Abundant and Reliable Energy from Thorium

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Flibe Energy
UT Energy Week
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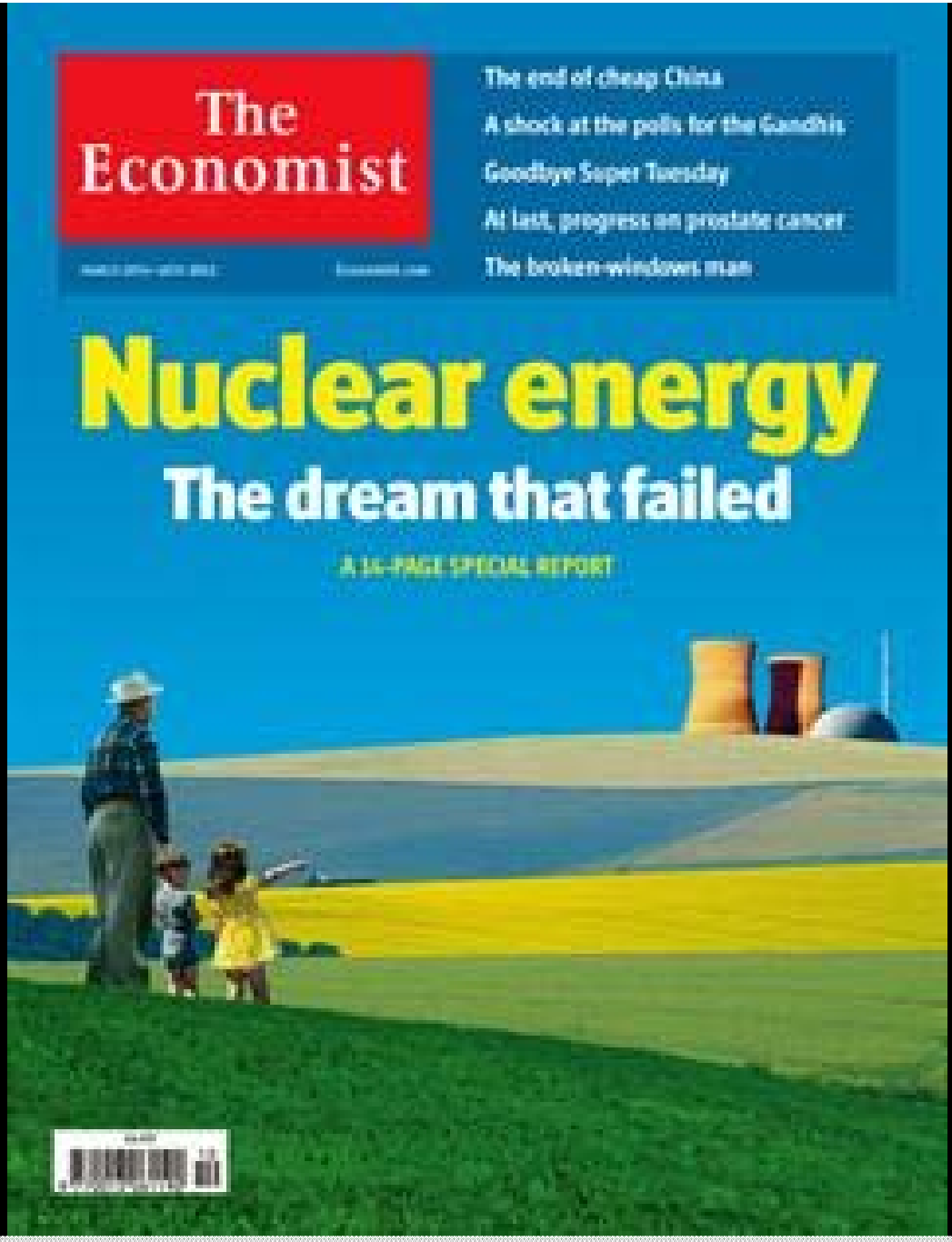
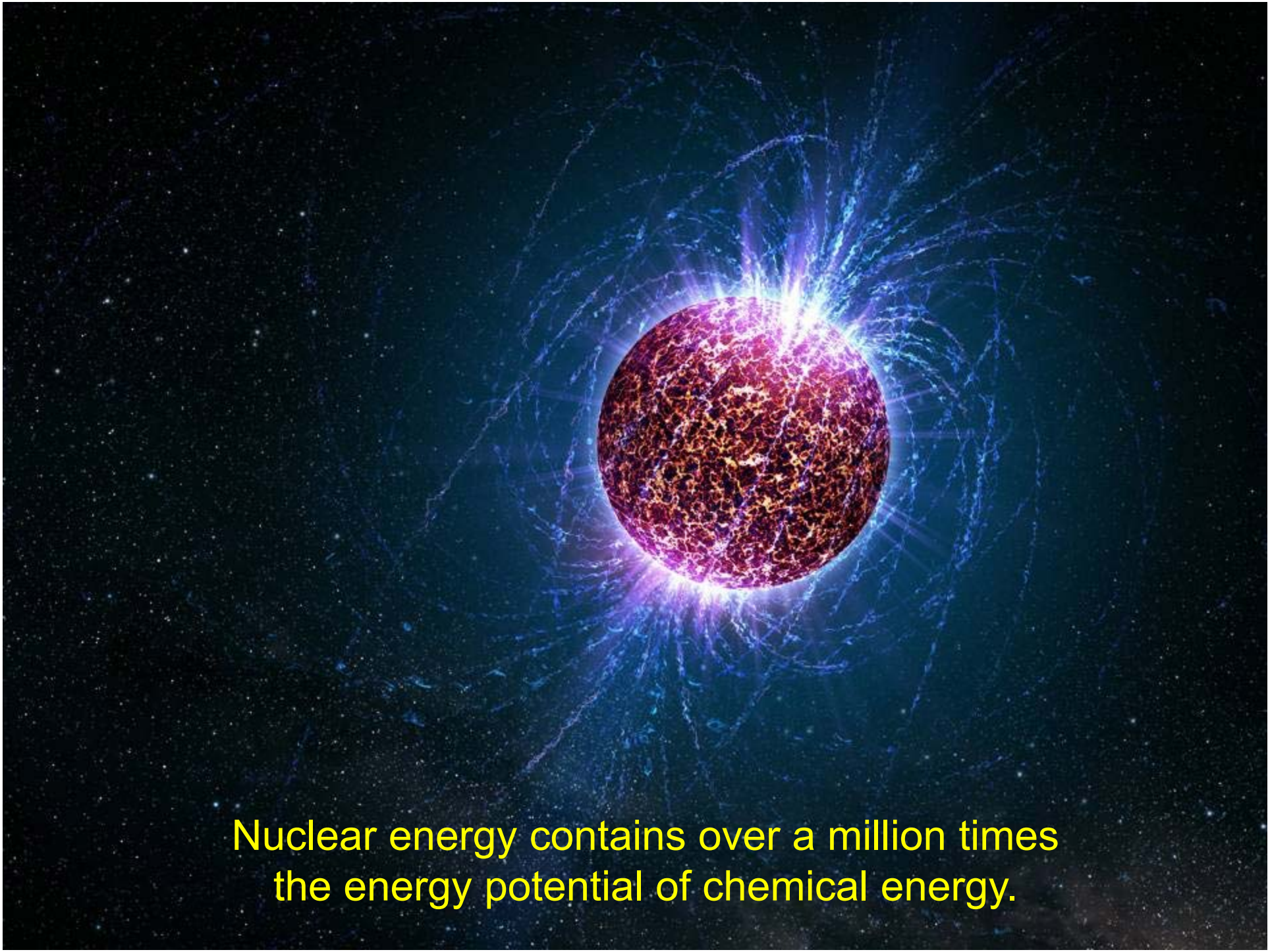
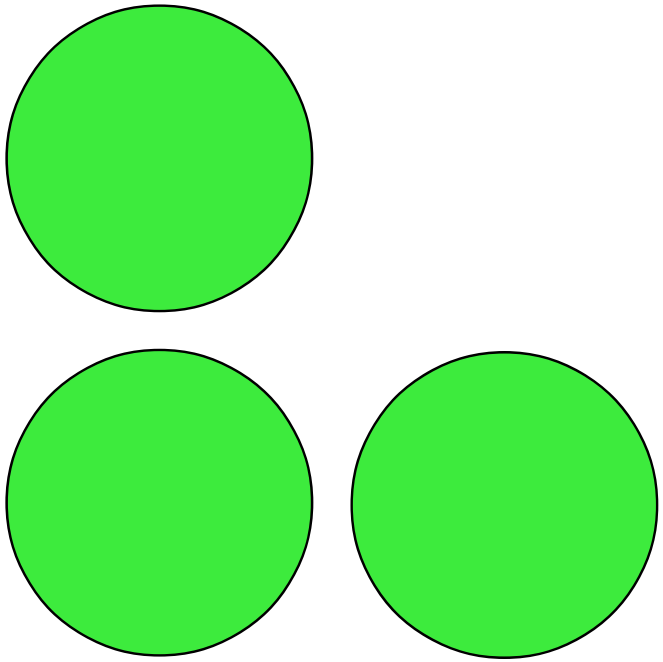
Gorleben
ist überall
Tag X – wir stellen uns que
mit der
erei!
neuerbare
d möglich



