When the Lights Go Out
A Question and Answer Session
Wolff Bachner and Tom Tamarkin

2060 And Lights Out: How Will America Survive Without Oil [Inquisitr Special Report]

Imagine what your life would be like without electricity. No gasoline for your car; no oil for your furnace; no refrigeration for your food and no air conditioning on those 100 degree days. To tell you that your life would change would be, at best, a gross understatement. The simple truth is that, without electricity and the oil we need to produce it, you would probably be dead within a year, along with millions of your fellow Americans.

We depend on electricity and oil for our very existence. Without sufficient energy, there would be no transportation, no life support in hospitals, no food in the stores, and no airplanes in the sky. We would be forced to live in a pre-industrial world with six billion hungry mouths to feed in every corner of the globe.

This is not a science fiction story. It is the future we are all facing unless our leaders accept reality and stop chasing the “Green Energy” fairy tale. The world is rapidly depleting its usable oil reserves and at the rate we are going, there will be no viable oil left by 2060.

Mr. Obama and the environmental zealots would like you to believe that wind and solar power will solve our problems. They never bothered to tell you that all the alternative energy sources combined

will only provide about five percent of our energy needs, and even that energy will be many times more expensive than oil based energy.

While our leaders pursue a suicidal pipe dream and their crony capitalist friends line their pockets with your hard earned tax dollars, they are willfully ignoring the truth. There are alternatives, but they need to be developed in a national program on the scale of the Apollo Moon Project. If we continue to follow the path our current leaders have chosen, and they refuse to develop a national plan for viable alternative energy, the results will be catastrophic.

Fortunately, there are still talented Americans who are up to facing the challenges of our future. One of the most outspoken advocates for a new national energy program is Tom Tamarkin; the man who invented the smart meter. Tom is determined to develop a workable energy program for our nation and for the world. One that will provide long term, sustainable energy that won't destroy our planet and empty our bank accounts.

There is a frightening bottom line to all of this. When it is all said and done, who sits in the White House won't make one bit of difference if we can't turn on the lights, drive our cars or refrigerate our food. We will all slowly starve or succumb to disease and violence unless we unite together behind a sane energy policy. The time has come to begin, before it is too late and our lives become a downward spiral into complete chaos.

As a first step towards restoring hope and developing a viable energy program for our country and our planet, The Inquisitr invited Tom Tamarkin, founder & CEO of USCL and EnergyCite®, for a no-holds barred discussion. Listen carefully to what Tom is saying; our very lives, and the lives of our children and grandchildren may depend on it.

Q1: Tom, welcome to ***The Inquisitr***. You are here today to discuss a subject that concerns the very existence of our species on this planet. Despite all the misleading and overly optimistic claims to the contrary, the truth is that by the year 2060, all the planet's known reserves of fossil fuel will run dry. Before we begin our discussion about the depletion of the world's oil reserves and the fact that there is no current alternative energy technology other than nuclear fission capable of replacing oil, I think it would be useful if you gave our readers an insight into your background as an innovator in the energy industry, and as a humanitarian trying to build a better world.

A1:

Thank you Wolff. I would like to make one small modification to your opening line. I would prefer to say that by 2060 fossil fuels will no longer be economically viable to recover and distribute. More about that later. And, I would prefer to dive into the big issues now and talk about my background and motivations at the end of this article.

Q2: You claim that the world's usable oil will be depleted by 2060. When we look at a chart of the planet's 10 largest oil reserves, we see Venezuela, a country hostile to the

United States, at the top of the list. They are followed by Saudi Arabia, a religious theocracy that has been accused of greatly exaggerating their remaining oil reserves, while using their enormous income from oil to proliferate internationally the most intolerant and radical form of Islam by subterfuge and bribery. Canada, third on the list, has vast fields of oil sands that are expensive to extract and highly polluting. Certainly the overall picture is cause for concern, but what proof can you provide that we are going to use up all of the world's oil reserves by 2060?

A2:

Firstly let's review what oil or petroleum is and how it was formed. Petroleum is a liquid fossil fuel formed from ancient fossilized organic matter such as zooplankton, algae, and various other plants and even primitive animals. Hundreds of millions of years ago when the Earth was warmer than it is today and with considerably more CO_2 in the atmosphere, certain nutrient rich environments produced tremendous amounts of this material which fell to the sea floor faster than it could decompose into methane gas and the like. Later as the sea levels changed and the ground level rose and fell as a natural part of our Earth's dynamic ever-changing geology, many of these deposits were covered with sedimentary shale rock formations. Under the enormous pressure of the shale, these organic deposits were transformed into hydrocarbons through a process of hydrocarbon pyrolysis in part aided by endothermic reactions. In some cases the temperature of the deposits was lower thus creating various forms of coal and in other cases the temperatures were warmer thus creating natural gases like ethane, methane, butane, and propane.

