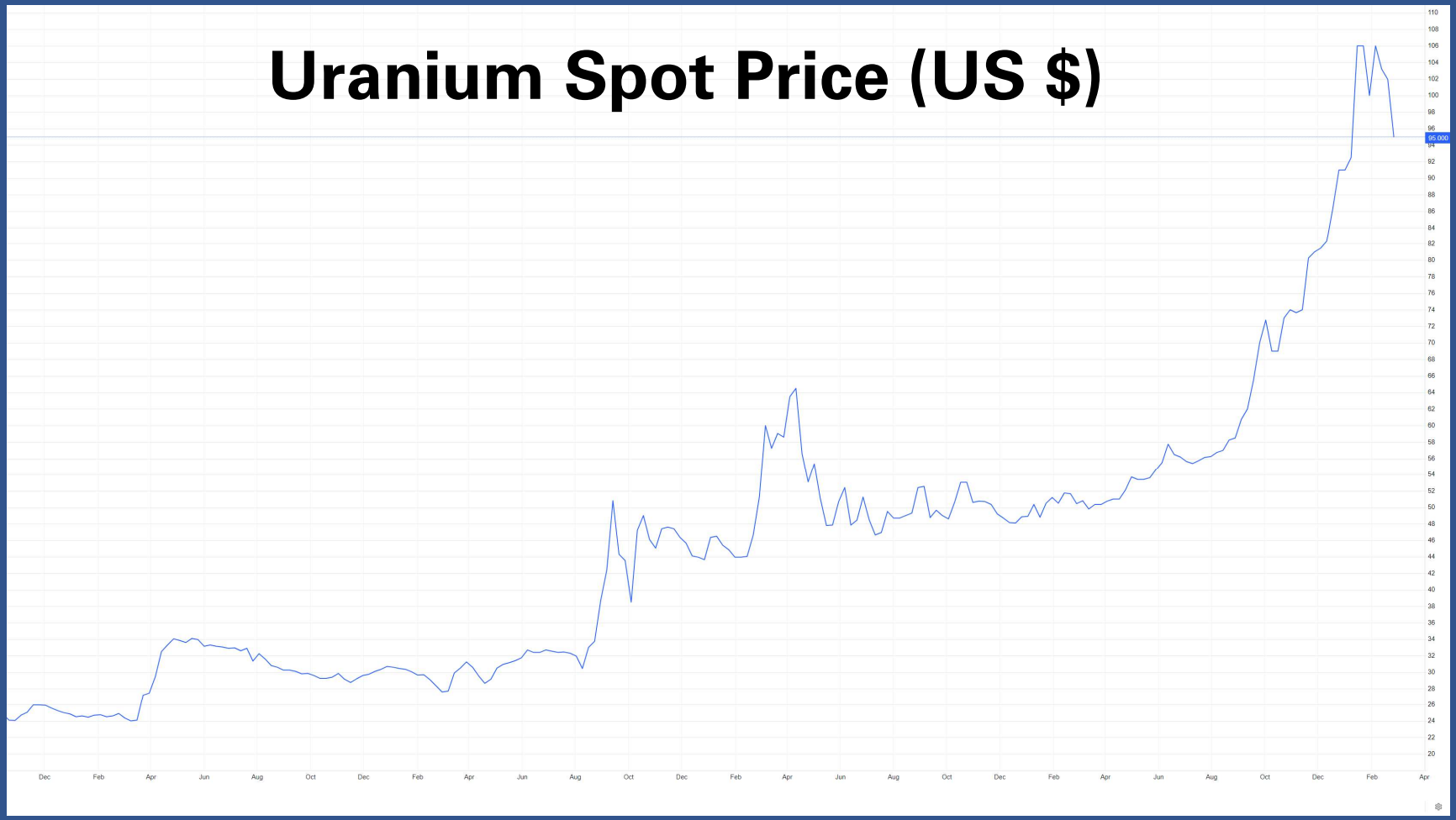


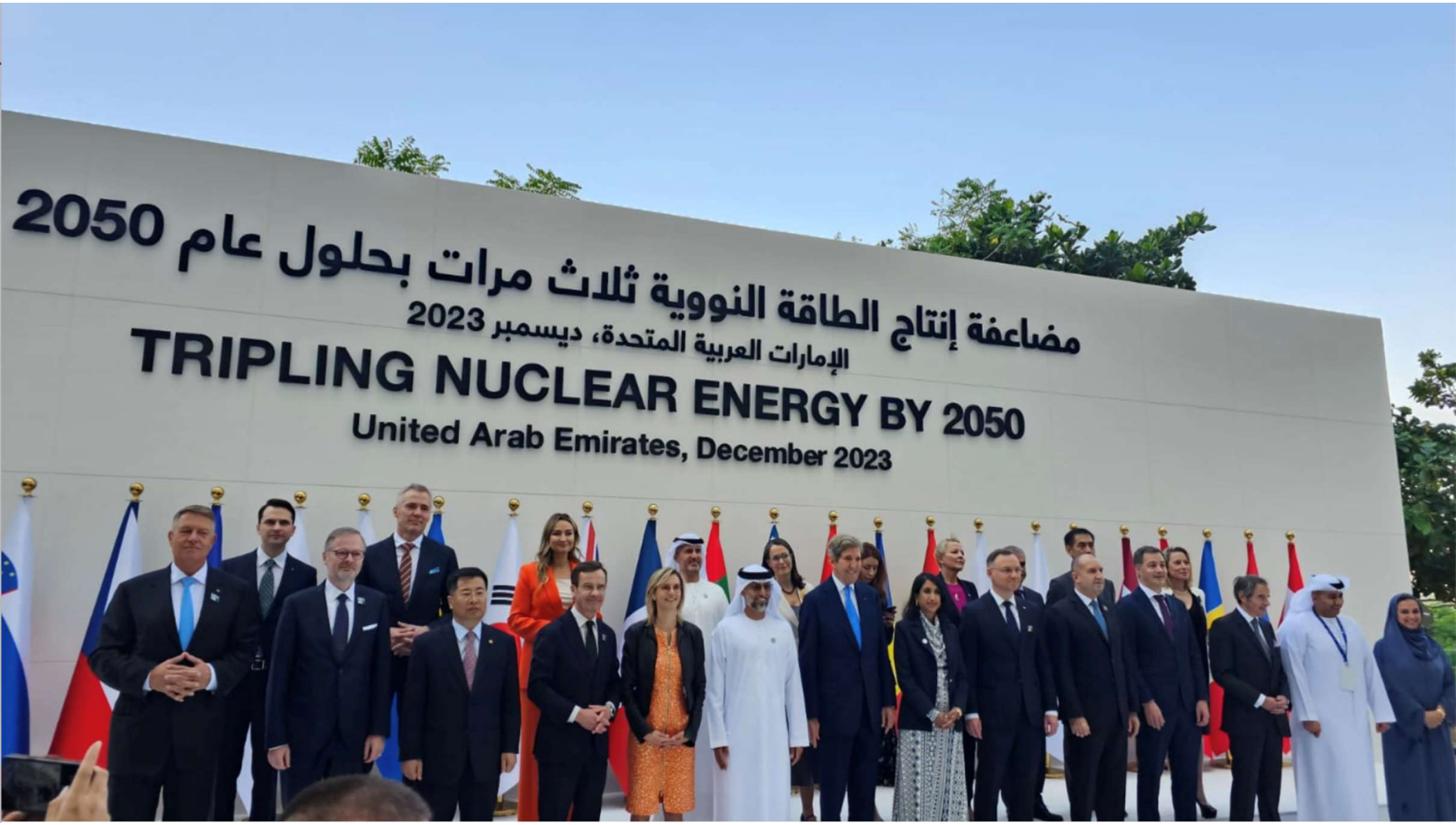


Source: Uranium 2020: Resources, Production and Demand, NEA No. 7551.

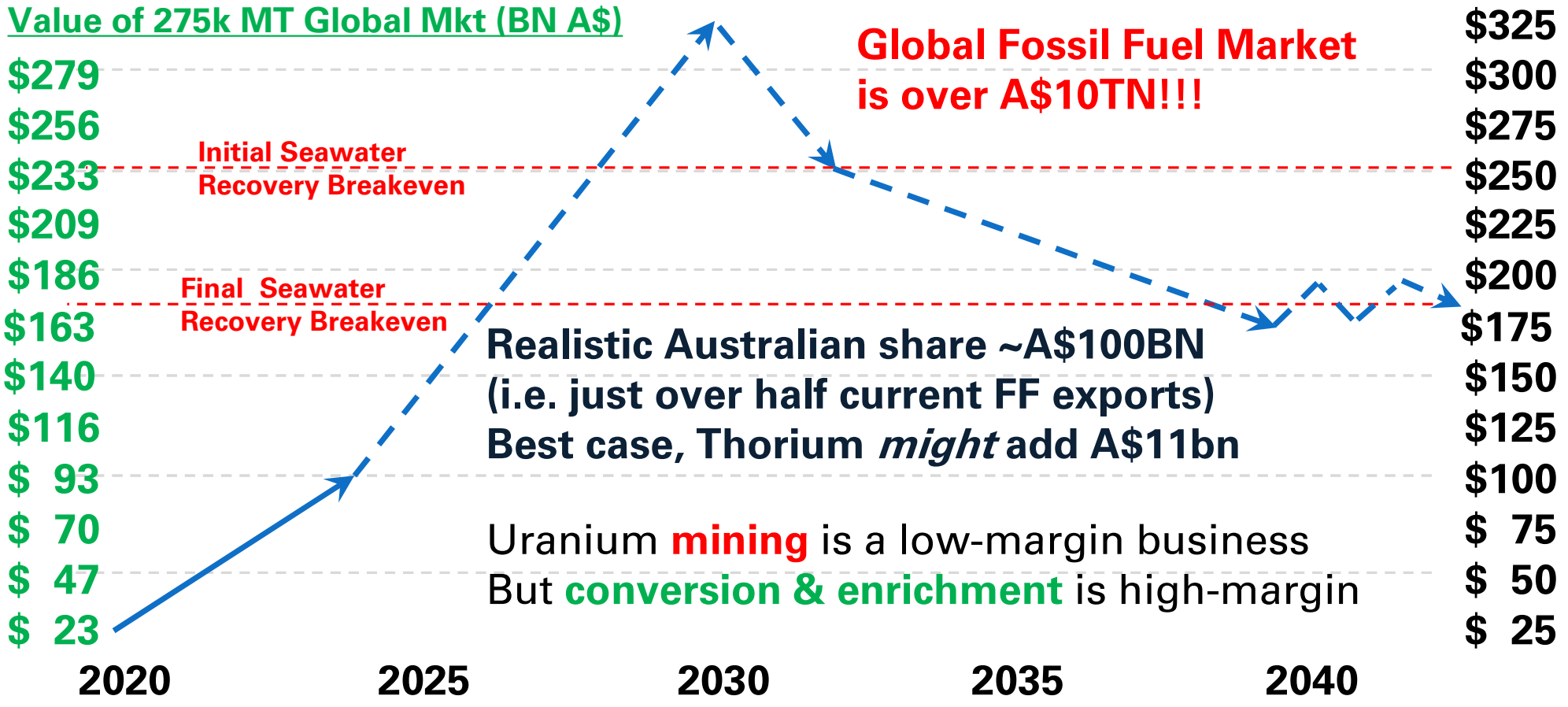
Australia has **TWICE** as much share of global Uranium reserves as Saudi Arabia had Oil reserves!

Uranium Spot Price (US $)

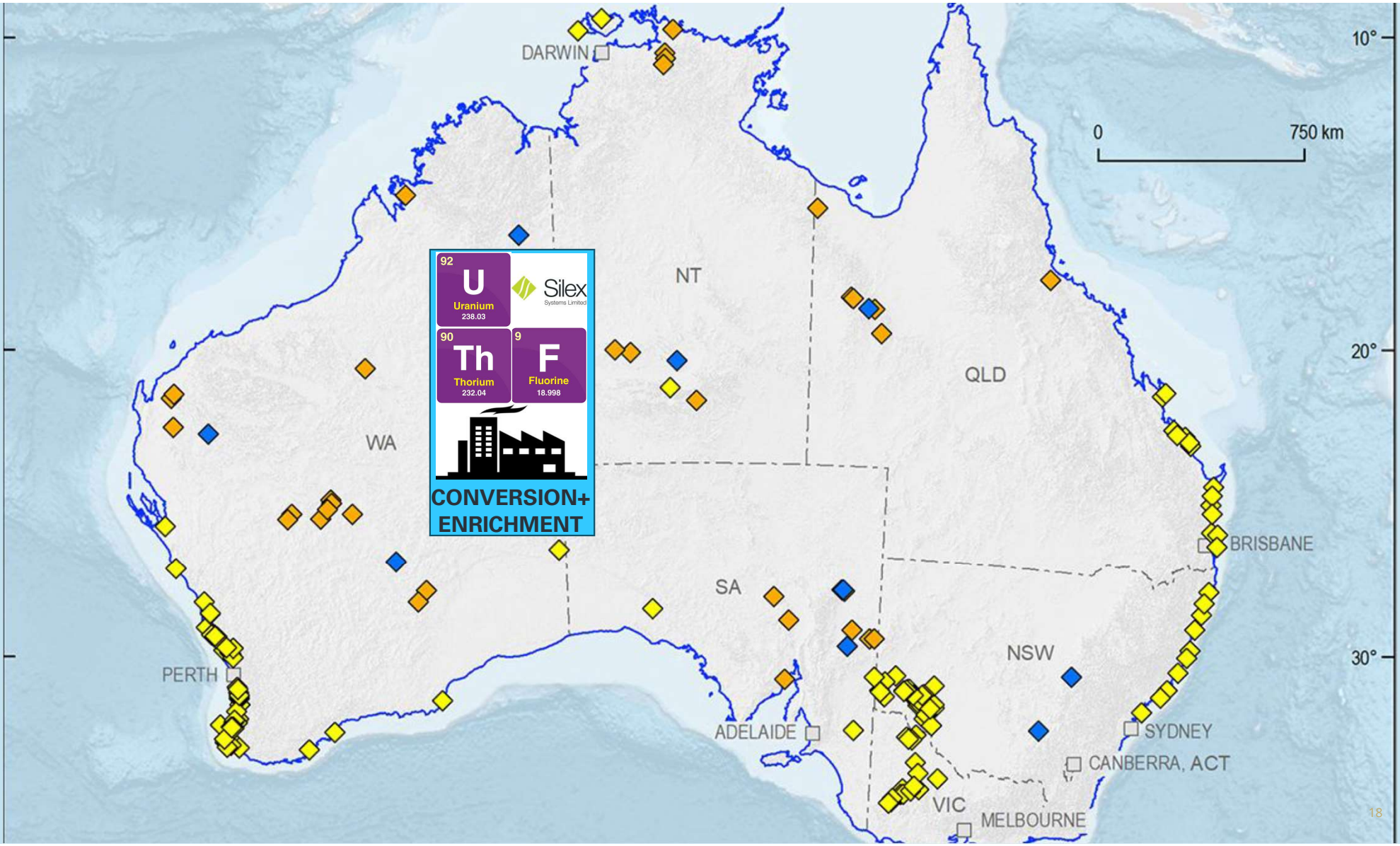



مضاعفة إنتاج الطاقة النووية ثلاث مرات بحلول عام 2050
الإمارات العربية المتحدة، ديسمبر 2023
TRIPLING NUCLEAR ENERGY BY 2050
United Arab Emirates, December 2023

Erik's Uranium Spot Price Forecast (2024 US $)



POLICY ERROR?


