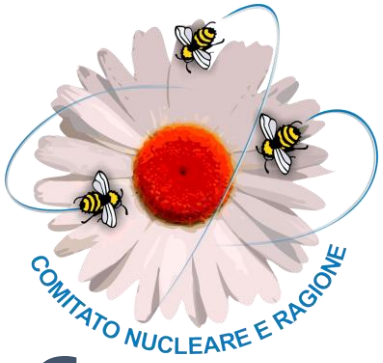


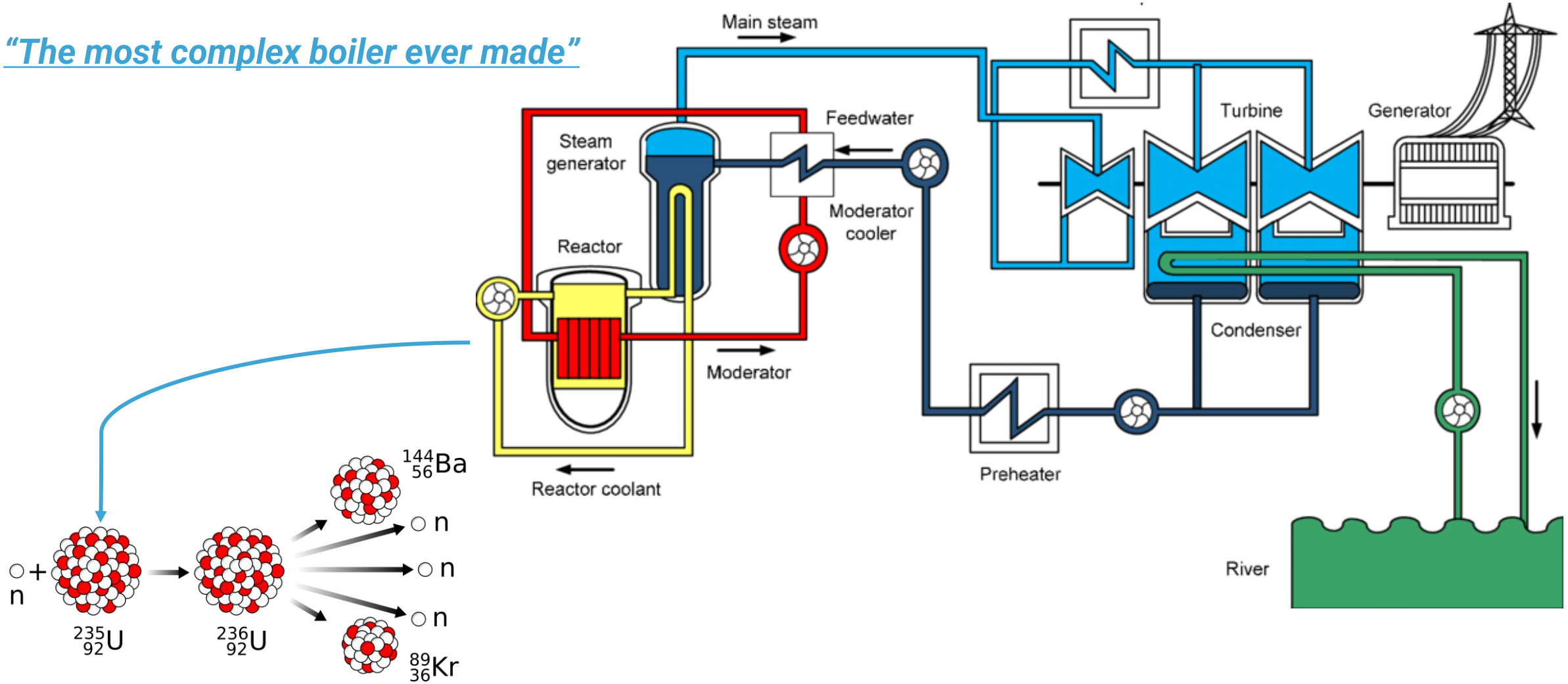
Nuclear: Ally or Enemy of Renewables?