Some readers may be reminded of the Russian theory which was developed in the 1850's known as the Abiogenic Petroleum Origin theory. That theory suggested that fossil fuels were not biological in origin; that these fuels are constantly created inside the Earth and hence are unlimited. Today that theory has been all but entirely disproven in the Western scientific community.

With respect to your question, the key word is "reserves." An oilman or economist would answer this question within the framework of terms such as Proven Reserves, Proven Developed & Proven Undeveloped Reserves, and Unproven Reserves, The United States Geological Survey uses terms like technically and economically recoverable. Additional terms are Unconventional Petroleum Resources which include extra heavy oil, oil sand, and oil shale. Generally speaking the total amount of unconventional oil resources in the world considerably exceeds the amount of conventional reserves. But they are much more difficult and expensive to extract, refine and distribute. And because of dangerous and environmentally risky recovery methods, this latter category is subject to many additional uncertainties involving government regulation especially in light of the United States recent statements regarding regulation of livestock emissions. And the above applies only to petroleum. We have the same issues in both coal and natural gas reserves.

So given all the ambiguities there is ample room for spin in projected depletion times. More often than not, the answer becomes a function of one's political viewpoint coupled with wishful thinking to support that viewpoint.

As an example here is an Energy Policy paper prepared by one of the presidential candidates campaign in the 2012 election (click here.) The paper is full of quotes from popular media publications and various think tanks sympathetic to the campaign's position. However there are virtually no energy facts, per se, citied.

I prefer to address the issue based on science as physicists would.

We do this by first determining what the total worldwide annual energy consumption is in terms of engineering or science units like a Joule (watt per second.) This combines all energy sectors like transportation, electricity, agriculture, potable water production and the like; i.e. everything that uses a source of energy. Then we look at the various forms of fossil fuel reserves and define them in total based in their potential energy once extracted and delivered. We do this for petroleum, natural gas and coal. We add these total available energy reserves and dived by the annual worldwide energy requirements. This gives us remaining years.

Thus the simple straightforward answer to your question is based on:

5.0×10^{20} Joules Total 2010 worldwide energy consumption.

6.9×10^{21} Joules Total estimated energy in worldwide natural gas reserves

7.9×10^{21} Joules Total estimated energy in worldwide petroleum reserves

2.4×10^{22} Joules Total estimated energy in worldwide coal reserves

3.88×10^{22} Joules Total estimated energy worldwide fossil fuel reserves

$(3.88 \times 10^{22}) \div (5.0 \times 10^{20}) = 77.6$ years best case.

So the preferred answer to your question is to say that technically & economically recoverable fossil fuels will be depleted in 78 years +/- 15 years. The principal unknowns here are the steep rate of increased energy demand now that third world nations want to become industrialized nations, the **P** or probability factor for unproven reserves, and just how much people can pay for energy before national economies collapse as a result of escalating energy prices.

To put this into perspective, it should be noted that the U.S. is number 12 on the continuation of the list of oil reserves you referenced in your set up. The U.S. has a proven reserve of about 26.5 billion barrels. That is 2.65×10^{10}. We use on average about 19 million barrels of refined oil products per day. That equates to $(2.65 \times 10^{10}) \div (1.9 \times 10^{7}) = 1{,}394.7$ days or 3.82 years.

Clearly, the U.S. could be petroleum independent soon and petroleum dry in the not too distant future.

Interestingly enough this comports with Sir Isaac Newton's writings in the late 1600s about "the end of the days as we know them now will begin after 2060." Perhaps that is the point in time when we no longer live on what material things our creator provided us like fossil fuels and we begin to live off the wisdom and knowledge our creator gave us by converting matter (from the Creation 13.7 billion years ago) to energy based on our understanding of science and how the universe works and as conveniently formulated by Albert Einstein as $E=MC^{2,}$ or Energy is equal to mass multiplied by the velocity of light squared.

