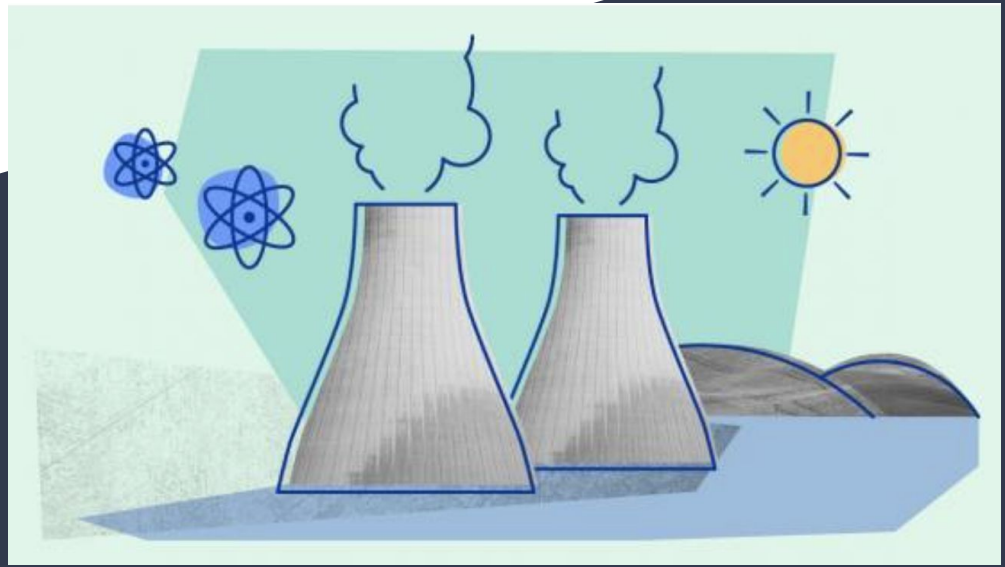
Nuclear Energy

A relic of the past or possible environment savior?