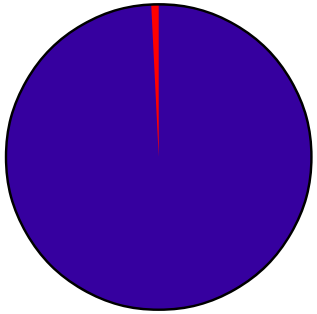
This is incorrect. Nuclear energy is our greatest hope for the future.


Nuclear energy contains over a million times
the energy potential of chemical energy.

Possible Nuclear Fuels

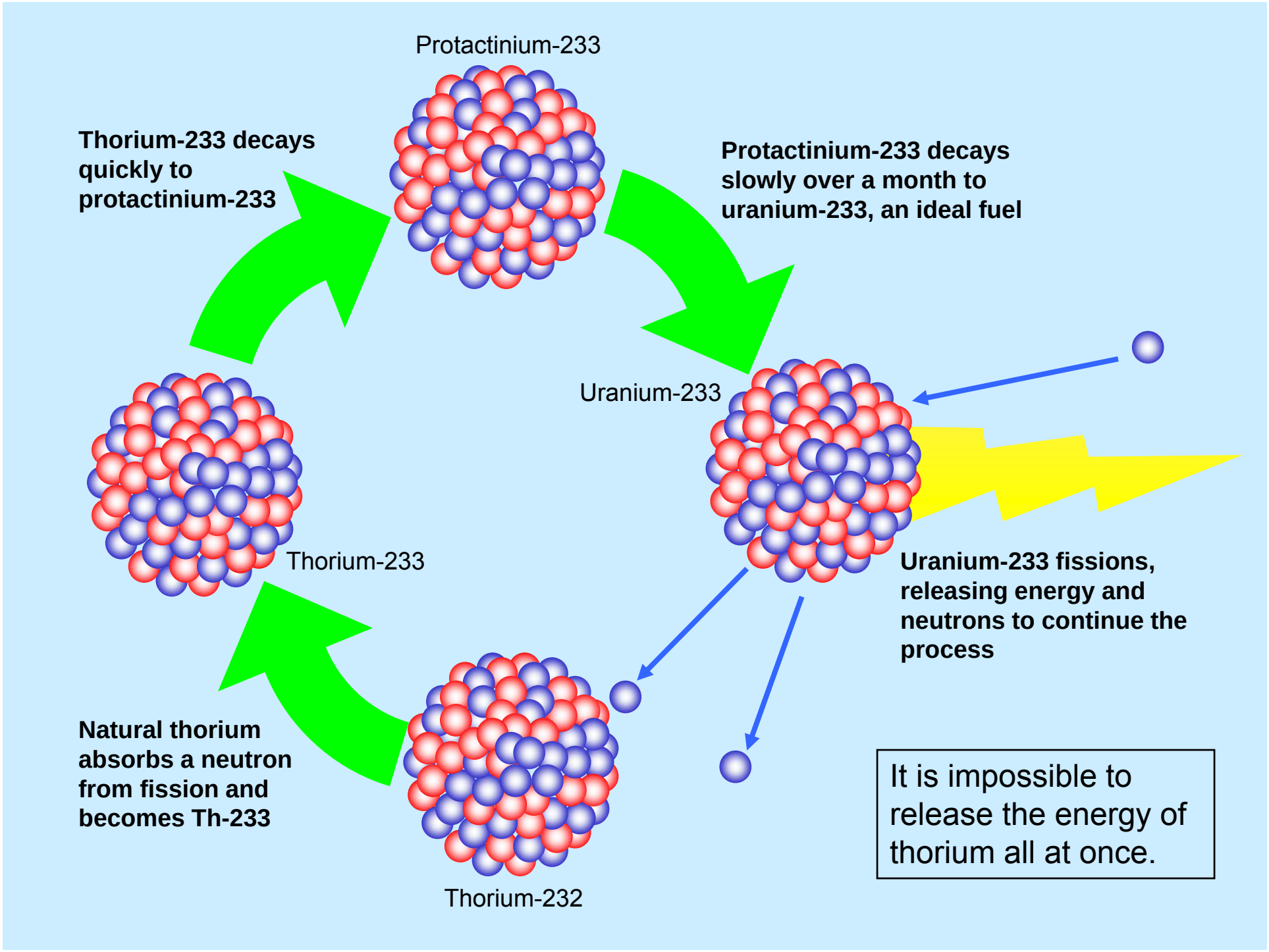


Natural Thorium
100% thorium-232

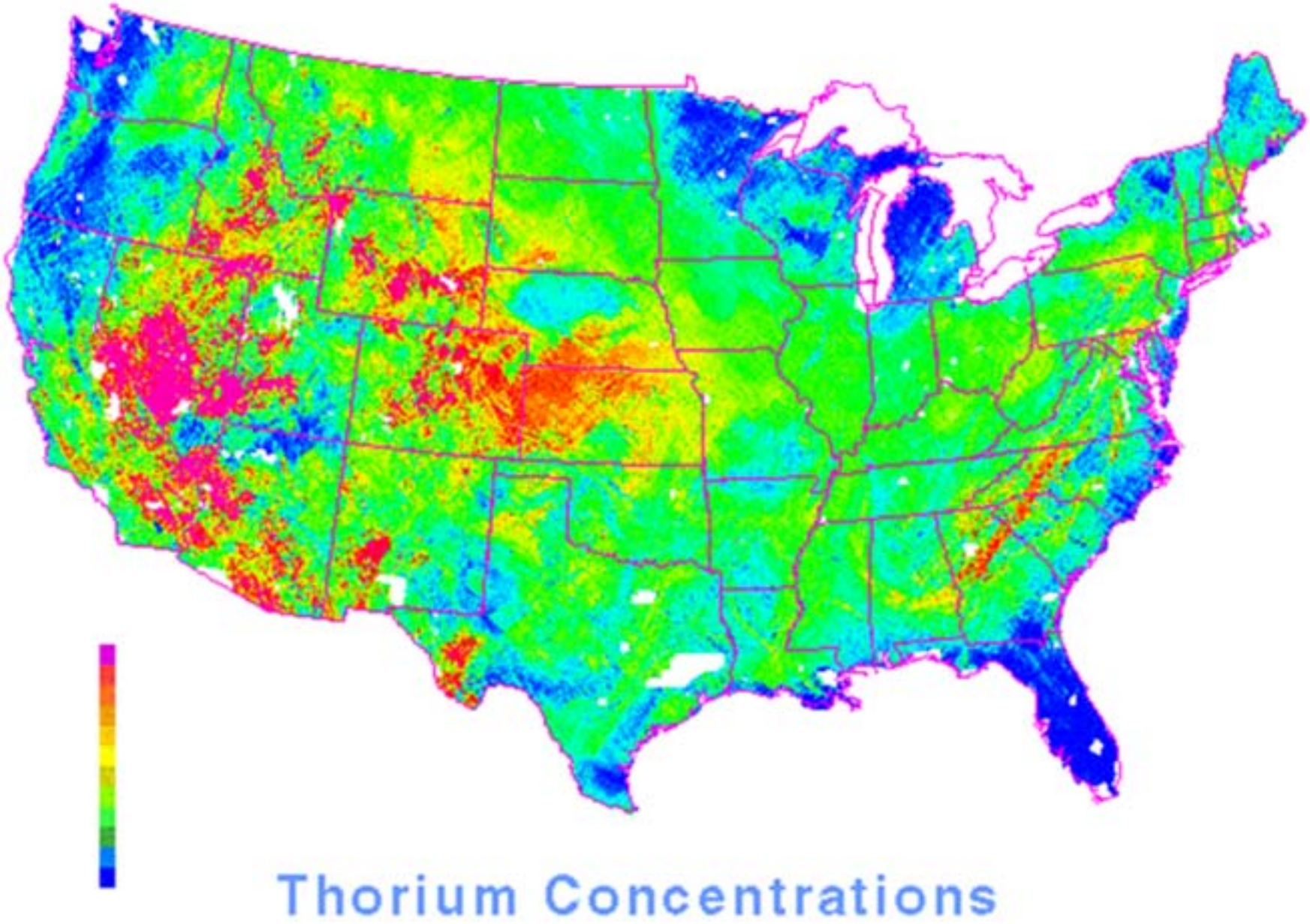


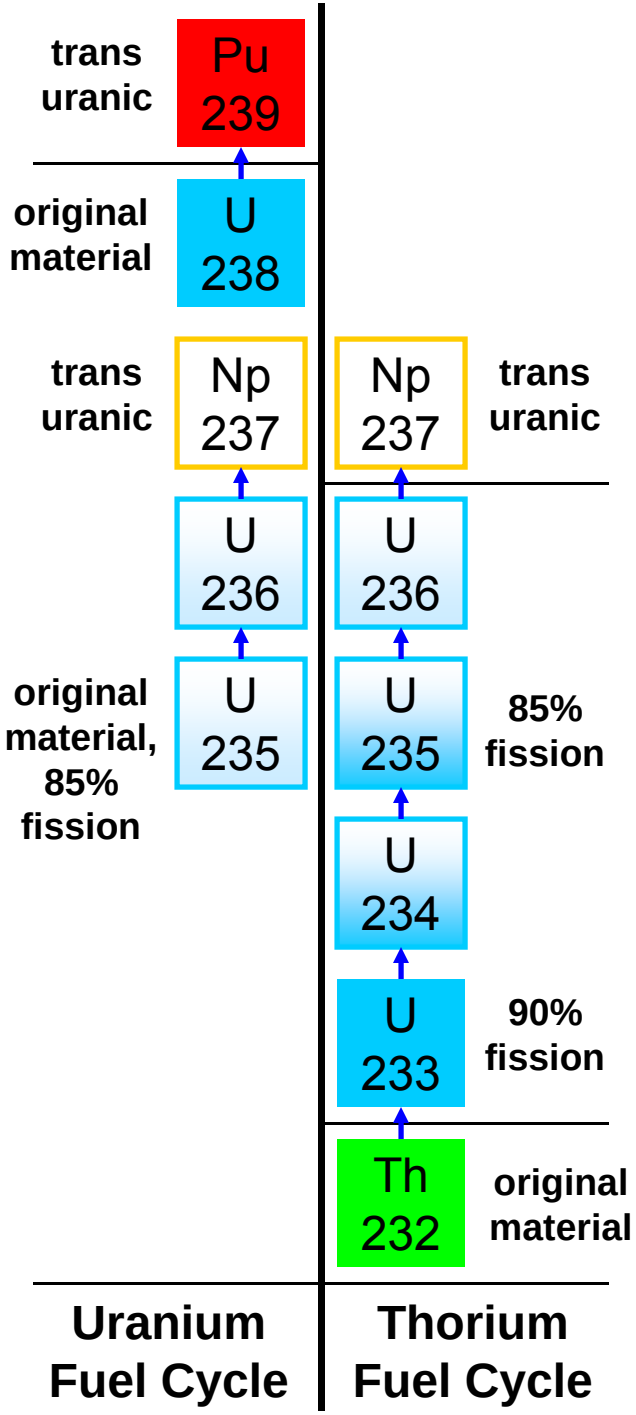
Natural Uranium
99.3% uranium-238
0.7% uranium-235