Q3: The United Nations, all the major environmental groups, and many world leaders insist solar power, bio-fuel, and wind power are the energy solutions of the future. President Obama has given billions to alternative energy companies that are supposedly developing advanced solar cells, highly efficient windmills, numerous types of bio-fuel, and long lasting batteries. If we combine all the various existing alternative energy systems into a well-managed, coordinated program and continue to improve the technology, why can't we use them to replace oil by 2060?

A3:

I have not found direct comments by world leaders or even our president that the alternative green sources like you mention…bio-fuel, solar, wind, tidal/hydrokinetic, geothermal, traditional hydroelectric, and the like…can collectively produce anywhere near the total amount of energy currently produced by hydrocarbon fuels. What I have found are statement after statement that "alternative fuels" can provide the future energy requirements of the world. However, that could imply two things. One is a drastic reduction of the amount of energy consumed based in part on enormous worldwide population reductions of Malthusian like proportions to say significantly under 700 million people worldwide, as well as a significant reduction in the standard of living of most of the remaining population. The second implication is that another form of alternative and "green" energy remains to be discovered before we run out of fossil fuels and in time to save mankind based on a projected 2050 worldwide population of 9 billion human beings.

On the one hand the UN has promulgated its ***Agenda 21*** program and has pressed for "sustainability" whatever that means. On the other hand the seven member nations of the ITER project, the U.S., EU, Japan, South Korea, Russia, India, and China indicate an implicit recognition of the need to develop much higher energy flux density power generation sources; hence the International Thermonuclear Experimental Reactor or ITER project.

In December 2008 I met with former CIA Director R. James Woolsey and I asked him if he had seen any analysis of future energy supply and demand studies which defined the amount of total practical power which could be generated form the alternatives defined above as a percentage of total demand by 2050. He told me no. He knew of no such studies. I mentioned to him that our

company planned to engage a team to do such an analysis and he responded by saying "why would we want to do that?"

In this photo to the left, Former CIA director James Woolsey and Tom Tamarkin meet in December 2008 to discuss this energy issue

On April 28, 2009 I contacted President Obama by letter as CC'd to Harry Reid, Diane Feinstein, Nancy Pelosi, and Secretary of the Department of Energy, Steven Chu and mentioned to Mr. Obama the fact that I had this conversation with the former Director of the CIA and I reiterated the need for this analysis. The president responded with a letter to me dated July 14, 2009 wherein he failed to address the need for analysis but did indicate that he would continue to advocate for wind, solar, bio-fuels and more fuel efficient cars.

I believe the response of President Obama is very symptomatic of the lack of understanding of science most leaders have and their wiliness to engage in wishful thinking in pursuit of favorable media treatment and poll numbers. And most leaders who are not knowledgeable in science tend to surround themselves with scientific advisors who use scientific terms to prop up the leader's wishful thinking and opinions, as opposed to challenge their underlying ideas based on hard facts.

On April 9, 2010 our company's 2050 Projected Alternative Energy Supply & Demand Study was published. The study concluded that: **"Using all realistic modes of alternative energy—solar/photovoltaic, hydroelectric, geothermal, tidal, wind, and biomass—alternative energy would provide the energy to meet just 3.7% of our projected requirement in 2050."** This, of course, is the direct bottom line answer to your question but it is important to understand why there is so much misleading information and confusion.

I have posted this paper for readers who want further information regarding the energy flux density issue (click here.) This refers to the amount of energy per unit volume of the fuel source or, in the case of solar energy, the square surface area of the collectors. There is little difference in the energy collected per square meter of collectors in photovoltaic panels or in concentrated solar using heated water or liquid salts. To its credit, Concentrated Solar Power integrates energy storage which is a major drawback of most alternative energies. To its detriment, Concentrated Solar Power is the least efficient in terms of converting the radiant sun energy to electricity.

Reverting back for a minute to my 2009 meeting with James Woolsey, I now need to stress a very important point. Mr. Woolsey is heavily invested in both solar energy firms and battery firms developing better batteries for the solar systems. At the time he was a senior partner in VantagePoint Venture Partners whose portfolio was almost exclusively alternative energy related. Later that morning Mr. Woolsey stated in an address to about 800 people that solar energy and better battery technology is the future of energy and the solution to Middle East turmoil as oil revenues in the Middle East become mitigated through alternative energies. He went on to say that fusion energy, the subject of ITER and the subject of greater emphasis later in this interview, was "pie in the sky."

