

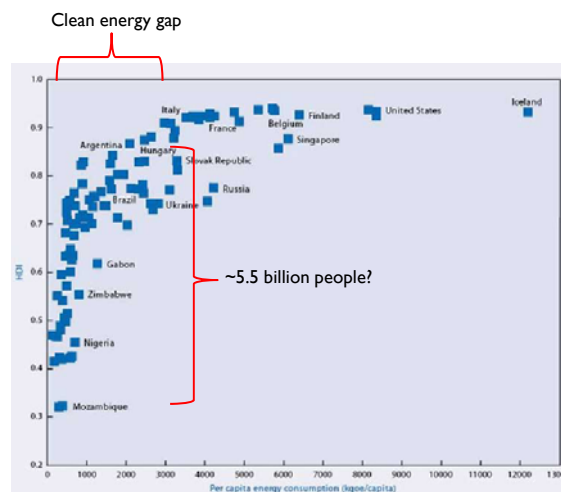
Dr Alvin Weinberg and the breakthrough reactor that will power the world



www.the-weinberg-foundation.org

Why does the AWF do what it does?

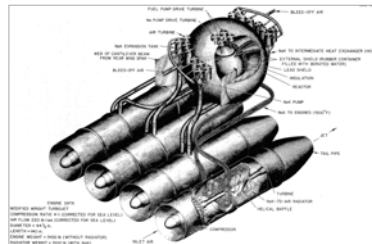
- Access to reliable, large-scale energy is essential to human prosperity and wellbeing;
- ~1.3 billion people have no access to electricity;
- Environmental consequences of unchecked increase in CO₂ ppm: climate change and ocean acidification;
- Human consequences of unabated fossil fuels: 7 million premature deaths from air pollution every year;
- We need urgently need a techno-fix



Source: United Nations Development Programme

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Dr Weinberg and the early days of nuclear energy



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What is a Molten Salt Reactor and how does it work?

- Molten Salt Reactors use liquid fuel.
- All other nuclear reactors use solid fuel.
- This is the critical difference.

Solid fuel (LWR/PWR)



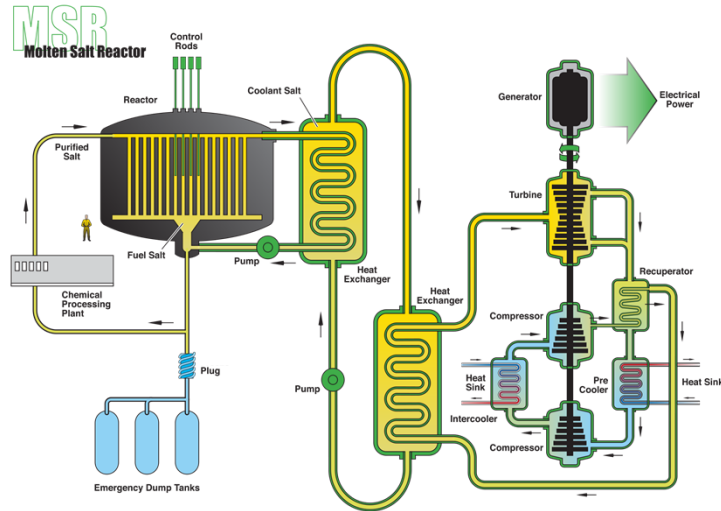
Vs

Liquid fuel (MSR)



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What is a Molten Salt Reactor and how does it work?



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Molten Salt Reactors: Nuclear, but not as we know it

	Molten Salt Reactor	PWR
Operation at atmospheric pressure?	✓	✗
Inherent safety?	✓	✗
Fuel efficiency?	✓	✗
Improved waste profile?	✓	✗
Can use thorium or "waste" as fuel?	✓	Sub-optimally
Mass-producible?	✓	TBC
High-temperature process heat?	✓	✗

"Was the Pressurized Water Reactor chosen for commercial power because it was obviously the best choice? Not as I remember the matter."

