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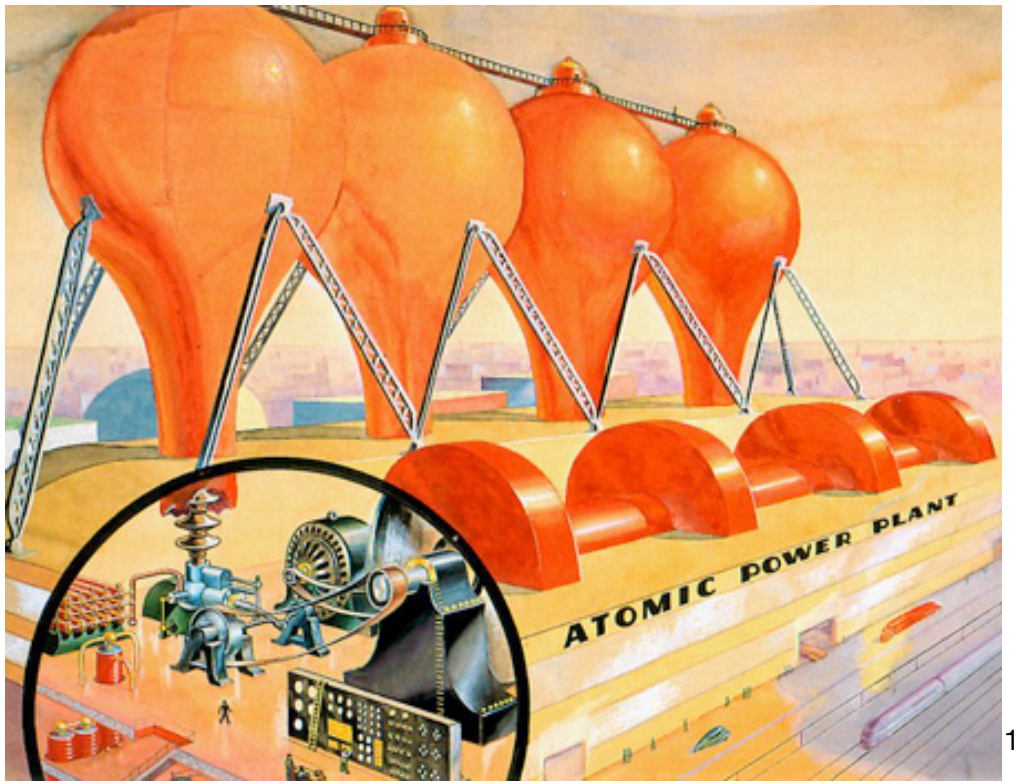
ENVS 119 - Energy & the Environment

10 - Nuclear Power, the undelivered promise



Nuclear : current state in the U.S

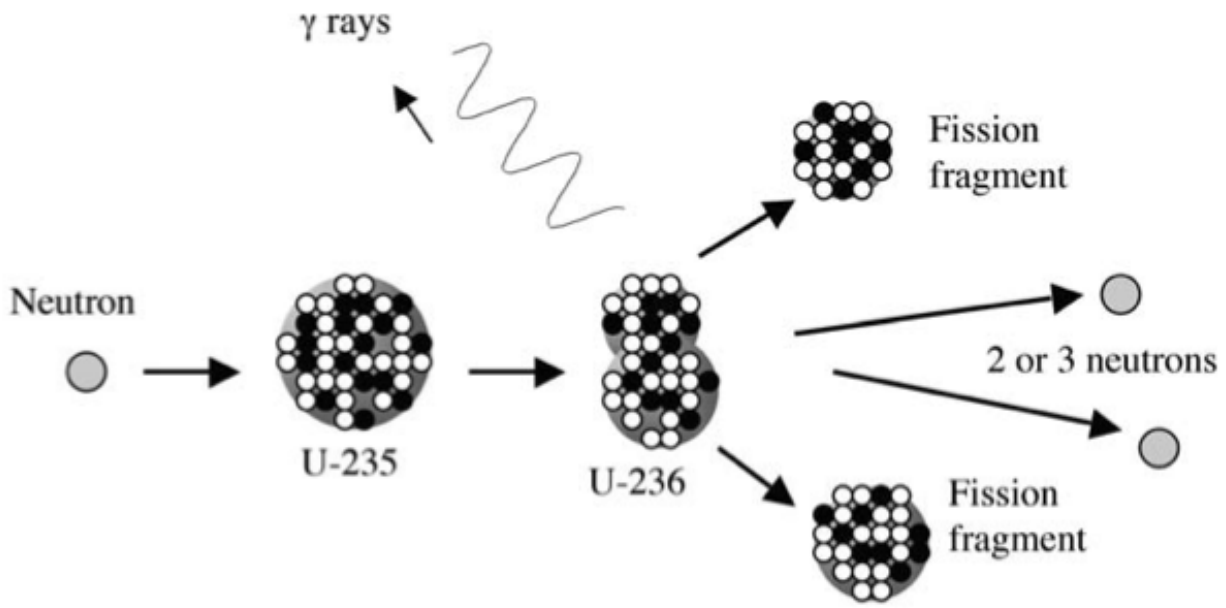
- 21% US, 17% global electricity
- US nuclear fleet capacity factor > 90%
- Global fleet: 443 reactors, 31 countries
- US industry characterized by stagnation / decline
- 39 orders for new plants since 1973 cancelled
- No new nuclear plants since 1978 in the US
- Existing US plants are beyond expected life