President Obama's letter to me notes the enormous investments made from the ARRA stimulus program into "green and clean energy." Large companies have received hundreds of millions…billions of dollars for projects such as the Ivanpah solar plant in California, the Crescent Dunes Solar project in Tonopah, NV, and various wind turbine and hydrokinetic projects off the North East Atlantic Coast which would never be profitable on their own were it not for government incentives and subsidies.

The situation is further exacerbated by BIG BUSINESS who has figured out how to capitalize on the media spun global warming and climate change issue. This has led to inappropriate legislation on requirements for "green power generation" which simply cannot be accomplished using the known green energy alternatives. Thus, the government encourages citizens to use less electricity. As an example the U.S. has now banned the production and distribution of low cost consumer grade incandescent light bulbs in the United States. Why? Because roughly a ¼ of all power used in homes has been used for lighting. LED light bulbs as an example use 1/10 the amount of power as incandescent bulbs. The LED bulbs also cost as much as 20 times the cost of the old incandescent bulbs. And more importantly the big companies who have tapped into this enormous "green business" have also tapped into enormous ARRA stimulus dollars dispensed by the Obama administration to among other things, implement the smart gird and deploy over a 100 million new "smart meters" by 2018.

The concept of the smart meter is not new. The Bush administration called for the replacement of over 100 million old fashion electric-mechanical power meters in its 2001, ***2030 Vision*** plan to rebuild the nation's electrical generation, transmission, and distribution system. However in the ***2030 Vision*** the smart meter was based on the concept of "distributed intelligence" and the meters ability to monitor and help the consumer control power use . Today the Department of Energy has "hijacked" the smart meter concept and has turned it over to "Big Green Energy" and "Big Data" by allowing remote computers to monitor, regulate, control, and even turn on and off power to virtually every house in America. Huge amounts of money will be made by "BIG DATA" managing all this needles meter data under contract to utility companies who simply want to generate and distribute power.

In so doing two things have occurred. Firstly, energy and energy facts have been decoupled from the consumer through automation. Secondly the consumer has turned over his life based on his need for energy to the utility and perhaps, in the future, the government. As energy supplies become tighter and more conservation regulations are put into place, the government can use this massive information gathering…home invasion and consumer spying…system to enforce

regulations. As an example, a consumer using banned incandescent light bulbs instead of the approved LED bulbs could be fined and even have his power shut off.

All of this results from the mistaken belief that there is no solution to energy beyond the known green energy alternatives which are simply unable to provide the large amounts of electricity needed to power the grid. The question of who is driving whom…business driving governments or governments driven business is the real issue here. The answer can be learned by looking at government leadership and following the money.

Today, the UN has unwittingly taken over the media and the minds of most Westerners with its emphasis on Global Warming or Climate Change caused by man. It has put forth solutions based on the "Big Green Energy" myth which is an extremely powerful economic engine the world over. Billions and billions of dollar equivalents are spent by companies and people annually on this myth but then end result is that this will lead to the UN's fall back positions on "sustainability" and massive population reduction. We must break through this myth.

In that connection I met with Mitt Romney in July 2012 as he was running for president and I urged him to fess up to the people and speak about the Big Green Energy lies. Click here to see my letter to Governor Romney along with a compilation of the 22 references on page 2. The last paragraph on page one is my plea that the truth be told to our citizens.

Left: Governor Mitt Romney and Tom Tamarkin meet in Pittsburgh, PA in July 2012 to discuss this energy issue

Q4: Why is it even necessary to develop a new source of energy when we have enough uranium and thorium on the planet to last for hundreds of years? Shouldn't we just concentrate on developing safe fission reactors?

A4:

By all accounts the nuclear energy industry is the safest industry in the world as measured by number of fatalities caused by a nuclear plant versus the combined hours of operation of all nuclear energy plants worldwide. And you are correct we have enough uranium and thorium to power most of the world's energy needs (less the production of liquid or gaseous fuels for the

airline industry) for several hundred years. And it is interesting that you mention thorium because there is one community of advocates who are aggressively pushing the adoption of thorium plants due to some favorable safety considerations. To me it is almost inconceivable that we are not building new safer nuclear power station in the U.S. China certainly is!