DARWIN
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750 km
92
U
Uranium
238.03
Silex
Systems Limited
90
Th
Thorium
232.04
9
F
Fluorine
18.998
CONVERSION+
ENRICHMENT
NT
QLD
WA
20°
BRISBANE
SA
NSW
30°
PERTH
ADELAIDE
SYDNEY
CANBERRA, ACT
VIC
MELBOURNE

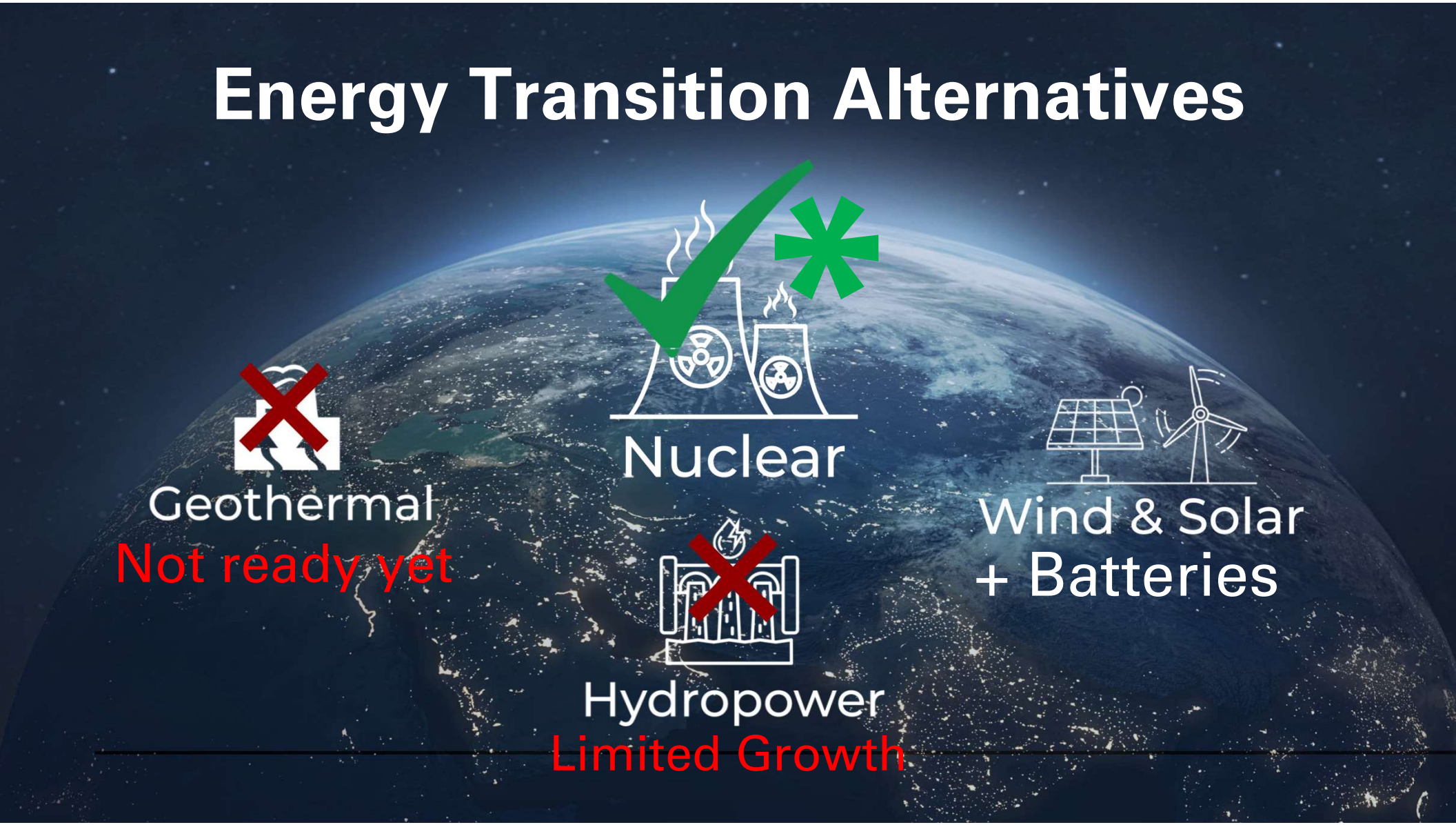
To replace Fossil Fuel Exports…

1. Lift the ban on Uranium and Thorium mining nationwide.
2. Lift the ban on Uranium conversion & enrichment nationwide.
3. Build a large conversion/enrichment facility to keep high-margin business in Australia; create more employment

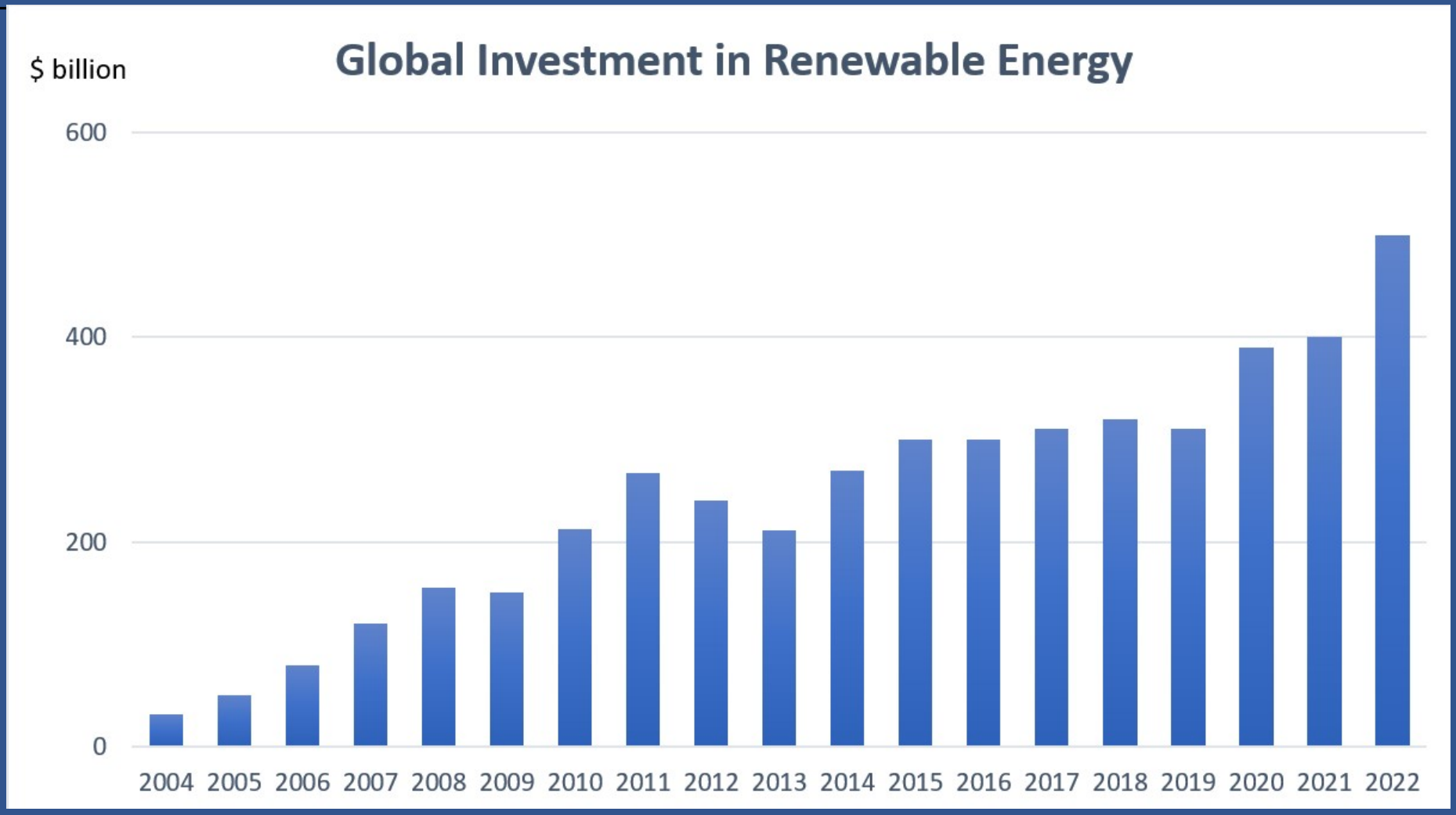
Australia's Dual Nuclear Agenda

Is Nuclear Energy right for use in Australia?

Energy Transition Alternatives



US $4.6TN SPENT GLOBALLY



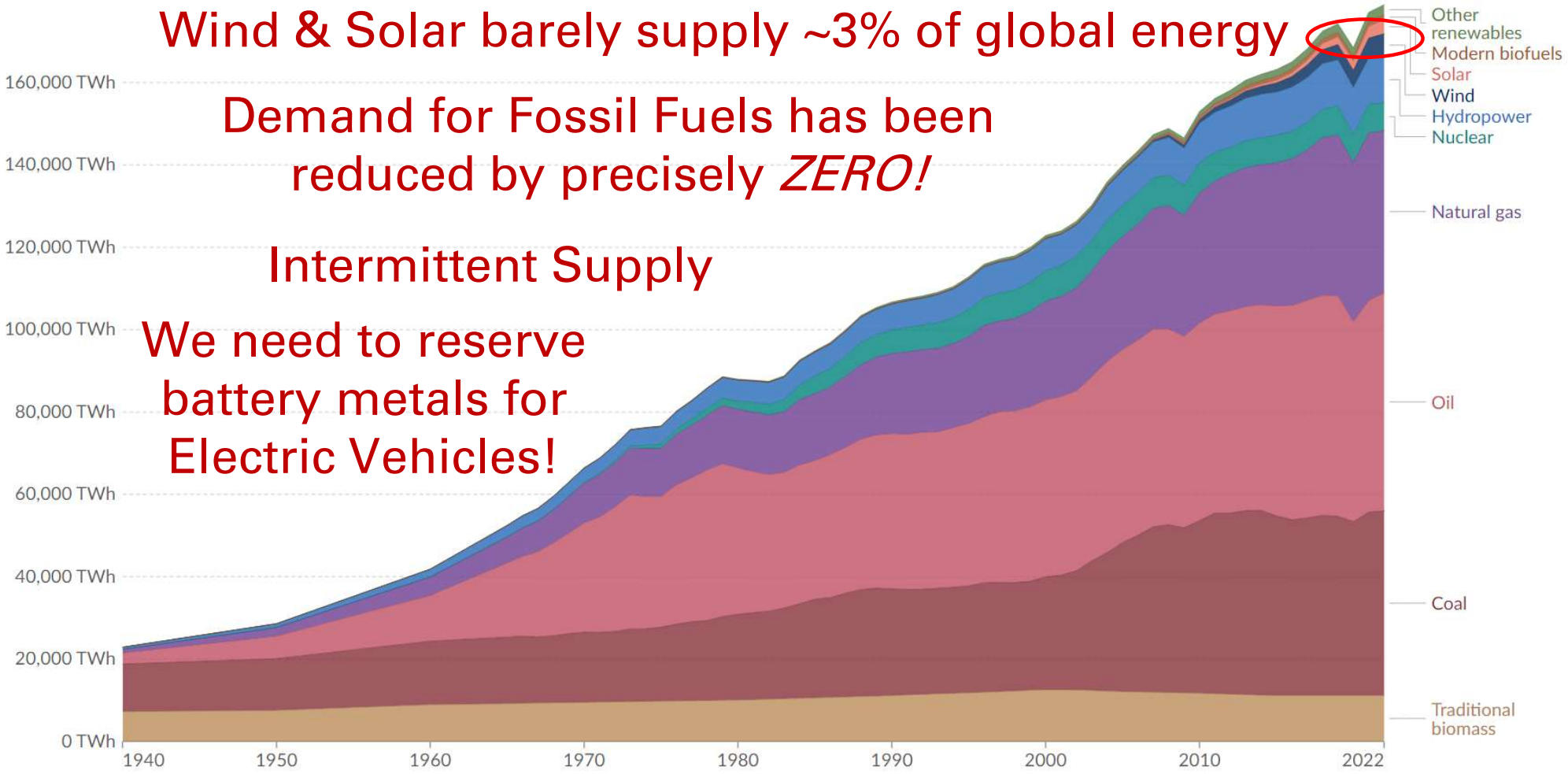
AFTER 25 YEARS AND $4.6TN…

Wind & Solar barely supply ~3% of global energy

Demand for Fossil Fuels has been reduced by precisely *ZERO!*

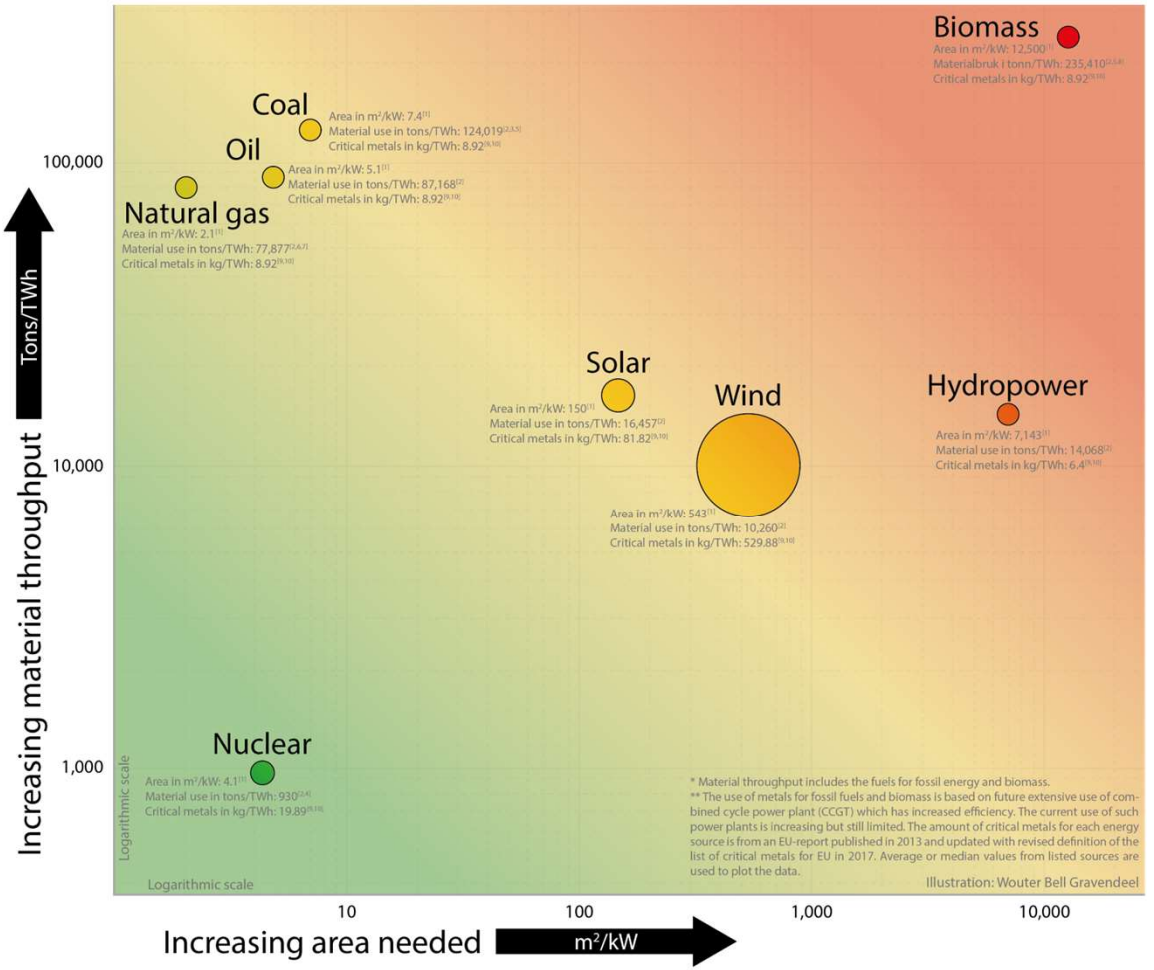
Intermittent Supply

We need to reserve battery metals for Electric Vehicles!



