Nuclear Fusion

CPSG 200
Science & Global Change Sophomore Colloquium
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What is Nuclear Fusion?

- Atomic nuclei come together = energy
- Must be done under certain conditions
  - High density
  - High temperature
- Goal = Ignition
  - Self-sustaining

https://www.iter.org/sci/tkmkresearch
How is Nuclear Fusion Used?

http://science.fusion4freedom.us/nuclear-fusion-reactors/
Benefits of Nuclear Fusion

- Neutral carbon emission
  - Produces helium as a waste product
- Abundant fuel sources
  - Deuterium and tritium (hydrogen isotopes)
- Short-lived radioactive waste
  - Radioactive plant components can be recycled or disposed of within 100 years
  - Similar in waste volume to a nuclear fission reactor
Benefits of Nuclear Fusion

● Fuel to energy efficiency
  ○ D-T fusion event: 17.6 MeV compared to U-235 fission event: 200 MeV
  ○ “100 kg of deuterium and 3 tons of lithium to produce the same amount of energy as a coal-fuelled power using 3 million tons of fuel”

● Safety
  ○ Small amount of fuel present at one time
Costs of Nuclear Fusion

- $3.5 billion for National Ignition Facility
- $17 billion for ITER construction
  - International nuclear fusion research project
- 7 major countries collaborating
  - Europe: ~45.5% costs
  - Other countries: ~9.1%
- Real costs for energy:
  3 cents per kilowatt hr

https://www.iter.org/newsline/-/2128
Criticisms of Nuclear Fusion

- Increased chance of radioactive contamination
  - Nuclear waste is hazardous to environment
- Expensive infrastructure
- Time required to construct nuclear fusion plants
- Requires material that can withstand extremely high heat
Summary of Nuclear Fusion

- Potentially large energy creating source
  - Fuel source in abundance, potentially can create more from water and lithium
- Extensive theoretical research, practicalities in question
- Potential dangers of radioactive contamination
- Large amounts of engineer and research work required in order to facilitate this alternative energy source.
- More of an ideal, futuristic method of energy generation than an idea that can be implemented now.
References

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Questions?