Riccardo Chebac
Comitato Nucleare e Ragione

Collegio San Giuseppe, Torino • 28/1/2022

Working Principle of a Nuclear Power Plant

"The most complex boiler ever made"



NUCLEAR ENERGY

Energy Density

NUCLEAR ENERGY

Power Density

Land Utilization

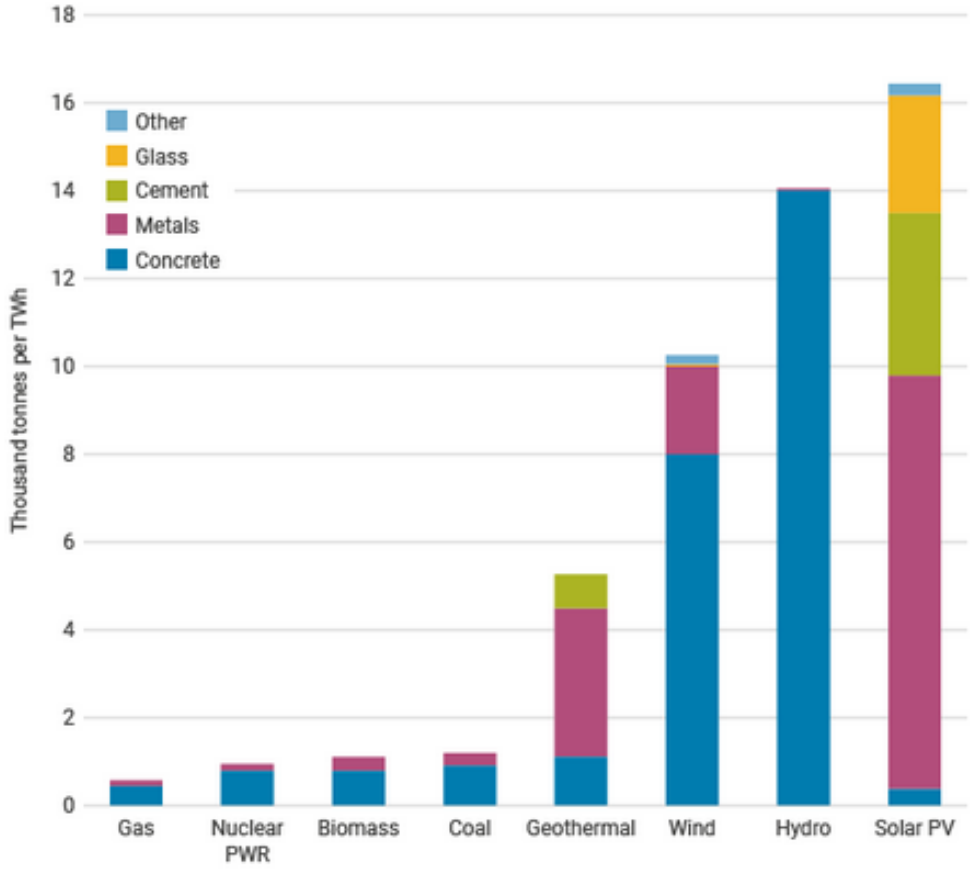
Nuclear plants in Belgium require **285** times less land than solar…

Source: Comparison between Doel Nuclear Plant and Kristal Solar Park in Lommel. If operated at 85% capacity factor, Doel's 570 megawatt (net) capacity would produce 22 terawatt-hours per year on an approximate land area of 1.1 square kilometers, for a density of 20 terawatt-hours per square kilometer. Kristal Solar Park has a power density of 0.07 terawatt-hours per square kilometer.

