Project Save Earth: Try or Die

The committee in was interviewing Ted Nelson on the status of the Tiny TED project. It was October 24, 2056, just another boring day for Ted. He was a nuclear engineer, the best known in his time actually. The profession of nuclear engineer in 2056 was immeasurably different from a nuclear engineer in 2006. It was such a time-consuming job that Ted didn't have time for a wife or family. He had been working on the Tiny TED project for 17 years and the committee wanted to make sure that their financial support of the project was worth it, all $27 billion.

As the committee went on with the relentless questions, it forced Ted to dig deep into his memories, unearthing some encouraging ones and some unpleasant ones. The committee asked Ted, "What made you get involved with the Tiny TED project?" Ted responded to the group of characterless drones of the committee, "Well, it all started with something called E85…"

George W. Bush was the president during the War in Iraq. The U.S. military unofficially defeated the Iraqi military. The Iraqis and people all over the Middle East stopped selling oil to the U.S. Panic swept all over America. Bush couldn't handle the stress of either seizing oil from the Middle East or finding a new source of energy, so he resigned and Hillary Clinton was elected as the first female president of the U.S. She won by a landslide because she made a very strong promise to find a new energy source for her beloved country. The car company GM developed, with some financial support from the government, an alternate fuel for cars. It was called E85. It was made from processing corn and adding some gasoline. This was the main source of power for the U.S. from 2010 when it first became used in power plants up to about 2018 when nuclear power became favored.

"Why do you think E85 went out of style and nuclear power became more commonly used?" a committee member asked Ted. Ted thought about it for a moment and then said, "One of the main reasons that E85 was developed was to decrease greenhouse gas emissions from burning fossil fuels. But when it failed one of its primary objectives by not decreasing greenhouse gas emissions, people began to lose confidence in it. It also was described as a temporary energy source by the government, so many people wanted an energy change that would reduce greenhouse gases emissions."

Ted had just gotten out of high school when scientists were becoming dubious about E85. He made it his goal in life to get rid of that uncertainty in energy sources and find a clean, cheap energy source for the entire world to use. Nuclear power was used in many countries for a considerable portion of their power generation. By 2020 (the year the U.S. went officially all nuclear), the U.S., China, and many European countries got 90% or more of their electric power from nuclear reactors. These nuclear reactors were powered by Uranium.

Uranium nuclear reactors didn't create greenhouse gas emissions, so the greenhouse gas level in the atmosphere finally started to decrease. People were skeptical of this huge-scale energy transition, but there were designated nuclear waste dumps in a few locations scattered throughout the country which kept the waste so far down into the earth, that they could not harm any living organisms on the surface. Those designated waste dumps made people feel secure about the transition to nuclear.

"You must have not liked Uranium power that we transitioned to, seeing as you built a reactor that was much better in every way except size and cost to build," a toneless voice of a committee member asked Ted. "What did you have against them?" Ted wondered why politicians had to be so ignorant and ask him questions that a kid could answer. He replied unwillingly, "Uranium reactors had side effects that most people didn't know about: the waste material produced by the reactors emits very harmful radiation that can alter the DNA or other crucial parts of plants and animals. The world was soon to realize the real significance of this harmful side effect." The man who asked him the question said, "But that crisis was an effect of bacteria." "No," Ted said. "You were misinformed by the very government you work for."

The rain forests of South America and Africa were being cut down and destroyed by humans for a very long time. Not just in these rain forests, but all over the world, strange things began to happen about 3 years after nuclear power became widely used. This widespread catastrophe started when engineers who worked at nuclear reactors noticed that fall was coming early in June of 2021. Ted's father was one of these nuclear engineers. Ted heard from his dad that the plants around the reactor complex where he worked were turning mainly hot pink, in the middle of the summer. Some radiation had gotten past the shielding of lead walls and leaked out into the world. When biologists examined the pink bushes from near the reactor, they found that the radiation had severely altered the plants. The chemical that plants used to use the sun's rays to produce food for themselves had been chemically altered from chlorophyll (which was green) to what they called flurophyll (which was pink). Similar occurrences were reported after a few years of use from reactors all over the world. Ted wasn't too happy that efforts to fix this problem and find yet another major energy source weren't accelerated enough. Eventually, the pink plants reproduced and sent pollen into the air. The flurophyll turned out to be almost like a poison for plants. The pink spread with 100 times the speed that was estimated by biologists.