Spatial and material requirements by energy source*

Bubble size represents each source's use of critical metal use**



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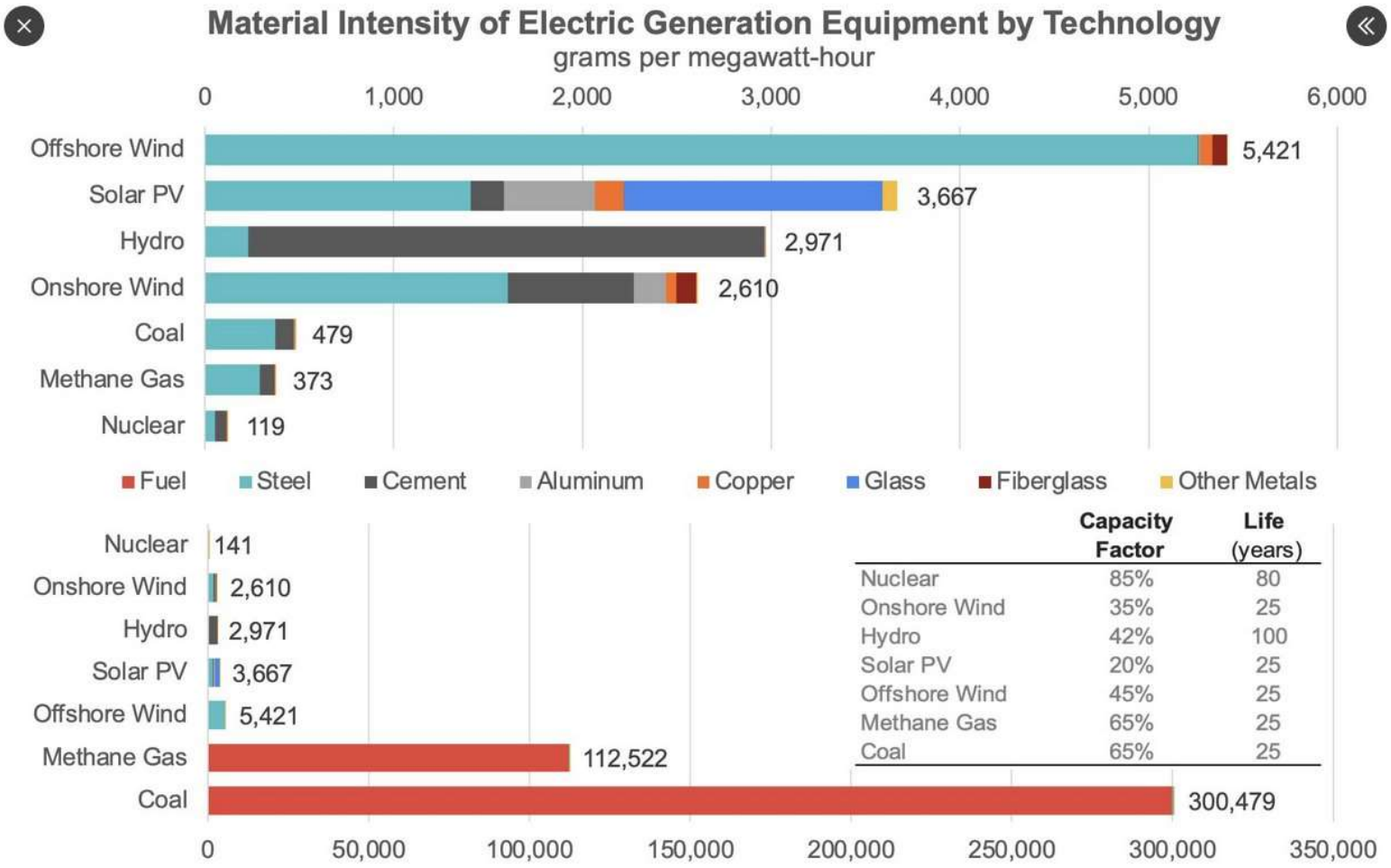


Fuel and Equipment Material Intensity of Electricity by Technology

grams per megawatt-hour

Chart by Isuru Seneviratne based on *How much coal/gas/oil matches the energy of a single nuclear fuel pellet?* (Touran, 2023), *Future demand for electricity generation materials under different climate mitigation scenarios* (Wang et al., 2023), capacity factors, lifetimes, and a uranium enrichment multiplier

Conventional Nuclear costs too much & takes too long

We need a **clean energy solution that costs less** than energy from fossil fuels. It also has to be fast to build, in order to make energy transition by 2050 plausible.

	Conventional Nuclear	Coal & Gas	Advanced Nuclear SMRs
			
Levelized cost of electricity USD/MW	**$50 - $150**	**$40 - $85**	**$20**
Time to build	**7+ Years** **4-5 Years**	**3 – 5 years**	**< 1 year**
Cost to build (per KW)	**$ 7,500 - $ 12,000** **$ 3,500 - $ 5,000**	**Coal $1,500 - $4,500** **Gas $ 958 - $1,810**	**$500* - $1,000**

$500/KW is the ultimate target, but will require modularization & mass production of all powerplant components including supercritical CO_2 turbines to replace steam turbines and modularized mass-produced electric generators.

Building power plants can be modularized in a similar way that McDonalds builds restaurants

McDonalds uses prefabricated modular design to build a restaurant in less than 24 hours

Groundwork ready

First module installed

4 modules later, in less than 5 hours

Final module of ground floor installed

Ground floor finished, modular roof now installed

Final restaurant, built in less than 24 hours

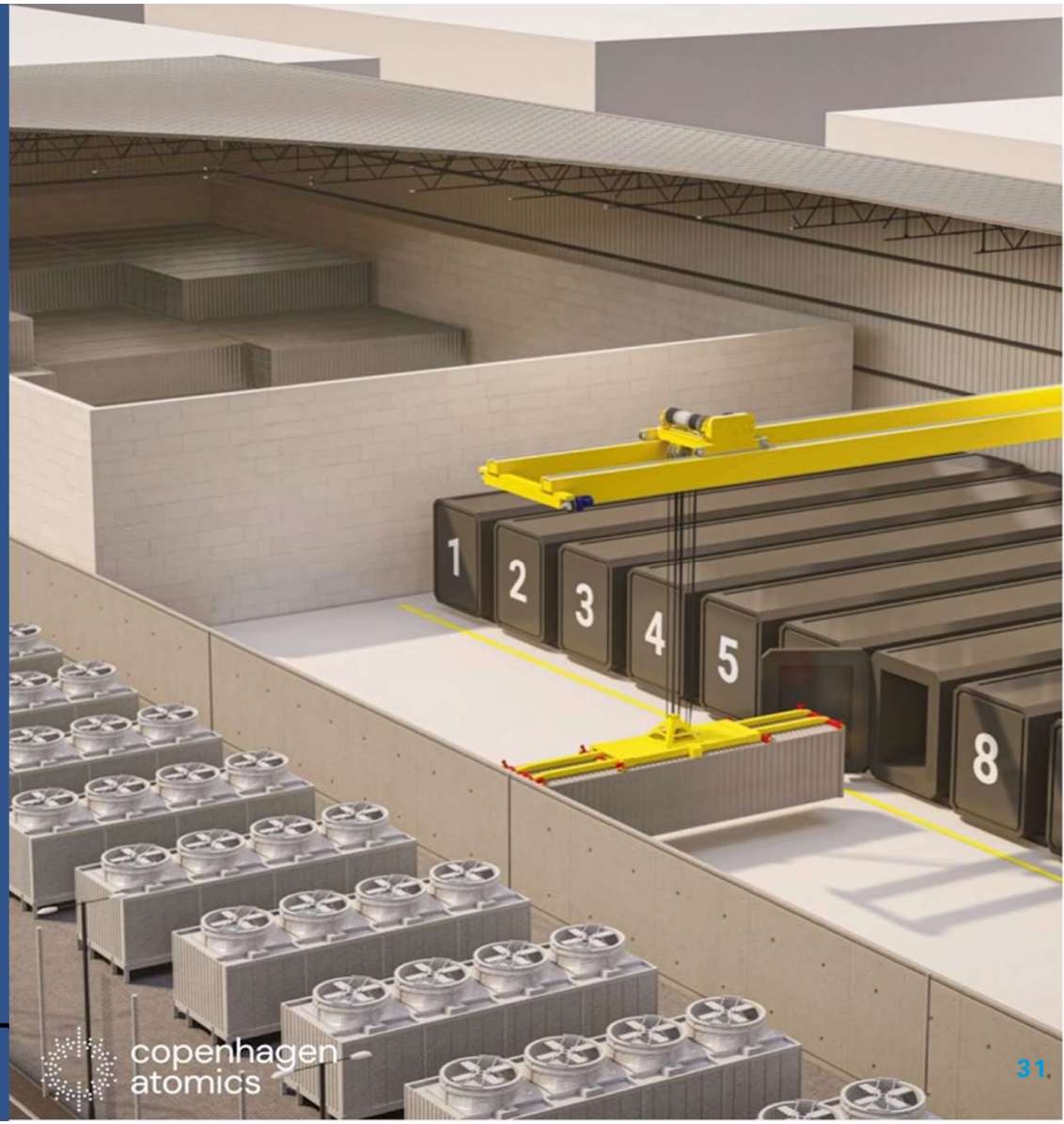
TIMELAPSE OF A MODULAR BUILD MCDONALDS RESTAURANT - COMPLETED BY SUMMERFIELD DEVELOPMENT AND DEVON CONTRACTORS AT WESTPARK 26, WELLINGTON, SOMERSET, UK IN 2021

GIGAWATT POWERPLANTS

MADE FROM FACTORY-BUILT SMRs RATHER THAN CONVENTIONAL LARGE SCALE NUCLEAR REACTORS

A conceptual visualization of a 1GW Power

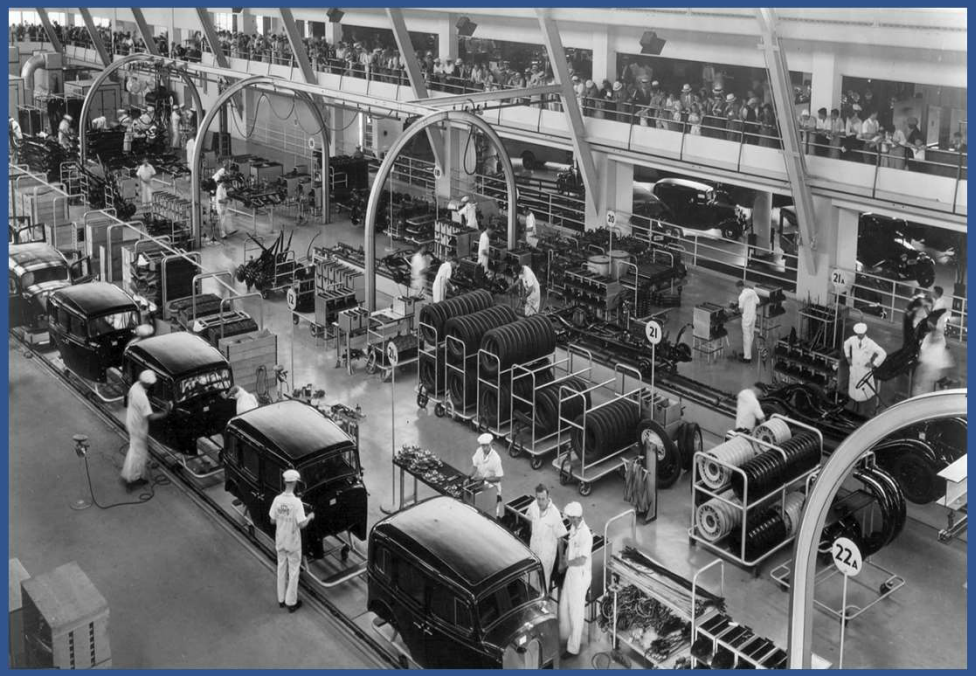
REMOTELY MANAGED SMRs IN THE FORM FACTOR OF STANDARD 40’ SHIPPING CONTAINERS



SMRs ARE BUILT IN FACTORIES, ON FULLY ROBOTIC ASSEMBLY AND TEST LINES

Scale Determines Cost

(Why right now is an unprecedented "Henry Ford Moment" in Nuclear History)



Ford Assembly line in the 1920s

- Embrace **economies of scale inherent to assembly line mass-production** of reactor modules, CO_2 turbines, and other powerplant components.
- **~415** power reactors operating today worldwide
- Opportunity to build **~180,000** more over 20 years (!)
  - Is there really demand?
- Unprecedented "**Henry Ford Moment**" of opportunity!
  - Even the "Green" Climate Community has warmed up to Nuclear
  - Energy Transition movement creates unprecedented demand for **economically viable clean energy**
  - **Beating *everyone* including fossil fuel energy on cost enables massive demand creation!**

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Erik's Substack

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The Nuclear Henry Ford Moment

For the first time ever, it will be possible to make Nuclear energy cost LESS than energy from fossil fuels. And that means Nuclear done right can fully...