Clearly nuclear fission should be the bridge to the next major transformation in energy production. Nuclear power works and is competitive in terms of the cost of generated power, and is extremely safe and reliable. However it has suffered over the years from poor public acceptance based on the misconceptions people have over safety issues. The origins of the anti-nuclear movement come from the early anti-war and anti-nuclear weapons movement. Unfortunately the nuclear power industry suffered "guilt by association" in the early days and the industry did not attempt to properly overcome this through PR efforts.
There is a myth in part created by the movie industry that a nuclear fission plant can suffer an atomic explosion just like an atomic bomb. This is categorically untrue. Due to issues relating to the fuel enrichment a nuclear power plant can never explode like an atomic bomb. What has happened in the two nuclear power plant explosions over the last 60 years is that either highly pressurized steam explodes or a buildup of hydrogen gas explodes. Also the movie portrayal of a nuclear meltdown sending nuclear materials deep into the Earth (if not through it) is a total fabrication of Hollywood. This paper sets forth the simple facts (click here.)

There are over 430 commercial nuclear fission power plants operating in 31 countries which collectively produce over 11% of the world's electricity. Seventy more reactors are under construction although none in the United States.

Certainly there have been accidents like Chernobyl and Fukushima. Chernobyl reactor number 4 was built in 1983 but was based on an old Russian design with known drawbacks. Approximately 30 people died as a direct result of Chernobyl; 2 the night of the explosion and 28 from exposure to radioactivity. For an excellent description of the Chernobyl event and its aftermath compiled by the World Nuclear Association click here.

The Fukushima plant disaster occurred not as a result of any internal plant operation issue but rather because the reactors were built very close to the ocean shore line and the plant fell victim to a an Earthquake and a tsunami which disrupted auxiliary power and caused an overheating within the reactor. There were no direct fatalities related to the building explosions. One man was killed in a construction crane accident caused by the Earthquake; two were swept out to sea in the tsunami, one died of a heart attack and one died 7 months later of natural cusses not related to radiation. For an explanation of the Fukushima event by the World Nuclear Association click here.

There have been no other serious nuclear power accidents in 60 years; the American Three Mile Island event in 1979 posed no health threats of imminent danger what so ever. For an explanation of the Three Mile Island event by the World Nuclear Association click here.

As can be seen the safety record of the industry is stellar. But the anti-nuclear fear mongers of the 60s and 70s have taken their toll and created a bureaucratic nightmare of regulatory issues. The problem has been further exacerbated by both liability issues and concerns of shareholder

discontent in the big companies who traditionally built nuclear power plants in the U.S. This affects their stock performance and their standing by government officials with stimulus and subsidy based checkbooks. Additional financially significant problems relate to the litigation invariably filed during the permitting process and the negative PR stemming from endless protests. The permitting process in and of itself can now last over a decade in the U.S. and cost upwards of a hundred million dollars.

We should be perfecting modern nuclear technology and power plants in our country but we are not.

The principal valid concerns surrounding nuclear fission are: Accidental radioactivity releases, potential for "melt down and non-nuclear explosion," the potential as terrorist targets, the potential to steal and subsequently market fissile fuel which can be used for "dirty bombs." The most significant issue is the radioactive waste generated by the reactors which has a half-life of 25,000 years meaning some long term solution must be found to store and/or destroy 60 years of radioactive waste generated to date, and do our best to limit future radioactive waste.

Q5: Well Tom, if, as you have just explained, nuclear fission creates as many problems as it solves, and all the current alternative energy technologies combined can't provide more than five percent of the world's energy needs, what is the solution?

A5:

Wolff, fission nuclear power creates real problems but they can all be dealt with. Even the big problem of the disposal of 60 years or radioactive waste produced by over 400 reactors in over 30 countries can also be dealt with. And interestingly enough, through a by-product of the solution to our future energy needs. We need more nuclear fission power now; not less.

The direct answer to your question concerning the longer term solution is energy produced from **controlled fusion**. However, there are some complicating factors. So let's start by summarizing our energy needs and available solutions once again. We will then frame the need to focus on reality and getting this done as opposed to talking us out of even starting.

Firstly realize that virtually all power on Earth (the sole exceptions being geo-thermal and tidal) comes from two sources.

1. Solar meaning the original energy came from the Sun.
2. Atomic meaning nuclear fission reactors built by man.

However, having said the above, we can reduce this even further. The sun generates it enormous energy by an atomic process called fusion. Thus we can say all energy on Earth has its roots in atomic production; fission or fusion.

At first blush people may say what about wind, or hydroelectric, or tidal/hydrokinetic, or bio-fuels, as examples. What about oil, natural gas, and coal? As stated earlier, fossil fuels like oil, coal and natural gas are the product of fusion created sunlight produced and stored over hundreds

of millions of years. Because they were harvested and produced over such a long time we have a comparative abundance of them on Earth.