Nuclear Energy : The future of the 50s

G.E -https://youtu.be/Gi-ItrJISQE

Current technology: Nuclear Fission

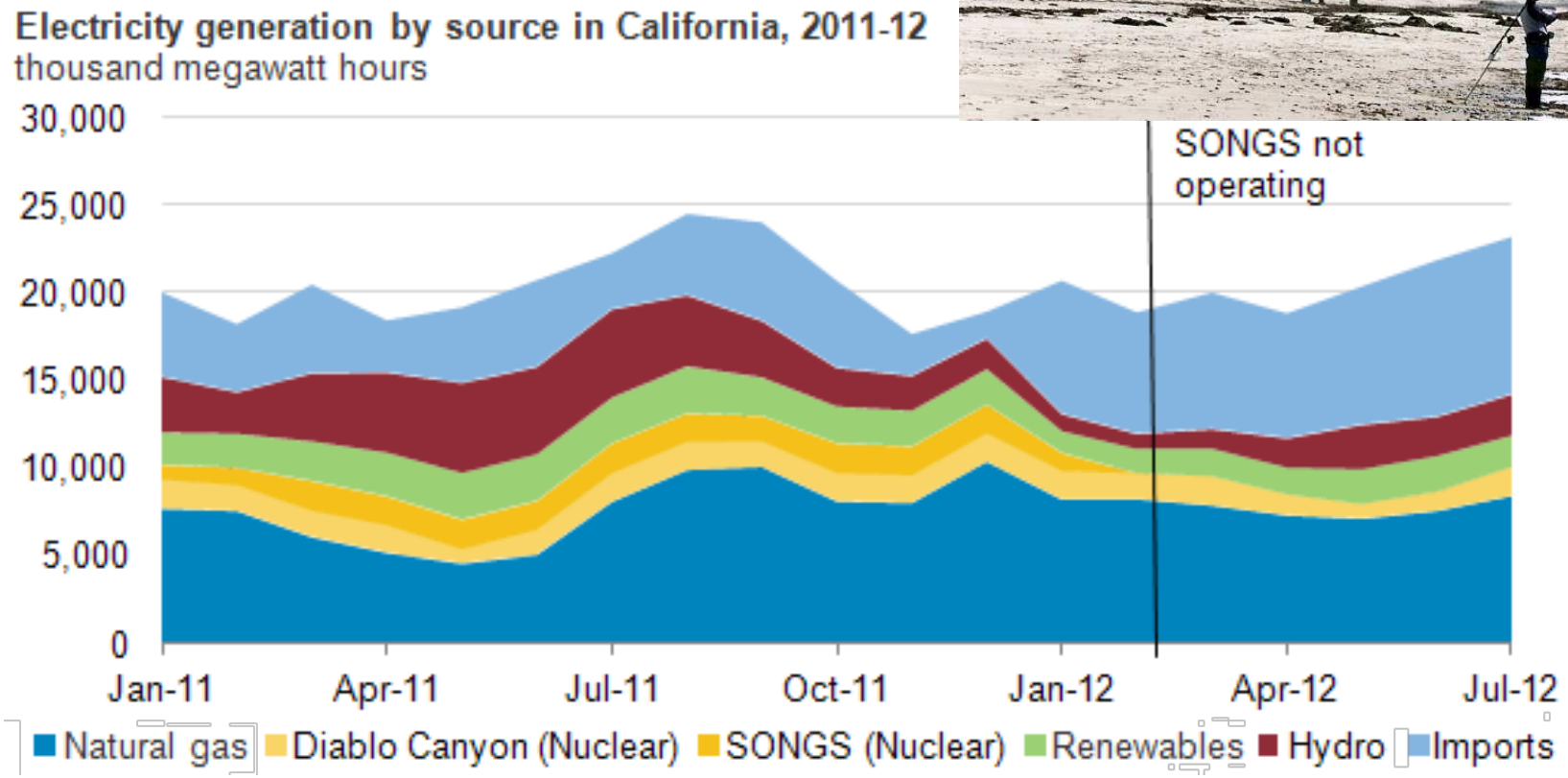
figure 4.10



The fissioning of U-235 creates two radioactive fission fragments plus two or three neutrons and gamma rays.

Randolph and Masters -Chap 4.7 p156

CA phasing out Nuclear Powerplants



Source: U.S. Energy Information Administration, EIA Forms 923 and 826

GHG and Nuclear - Not really Carbon free!

