Fusion Confusion

By Clark M. Thomas

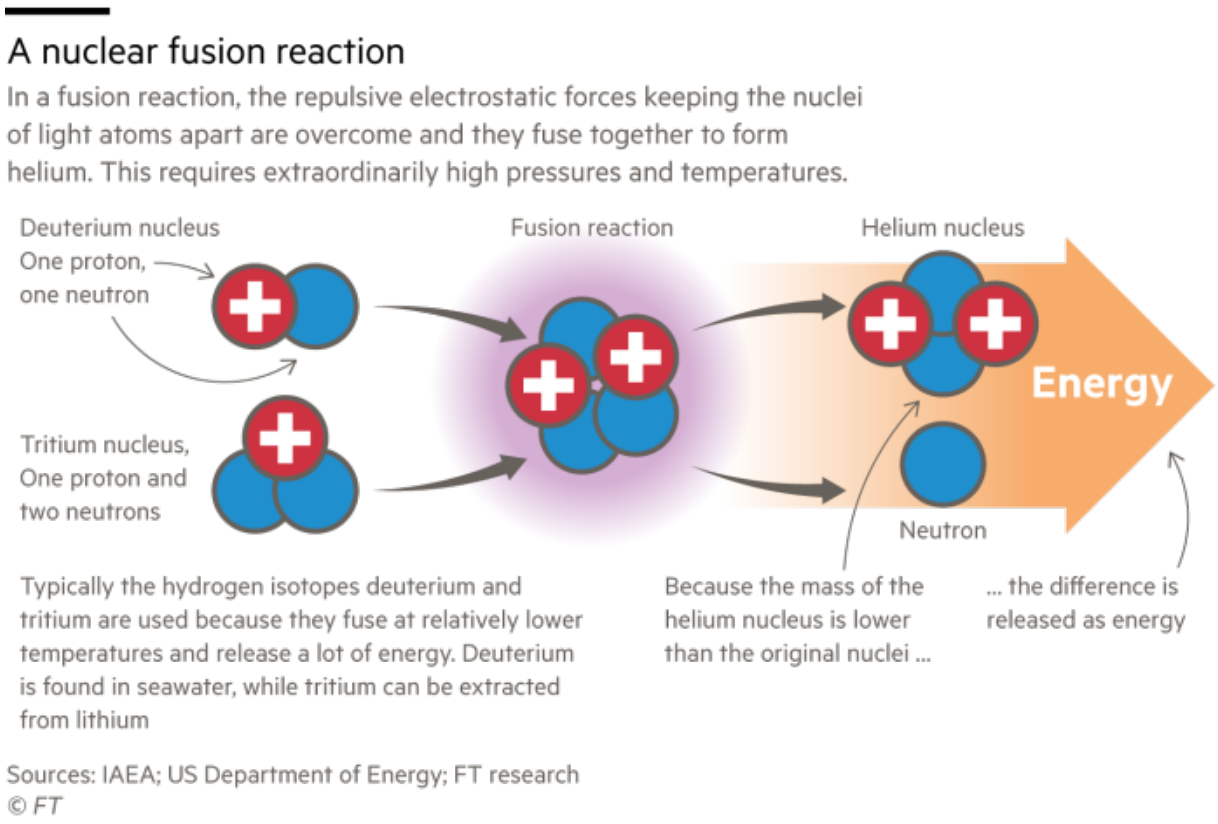
Abstract

With the latest hyped "breakthrough" in controlled nuclear fusion reaction, it is predicted by those who have a financial interest in such research that we could fairly soon enjoy clean, abundant electricity in unlimited quantities. Will this fusion technology help solve our biosphere's dual "population" and "heat pollution" crises soon enough to make a real difference? Or will today's techno-hype yield more confusion over humanity's prospects for survival?

After decades of trying to replicate solar core thermonuclear energy by fusing hydrogen atoms with lasers, a net-positive fusion reaction has been achieved at a tiny target on a laboratory scale. Research scientists used multiple lasers to yield slightly more fusion energy from a tiny target than was directed to the target itself. This was the "experimental breakthrough." Basic nuclear science has long understood the fusion challenge. Factor in the vast amount of "outside" energy that was needed to power up and precisely direct several laser beams toward their target.