Within 6 months, the fission products that were leaking from reactors went into the atmosphere and drifted all over the world emitting so much radiation, that all plants were altered. The substance known as chlorophyll ceased to exist, and everywhere it once existed, it was replaced by that annoying hot pink flurophyll. All of the plant species in the world turned pink in their leaves and anywhere else that they were green. That set Ted off. He then made it his goal in life to rid the science world of its simple yet devastating errors of calculation and common sense and find some divine energy source that could save the planet once and for all.

WAY back around 2006, when people heard the word "nuclear," they relate to the kind of nuclear reaction called nuclear *fission*. Nuclear *fission* is the splitting of an atom to release energy in the form of heat, light, and gamma rays. This was the type of nuclear reaction used in the nuclear bombs dropped on the Japanese cities of Hiroshima and Nagasaki during WWII. Somewhere along the line, Hydrogen bombs were developed which consisted of nuclear *fission* device that generated enough heat to cause hydrogen atoms to fuse together in the nuclear reaction called ***fusion***. This new *fusion* bomb released almost 1000 times the energy of the Hiroshima nuclear bomb. If this new type of nuclear reaction can be contained and controlled safely, then it will solve the world's energy problems on the spot.

Nuclear *fission* is not too hard to achieve. Rods made from Uranium are bombarded with neutrons which causes the atoms to split and give off energy. Nuclear ***fusion***, on the other hand, is incredibly difficult to achieve. The atoms of hydrogen that are needed to fuse need to come within 0.000000000001 mm of each other, but since they are both charged positively and opposite charges repel, the atoms push away from each other with great force that is hard to overcome. The fuels needed for a nuclear fusion reaction are 2 isotopes of hydrogen, that is, hydrogen atoms with extra neutrons. One of them is deuterium, (an isotope of hydrogen with 1 proton and 1 neutron), which is fused with either tritium (another isotope of hydrogen that doesn't occur naturally and is radioactive which has 1 proton and 2 neutrons), or other deuterium atoms. When deuterium is fused with more deuterium, the new atom is Helium-3 (an isotope of helium with 2 protons and 1 neutron). 2 Helium-3 atoms combine to form a Beryllium-6 atom (an isotope of Beryllium with 4 protons and 2 neutrons) which almost instantly decays into a helium-4 atom (normal helium with 2 protons and 2 neutrons). When deuterium is fused with tritium, the new atom is Helium-4, so it skips all of the other steps. When Ted first saw all of these complex steps and other information about nuclear fusion, he almost quit studying physics to enter another field (working at McDonalds looked more promising than nuclear fusion), but somehow he kept himself going and went on to be very successful with his nuclear fusion project.

Ted researched nuclear fusion for 6 whole years. The government found out about what his goal was and he was appointed as the head of Project Tiny TED: Tritium Entwining with Deuterium; "Tiny" because the reactor itself would likely be around 10 stories tall, (no relevance to the head of its project of course…). The Tiny TED project was put together in March of 2029. It was the most challenging, limit-pushing, stressful, impossible task ever given to a scientist. Ted had to work with various types of scientists for 17 years straight. They investigated all of the ways that fusion could be achieved. They came up with a way to contain deuterium plasma and tritium plasma using extremely powerful magnetic fields. The extreme heat that the plasma has causes the atoms to move so fast that they can overcome their repelling charges and fuse to become… **HELIUM!** A test of this kind of reactor didn't occur until 2042, but it was incredibly successful. The government was elated to see such results and gave the Tiny TED project a grant of $24 billion to get a full-scale reactor built and fully functioning. Finally… In 2049, the Tiny TED hydrogen fusion reactor's construction was completed in Tusken Crest, NV outside of Las Vegas. The reactor exceeded its

expectations unthinkably. It generated enough power to support the entire West Coast of the U.S. Ted was appointed as the head supervisor of the Tiny TED staff which consisted of 2,368 workers, engineers, supervisors, and any little job that might need to be filled.

The committee never really knew about what the reactor was like, so hey asked Ted. Ted took a deep breath and spouted out, "The reactor consists of a huge hollow cavity that resembles a doughnut with a flat inside of the hole. The hydrogen plasma circles around inside the cavity at incredible speeds. Normally it would melt off the sides of the reactor core, but there is a super magnetic field that keeps the hydrogen plasma inside the cavity where the atoms fuse. There are then many parts that are used to harness the energy released, channel away the waste products, generate magnetic field, add more plasma fuel, and countless other tasks."