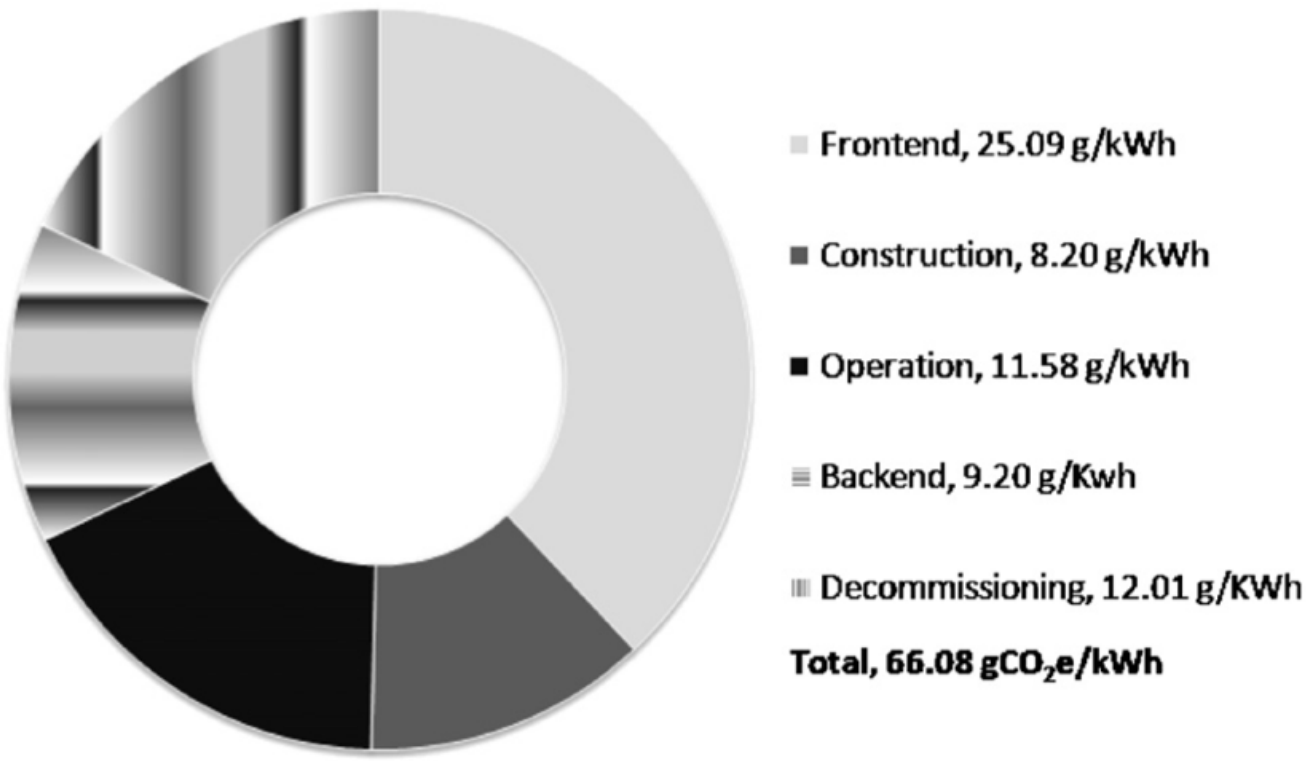


Fig. 4. Mean emissions reported from qualified studies for the nuclear fuel cycle (g CO_2e/kWh).

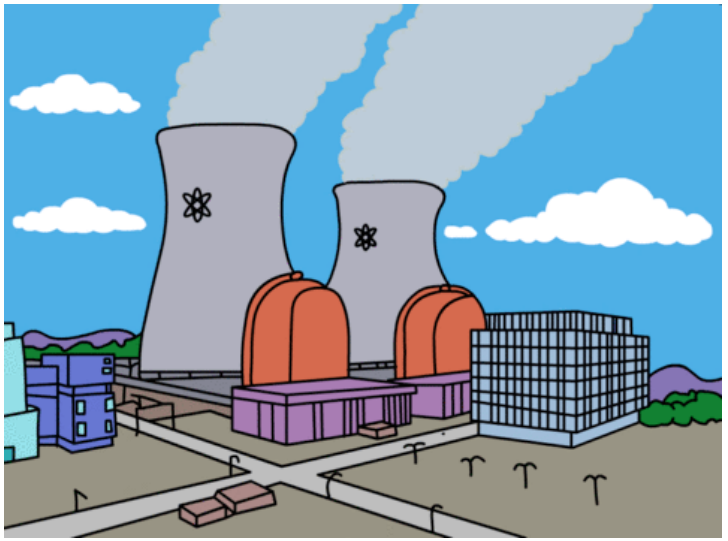
66$_{gCO_2e/kWh}$ v. 195$_{gCO_2e/kWh}$ for PG&E!

Source: http://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

Env. movement still opposed, Why?

Low carbon but… issues!

1. Cost / time to build
2. Non renewable U235
3. U235 dependance
4. Safety
5. Nuclear waste
6. Nuclear proliferation/safety