—Dr Alvin Weinberg, Co-inventor of the Pressurized Water Reactor (1991)

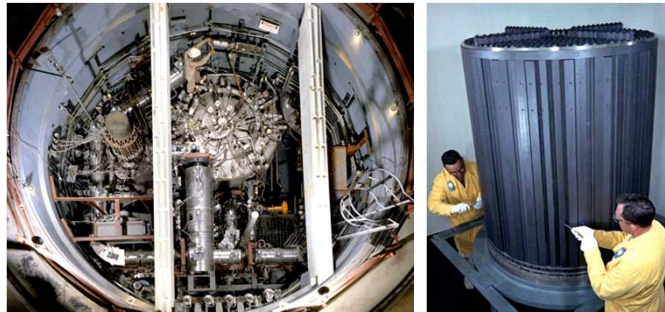


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Molten Salt Reactor Experiment (MSRE): a giant leap in clean energy technology

“We were delighted with MSRE. Here we had a high-temperature fluid-fuel reactor that operated reliably and, even in the primitive embodiment represented by MSRE, had remarkably low fuel costs.”

-Dr Alvin Weinberg, *The First Nuclear Era – The Life & Times of a Technological Fixer*



“At ORNL work on the [MSR] has been very successful... [MSRE’s] programme was completed last year...having run for over twice its designed lifetime. The stability of the salt has been excellent.”

-New Systems Forum, UK Atomic Energy Authority, 1970

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We so nearly had MSRs. An enormous wrong-turn.

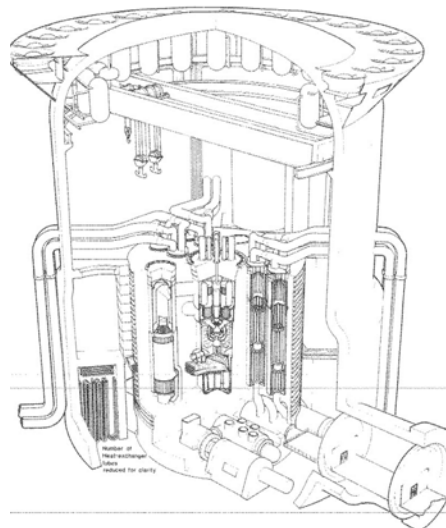
- China, France, India, Switzerland, UK and US all had serious programmes
- MSRs were seen as real competitors in the early 1970s
- France planned 250MWe Molten Salt Reactor by the end of the 1970s

“ORNL are currently working on the reference design of a single fluid 1000MWe Molten Salt Breeder Reactor”

-UK Atomic Energy Authority, *New Systems Forum, “Molten Salt Reactors”* (1969)

- So what went wrong?

Right: UK Atomic Energy Authority design for MSR, 1976



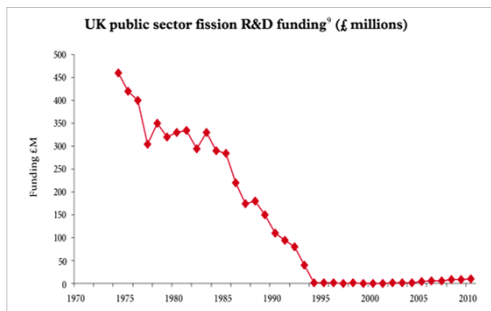
2500 MWe Helium Cooled MSFR with integrated gas turbine plant

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Why don't we have MSRs today? Was the Bomb the main factor?

"With the heavy commitment of resources to LMFBR programme the most promising route to MSR development [is] by international collaboration...The extent of US involvement will continue to be uncertain until...support from the Edison Electric Institute and the Utilities is known."

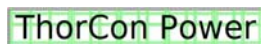
-Long & Simmons, UKAEA, "Further discussions on Molten Salt Breeder Reactors", 8 June 1973



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The revival...

- Resurgence of MSRs worldwide;
- Stimulated by various factors
- China has major national MSR programme. India too?
- Private sector now taking serious interest:



- Will Governments continue to hold back MSRs?

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“We need...[to] allow our energy system to develop along lines that make sense not only to proponents of a particular technology or of a particular social philosophy, but to the majority of the people whose descendants will inherit the energy system we bequeath them.”

-Dr Alvin Weinberg, “Energy Wars” (1978)

“To deny a rebirth of nuclear energy is deny human ingenuity and aspiration. This I cannot do. During my life I have witnessed extraordinary feats of human ingenuity. I believe that this struggling ingenuity will be equal to the task of creating the Second Nuclear Era.”

-Dr Alvin Weinberg, The First Nuclear Era – The Life & Times of a Technological Fixer (1994)



Thank you.

david.martin@the-weinberg-foundation.org
[@thorium_wf](#)

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