Bio-fuels, meaning everything from trees to corn based ethanol simply convert fusion created sunlight into energy using photosynthesis. The amount of energy produced is a product of the surface area of the plant's solar receptors (leaves) and the growing time, less the energy used to harvest the plants and produce the fuel. This is why corn based ethanol is only cost effective when subsidized by government monies and tax credits. It takes far more energy to produce the fuel than is created by the burning of the fuel. Dr. Tad Patzek, Chairman of Petroleum & Geosystems at UT Austin wrote an excellent paper on the efficiencies of corn-ethanol wherein he notes it takes a minimum of 2.3 times more energy to produce the ethanol and often as much as 7 times more energy than is returned by burning the ethanol (click here.)

Hydroelectric simply convert's fusion produced sun light into the movement of water through evaporation and rain at higher elevations into kinetic energy as the water flows downstream to a lower elevation due to gravity and turns an electro-magnetic generator to produce electricity. Similarly hydrokinetic or underwater ocean currents work in a similar way as ocean water is heated by the sun and currents are created as a result of dissimilar temperatures as the warmer water meets cooler water at the boundaries of the continental ocean shelf floors. The rotation of the Earth marginally contributes to the underwater currents as does the differences in the sea water density as a function of dissolved salts; the latter is driven again by the Sun.

Geo-thermal and tidal energy are formed by gravity related effects and pressure, although one school of thought is that even geo-thermal energy is produced in part through the decay of nuclear elements deep inside the Earth's inner core. Other theories suggest the Earth's internal heat is produced by electrical and magnetic disturbances relating to the spinning of the Earth's outer core relative to its inner core as these cores are comprised of magnetic materials like iron, nickel and cobalt. We have no way to detect radioactive material in the Earth's core and therefore that theory is subject to doubt especially in view of the age of the Earth and the half-life of radioactive elements and isotopes.

This illustration shows how America's energy is produced today. This data was compiled by the Lawrence Livermore National Laboratory in cooperation with the Department of Energy and is very accurate. As can be clearly seen, oil, coal, natural gas, and nuclear produce most of our commercially distributed energy. Biomass has some production impact but only because of the massive corn farm subsidies the government has given away.

As can be seen, in 2013, solar accounted for less than 0.36% of total production whereas nuclear accounts for 8.5% (based on total of 97.4Quads consumed; a Quad is 1.055×10^{18} Joules.)

Given the fact that petroleum is the first of the fossil fuels forecast to be depleted based on economic and regulatory viability, transportation will have to shift from liquid fuels which have an extremely high energy flux density to electric based vehicles; the exception being aircraft. Aviation as we know it today can never be powered by electricity.

Slightly less than 3 times more energy is used today by the transportation industry than the residential consumer electricity consumption. In order to make up this shortfall roughly four times more electricity will have to be produced in this country alone by mid-century as petroleum is phased out. Although electric vehicles are very efficient in terms of the mechanical energy produced from electricity, the mass (weight) of the batteries is so much greater than that of gasoline. Therefore much more energy is consumed during acceleration based on simple Newtonian physics given the 1,000 pounds and even more of these massive batteries.

The only material contender is nuclear. Material meaning an energy form known to be large (>5% of total needed) and practical. The leading environmentally friendly alternative is Concentrated Solar Power with integrated storage (molten salts.) To put this in perspective, the largest American CSP pant currently being built is the Crescent Dune plant in Tonopah Nevada. This plant uses a 540 foot high tower surrounded by 17,500 computer controlled mirrors, each 64 square meters in size, to precisely track the sun and focus the sun's energy on the solar tower to convert that energy into 1,050 F degree heat to melt sodium nitrate based salts to turn an electro-magnetic generator. The facility takes up 1,600 acres or 6 km^2 (2.32 miles) of land and can only produce about 500 gWh of power annually.

Above photo is an aerial view of the Crescent Dunes Concentrated Solar plant in Nevada

In order to produce the energy needed to power America by 2050 solely from Concentrated Solar Power would take approximately 60,000 plants the size of the Crescent Dune project.

Referring to the U.S. Energy Production and Use illustration of Lawrence Livermore National Laboratory, this breaks down roughly as follows:

20,687 CSP plants to replace current petroleum production & use
15,676 CSP plants to replace current natural gas production & use
10,609 CSP plants to replace current coal production & use
4,874 CSP plants to replace current nuclear fission production & use
2,646 CSP plants to replace current Biomass production & use
1,508 CSP plants to replace current hydroelectric production & use

4,000 CSP plants are required to allow for rotational shutdown and maintenance on a nationwide base of 56,000 operating plants.