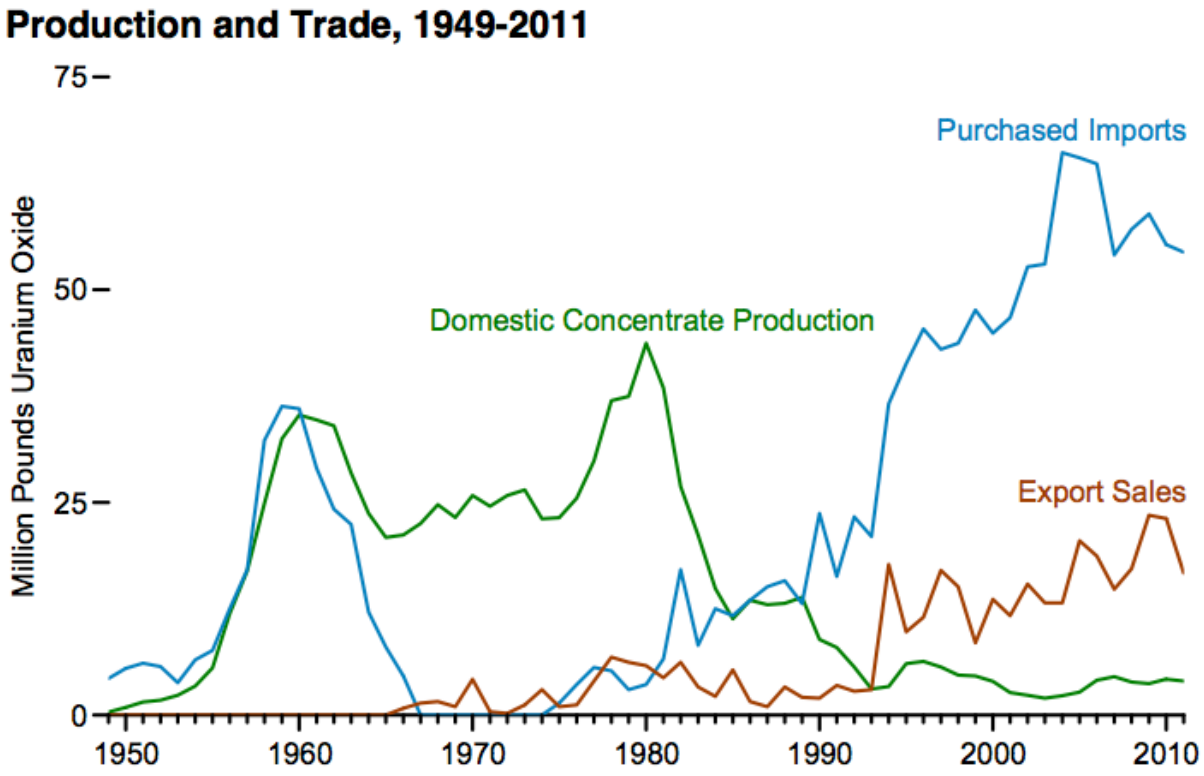


Cost/Delays - Euro EPR (Flamanville, France)

- European Pressurized reactor “passive” design
- "*...appears to have the potential to be significantly safer and more secure against attack than today's reactors.*” Union of Concerns Scientists