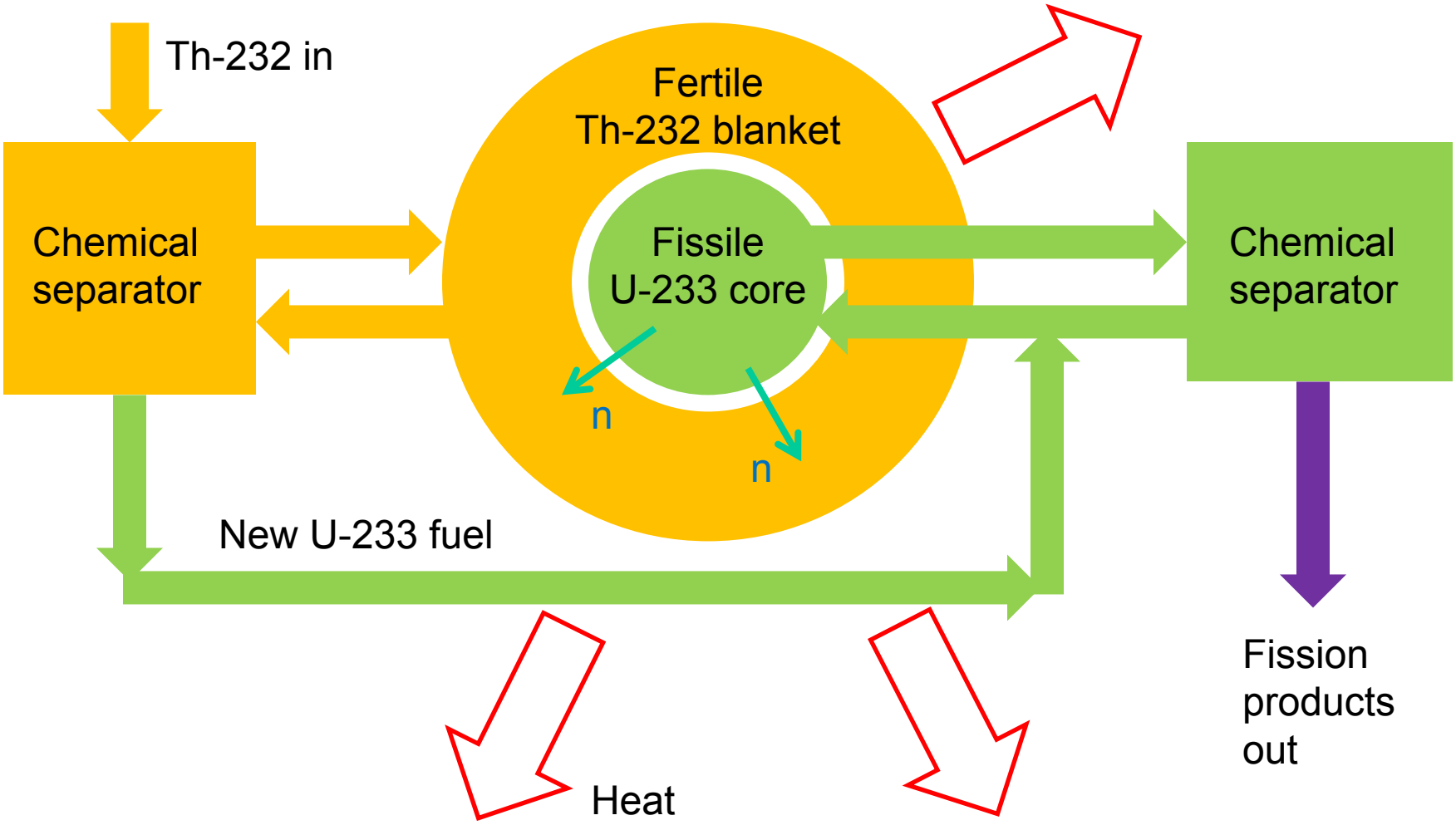
Only a small fraction of natural uranium is fissile. Most uranium and all thorium is “fertile” and can be converted to fissile material through neutron absorption.


Protactinium-233
Thorium-233 decays quickly to protactinium-233
Protactinium-233 decays slowly over a month to uranium-233, an ideal fuel
Uranium-233
Uranium-233 fissions, releasing energy and neutrons to continue the process
Thorium-233
Natural thorium absorbs a neutron from fission and becomes Th-233
Thorium-232
It is impossible to release the energy of thorium all at once.

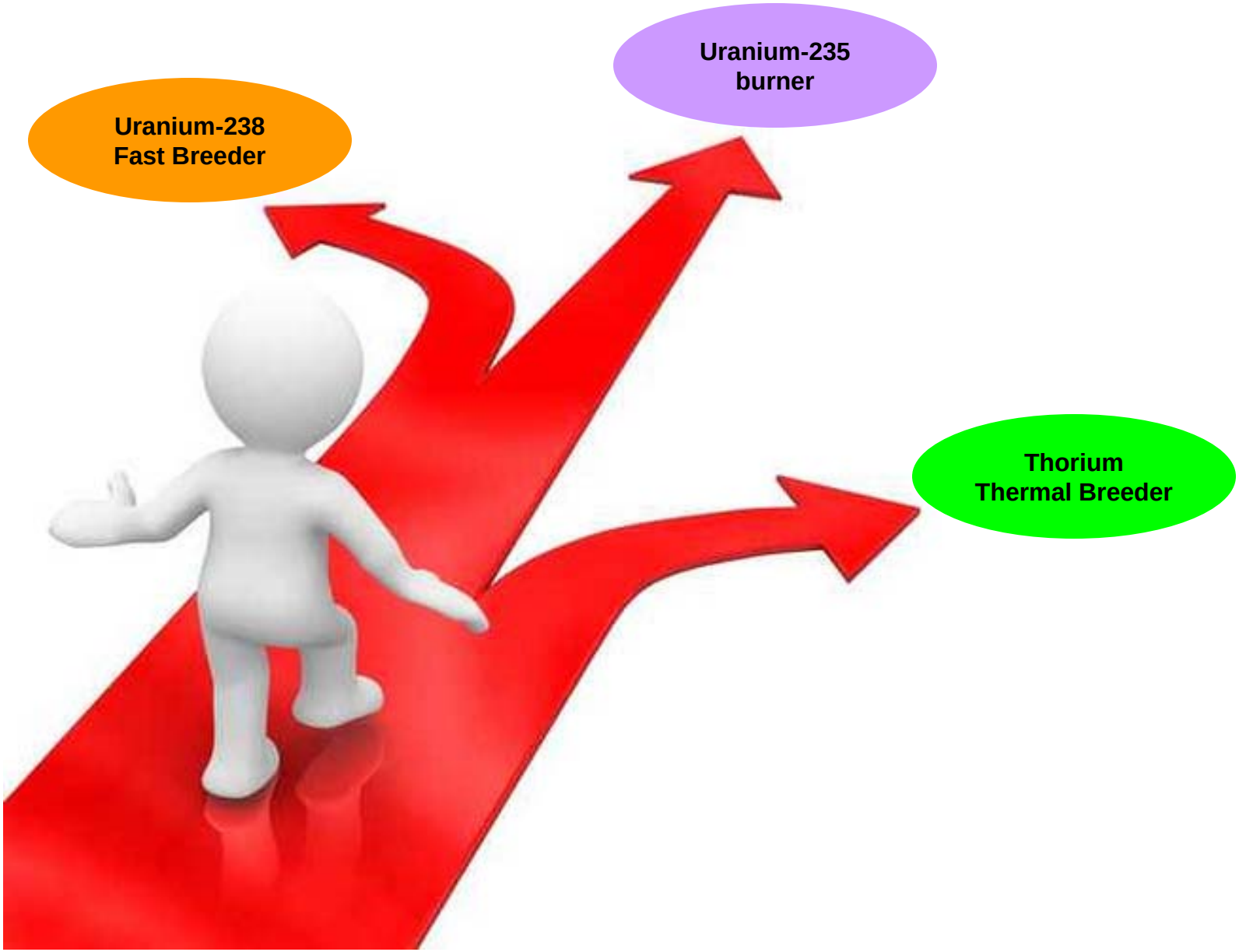
Thorium is a common mineral in the US and world




trans uranic
Pu 239
original material
U 238
trans uranic
Np 237
Np 237
trans uranic
U 236
U 236
original material, 85% fission
U 235
U 235
85% fission
U 234
U 233
90% fission
Th 232
original material
Uranium Fuel Cycle
Thorium Fuel Cycle