Where do we go from here in the real world? This essay is not a physics how-to-do-it essay. You can visit links from within this essay for a deep dive into the science itself. I will nevertheless cover some basics herein, if you choose not to dive deeper. The purpose of this essay is to go behind and beyond the breathless media headlines around this modest, predicted "breakthrough."

Fission and Fusion Reactors



The realities of nuclear physics have been there to discover and use, even to our ultimate peril. The basic equation, E=mc^2, is well known, at least superficially. It is much more than a coat hanger for interesting theory. We can mathematically perceive the equivalence of energy and mass therein.

We can even infer physically how the speed of light (or "c") in a vacuum is derived from the basic matter/energy equation from over a hundred years ago, with one clarifying modification. That one modification points to a foundational change in particle and field physics: The real "baby revelation" is not the experimental fusion power bump currently hyped – but envisioning the "yin/yang" matter/energy, sub-Planck, spherical particle chains that underlie all physics, including fusion energy generation.

Current nuclear power stations are all fission technology, with the same science we used on WWII Japan. Reactors range from old Soviet plants, to new fission designs promoted by Bill Gates. Fusion reactors, by comparison, were conceived several decades ago. Only now have laser technology and the many research billions started to point toward future practical results.

What will it take to raise today's "fusion baby" into a spiffy college graduate? Will its eventual "graduation" really change the future *survival equation* for our species, and for the survival of millions of other innocent species who must follow us into heating hell? Can today's greedy but scared human populations learn to seriously distinguish between *biosphere takers and caretakers*?

Simultaneously, other types of fusion energy generation are being explored, mostly along models of *magnetically confined plasma*. These experiments are in some ways more advanced in Europe than the laser technology favored in American labs; and also less likely to ever make it to your future energy grid. I won't spend time in this essay on the differences among fusion visions and technologies, but you can deep dive here for a very excellent discussion from an unbiased expert.

Hype Versus Reality

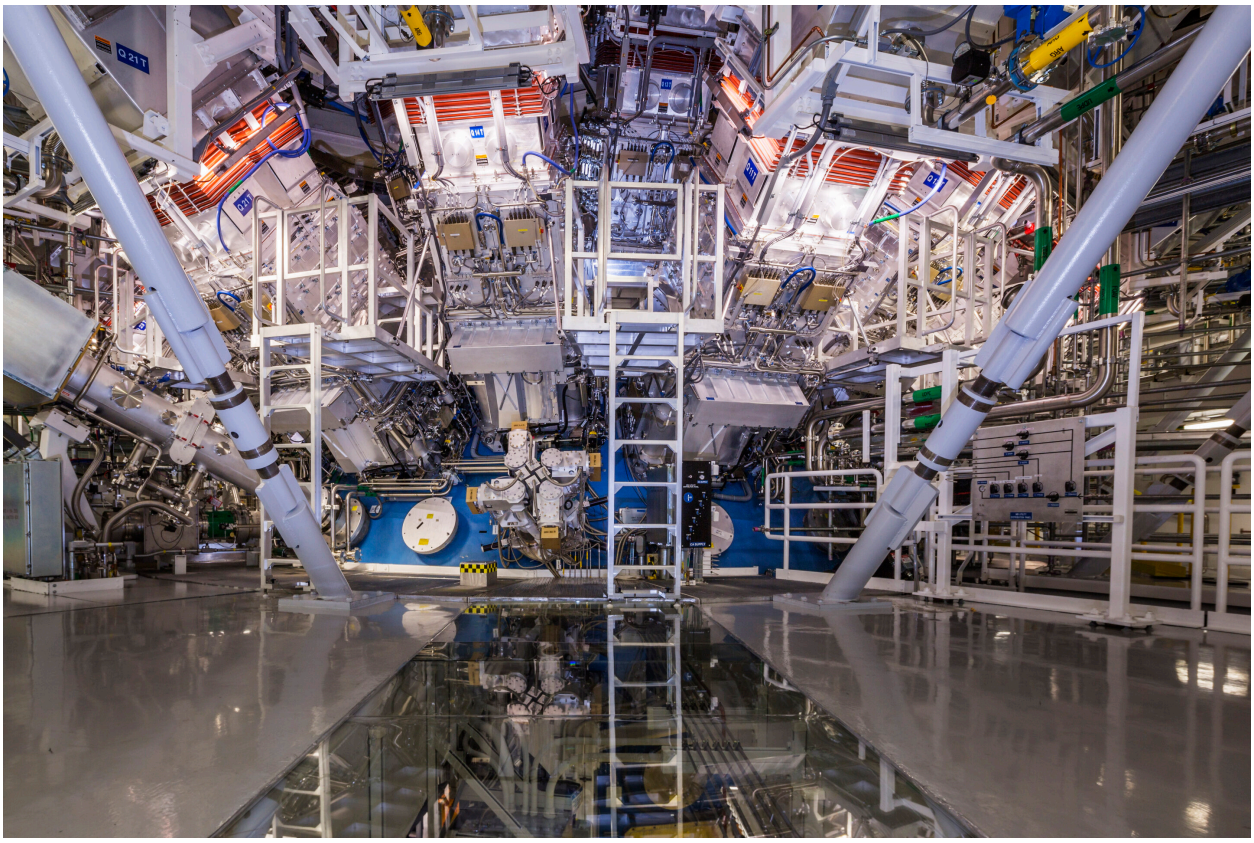
We should not be seriously talking about preparing to visit, then colonize, Mars with many billions of taxpayer dollars. This interplanetary exodus fantasy is funky reality, and I am carefully speaking as an avid astronomer of some sixty years. If going to Mars were the only way to soon save our biosphere, then a blank check would be OK. Meanwhile, won't the new nuke energy be "too cheap to measure," as was claimed in the 1950s?