FEB 26 • ERIK TOWNSEND

The History of Nuclear Energy

1951
First Demonstration of Electricity from Nuclear Energy

1954
U.S.S. Nautilus Nuclear Submarine and **Pressurized Water Reactor** (PWR)

1958
Molten Salt Reactor Experiment Commissioned

1960-1973
Ground-breaking research in Molten Salt Reactor Experiment @ Oak Ridge, Tennessee

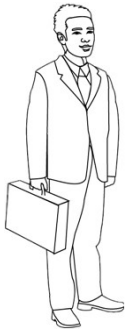
1973-2012
Oak Ridge research abandoned; Politics take over; PWR remains de-facto standard design

~2012-Now
Cottage Industry forms to commercialize advanced reactor designs

Western Governments have yet to recognize strategic value of Advanced Nuclear

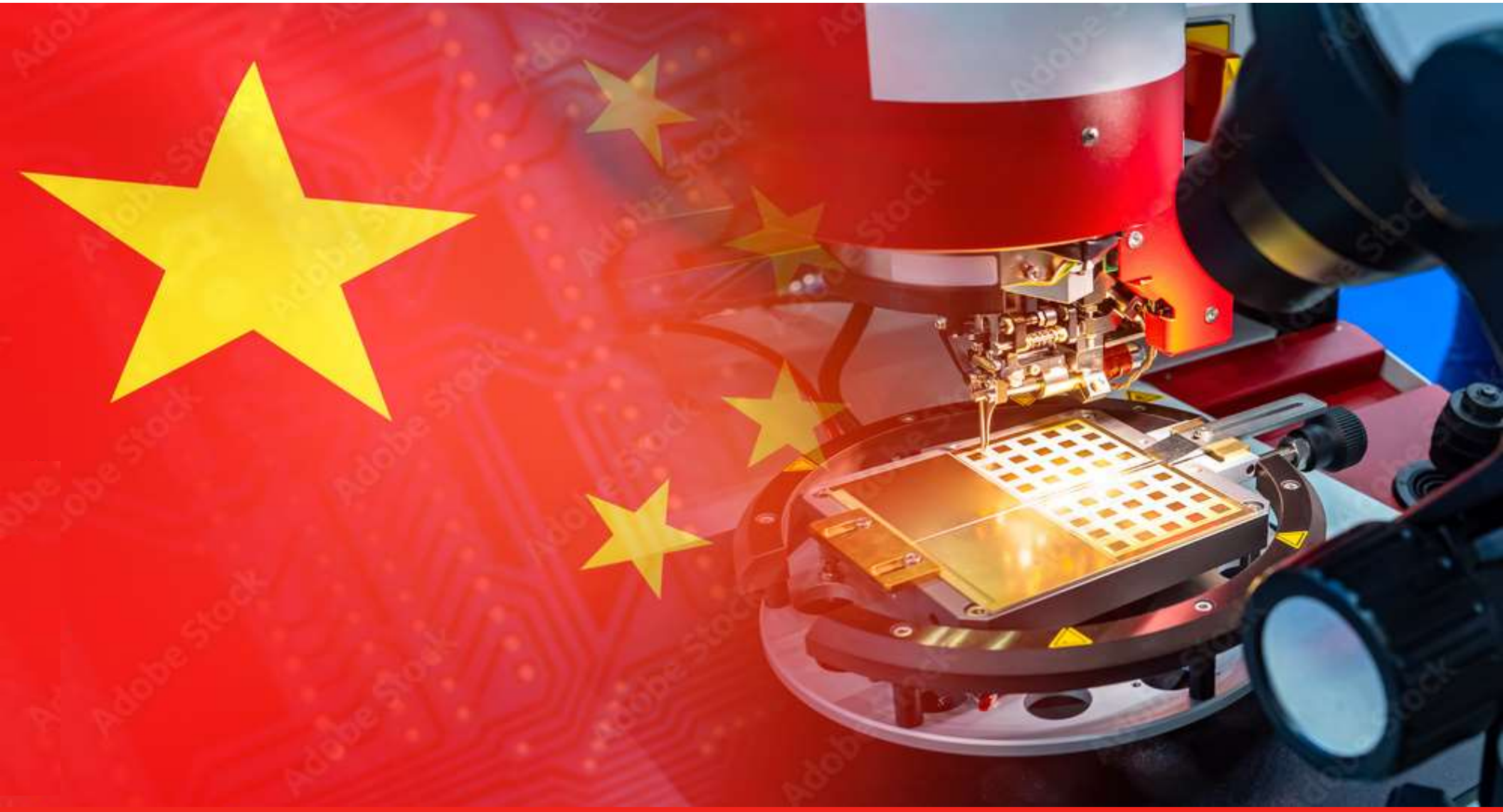
Advanced nuclear <u>engineers</u> and <u>entrepreneurs</u> are ready to build the technology we need RIGHT NOW…

Engineers

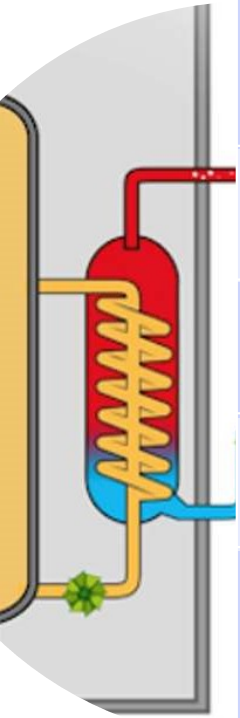


Entrepreneurs

…but <u>investors</u> know better than to invest in an idea that depends on nuclear regulators approving something new and different.



Advanced Nuclear Technologies



Feature	Benefit
Unpressurized molten salt coolant	Completely eliminates **core depressurization** and **hydrogen explosion** risks. Can **operate in the desert,** without requiring cooling water.
Liquid Fueled	Eliminates **melt-down** risk & enables **load-following.** Can **refuel** while operating.
Much higher temperatures than pressurized LWRs	Use for **seawater desalination** & **hydrogen** based **synthetic liquid fuel** production.
Thorium Fueled	Reduces waste storage to 300 years from 100k years and **reduces weapons proliferation** risks.
Waste Burning	Can burn spent nuclear fuel waste from reactors of yesteryear, disposing of that waste and eliminating need to store it for 1,000's of years.
Fully automated, remotely managed	No control room or human operator needed. Human operator error risk eliminated.

OUR NEXT CHALLENGE:

STEAM TURBINES

- COST TOO MUCH
- TOO BIG TO MODULARIZE
- ONLY ~40% THERMAL EFFICIENCY
- REQUIRE TOO MANY REACTOR MODULES

SIEMENS SST-9000 COSTS WELL OVER $1BN INSTALLED!

SUPERCRITICAL CO_2 TURBINES

- REPLACEMENT FOR STEAM TURBINES
- MUCH SMALLER (1/10TH SIZE/WEIGHT)
- MUCH LESS EXPENSIVE TO MANUFACTURE
- HIGHER THERMAL EFFICIENCY (50%)
- REQUIRES 20% FEWER REACTOR MODULES
- CONDUCIVE TO MODULARIZATION
- THE UNIT IN PHOTO IS 10MW. IMAGINE A 500MW MASS-PRODUCED VERSION IN A 40’ SHIPPING CONTAINER

THORIUM LIQUID-FUELED MOLTEN SALT REACTOR circa 1964

MOLTEN SALT REACTOR EXPERIMENT, OAK RIDGE, TN

TERMINOLOGY ALERT!

MSR = *Molten Salt Reactor.* A technical term referring to a nuclear reactor that is cooled by molten salt rather than water, solving several safety problems.

SMR = *Small, Modular Reactor.* A marketing term (exact meaning depends on who's using it) describing a new generation of nuclear reactors built in factories and requiring little or no on-site assembly & construction.

Conventional Nuclear Fuel Cycle

<5% of LEU fuel is actually used.
The rest is *wasted*, quite literally!

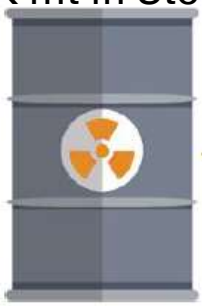
NUCLEAR WASTE REPROCESSING

Recycling

Used nuclear fuel

7,800 -> 23,400 mt Annually

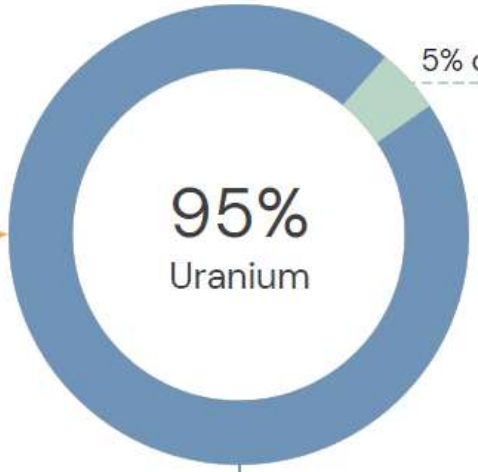
250K mt in Storage



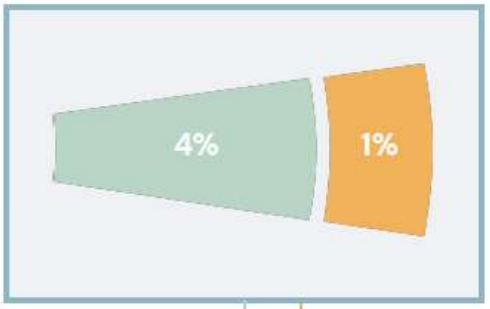
Used nuclear fuel

100,000 YEARS

Global uranium market



5% other

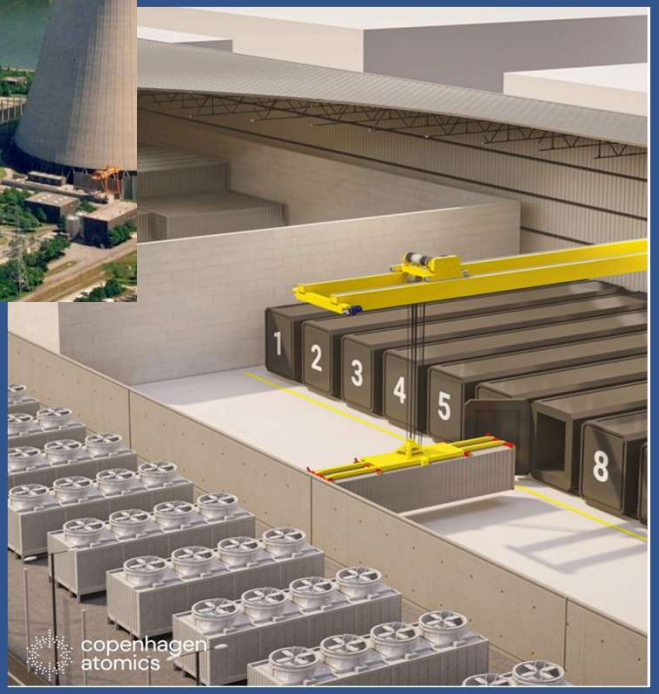


Storage of
Fission Products
300 years

Plutonium and
long-lived actinides

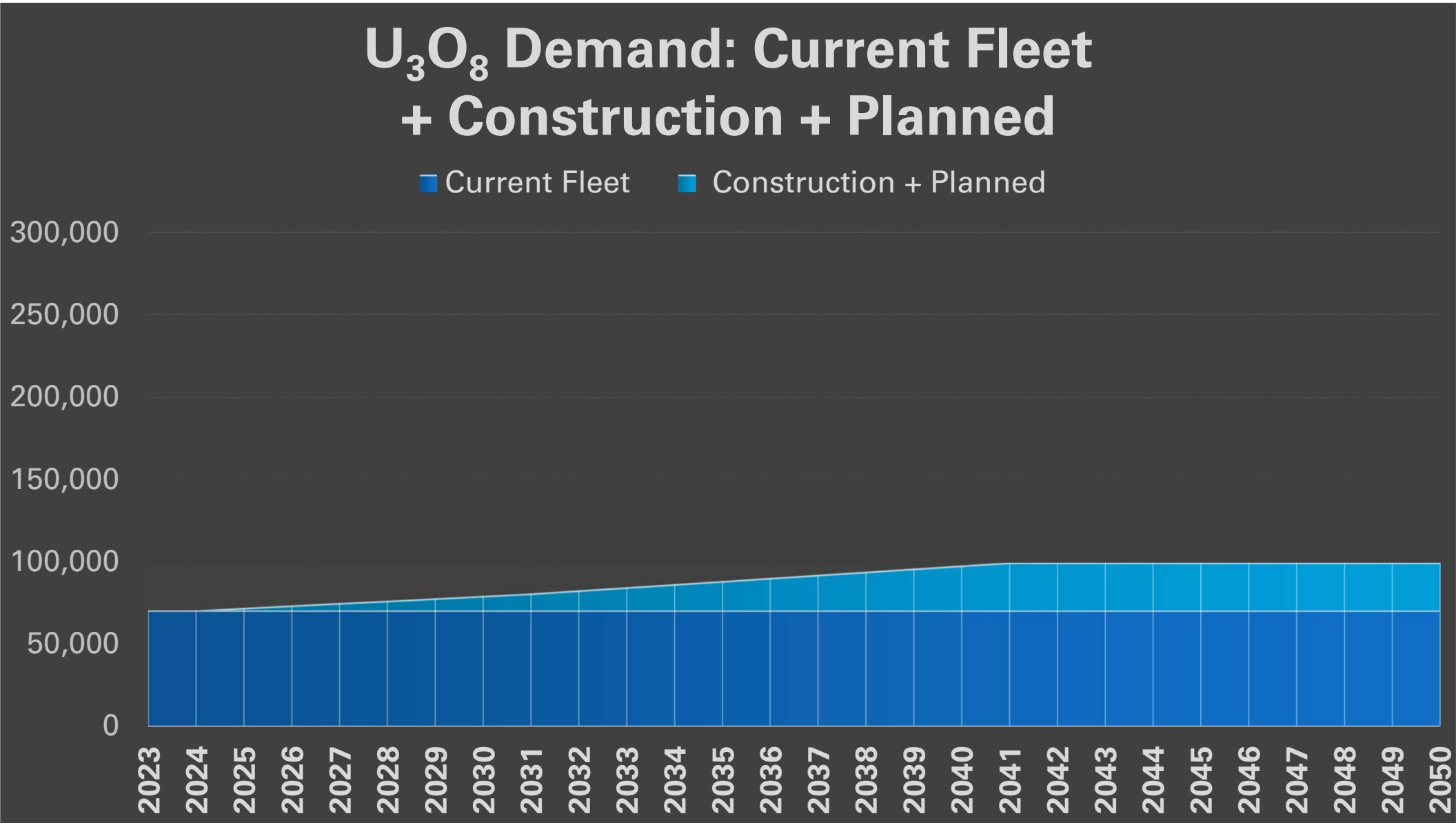
copenhagen atomics

OPTIONS FOR TRANSITION TO NUCLEAR ENERGY



CURRENT GLOBAL FLEET

- 413 Power Reactors; 371 GW of Electricity
- 61 more reactors under construction; 110 Planned
- Very expensive bespoke on-site construction (5-10 years)
- Supplies ~3.5% global energy