…and **412** times less area than wind

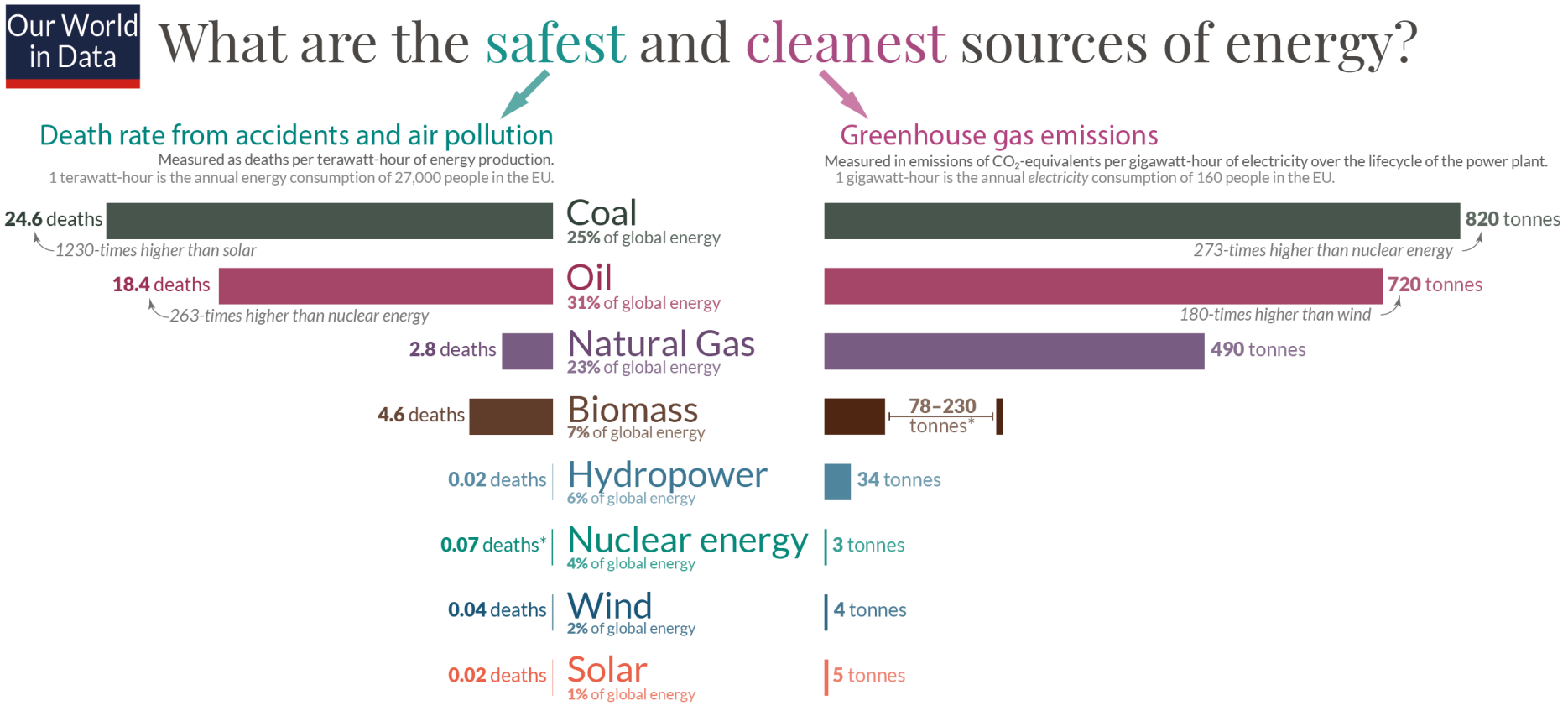
Source: Comparison between a facility like Doel Nuclear Plant if operated, and assumed production from Rentel wind farm. If operated at 85% capacity factor, Doel's 2.91 gigawatt (net) capacity would produce 22 terawatt-hours per year on an approximate land area of 1.1 square kilometers, for a density of 20 terawatt-hours per square kilometer. Rentel has a power density of 0.05 terawatt-hours per square kilometer.

