Hydrogen vs Nuclear

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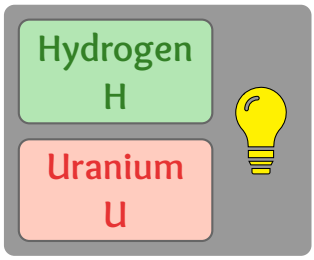

Campaigners for the uptake of nuclear energy extol nuclear's relative safety, nuclear's cost, nuclear's short-term cleanness, and nuclear's steady baseload potential. And conversely, they might criticise renewables for countervailing reasons. I understand the arguments. However, my present misgivings for a wide uptake of nuclear are twofold:

Firstly, high-level nuclear radioactive waste remains biohazardous for very long times, far longer than what we are able to plan for. While the primary fission products caesium-137 and strontium-90 decay over several decades, with half lifes of about 30 years, certain long-lived fission products remain radioactive for much longer. The radioactive isotope technetium-99 has a half life exceeding 200 000 years. And in addition to these fission products, nuclear reactors produce certain actinide by-products, also with very long decay times. Plutonium-239 has a half life of 24 000 years, for instance. Spent nuclear can be chemically reprocessed to remove these actinides, but this is often not economically feasible. Nuclear high-level waste products are currently small by volume. But wide uptake of nuclear will increase this volume.

To my knowledge, there are no facilities for permanent disposal of high-level nuclear waste. As far back as 1987, the Department of Energy in the US was tasked to design and construct an underground geologic repository at the Yucca Mountain, Nevada. But progress was suspended in 2010. This absence of permanent disposal facilities reflects the difficulty in dealing with waste material which remains hazardous for such long times.

Secondly, the current rhetoric around energy supply seeks to juxtapose nuclear with renewables, as if that's all there is. I understand the juxtaposition. But the rhetoric is unfortunate because it masks the viability of alternatives. I believe there is an alternative which is better than both fossil and nuclear: hydrogen. With hydrogen as an energy currency derived not from fossils nor from nuclear but from renewables, we may eliminate the production of hazardous waste, thereby helping to promote a more sustainable future.

Methane pyrolysis and water electrolysis are promising industrial processes for the production of hydrogen. And when powered by renewables, both have low carbon footprints. In fact, both produce zero atmospheric carbon dioxide. My reading suggests that water electrolysis coupled either to concentrated solar power or photovoltaics are viable sources of molecular hydrogen.

I accept that, right now, nuclear is cleaner than fossils. But I worry that both the rhetoric and a widespread uptake of nuclear shifts attention away from hydrogen and a solar hydrogen economy, and serves to entrench an energy economy which is, well, still dirty.

This is an informative review paper:

Sema Baykara
"Hydrogen: A brief overview on its sources, production and environmental impact"
International Journal of Hydrogen Energy
43(23)
2018
https://doi.org/10.1016/j.ijhydene.2018.02.022

Quoting:

> "Hydrogen produced from water and terrestrial biomass using solar energy is the most sustainable energy currency in the long term. Timely implementation of educational, financial, legislative, social and technological initiatives are necessary to make this happen."