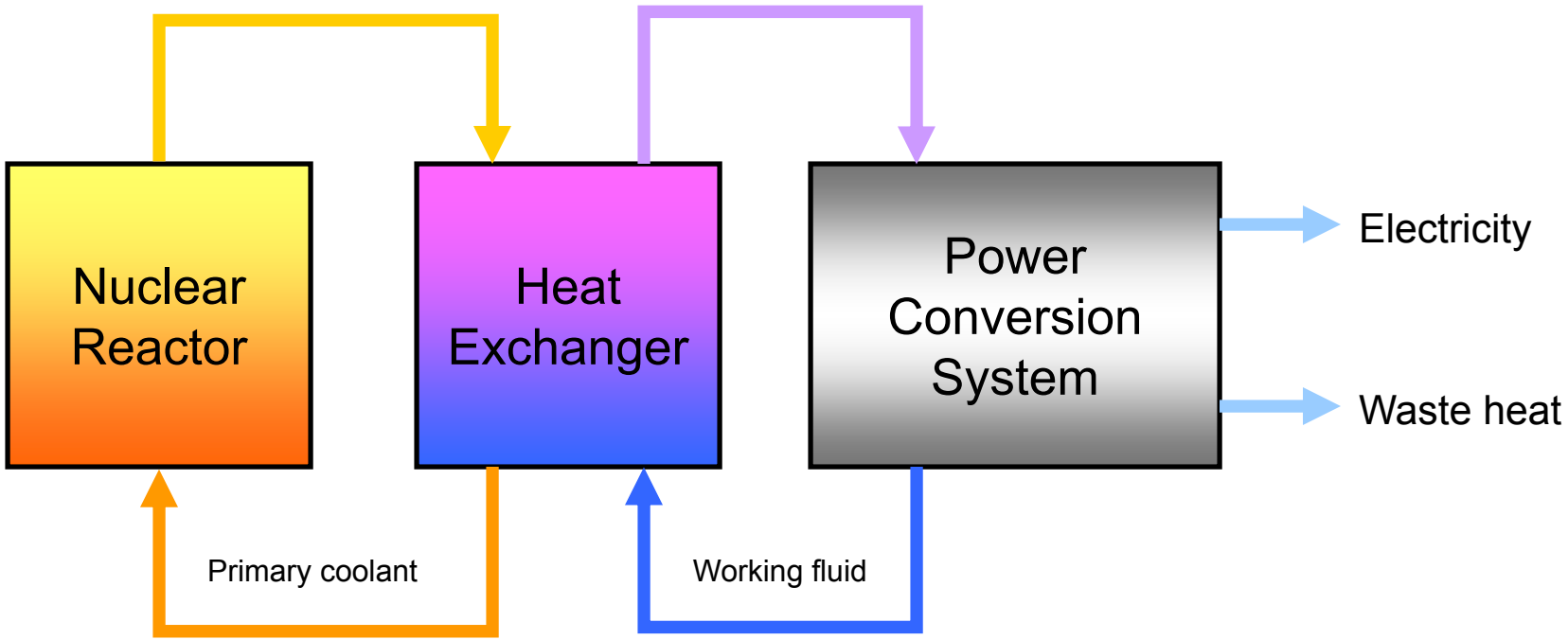

Th-232 in
Fertile
Th-232 blanket
Chemical
separator
Fissile
U-233 core
Chemical
separator
n
n
New U-233 fuel
Fission
products
out
Heat

Three Nuclear Options



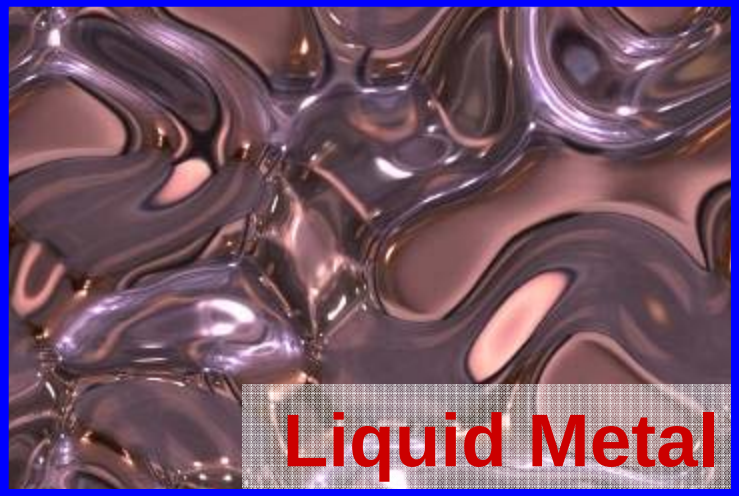
Fundamental Nuclear Reactor Concept

In its simplest form, a nuclear reactor generates thermal energy that is carried away by a coolant. That coolant heats the working fluid of a power conversion system, which generates electricity from part of the thermal energy and rejects the remainder to the environment.

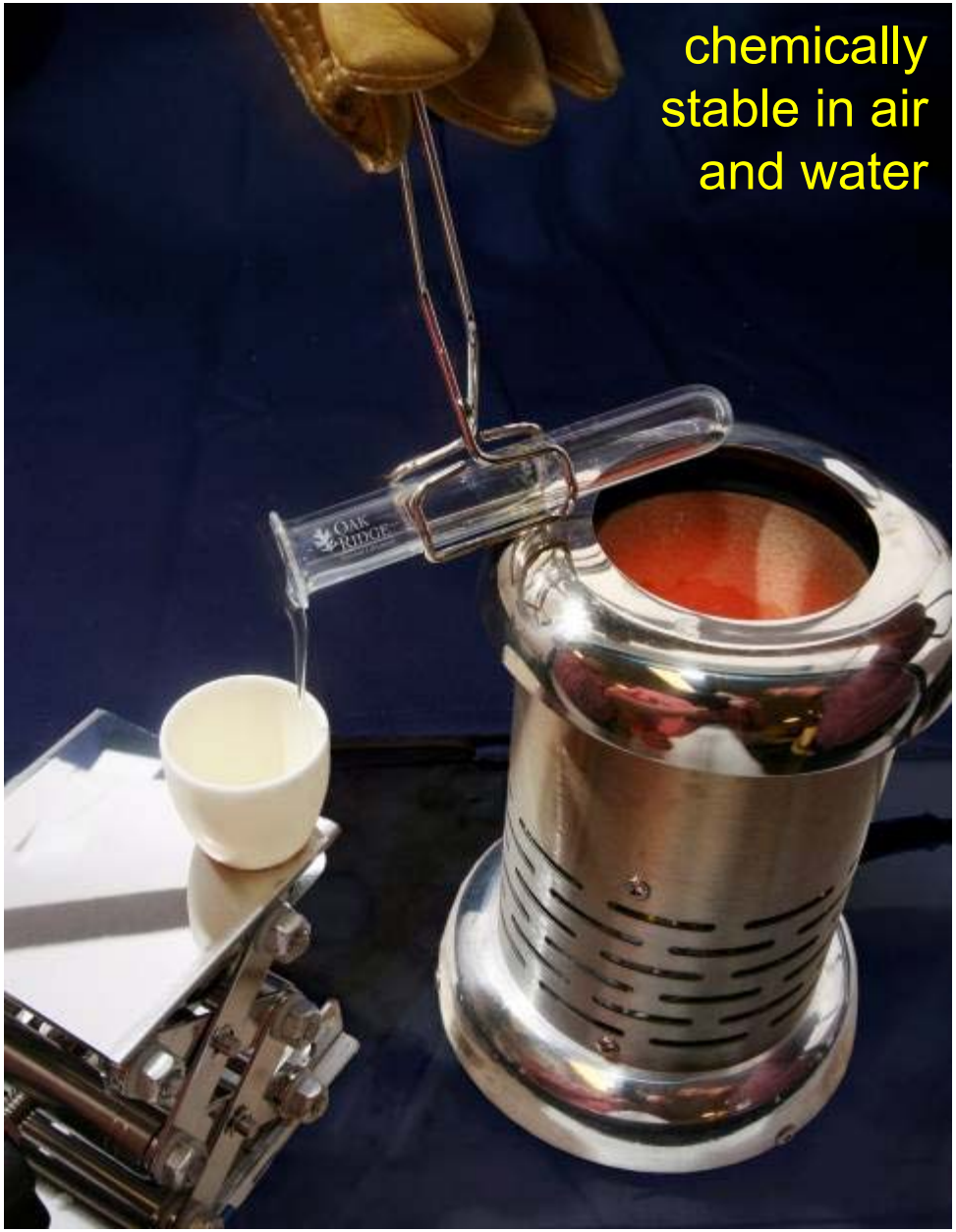


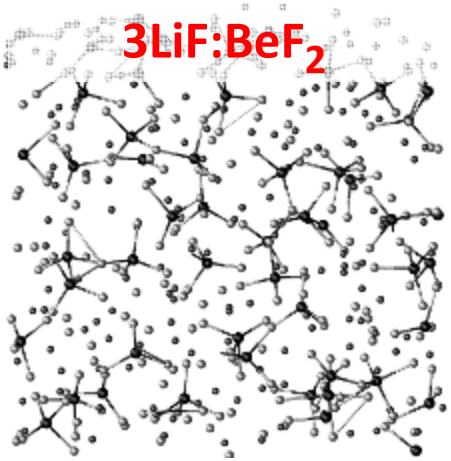
The primary coolant chosen for a nuclear reactor determines, in large part, its size and manufacturability. The temperature of the coolant determines the efficiency of electrical generation.