This is neither practical nor feasible.

This takes us back to three fundamental alternatives.

1. Huge reduction of population and a corresponding reduction of required energy.
2. The enormous expansion of nuclear fission plants by a factor of 12.
3. The harnessing of a new source of energy. The energy produced by the process powering the Sun but done on Earth. This is **controlled fusion.**

Agenda 21 and the environmental "Sustainability Movements" aside, **1**above must be discounted by a moral and thinking society.

Therefore the only realistic solution is number 2 and/or the combination of **2** and **3**; phasing out **2** once **3** becomes commercially viable.

So the answer to your question, Wolff, without any hesitation or equivocation what so ever is **we must develop controlled fusion.**

Fusion is the only realistic long term solution.

However fusion is science based and requires a lot of scientific intellectual capital to be invested before it is ready to produce power. We know it can be done. We have used it in weapons. In 1961the Russians demonstrated a fusion reaction which produced 2.4×10^{17} joules of energy in less than 1 1/10 of a second; about as much energy as many developed countries consume in one year! The trick, of course, is to produce the energy in a controlled and sustained environment as opposed to a weapon which was the Russian's October 1961 demonstration, called the Tsar Bomba.

Fusion is a form of atomic energy. Unlike nuclear fission, however, it produces no direct radioactivity. It cannot blow up or melt down. It does not use heavy metal radioactive fuels like uranium, plutonium, or thorium.

In the future as fusion is further refined and developed it can be used to:

- Produce electricity without the thermal losses of steam turbine generated power. (See the rejected energy in gray in the LLNL illustration.) This will be done in later generation aneutronic fusion systems using magnetohydrodynamics producing electrons directly from the atomic processes.
- Produce liquid and gaseous fuels of high energy flux density using natural carbon and even CO_2 in the atmosphere combined with hydrogen from water. This is needed in the foreseeable future for aviation and perhaps short term to mid-term ground transportation.

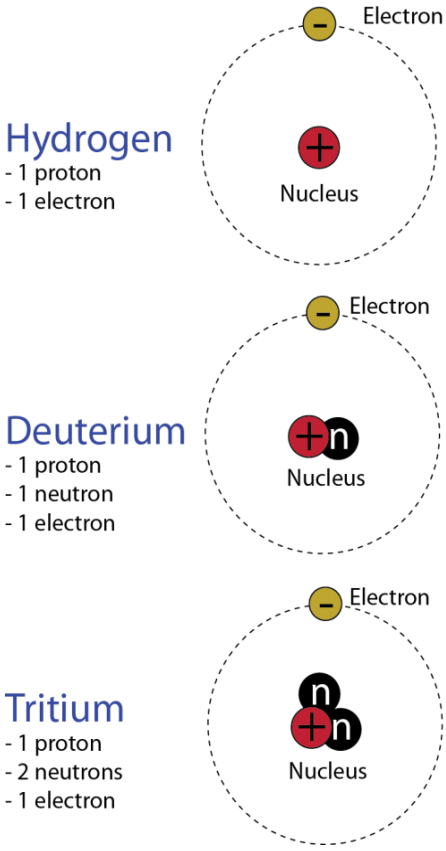
- Fusion will be used to produce and transport unlimited potable water for cities and agriculture and the energy for sustainable agriculture to feed the world with a population of over 9 billion people.
- Fusion can be used to mitigate and render harmless 60 years of nuclear fission radioactive waste resulting from the hundreds of fission reactors worldwide.
- The announcement by the United States that it will develop fusion and its commercial byproducts over the next two decades will go a long way in stabilizing the Middle East who currently uses oil revenues to fund Jihad and terrorism. See my article "Reversing the Decline of America" (click here.)

What is Fusion & how does it work?

Fusion is the energy that powers the Sun and other stars. It has been a goal of scientists around the world to harness this process in a controlled and sustainable environment by which the stars "burn" hydrogen into helium for energy production on Earth since it was discovered in the 1940′s.