U_3O_8 Demand: Current Fleet + Construction + Planned
Current Fleet
Construction + Planned
300,000
250,000
200,000
150,000
100,000
50,000
0
2023
2024
2025
2026
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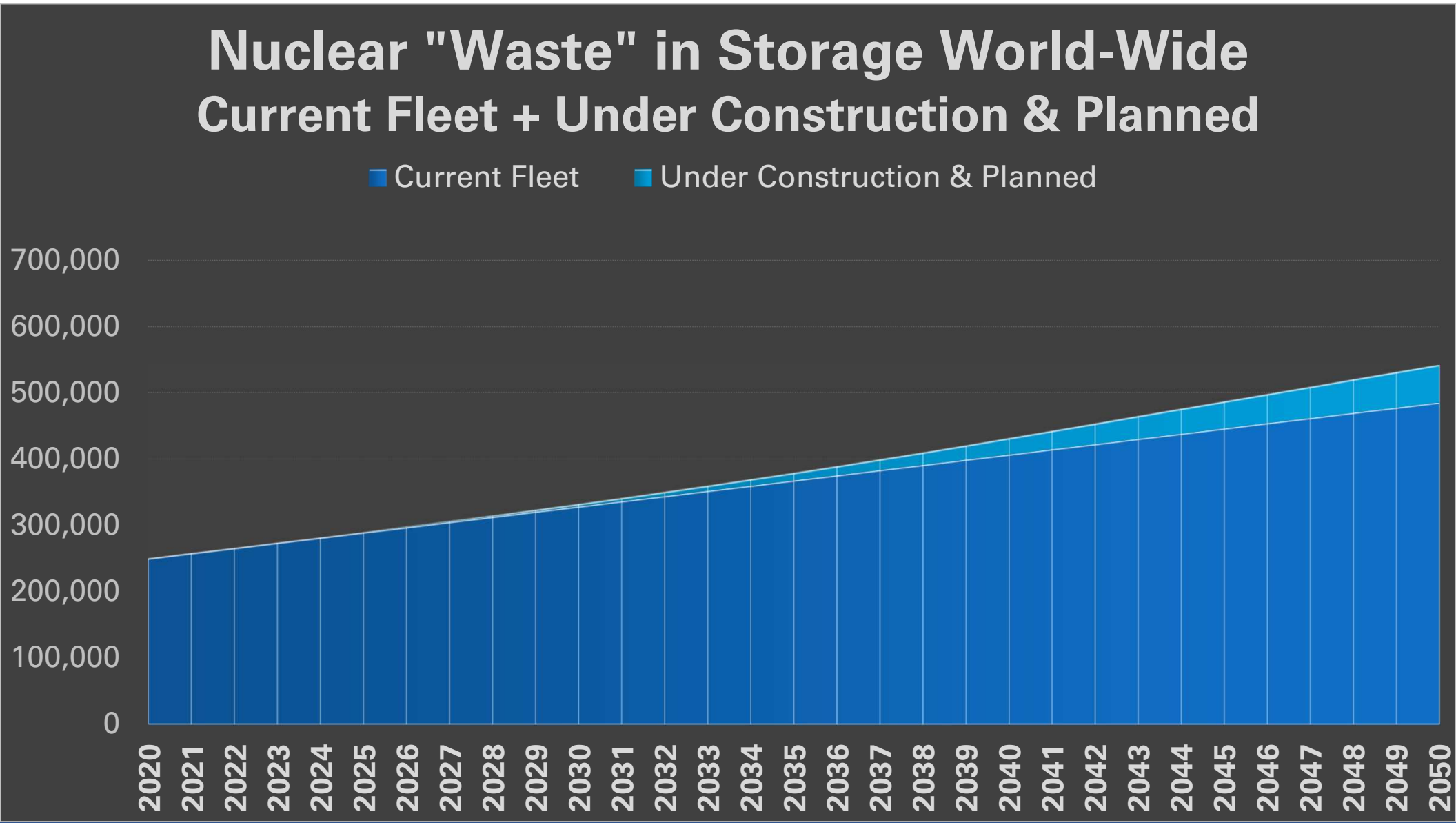
Nuclear "Waste" in Storage World-Wide
Current Fleet + Under Construction & Planned
Current Fleet
Under Construction & Planned
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
2020
2021
2022
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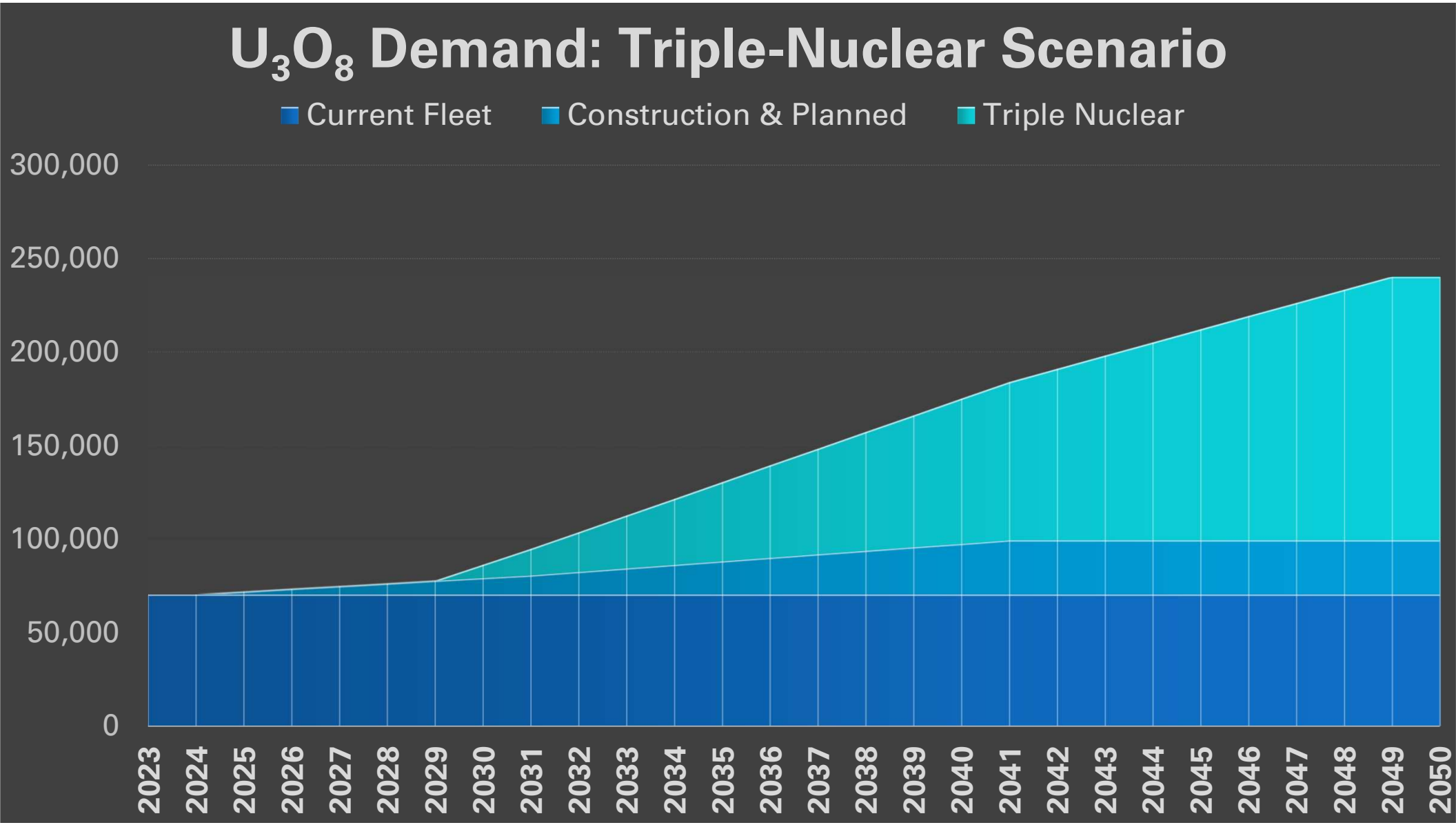
2050

“TRIPLE-NUCLEAR” PLEDGE

- Build another ~742GW Conventional reactors by 2050
- Approximate cost US$3.7tn - $11.2tn
- Build time ~ 5 – 10 yrs
- Electricity much more expensive than fossil fuels or renewables
- Supply ~11% of global energy


U_3O_8 Demand: Triple-Nuclear Scenario
Current Fleet
Construction & Planned
Triple Nuclear
300,000
250,000
200,000
150,000
100,000
50,000
0
2023
2024
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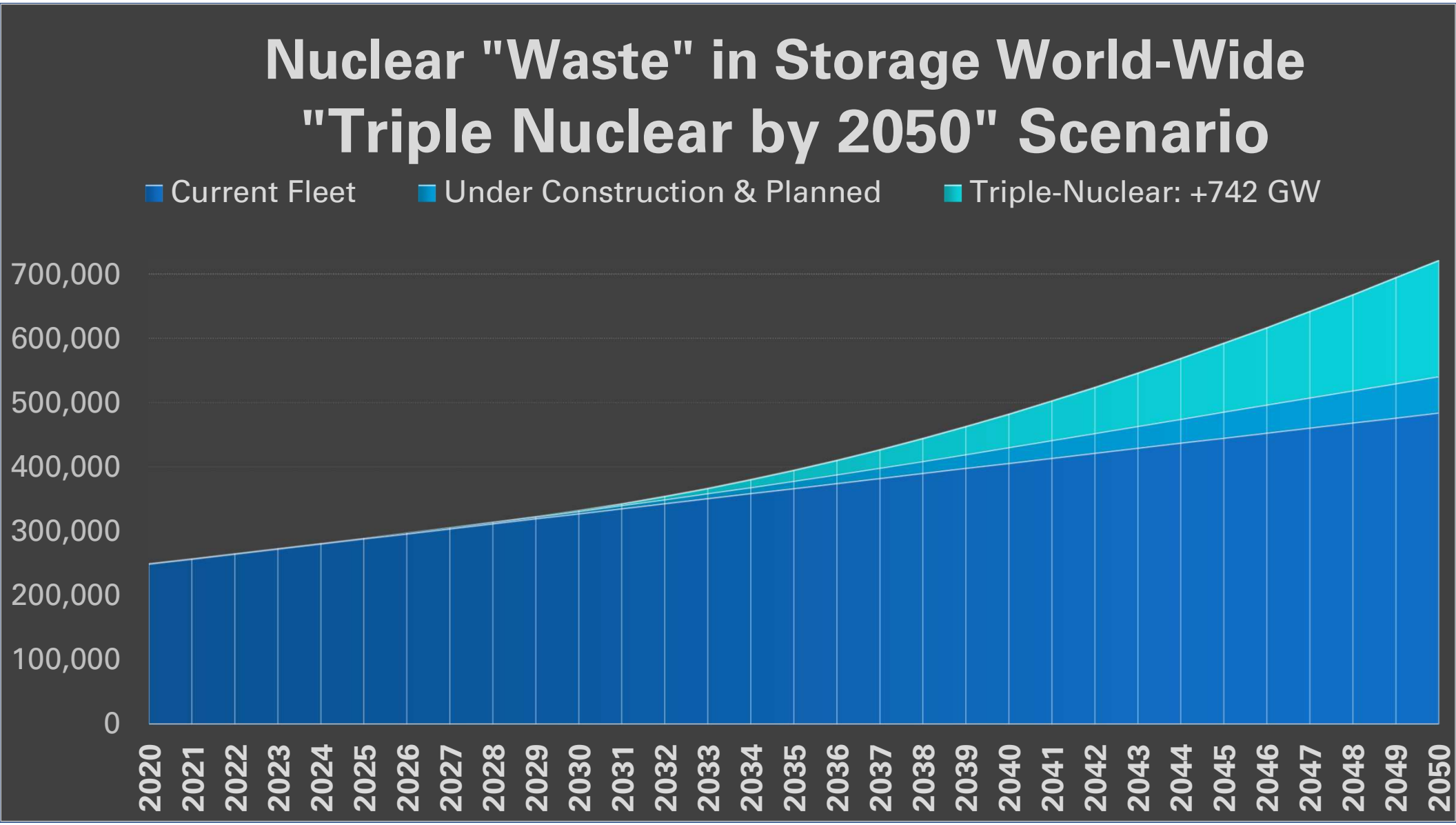
Nuclear "Waste" in Storage World-Wide
"Triple Nuclear by 2050" Scenario
Current Fleet
Under Construction & Planned
Triple-Nuclear: +742 GW
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
2020
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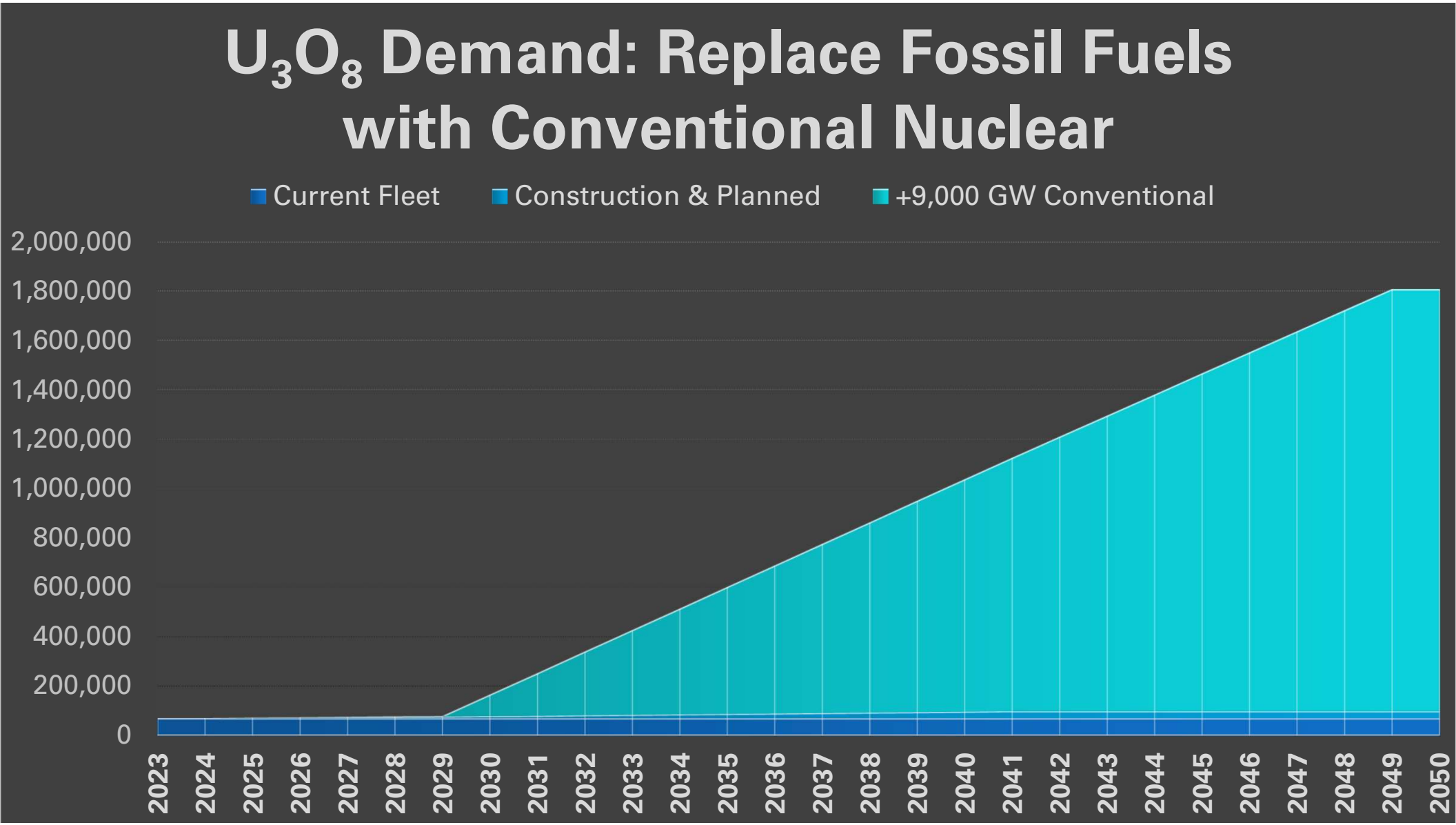
2050