Earth is today similar to a rubber band increasingly stretched, while decision makers chase experimental rabbits into holes that may be our collective graves. Weird global weather from 2022 will only accelerate toward a nasty new normal extremely hostile

to advanced life forms. The onrushing "boiling new normal" will persist on its own for many centuries. *Weather* extremes today foretell cascading hot *climate* changes supercharged by out-of-control greenhouse gas *positive feedback loops*.

Nevertheless, there are still things we could do to somewhat help our biosphere, starting now, which may help stave off global disaster, so that by the 22nd century we might engineer and enjoy fruits of our wisdom. Though it's unlikely we Stone Age humans in modern clothing are psychologically capable of acting wisely in the near term, the path of wisdom is much better than sending vanity arks to Mars to save our remnants. There is no Plan B, because there is no friendly Planet B.

Breathless media hype over sexy fusion reactors typically is accompanied by one or more fantastic photos of truly exotic machinery. Here below is only part of the laser array needed to slightly ignite a tiny pellet of hydrogen:



Not long ago Big Physics awed and mystified funding sources with similar fantastic images of parts of the Large Hadron Collider. That visual hype was served up to secure many more billions for the goal of reaching a better grasp on the foundations of physics. They missed their physics target with their puny design, and have little to show for many years of ever larger colliders that are still far too feeble to capture the real mass/energy foundational level of physics.

For example, the LHC could not prove supersymmetry. I will soon write a thesis that shows how it does work, at least on local scales. Charge for this correct model will be zero.

Indeed, the enticing discovery of the Higgs boson has since disappointed. Years ago I explained what it is, and is not, and within the proper context. Again, charge for that truth was zero.

Real Energy Allies for an Existential Crisis

Media people are free to hype anything for corporate profits. Scientists and decision makers cannot play with fantasy when the clock is ticking toward where we run out of easy, possible fixes.

We now look at some of the ways we can best remediate within currently approved technology. Each technology has both pluses and minuses. It is most likely that an orchestrated variety of technologies will be needed both soon and after climate change challenges the vitality of established social structures.

– Conservation –

Conservation, including insulation, is the most obvious way to produce more *net* quality energy for our needs. In every time and place conservation has its utility. Some conservation still uses carbon energy, such as most of today's electric vehicles using electricity generated by coal-powered plants.

The field of conservation includes the embrace of heat pumps that cost less to run. Weatherized structures can become more energy efficient. The list of ways to use less potentially polluting energy is long and well known. Of course, conservation is only one part of the wise equation.