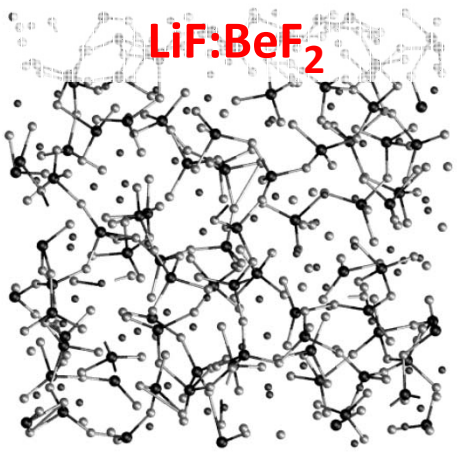
Coolant Choices for a Nuclear Reactor

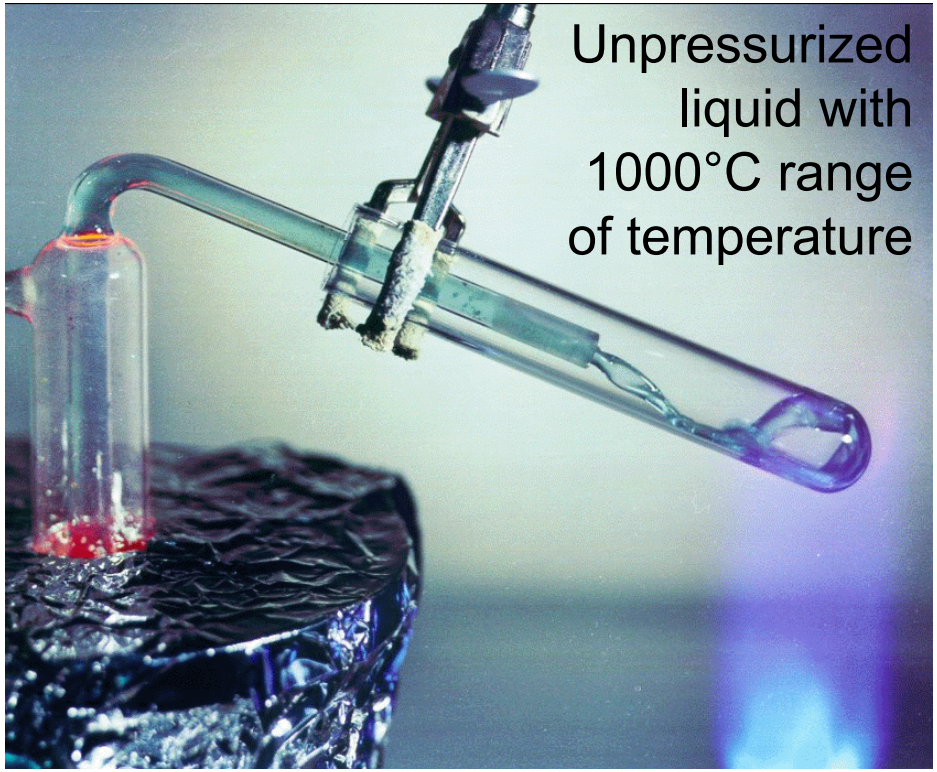
Coolant Temperature \ Pressure	Atmospheric-Pressure Operation	High-Pressure Operation
Moderate Temperature (250-350 C)	 Liquid Metal	 Water
High Temperature (700-1000 C)	 Liquid Salt	 Gas