REPLACE FOSSIL FUEL ENERGY

- Probably impossible…
- Build another 9,000 GW of conventional reactors (!)
  - 24x, not 3x current fleet
- Approx cost US$45tn - $135tn
- Build time ????
- Electricity much more expensive than fossil fuels or renewables
- Supply ~85% of global energy


U_3O_8 Demand: Replace Fossil Fuels with Conventional Nuclear
Current Fleet
Construction & Planned
+9,000 GW Conventional
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
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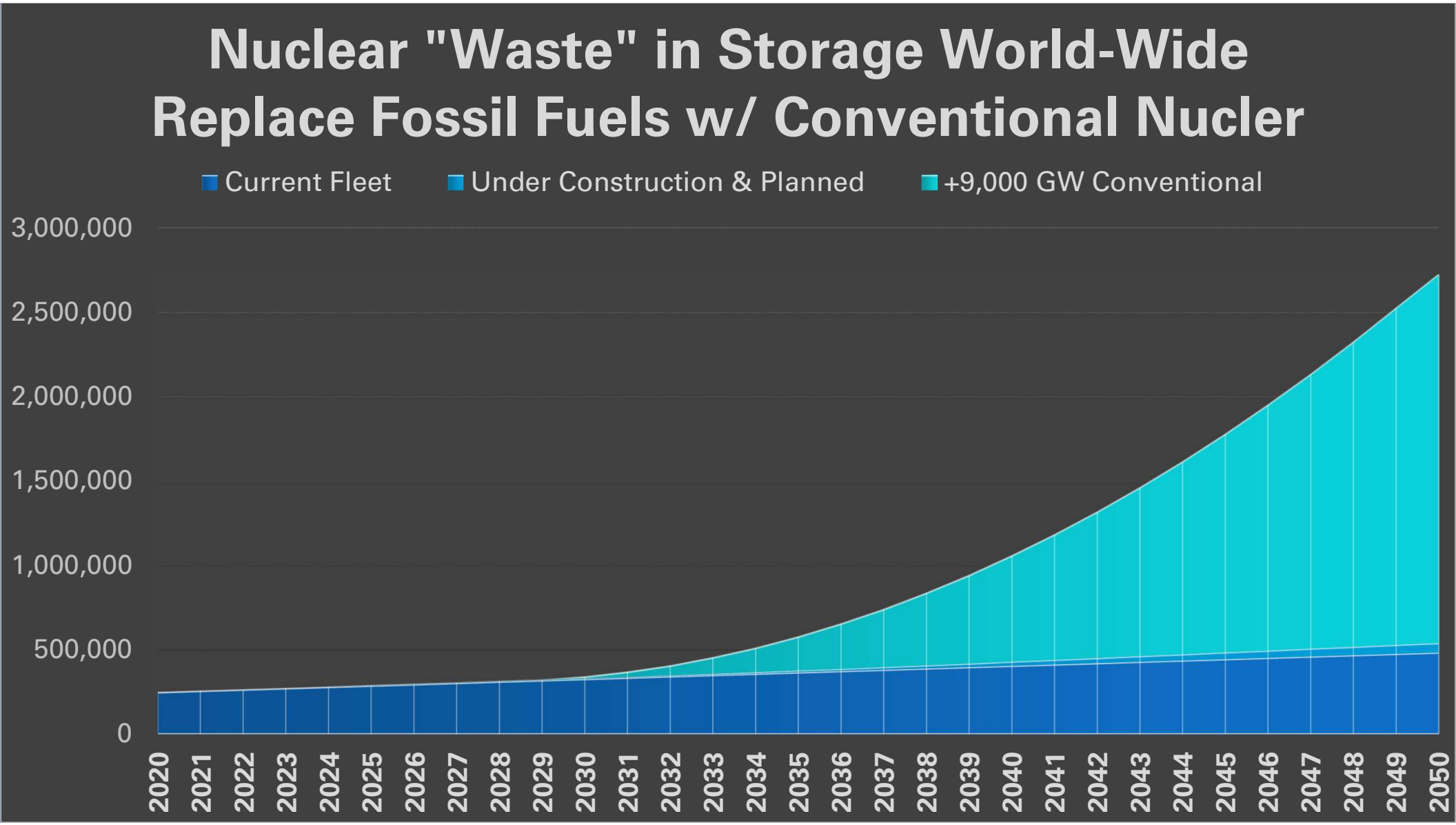
Nuclear "Waste" in Storage World-Wide
Replace Fossil Fuels w/ Conventional Nucler
Current Fleet
Under Construction & Planned
+9,000 GW Conventional
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2,500,000
2,000,000
1,500,000
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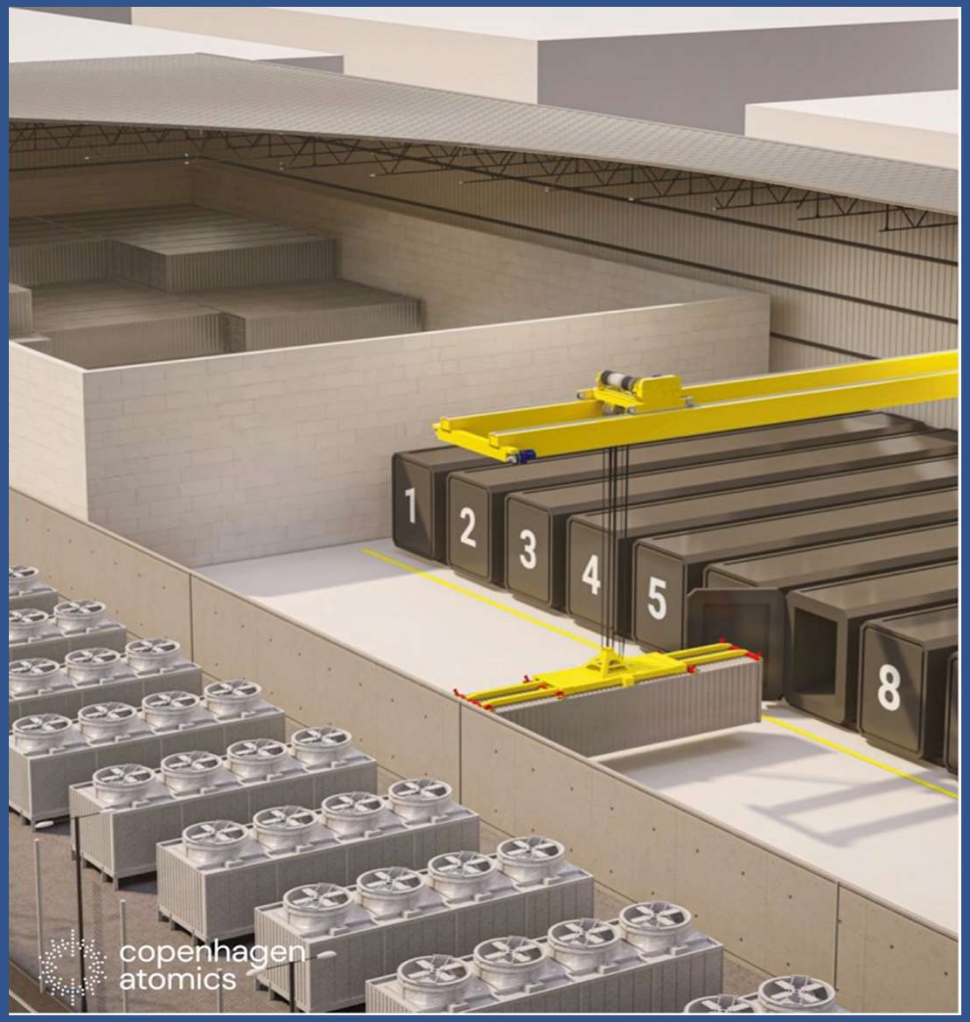
WE NEED A COMPLETELY DIFFERENT APPROACH!



NO ENRICHMENT REQUIRED

NO WEAPONS PROLIFERATION RISK

90 Th Thorium 232.04

PRIMARY FUEL

5% U-235 95% U-238

235 92 U

92 U Uranium 238.03

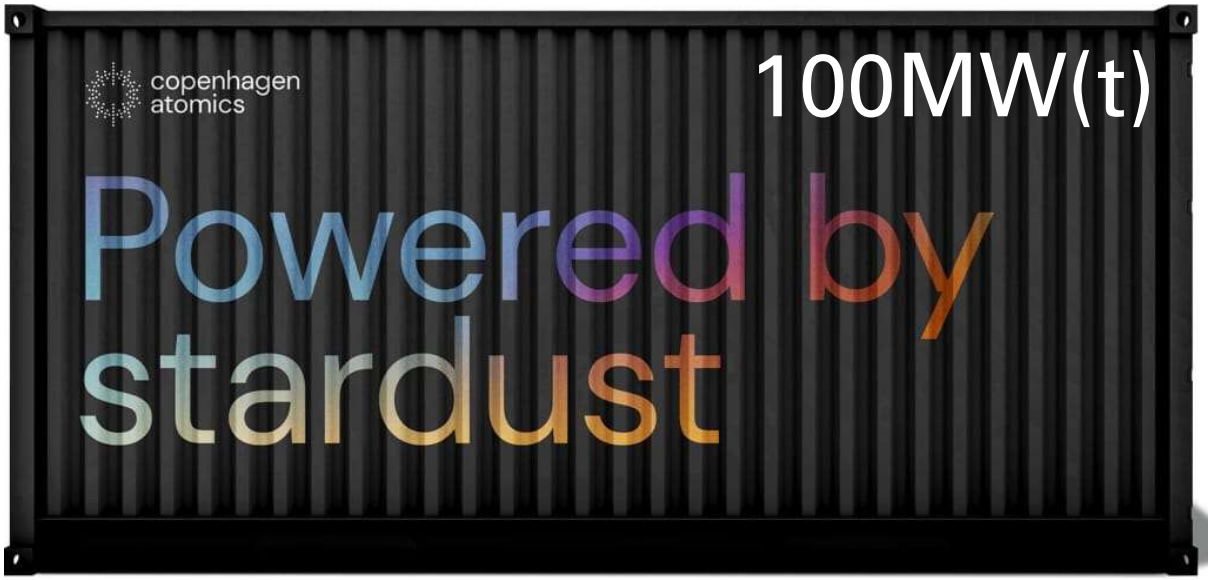
LOW ENRICHED URANIUM

OR

RECYCLED SPENT NUCLEAR FUEL WASTE

JUST ONE INITIAL LOAD REQUIRED

"KICK-STARTER" FUEL



36kg of Thorium per year!

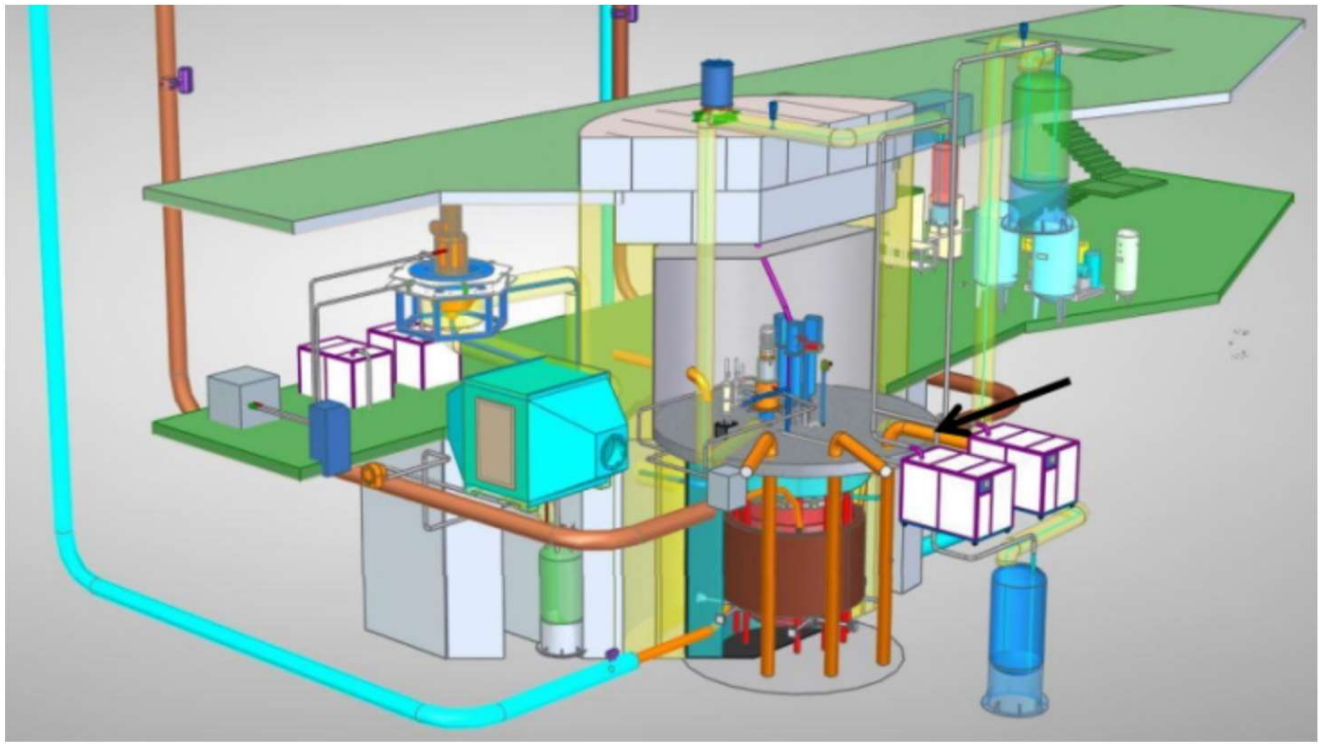
613,000 metric tons COAL per year (89km railway train)

Operating permit issued for Chinese molten salt reactor

15 June 2023

Share

The Shanghai Institute of Applied Physics (SINAP) of the Chinese Academy of Sciences has been granted an operating licence for the experimental TMSR-LF1 thorium-powered molten-salt reactor, construction of which started in Wuwei city, Gansu province, in September 2018.