– Solar, Wind, Tidal, Geothermal –

All of these technologies are both old and new. Eventually, solar energy from the Sun will produce a strong portion of the world's energy supplies, not just food. On the down side, most of these alternate sources of energy are subject to fluctuating light and dark, and seasonal cycles. Clouds alone limit solar panels at irregular times. Storage batteries aren't cheap. While today's tropical and temperate zones become more challenging, billions will migrate toward both poles. Polar lands are subject to poor solar flows at the very time people need the most lights and heat.

Storage of cyclical energy is a challenging opportunity. Lithium batteries can work in some applications; but lithium is a fairly rare battery element, and such batteries need to be regenerated after a number of years. No form of energy storage is a climate panacea, but storage and conservation are natural allies for us. There are additional storage technologies, but this short list covers most of what is affordable and available now at scale.

Solving The Greatest Energy Challenges

The greatest challenges for any type of nuclear or conventional power plant are not within the generation itself. Energy grids need to affordably get their power to residential and commercial customers without losing much along the way. Some waste is OK in today's coal, oil, gas, and large nuclear generation world. That waste will not be OK in the brave new world we will inhabit.

Envision a large water bucket with several significant leaks. It may be possible for water to be transmitted by one such bucket (or power line), but still not very far. It would be possible to

affordably get the same amount of power to fairly distant customers if only the bucket did not leak. In this case, we are talking about superconducting cables, something that has never been created in laboratories except very close to absolute zero. Such a requirement forbids superconducting cables in the real world for long distance power distribution.

As billions flee rising sea levels and areas where farming was efficient, there wlll be radical shifts in urban areas. Each large nuclear plant, fission or fusion, will cost billions of dollars, and take decades to build. Such plants will not be practical and affordable away from significant urban populations.

Smaller power plants and lower distribution costs will still be needed away from both surviving and new large metropolitan areas. All of the problems associated with affordable power generation and distribution beyond conservation and renewable energy 24/7/365 will be helped by adding more appropriate energy generation choices to the mix.

Synergetic Population + Pollution

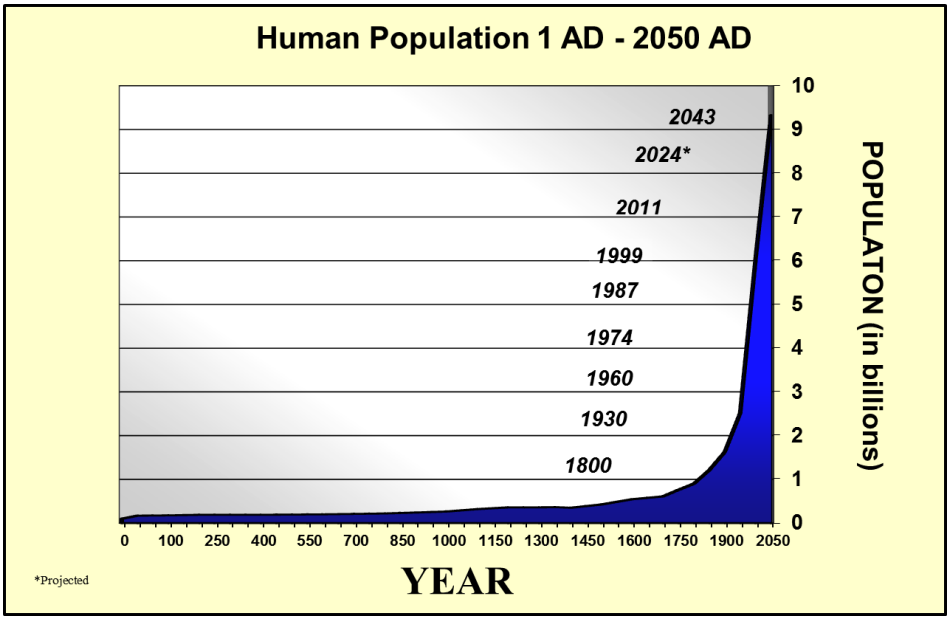
During most of our naked ape species' evolutionary existence net global population hardly changed, averaging well below one billion. Even though the average female had multiple births, morbidity and mortality rates were sufficiently high to keep our numbers in harmony with our varied habitats. This is how the natural world works, and you can easily observe this dynamic harmony among and within wild species in your locality.