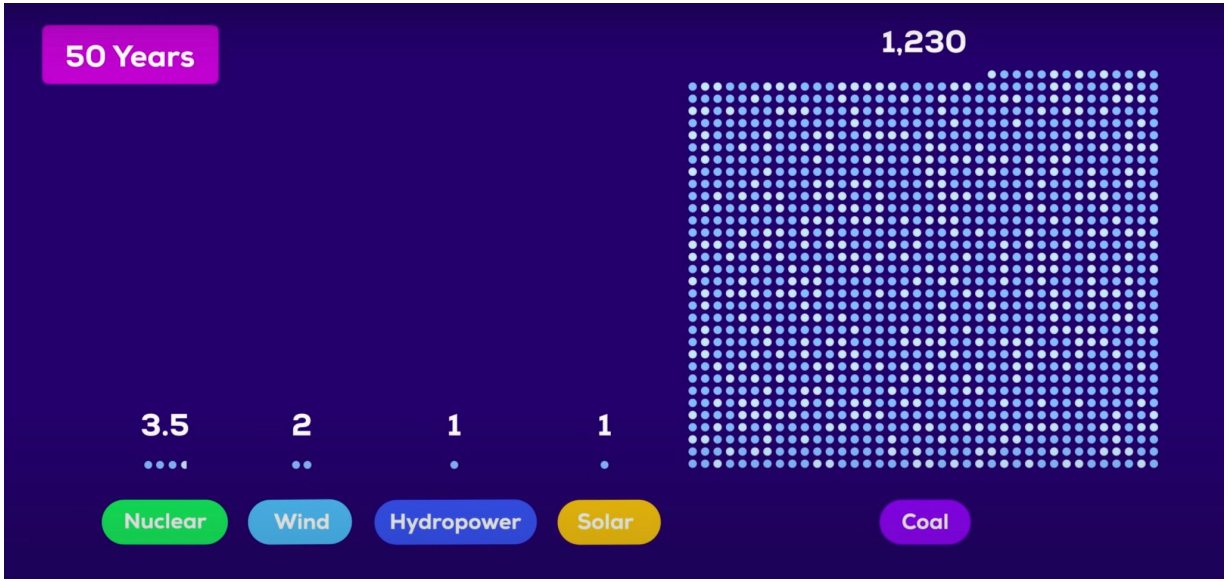
Anti-Nuclear Movement

- Nuclear power became an issue of major public protest in the 1970s.
- In the early 1970s, there were large protests about a proposed nuclear power plant in Wyhl, Germany. The project was cancelled in 1975 and anti-nuclear success at Wyhl inspired opposition to nuclear power in other parts of Europe and North America.
- Fossil fuel companies have been leading the recent push against nuclear power, knowing that they pose a serious threat to their industry
- Groups include Friends of The Earth International, European Nuclear Disarmament, American Petroleum Institute, etc.

Common Nuclear Misconceptions – Main misconceptions held by the public about nuclear power:

Nuclear power is not safe:
Many people still believe that nuclear power is inherently unsafe due to the potential for accidents or radiation leaks. While it is true that nuclear accidents can have serious consequences, modern nuclear power plants are designed with multiple safety features to prevent accidents and minimize the impact of any incidents.

Death rates from different energy sources per 1 terawatt hour:

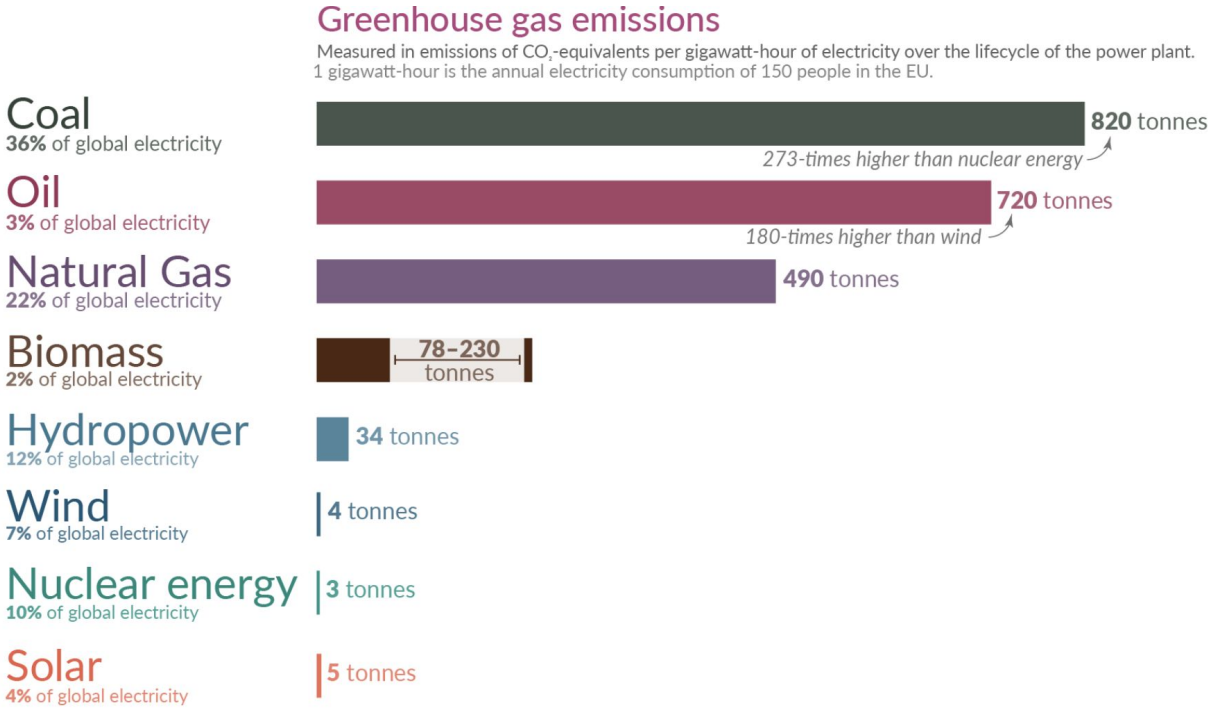


Our World In Data, 2020

Common Nuclear Misconceptions – Main misconceptions held by the public about nuclear power:

Nuclear power is not clean:

While nuclear power does produce radioactive waste, it is not a significant source of air pollution or greenhouse gas emissions. In fact, nuclear power is one of the most low-carbon energy sources available, and can help reduce reliance on fossil fuels.