Resource Utilization



NUCLEAR ENERGY

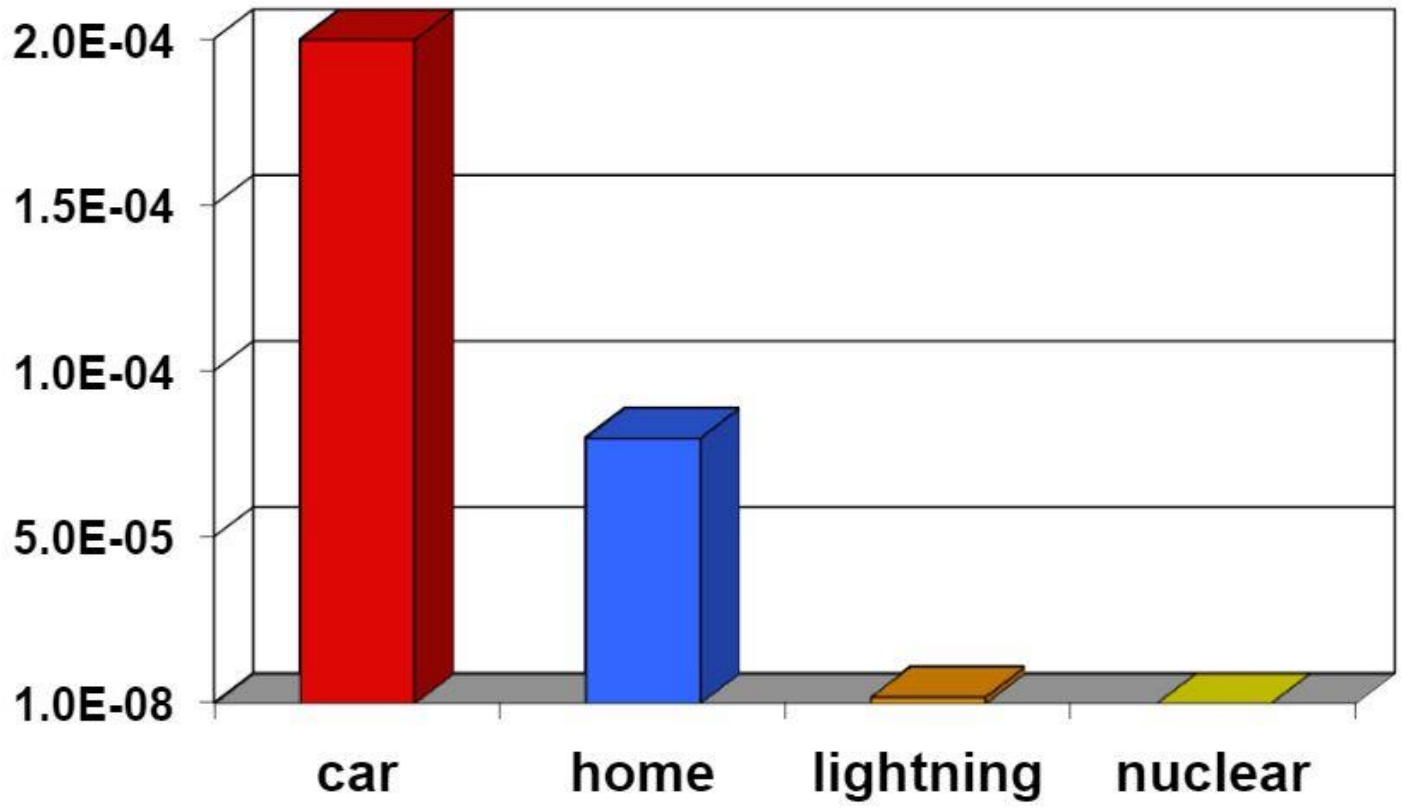
Safety and CO2 Production



*Life-cycle emissions from biomass vary significantly depending on fuel (e.g. crop resides vs. forestry) and the treatment of biogenic sources.
*The death rate for nuclear energy includes deaths from the Fukushima and Chernobyl disasters as well as the deaths from occupational accidents (largely mining and milling).
Energy shares refer to 2019 and are shown in primary energy substitution equivalents to correct for inefficiencies of fossil fuel combustion. Traditional biomass is taken into account.
Data sources: Death rates from Markandya & Wilkinson (2007) in *The Lancet*, and Sovacool et al. (2016) in *Journal of Cleaner Production*;
Greenhouse gas emission factors from IPCC AR5 (2014) and Pehl et al. (2017) in *Nature*; Energy shares from BP (2019) and Smil (2017).
OurWorldinData.org – Research and data to make progress against the world's largest problems.