- 2005 cost was estimated to 3.3 billion Euros (started in 2007)
- 2015 cost is now estimated to 8.5 billions Euros
- 2020 Still not opened! (2024)

Uranium = Energy Dependance

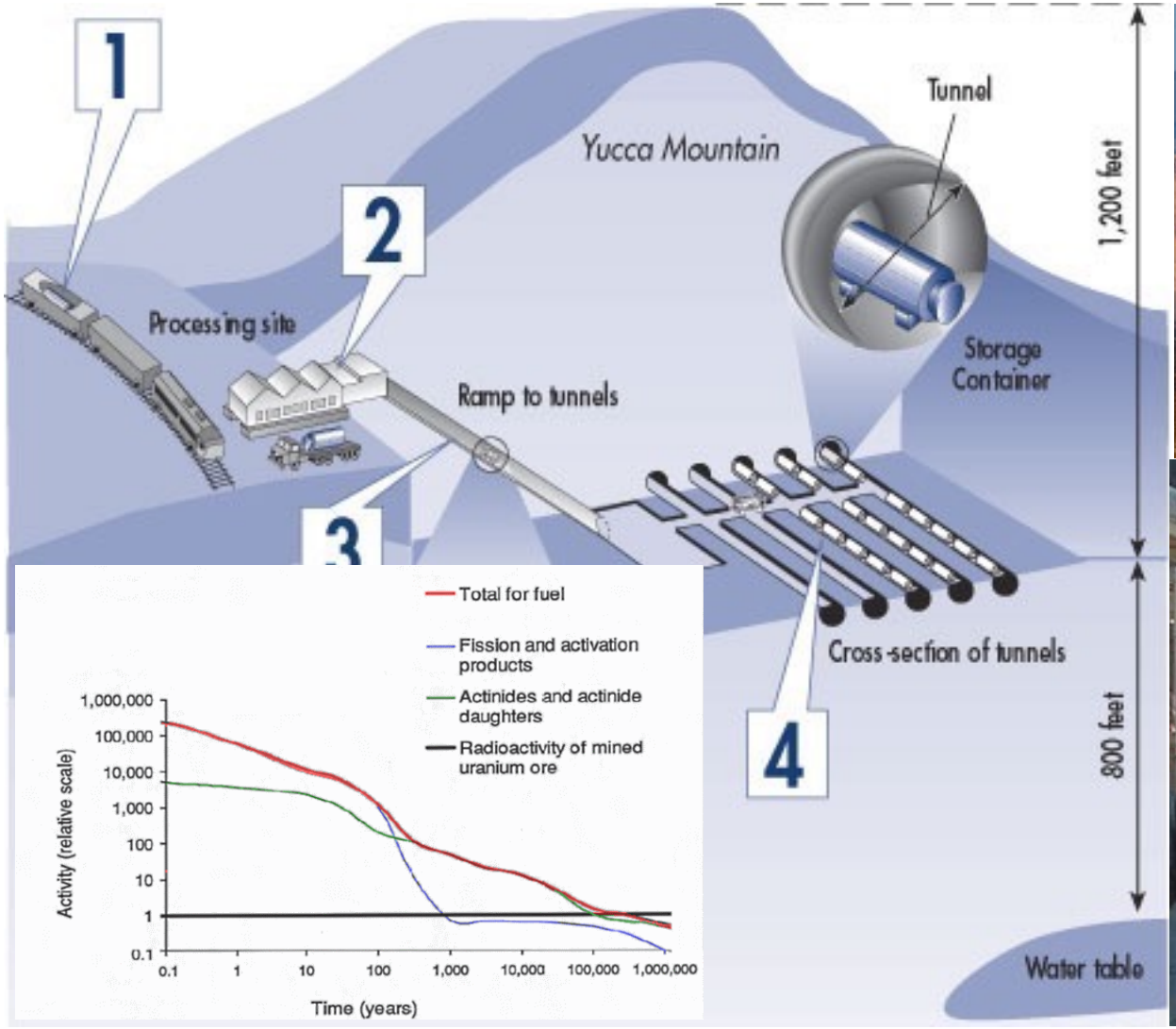
The US relies on purchased imports from Canada and Australia, and exports most of what it mines