The graph below shows what happened beginning around 1750, when the Industrial Revolution began in England with coal and industry helping the crown collect colonies. Move forward to a mere decade ago, when the global population was seven billion. Now it just turned to eight billion, along an accelerating curve. Just after 1750 the world's population of *Homo boobens* (H.L. Mencken's term) was at one billion.

People love to turn fantasies into visions of self-serving reality. One of the primary social fantasies is *the theory of mercantilism*. Basically, the more population a big country such as France or Germany has, the more powerful its armies could be. That old theory still resonates in Russia, as would-be Tsar Putin shovels conscripted cannon fodder onto the fields of slaughter.

The Reverend Thomas Malthus in 1798 introduced what we know as *Malthusianism*. He said population tends to increase *geometrically*, while resources tend to increase *arithmetically*, over the long run. A grade school analysis of what will happen within a finite global biosphere yields the inescapable conclusion that the piper must be paid. Malthus said there are ways to avoid global disaster: Chief among these are church-approved sexual abstinence, and "positive checks." *Positive checks* are unwanted mass deaths due to famine, war, diseases, and climate disasters.

The graph below shows where things are going in terms of sheer numbers. There is a synergetic element associated with post Industrial Revolution societies: the *Revolution of Rising Expectations*. When individual families have more to eat, and better health services, more of their progeny survive. Since most societies prefer large families, the positive-checks formula is now set for killer droughts, rapidly rising ocean levels, and so forth.



Technology Versus Time

It has become increasingly difficult for *the willfully blind* to claim that accelerating vector changes in our climate are normal variations in annual weather patterns. More people are accepting the idea that we humans are doing something that God didn't do earlier, except for some Bronze Age calamities. Going from mere "acceptance" to *timely effective action* is the great challenge not yet seriously contemplated or attempted on a *sufficient scale*.

In 1974 I wrote a seriously researched book manuscript, The American Eutopia, dealing with overpopulation. It was rejected by both trade and scholarly publishers. Trade editors said it was a scholarly book, and scholarly editors said it was a trade book. Their real objection was unsaid: They didn't consider the vast implications of Malthusianism to be a serious problem. Even I back then did not properly calculate the accelerating dynamics of greenhouse gases. Yes, there is a categorical difference between "geological time" and "human time." *Homo boobens* we all are.

The Bottom Line

We have belatedly come to the first decade of common consciousness for how serious our emerging crisis has become. Over billions of years nearly every large species has vanished, or radically morphed. We have been arrogant to assume that our own species must be outside this nearly 100% extinction formula.

I have no doubt that action will continue to be taken against climate change. Just this past month the American budget now has tens of billions of dollars for solar energy, heat pumps, and more electrical vehicles. Fine as it goes, but is this enough, and soon enough? Elsewhere in the world societies that are trying to emulate American prosperity, primarily India and China, are belching out huge quantities of industrial coal gases to satisfy dreams and needs of their billion-plus home populations.

Token efforts are being made to capture greenhouse gasses. Several technologies exist, but they are at best a side show to what is needed in the global perspective. There are also some noble recycling efforts, also of minor global significance. What is needed is not to belch out climate accelerants in the first place.

Since this essay was inspired by the perfumed vision of clean fusion energy, let me conclude that fusion is still very OK to develop for one form of preferred energy generation near large population concentrations – while we also admit we are *not now* doing enough to tame the immediate global climate danger.

If we procrastinate, dreaming of the future power of fusion plants, when new and safer variants of fission plants are already being developed by Bill Gates and others, critical ecosystem time will be wasted while the climate bomb escapes our control, then explodes by next century.

Let's instead turn the global heat bomb into a firecracker that scares, but does not devastate. We can do it globally, but only now with powerful remediation. Think of this strategy as a variant of the "ounce of prevention is worth a pound of cure." It may seem to a crafty few that more money is to be made going after the pound of cure. However, existence itself is at risk.

The key to global climate success will always be *doing enough soon enough* without delay, to avoid billions of innocent deaths in a century or two.

We are the supreme hyperkeystone species, and we therefore spiritually owe millions of additional species our very best efforts. By helping them we help ourselves. We all are souls clinging to the skin of a small blue ball floating in vast black space.