Fluoride salts are an ideal coolant

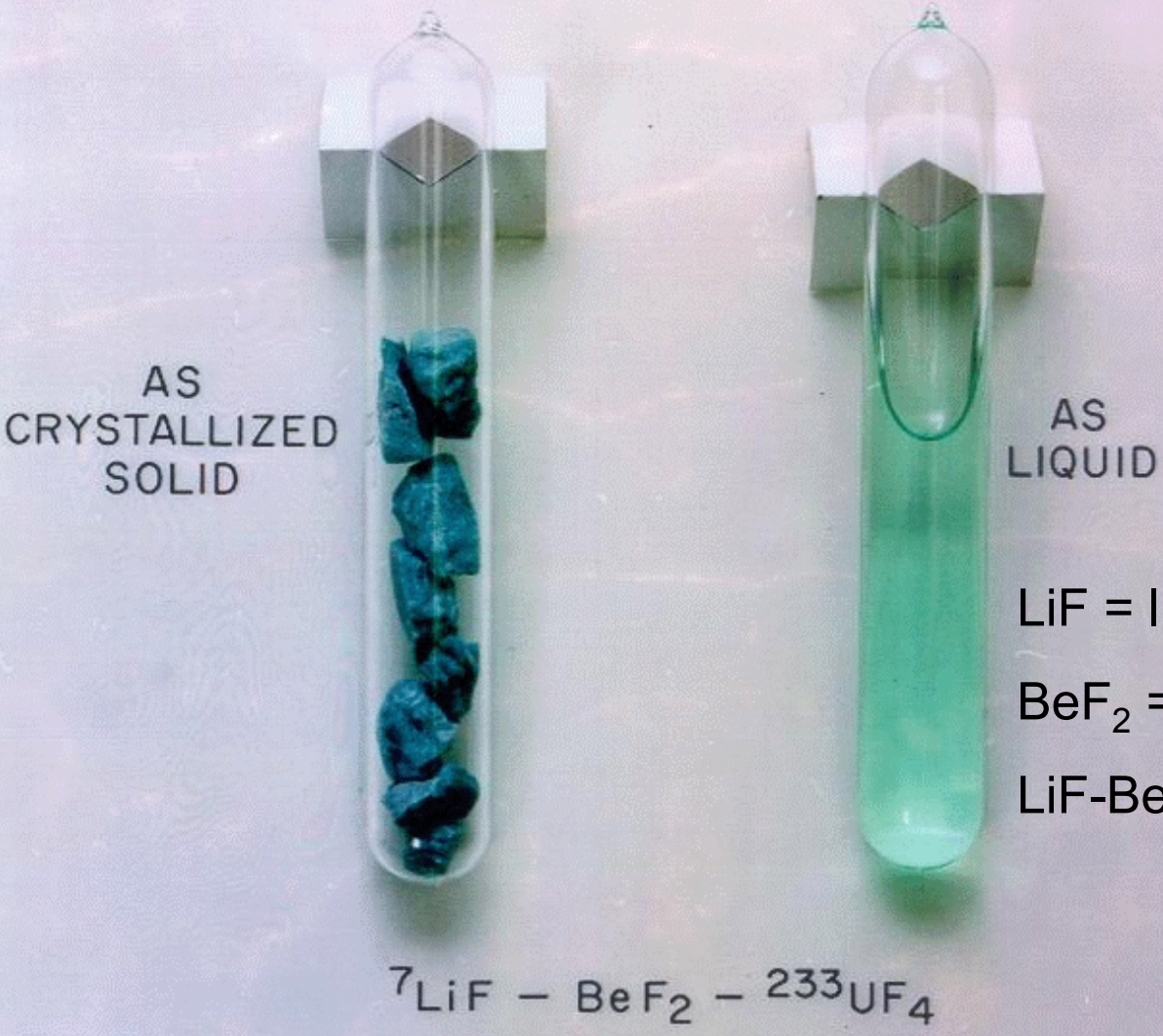








“F-Li-Be” appears to be the best nuclear fluoride salt



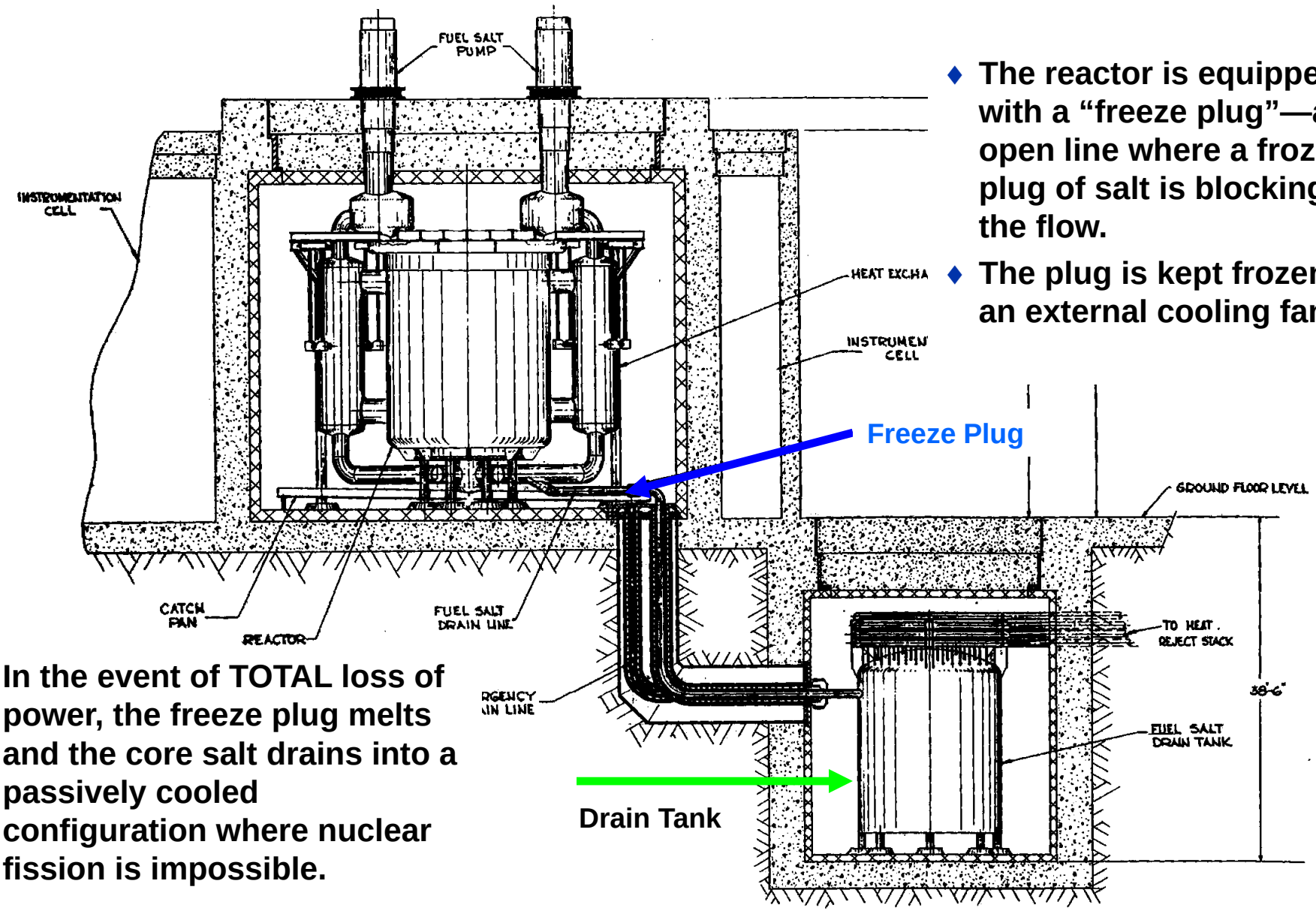
LiF = lithium fluoride

BeF_2 = beryllium fluoride

LiF-BeF_2 → “FLiBe”