Risk Perception

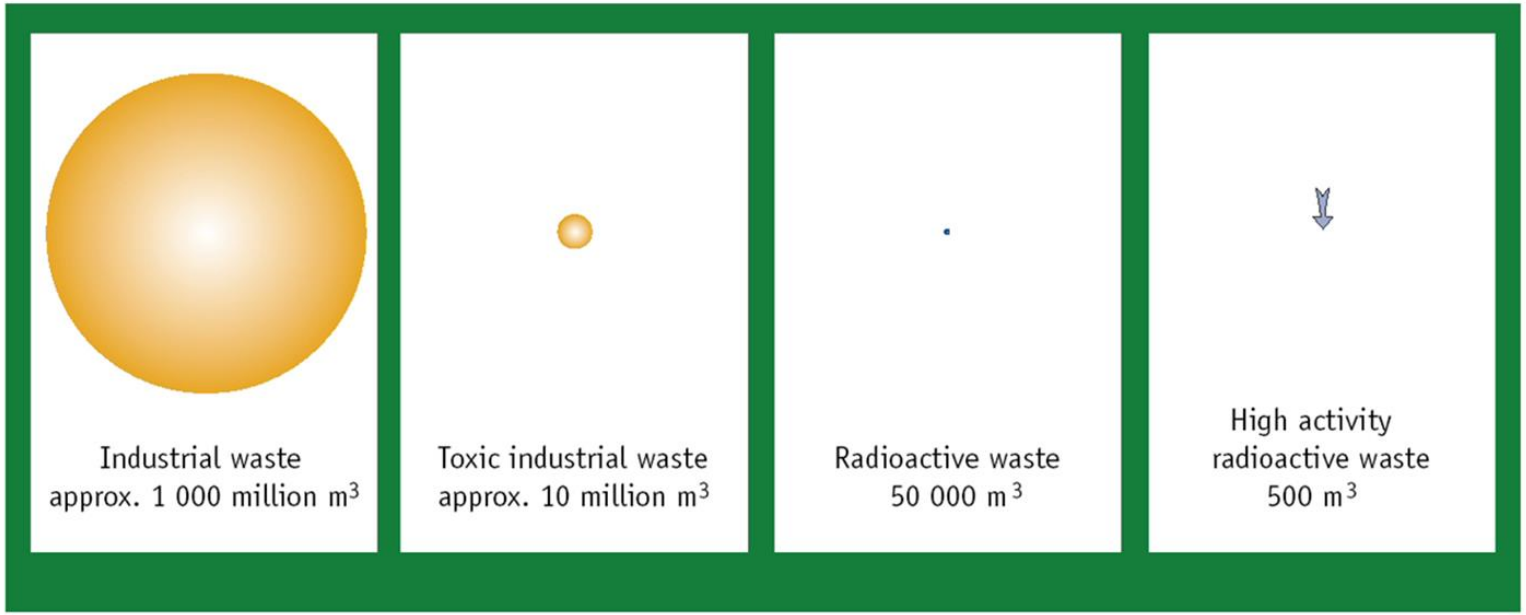
Estimated lethal accidents frequency



Nuclear Waste Production

If the whole energy spent during the life of a person came from nuclear the total volume of high-level waste produced would be a 33cL can

