

Hydrogen fusion for sustainable energy

Research Question:

How can hydrogen fusion for the effective production of electricity become a major energy source in the United Arab Emirates?

Situation:

The universal demand for energy is increasing in modern society. We rely on energy for almost in everything in our lives.

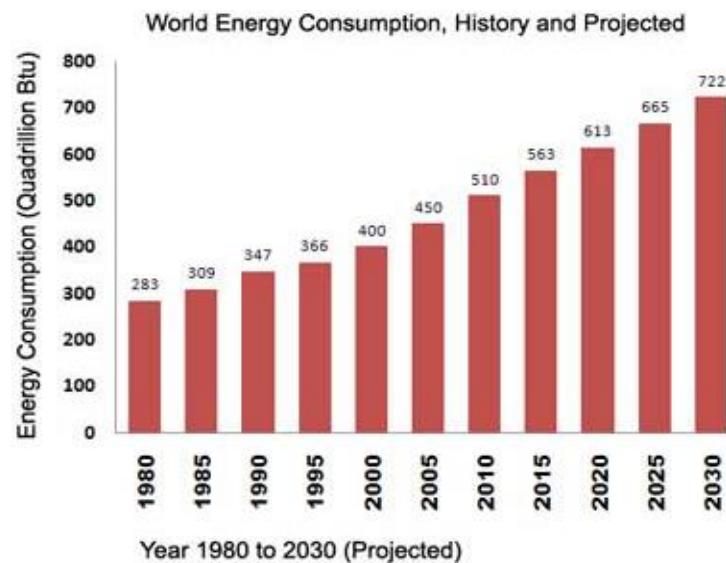


Table 1: World Energy Consumption [1]

This energy may be generated from fossil fuels. However, fossil fuels are insufficient and harmful to the planet.

Researchers have developed some sustainable energy sources such as, wind, water and solar. As a matter of fact, these sources are not efficient. One solution to this problem is hydrogen fusion.

What is Hydrogen Fusion?

Hydrogen Fusion is the opposite of fission. Hydrogen Fusion happens when two hydrogen atoms combine to produce one helium atom which releases high amounts of energy, which comes in the form of heat.

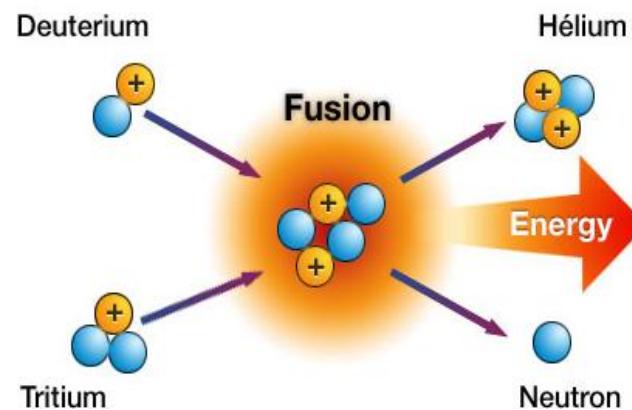


Figure 1: Deuterium-Tritium (Hydrogen) Fusion [2]

Problem:

1. The formation of Hydrogen Fusion occurs at a considerable high temperature
2. Cost is the main issue that challenges Hydrogen Fusion

Solution:

1. The further research of plasma could help us find new properties that may let us achieve the required temperatures for Hydrogen Fusion to occur
2. Cold fusion can be conducted at room temperature. Although the process releases lower amounts of energy compared to the normal Hydrogen Fusion.
3. a) Hydrogen Fusion may have high costs but it costs around a normal nuclear plant. The International Thermonuclear Experimental Reactor (ITER) has almost the same cost as the nuclear plant being built in Abu Dhabi
3. b) Maintenance costs are relatively low as the waste is significantly smaller than that of the waste of a normal nuclear plant

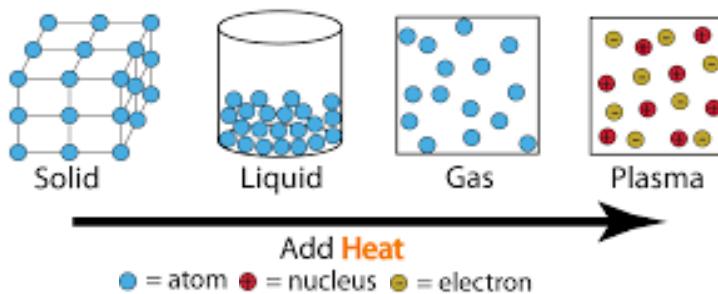


Figure 2: States of matter [3]

Evaluation:

The magnetic confinement fusion will be used to contain the high temperature plasma from escaping the reactor. It uses high superconducting metals to produce high magnetic field to achieve the confinement. (cryogenic cooling)

Other than the other types of fusion process using the deuterium-tritium (DT) fusion reaction is the best option since the fuel is abundant and it releases high energy and temperature for plasma to occur.[4] DT fusion reactors use heat engines (turbines) to produce electricity because it's the simplest and cheapest way to assemble and build.[5]

The cost of such project will in the range of \$10-\$20 billion which is much cheaper than the \$50 billion nuclear fission reactor being built in the UAE.[6]

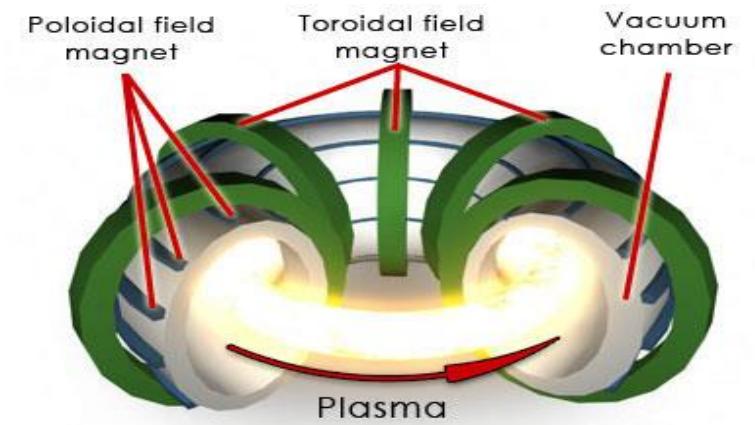


Figure 3: High temperature plasma circulating the reactor [7]

References:

- [1] Richard John, World Energy Consumption, June, 2010 <http://www.confusedaboutenergy.co.uk/index.php/world-energy-issues/energy-consumption-worldwide#.WCXyNXdh2CQ>
- [2] ITER, Understanding Fusion, 2015 <http://fusionforenergy.europa.eu/understandingfusion/>
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- [4] Fueling the Fusion Reaction, ITER, <https://www.iter.org/sci/fusionfuels> 09-Nov-2016.
- [5] How do we turn nuclear fusion energy into electricity?, Vision of Earth, 2016. <https://www.visionofearth.org/industry/fusion/how-do-we-turn-nuclear-fusion-energy-into-electricity/>.
- [6] Nuclear Power United Arab Emirates, 2016, <http://www.world-nuclear.org/information-library/country-profiles/countries-t-z/united-arab-emirates.aspx>
- [7] How Nuclear Fusion Reactors Work, HowStuffWorks, 2016, <http://science.howstuffworks.com/fusion-reactor3.htm>.