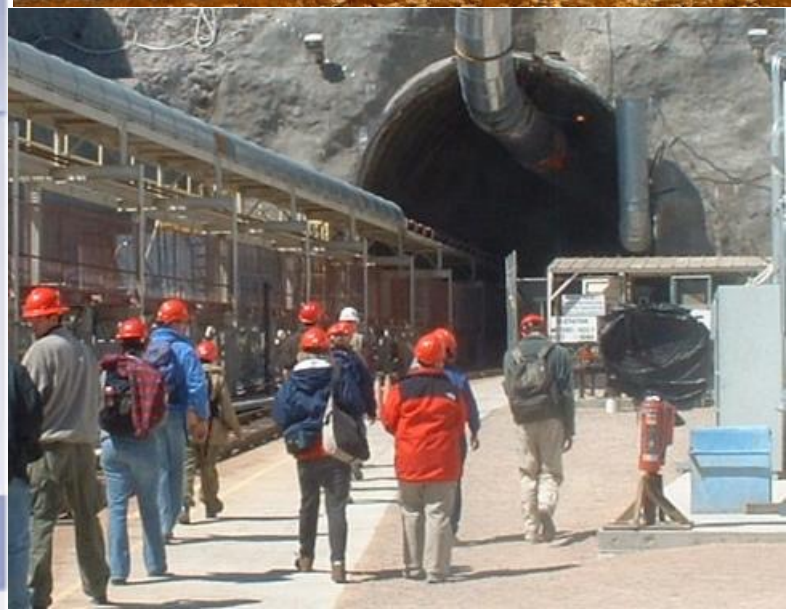


Power Plants Disasters = Loss of Public Support

- U.S (3 miles island - March 28, 1979)
- Russia (Chernobyl - 26 April 1986)
- Japan (Fukushima - 11 March 2011)

Nuclear waste - Yucca Mountain, NV?





Source: IAEA (referenced in Radioactive Waste in Perspective NEA 2010, p74)

Nuclear Energy Future - End

- Fusion research: Helium 3 (direct electricity conversion, no radioactive fuel)
- Thorium reactors (more abundant than U, less waste)
- Smaller reactors (300 Mw v 2,000 Mw) - mass produced
- Should government subsidize nuclear (research)?
- Q/A