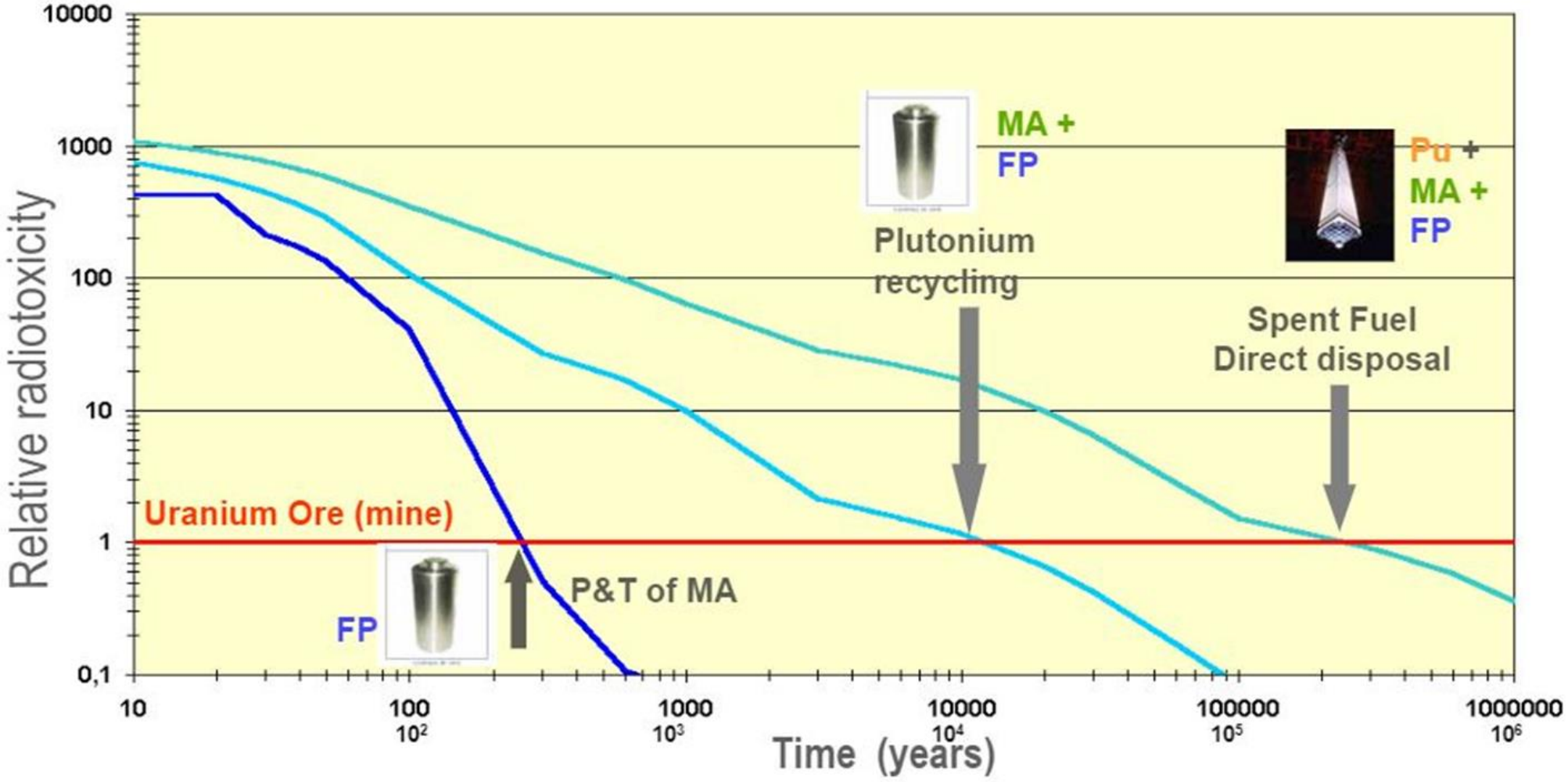
Figure 4.2: Waste generation comparison – yearly production of waste in the European Union



Source: *Nuclear and Renewable Energies* (Rome: Accademia Nazionale dei Lincei, 2000), updated with data from the European Commission, *Radioactive Waste Management in the European Union* (Brussels: EC, 1998).

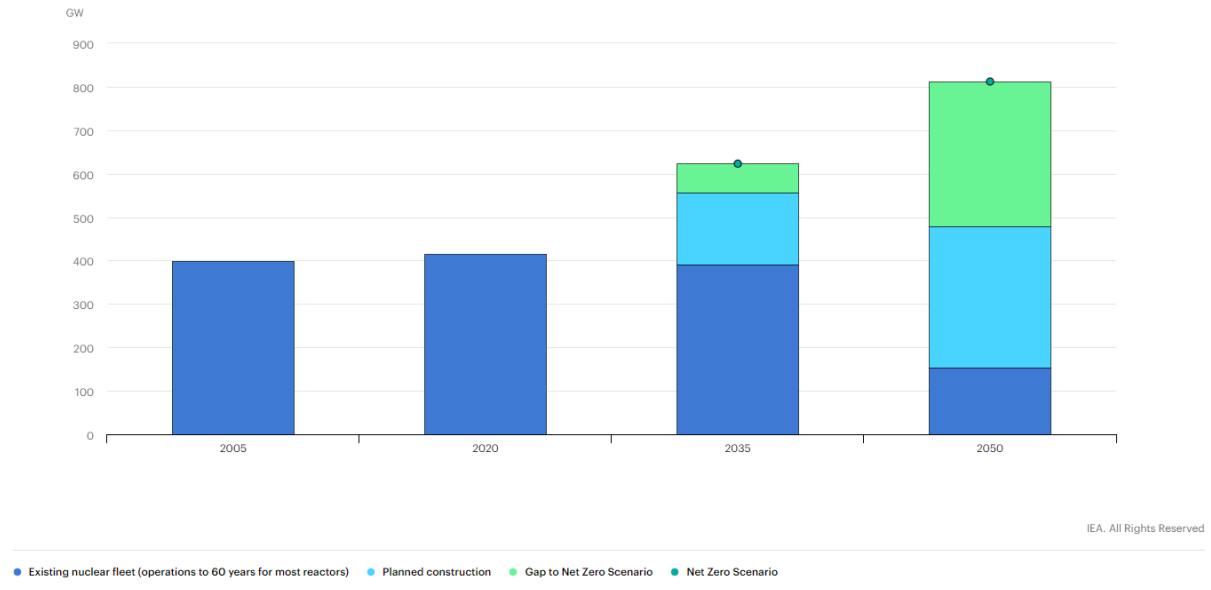
Quantity of vitrified HLW produced by a French citizen in his / her **entire life**