A cutaway of the TMSR-LF1 reactor (Image: SINAP)

Zhao DaShuai 无条件爱国 🇨🇳
@zhao_dashuai

China will build nuclear powered container ships☢️

It's powered by a Thorium Molten Salt Reactor (MSR), the significance of which is beyond shipping.

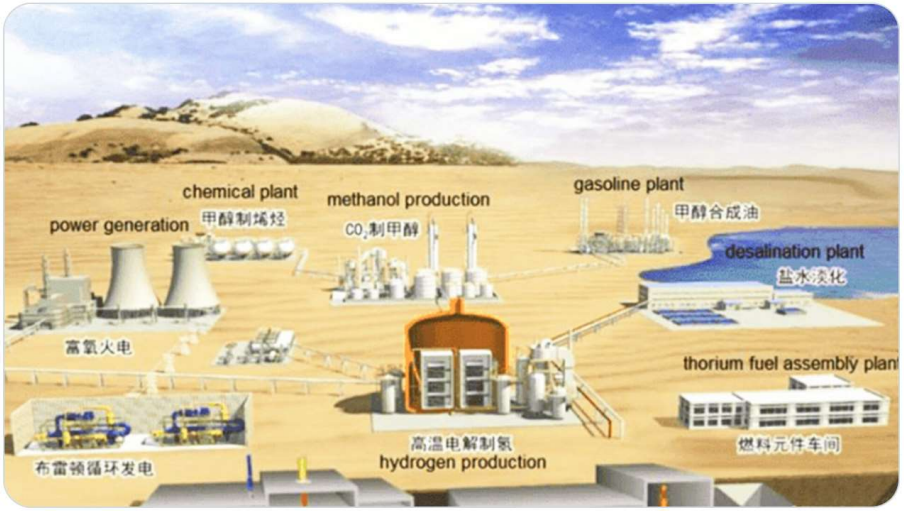
The immediate [other] application would be nuclear powered aircraft carrier.
1/3

Zhao DaShuai 无条件爱国 🇨🇳 @zhao_dashuai · 13h

Thorium Molten Salt Reactor (MSR), would provide affordable and safe nuclear energy.

MSRs doesn't need water for cooling, so they can be built away from seas or rivers.

Allowing much greater flexibility in location choice, very important for a continental country like China.



3 38 248 6.7K

ERIK'S ENERGY TRANSITION VISION

1 Let "Triple-Nuclear" move forward *elsewhere*

Tripling nuclear using *conventional* technology will increase Uranium demand by 140k MT and triple nuclear waste

2 Re-process ALL Nuclear Waste in storage worldwide.

Yields 2,500 mt plutonium, kick-starts first 12,500 MSRs = 1,250GW(t) + 1,170 =117 GW/yr

3 Mass-produce 9,000 GW modular power plants based on Thorium MSRs (24x)

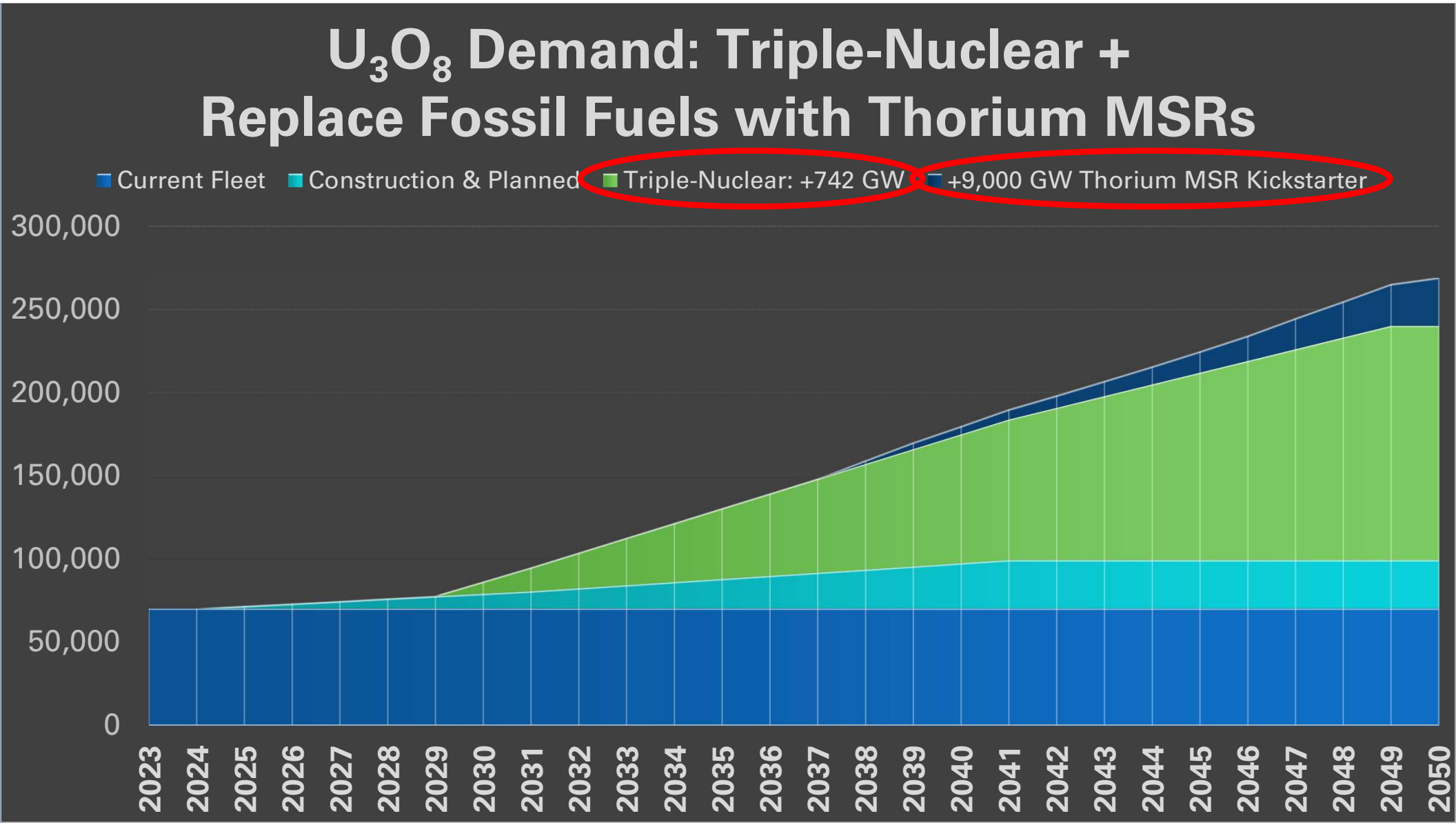
Fully replace ALL fossil fuels!

1 Reactor *per hour* 24/7/365 for 20 years!

Costs $4.5tn - $6.75tn

ZERO risk of melt-down or hydrogen explosions

SOLVE ENERGY TRANSITION WITH THORIUM MSR MODULAR POWER PLANTS


U_3O_8 Demand: Triple-Nuclear +
Replace Fossil Fuels with Thorium MSRs
Current Fleet
Construction & Planned
Triple-Nuclear: +742 GW
+9,000 GW Thorium MSR Kickstarter
300,000
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200,000
150,000
100,000
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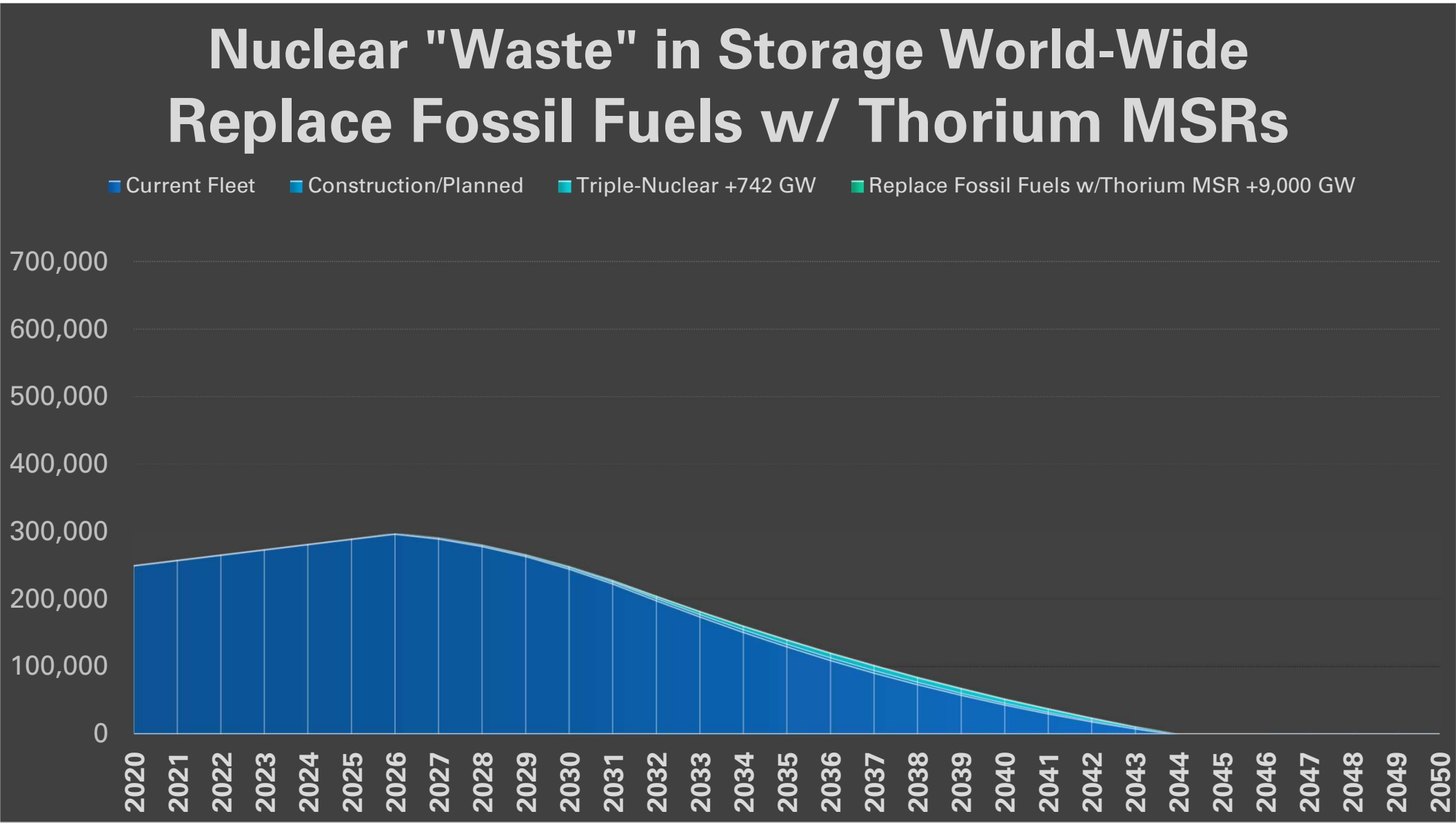
Nuclear "Waste" in Storage World-Wide
Replace Fossil Fuels w/ Thorium MSRs
Current Fleet
Construction/Planned
Triple-Nuclear +742 GW
Replace Fossil Fuels w/Thorium MSR +9,000 GW
700,000
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500,000
400,000
300,000
200,000
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Yin MR
@YinZP365

🇨🇳 China has completely solved safety problem of nuclear power plants! On Dec 6, my country's Huaneng Shidao Bay High Temperature Gas-cooled Reactor Nuclear Power Plant, world's first fourth-generation nuclear power plant with completely independent intellectual property rights,

Yin MR @YinZP365 · 17h
was officially put into commercial operation! It is the world's first inherently safe nuclear power plant.

The first point is that inherent safety of this nuclear power plant, whether it is Fukushima Nuclear Power Plant or Chernobyl, is due to the failure of the cooling system,

2 14 91 2.6K

Yin MR @YinZP365 · 17h
which causes the core of the nuclear reactor to melt down and finally the radioactive material leaks out. However, my country's fourth-generation nuclear power plants can ensure that even if all cooling capabilities are lost without taking any intervention measures,

1 14 79 2.5K

Yin MR @YinZP365 · 17h
the reactors can remain in a safe state and there will be no leakage of any radioactive materials.

Second point is that the temperature at the outlet of the high-temperature gas-cooled reactor reaches over 1,000 degrees. It can produce hydrogen by thermally decomposing water,

3 13 81 2.4K

Yin MR @YinZP365 · 17h
which once and for all solves the most critical cost problem of hydrogen production. In this way, low-cost hydrogen can be synthesized into ammonia and finally methanol, or even steelmaking, or even the future cost of hydrogen energy will become cabbage price.

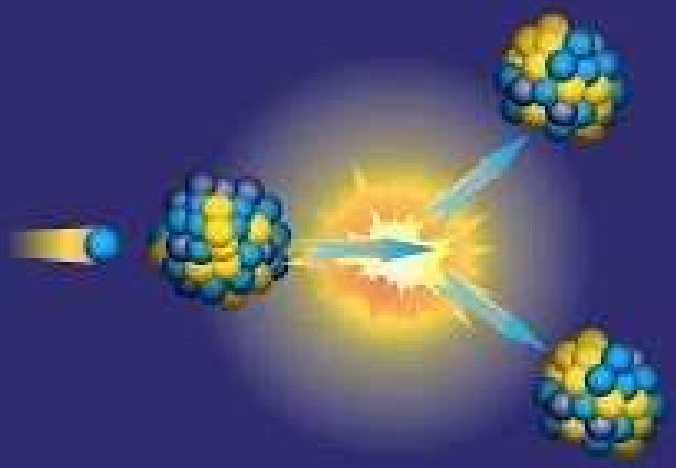
1 14 86 2.2K

Yin MR @YinZP365 · 17h
With the breakthrough of this nuclear power technology, you will see that a series of industries will usher in changes!