FLUORIDE FUEL FOR A MOLTEN SALT REACTOR

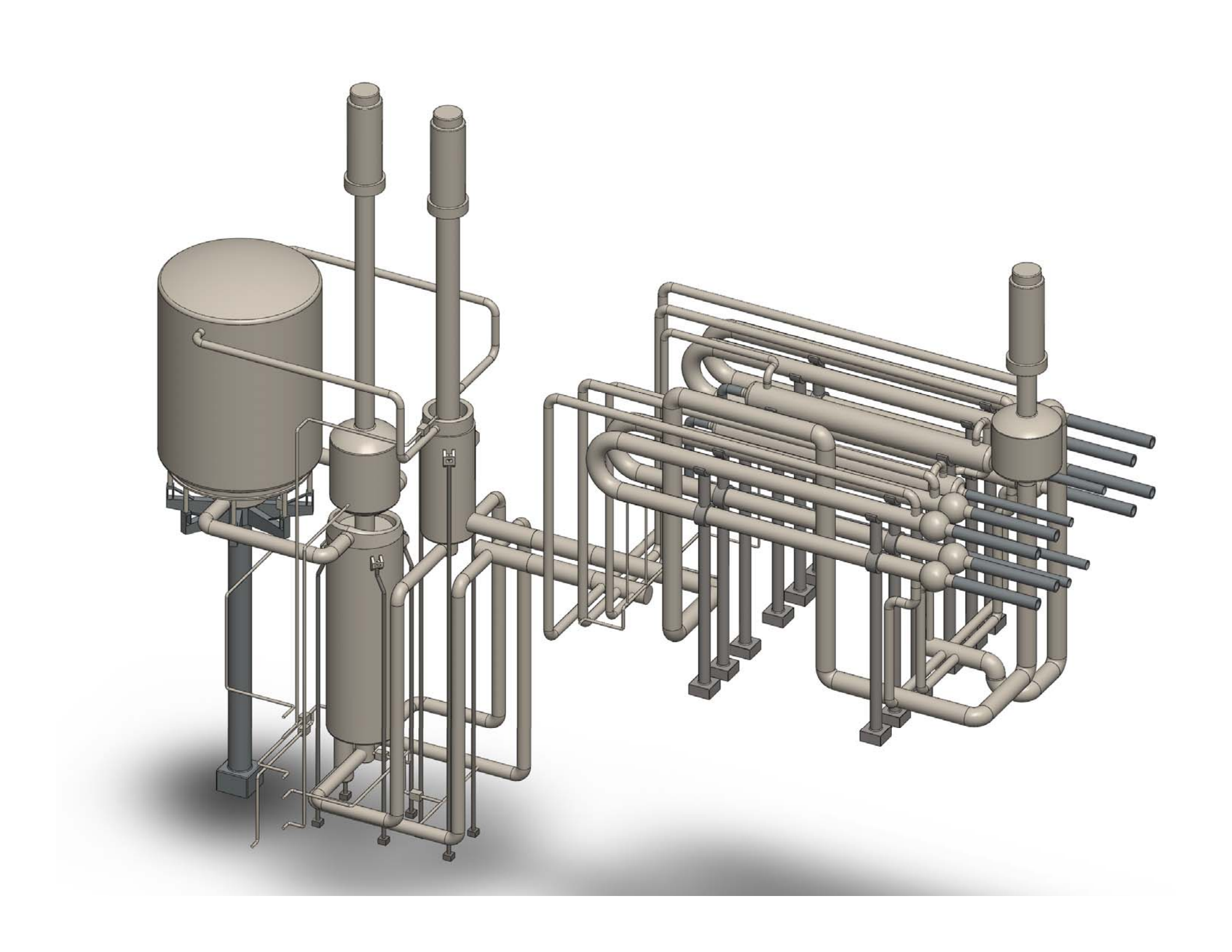
Flibe



- The reactor is equipped with a “freeze plug”—an open line where a frozen plug of salt is blocking the flow.
- The plug is kept frozen by an external cooling fan.

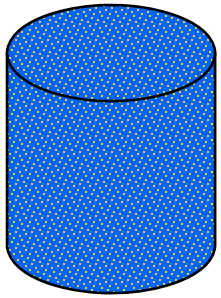
- In the event of TOTAL loss of power, the freeze plug melts and the core salt drains into a passively cooled configuration where nuclear fission is impossible.

Our mission is to supply the world with affordable and sustainable energy, water and fuel.

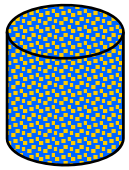


Today's Uranium Fuel Cycle vs. Thorium

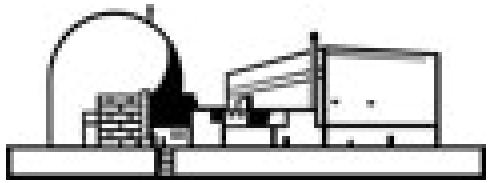
mission: make 1000 MW of electricity for one year



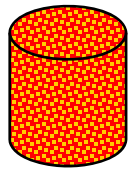
250 t of natural uranium containing 1.75 t U-235



35 t of enriched uranium (1.15 t U-235)

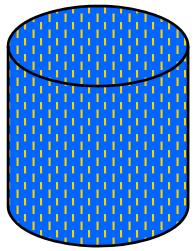


Uranium-235 content is "burned" out of the fuel; some plutonium is formed and burned



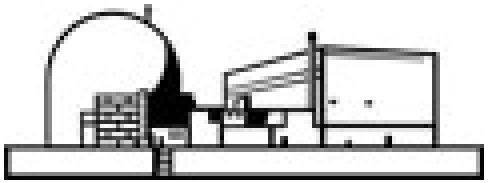
35 t of spent fuel stored on-site until disposal at Yucca Mountain. It contains:

- 33.4 t uranium-238
- 0.3 t uranium-235
- 0.3 t plutonium
- 1.0 t fission products.



215 t of depleted uranium containing 0.6 t U-235—disposal plans uncertain.

One tonne of natural thorium

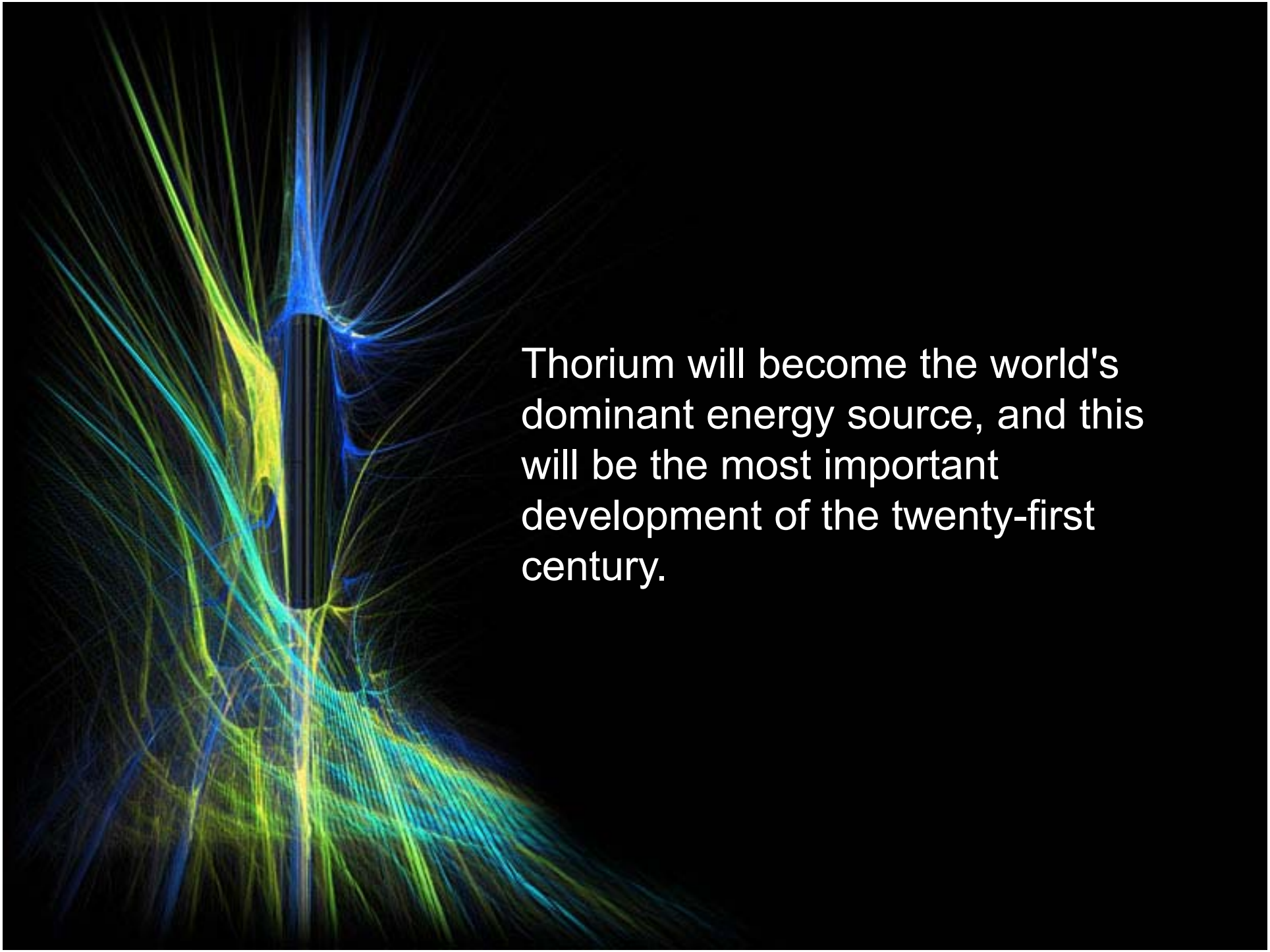


Thorium introduced into blanket of fluoride reactor; completely converted to uranium-233 and "burned".

One tonne of fission products; no uranium, plutonium, or other actinides.

Within 10 years, 83% of fission products are stable and can be partitioned and sold.

The remaining 17% fission products go to geologic isolation for ~300 years.


Thorium will become the world's dominant energy source, and this will be the most important development of the twenty-first century.