Once Tiny TED was built, the lifestyle of the world changed entirely within 5 years. Eight more reactors identical to Tiny TED were built in the U.S. which generated enough power to support the entire nation with a surplus unconsumed. The U.S. built many fusion reactors all over the world in countries such as China, Japan, Britain, and many other countries in Europe, especially France who had been using nuclear *fission* reactors for most of their power since the 2000s. That willingness of the U.S. to help the world in any way they could and Ted's drive to succeed saved almost all animal species, including those fragile *Homo sapiens,* from certain extinction. The surplus of power in the U.S. gave companies a lot of room to grow and advance technologically, **especially** car companies.

Ted thought that the committee had heard enough about the reactor itself. He asked them, "You need to know how contributive the reactor is to society." He paused and thought how to put it in Nuclear Fusion for Dummies format and then began with, "Now that you know Tiny TED, meet his children: *transportation*, *innovation*, and *surplus*. You have heard Tiny TED's story, now listen to his children's."

"*Transportation* pulled off a 64-foot technological triple jump from the 2000s to the 2050s (it beat the previous world record of about 60 feet which was held by a human). The triple jump is a track & field event that consists of a hop, a skip, and a jump. In the 2000s, almost all cars were powered by gasoline. The hop threw cars to E85 from gasoline in the 2010s. The skip bounced the majority of transportation to electric power in the mid 2020s since almost everything was run on nuclear fission reactors which only generated electricity. Even though these changes made transportation healthier for the environment (except for the fact that ALL THE PLANTS IN THE WORLD WERE HOT PINK!), the speed factor was never greatly changed. People had more things to do, more appointments, more meetings, more soccer games, more track meets, more, **more**, **MORE**, **MORE!!!!** The final jump part of the triple jump in the late 2040s and 2050s shot transportation to the sky, literally, to help satisfy the demand for **MORE**.

"Tiny TED's other 2 children, *innovation* and *surplus*, combined to make an astonishing change in how people live their lives. When the U.S. had 9 more fusion reactors built, there was such a *surplus* power that car companies figured that they could put it to use. Cars had always conserved energy and space by moving on the ground and using gravity to its positive side. But now that those limits were considerably decreased, car companies looked to the sky where road space was limitless. Since resources were so ample, mainly electricity, practical, flying, *innovation* developed distorted-bubble-like aircraft that were about the size of a minivan. They were basically the new form of flying transportation that most people could afford. These new *flying bubbles* earned the name of flubbles. You all know what flubbles are, right?" The committee all nodded their heads like dazed robots. Flubbles were affordable for anyone who could afford a car. They utilized the *surplus* of electricity from the fusion reactors to power the craft. Flubbles were powered by was an immense propeller incased in the bottom of the craft to provide upward lift and two jet-like turbines incased in the back of the craft that gave it forward or reverse thrust. There was also a small turbine on each side of the front to steer the flubble. When it was going fast enough, the bottom propeller would cut out and wings would extend from the side enabling faster speeds. Computers that operated at breakneck speeds were in every single flubble and were linked wirelessly to numerous stations on the ground that regulated imaginary air roads to prevent collisions. They were also linked to every other flubble in their area to avoid having their paths cross. These flubbles turned out to be extremely popular and reliable.

As if the committee wasn't sufficiently amazed with Tiny TED's capabilities, Ted then went on. "You all remember when the Chinese Pacific Naval Fleet attacked Pearl Harbor in 2051, right?" The committee nodded their heads. "Well, the Chinese fleet found that the whole American Pacific Fleet was 620 miles away practicing tight maneuvering and formations. The Chinese then made a hasty retreat West. The American fleet received word of the Chinese and began the pursuit. The American battleships, destroyers, and aircraft carriers sunk the entire Chinese fleet before the Chinese had traveled 200 miles. The American ships went 3 times as fast as the Chinese ships thanks to some modifications suggested and strongly supported by me.

"After Tiny TED was developed, we created a new type of experimental reactor that fused deuterium with deuterium instead of deuterium with tritium. These reactors were smaller on average, so we installed a reactor on the battle ship U.S.S. Vermont. The reactor provided so much power that the ship could move at astonishing speeds. They never need to be refueled either, since deuterium can be extracted from seawater. A water molecule consists of 2 hydrogen atoms and one oxygen atom. Some of those hydrogen atoms are deuterium which is extracted and fed into the fusion reactor. So gentlemen, as you can see, the fusion project has influenced our lives in many more ways than you might have thought."