Our World In Data, 2020

Common Nuclear Misconceptions – Main misconceptions held by the public about nuclear power:

Nuclear power is too expensive: The initial capital cost of building a nuclear power plant can be high, but over the lifetime of the plant, the cost of producing electricity can be competitive with other forms of energy. In addition, advances in nuclear technology have led to the development of smaller, more modular nuclear reactors that can be built at a lower cost. For example, the Breeder reactor type

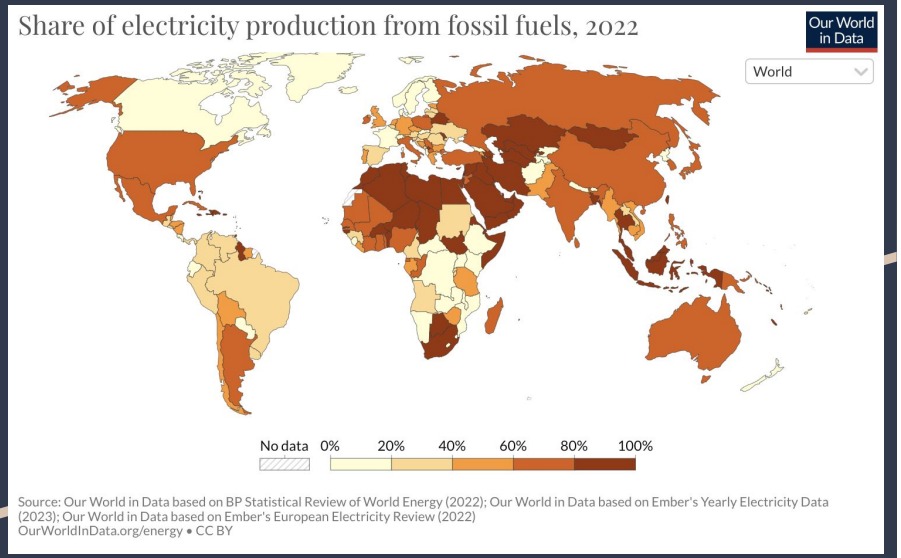
Table 1b. Estimated unweighted levelized cost of electricity (LCOE) and levelized cost of storage (LCOS) for new resources entering service in 2027 (2021 dollars per megawatthour)

Plant type	Capacity factor (percent)	Levelized capital cost	Levelized fixed O&M[a]	Levelized variable cost	Levelized transmis-sion cost	Total system LCOE or LCOS	Levelized tax credit[b]	Total LCOE or LCOS including tax credit
Dispatchable technologies								
Ultra-supercritical coal	85%	$52.11	$5.71	$23.67	$1.12	$82.61	*NA*	$82.61
Combined cycle	87%	$9.36	$1.68	$27.77	$1.14	$39.94	*NA*	$39.94
Advanced nuclear	90%	$60.71	$16.15	$10.30	$1.08	$88.24	-$6.52	$81.71
Geothermal	90%	$22.04	$15.18	$1.21	$1.40	$39.82	-$2.20	$37.62
Biomass	83%	$40.80	$18.10	$30.07	$1.19	$90.17	*NA*	$90.17
Resource-constrained technologies								
Wind, onshore	41%	$29.90	$7.70	$0.00	$2.63	$40.23	*NA*	$40.23
Wind, offshore	44%	$103.77	$30.17	$0.00	$2.57	$136.51	-$31.13	$105.38
Solar, standalone[c]	29%	$26.60	$6.38	$0.00	$3.52	$36.49	-$2.66	$33.83
Solar, hybrid[c,d]	28%	$34.98	$13.92	$0.00	$3.63	$52.53	-$3.50	$49.03
Hydroelectric[d]	54%	$46.58	$11.48	$4.13	$2.08	$64.27	*NA*	$64.27
Capacity resource technologies								
Combustion turbine	10%	$53.78	$8.37	$45.83	$9.89	$117.86	*NA*	$117.86
Battery storage	10%	$64.03	$29.64	$24.83	$10.05	$128.55	*NA*	$128.55