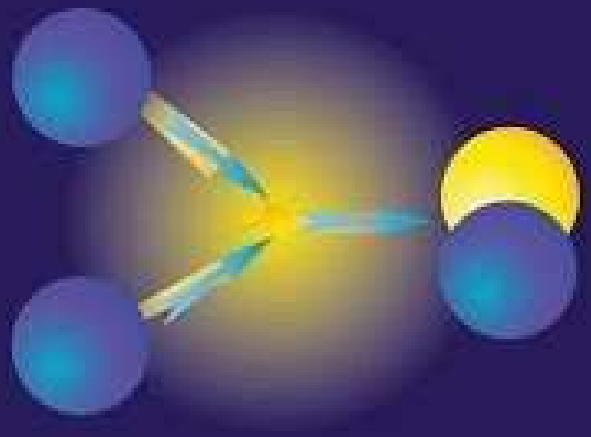
The third point is that with completely independent intellectual property rights, from design to manufacturing to debugging to operation,

1 13 80 2.3K

Fission vs. Fusion

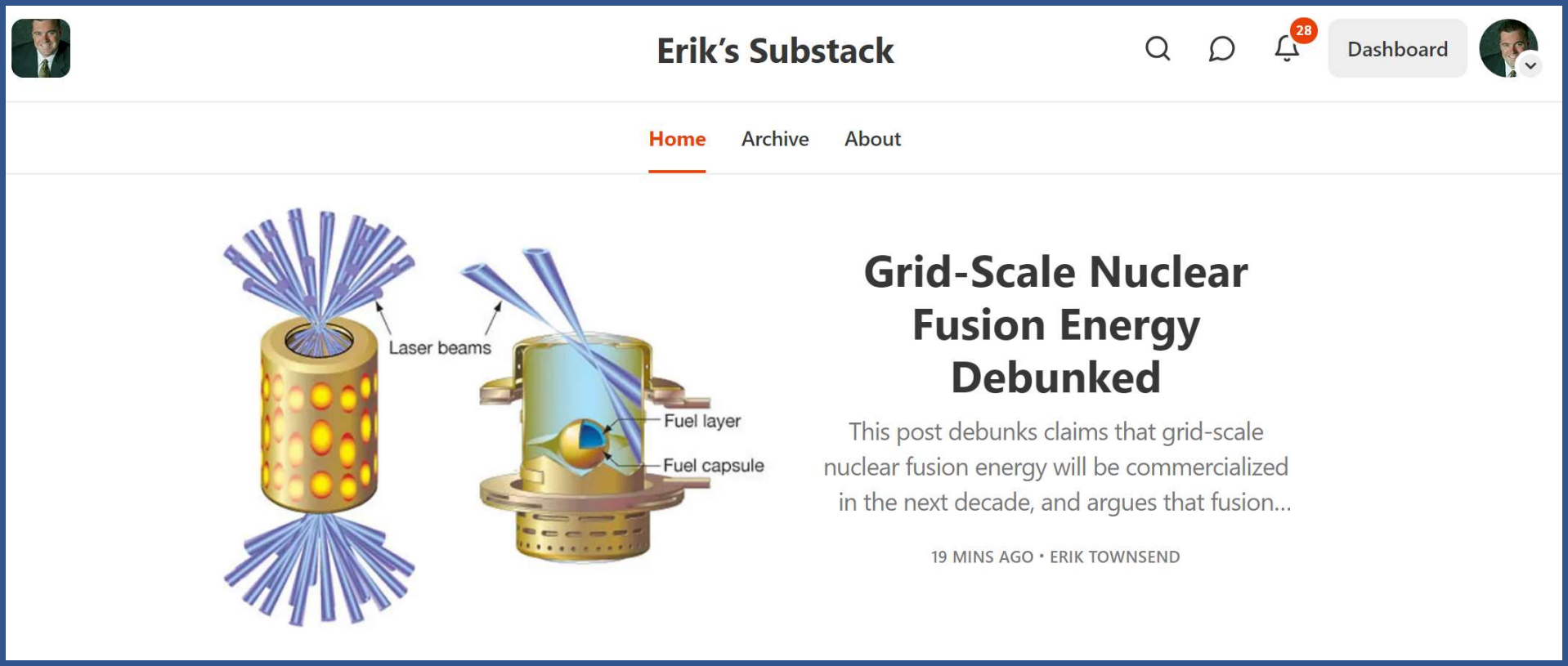


Splits a larger atom into 2 or more smaller ones

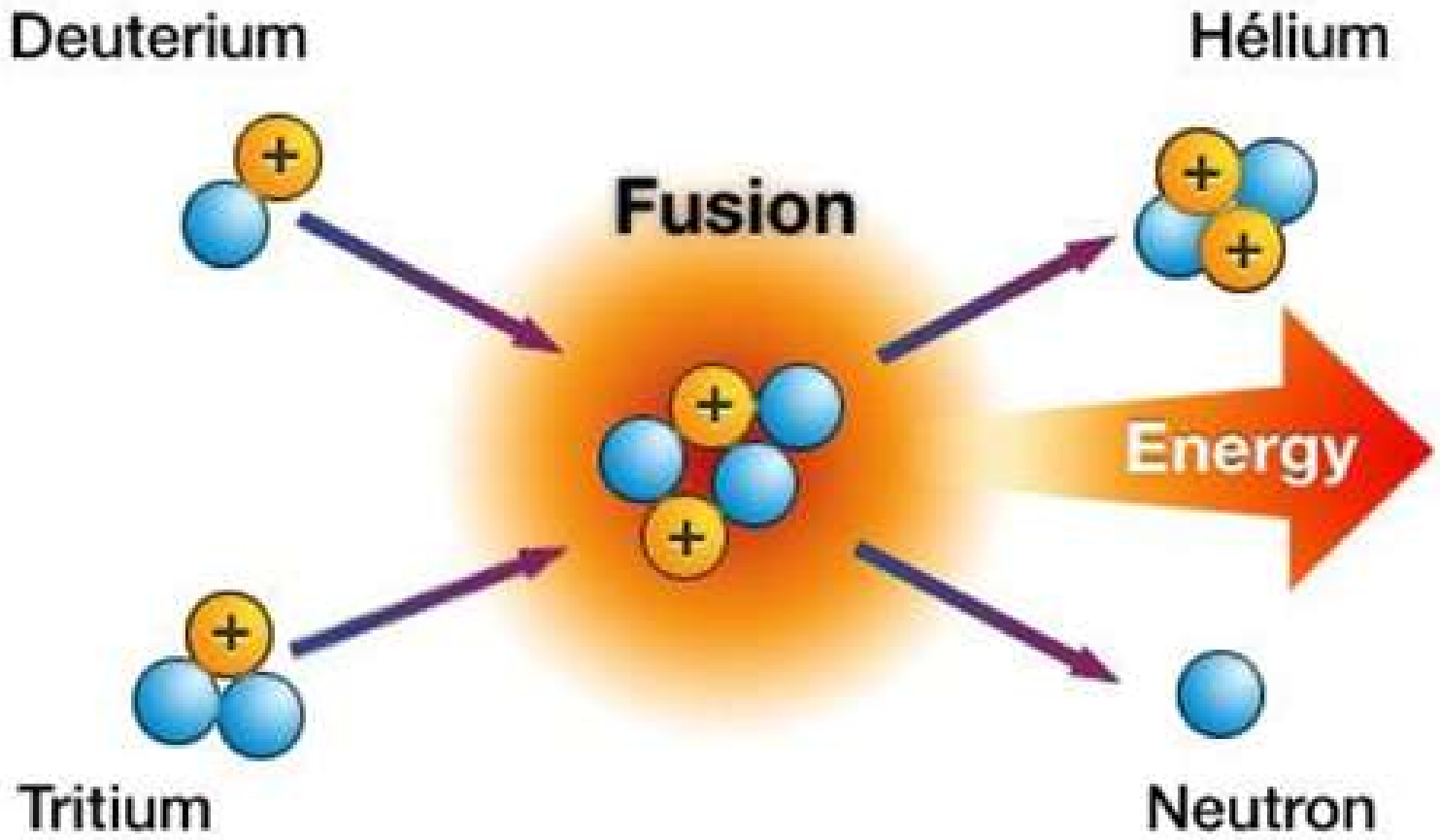


Joins 2 or more lighter atoms into a larger one

eriktownsend.substack.com



MY SUBSTACK POST DEBUNKING FUSION ENERGY HYPE


Deuterium
Hélium
Fusion
Energy
Tritium
Neutron

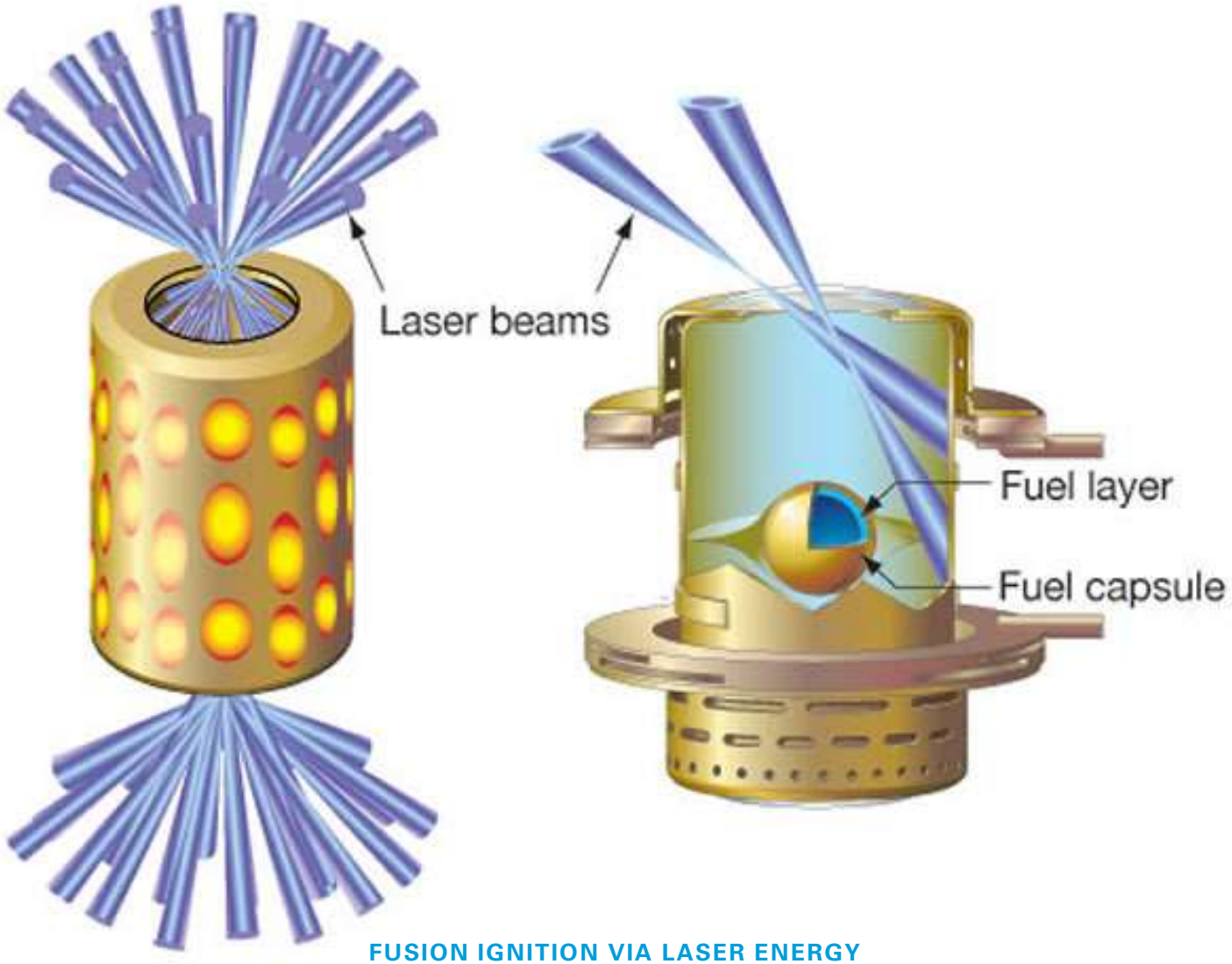
US scientists confirm 'major breakthrough' in nuclear fusion

Successful experiment could pave way for abundant clean energy in future, but major hurdles remain

'Major scientific breakthrough': US recreates fusion – video

Scientists have confirmed a major breakthrough has been made that could pave the way for abundant clean energy in the future after more than half a century of research into nuclear fusion.

Researchers at the US National Ignition Facility in California said fusion experiments had released more energy than was pumped in by the lab's


Laser beams
Fuel layer
Fuel capsule

Nuclear fusion for the grid is coming much sooner than you think

Britain is on the brink of striking gold in the race for limitless energy

AMBROSE EVANS-PRITCHARD

13 March 2024 • 6:00am

"Dr. Mumgaard said Commonwealth is eyeing costs of $60-80 MWh with scale, undercutting the 24/7 cost of intermittent renewables paired gas peaker plants or with energy storage in most places. 'It might be even lower. We don't use uranium. There is no risk of melt-downs,' he said."

Nuclear fusion for the grid is coming much sooner than you think

Britain is on the brink of striking gold in the race for limitless energy

AMBROSE EVANS-PRITCHARD

13 March 2024 • 6:00am

"The allure of fusion is by now well understood. It generates four million times more energy than fossil power, without emitting CO2 or methane. It creates almost no long-term waste. Its main by-product is inert helium."

Nuclear fusion for the grid is coming much sooner than you think

Britain is on the brink of striking gold in the race for limitless energy

AMBROSE EVANS-PRITCHARD

13 March 2024 • 6:00am

"It uses almost no land, and little water, and can be made practically invisible. Unlike today's fission, it produces industrial high-grade heat to help decarbonise glass, cement, steel, ammonia, hydrogen, etc. It runs continuously if you need it, or is dispatchable if you don't."

Nuclear fusion for the grid is coming much sooner than you think

Britain is on the brink of striking gold in the race for limitless energy

AMBROSE EVANS-PRITCHARD

13 March 2024 • 6:00am

"The fuel is effectively limitless for thousands of years and can be obtained anywhere: deuterium from seawater, and tritium by breeding with small amounts of lithium. There is no risk of a runaway chain reaction. It does not use fissile materials and is useless for weapons."


“If we swallow this new lie that we should stop the rollout of green energy and that nuclear energy will be our fairy godmother, we will be worse off again”

“These misinformed, unscientific, uneconomic, plucked-out-of-thin-air, bulldust nuclear policies of politicians – masquerading as leaders – help no one.”

-- Dr. Andrew “Twiggy” Forrest

"Australians don't want nuclear power."

--Sarah Hansen-Young
Senator (Greens), So. Australia


DARWIN
SMR
10°
0
750 km
NT
SMR
20°
QLD
SMR
92
U
Uranium
238.03
Silex
Systems Limited
90
Th
Thorium
232.04
9
F
Fluorine
18.998
CONVERSION+
ENRICHMENT
GREEN STEEL
WA
SMR
BRISBANE
SA
SMR
30°
PERTH
ADELAIDE
SYDNEY
CANBERRA, ACT
MELBOURNE

www.energytransitioncrisis.org

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