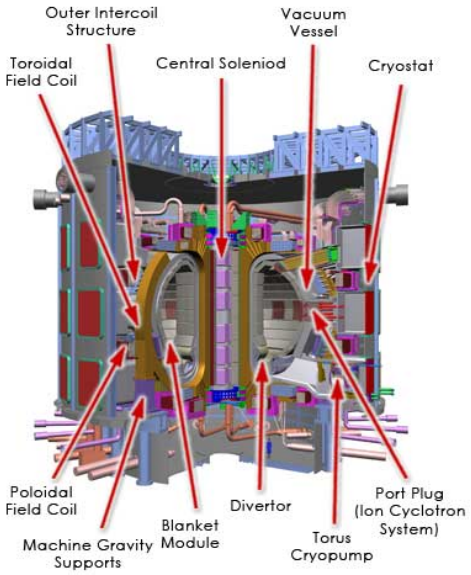
The committee members came to a decision when they heard how important Tiny TED and the other in 9 full-size fusion reactors are to society. They gave him more funding to do whatever he wanted with the fusion reactors and their technology. Whether he wanted

to improve them or build more of them, they didn't want him to have any financial limits. He was happily dismissed from the committee hearing with a check in his pocket for $20 million more to spend on anything he might need.

Ted flew his Lamborghini Trescablo flubble all the way across the country from Washington D.C. to the Tiny TED reactor in Nevada in 15 minutes (42,376 horsepower can get you places). He went through the rest of a normal boring day every day that many people always pulled through: tests, checks, readings, reports, and annoyances that he didn't have before the reactor was built. Ted knows how important his job is (he had better know if he is making $2 million a year), but he got discouraged when he saw the list of all the events he had missed in half a day. It had never quite hit him, but he realized that he had accomplished his goal and saved the world. He glanced at the 44-page report of the reactor test sitting mockingly on his desk. He then got right to work on reading it all. He took a deep breath and said to himself, "I love my job."

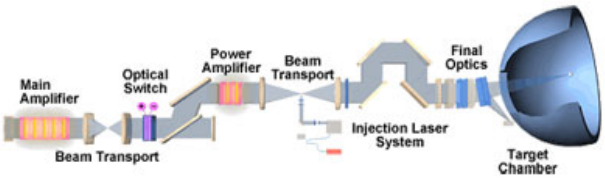
Afterword

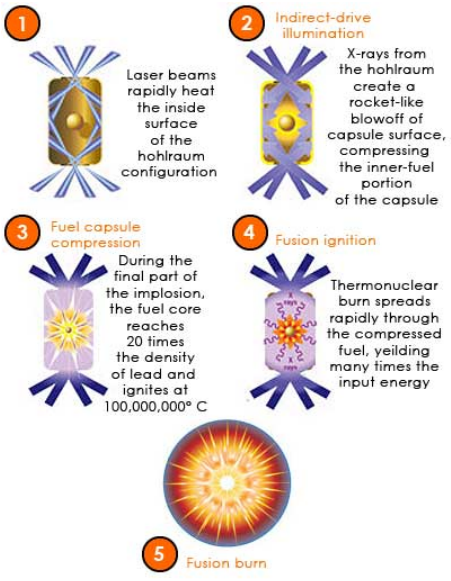
I learned so much from writing this essay. Getting a physics degree and finding an alternate energy source for the world to use is something I might do in my life. It was great to have a way to express how I thought about this matter. I learned so much about the physics of nuclear reactions that many people could care less about, but now I feel a step ahead of everybody.



My story starts with a scientist being interviewed by a government committee on the status of his nuclear fusion project. He tells them the story of how energy sources have come a long way bouncing between a few energy sources. He shows them how the current technology affects their lives so much in ways that they would never notice. They decide to give him more money to spread the technology to get the whole world to use this new clean source of energy. Ted goes back to work and realizes that even though his job can get stressful, he loves it and likes saving the world.

I don't have any idea how much money the nuclear fusion project would cost because I don't know what kind of funding that project would need or how much the government would support it. My best guess is not very educated in my opinion: from $250 billion to $300 billion is what I think would end up going into the project.





I got my information on nuclear fusion from the following website: http://science.howstuffworks.com/fusion-reactor.htm. That website told me everything I needed to know about these fusion reactors that could save the world.