Source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*

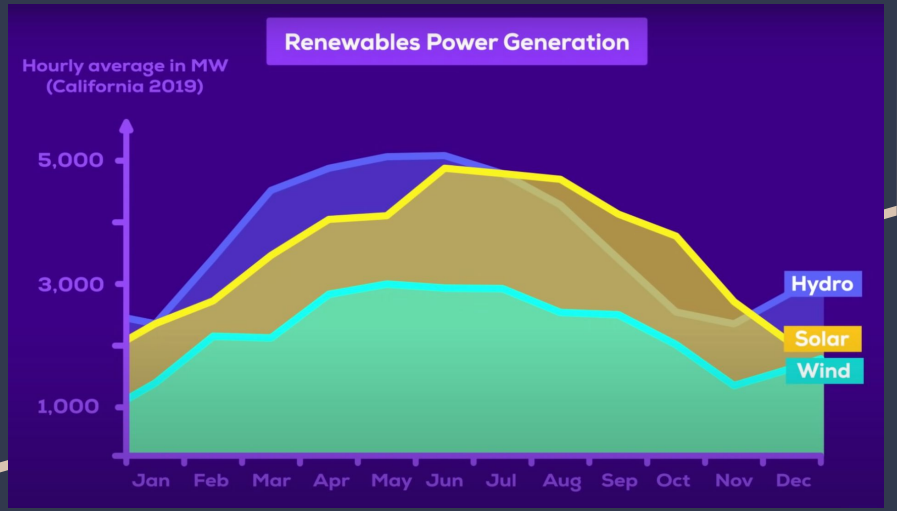
US Energy Admission Administration, 2022

Environmentally Friendly (Mostly)



- One of, if not the lowest contributors to greenhouse gas emissions
- If we look at the countries with the most low-carbon electricity in the world, they get most of their energy mainly from two sources: nuclear or hydropower
- Take for instance France and Sweden. 67% of France's energy comes from nuclear, making up the majority of their power mix. Sweden similarly has 30% of their total energy come from nuclear, with only hydro beating it out at 45%.

Practicality



Annual Report on Market Issues and Performance, 2019

- Giving up nuclear means turning back to fossil fuels; Germany and Japan are a few examples
- Reliability and consistency of renewable energy sources leaves the door open for nuclear
- Nuclear can and should be used as a stepping stone
- If preventing rapid climate change as quickly as possible is our goal, it might be a good idea to see nuclear and renewables not as opponents, but as partners.

Valid Concerns: Nuclear Waste

“Safe methods for the final disposal of high-level radioactive waste are technically proven; the international consensus is that geological disposal is the best option.” - World Nuclear Association, 2022

- The public opinion on the safety of nuclear waste disposal contradicts the scientific consensus
- There are three different types of nuclear waste, classified by their radioactivity: Low level waste (90%), intermediate-level waste (7%), and highly contaminated waste(3%).
- Until renewable energies are able to cover the complete energy demands of mankind, it is arguably safer to store nuclear waste for the time being than to inhale poisonous gases and promote rapid climate change
- New technologies: The already mentioned Breeder reactor can turn radioactive waste into new fuel

Other Concerns: Nuclear power plants are vulnerable to terrorist attacks

- Surprisingly common argument by the anti nuclear movement
- Nuclear power plants are highly secure facilities that are designed to prevent unauthorized access and protect against potential threats.
- The risk of a successful terrorist attack is extremely low, with very little attempts being made in the first place.
- Other critical infrastructures are also vulnerable to terrorist attacks

In Conclusion

Nuclear power has numerous advantages that make it a compelling option for meeting the world's energy needs. It is a reliable and affordable source of clean energy that produces low levels of greenhouse gas emissions. It also has the potential to reduce dependence on fossil fuels and increase energy security.