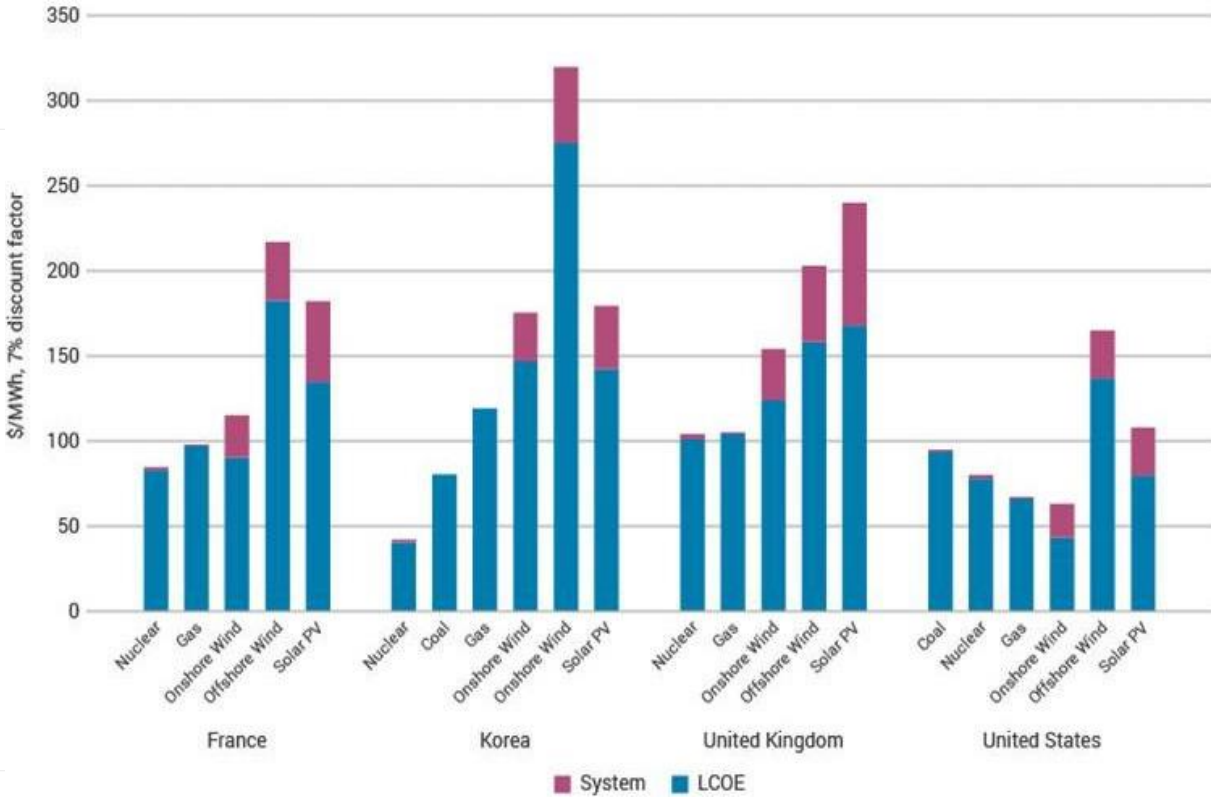
Waste Decay Time



NUCLEAR WASTE

Economics: The Choice is Ours





Economics of Nuclear

On the Horizon

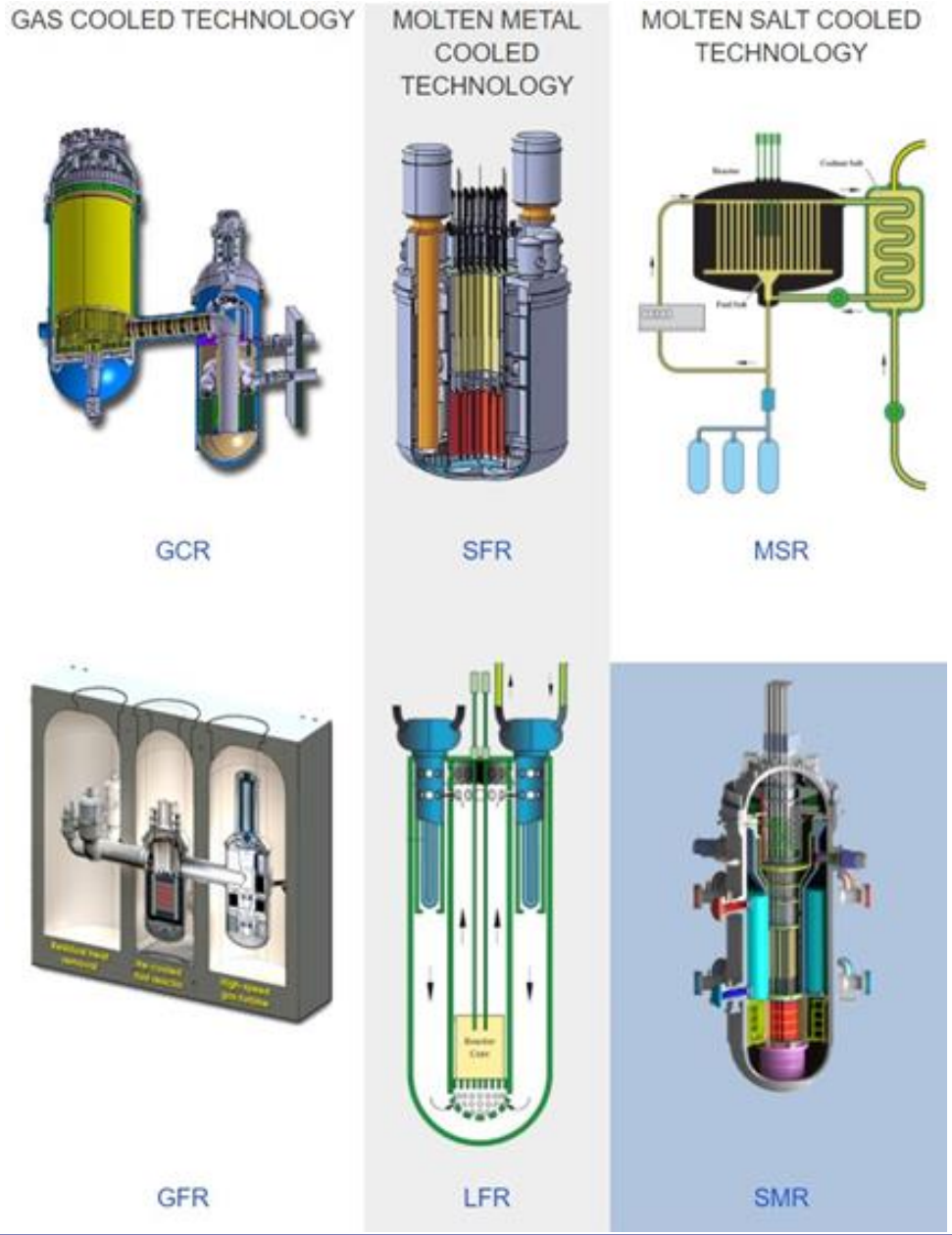
"A good investor has to consider the long-term"

SMR

- Definition: Reactor with power output < 300 MWe
- Modularity: limited on-site preparation
- Lower capital investment
- Siting flexibility

Gen IV

- Evolutionary → Revolutionary
- Goals:
  - Waste minimization
  - Effective fuel utilization
  - Higher safety
  - Better economics
  - Proliferation resistant



THANK YOU FOR THE ATTENTION

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