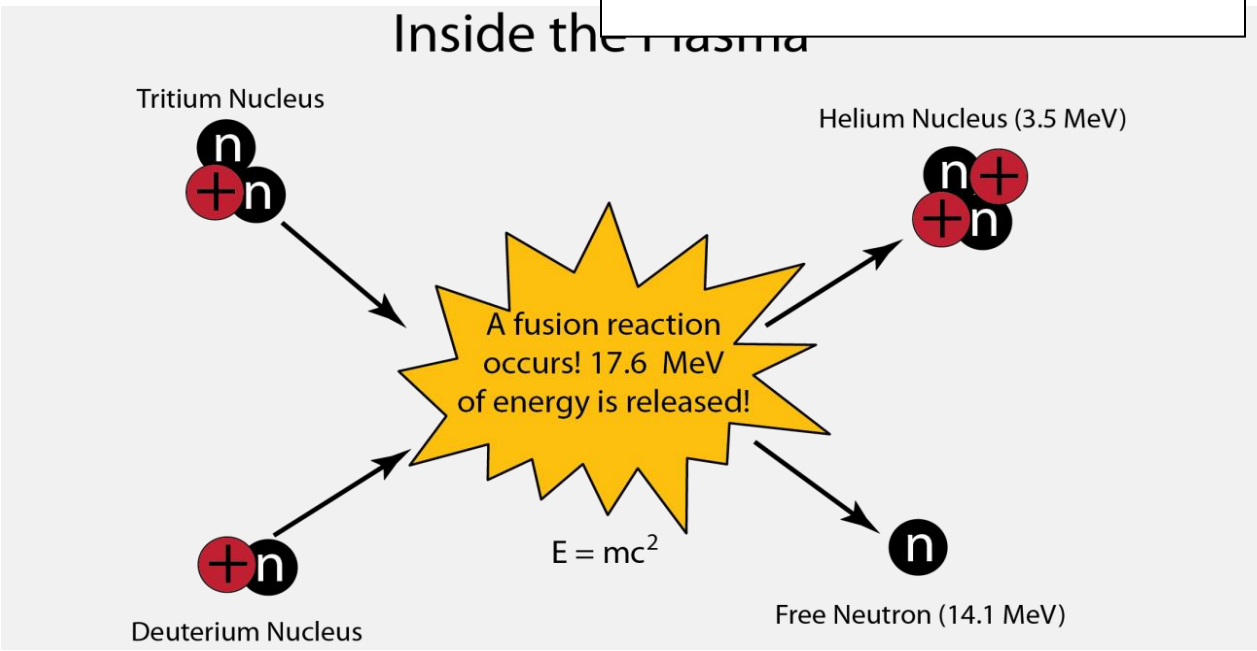
Nuclear fusion is the process by which light nuclei fuse together to create a single, heavier nucleus and release energy. Given the correct conditions (such as those found in plasma), nuclei of light elements can smash into each other with enough energy to undergo fusion. When this occurs, the products of the fusion reaction have a smaller total mass than the total mass of the reactants. The mass difference is converted to energy as determined by Einstein's famous formula, $E=mc^2$. Here, m is the mass difference and c is the speed of light. c^2 means the speed of light squared or times itself. Even though the mass difference is very small, the speed of light is extremely large (about 186,000 miles per second or 34.6 billion when squared,) so the amount of energy released is also very large.

Isotopes of Hydrogen



The "easiest" (most energetically favorable) fusion reaction occurs between the hydrogen isotopes deuterium and tritium. Hydrogen, deuterium, and tritium all have one electron and one proton; they only differ in the number of neutrons present in the nucleus. These differences are demonstrated in the figure to the left.

When the nucleus of a deuterium atom crashes into the nucleus of a tritium atom with sufficient energy, a fusion reaction occurs and a huge amount of energy is released, 17.6 million electron volts to be exact. To put this in terms of energy that we all experience, **a single nuclear fusion reaction releases about 10,000,000 times as much energy as the combustion of gasoline.** The fusion reaction products are a neutron and a helium nucleus. The huge amount of energy released during every fusion reaction makes it so attractive and is one of the reasons it has earned the nickname of the "holy grail" of energy sources.



When a deuterium and a tritium nucleus collide with enough energy they fuse together into a helium nucleus and release a neutron. A small amount of mass is converted into energy in this reaction.

For our presentation on "what is fusion and how does it work?" written for children and the parents of children click here.

Once we have demonstrated sustained fusion using the Deuterium Tritium reaction in a controlled environment leading to net increases in energy gain…meaning more energy is released than put into the process of creating the reaction...the next step is the refinement of "reactor" technology to commercialize it. Today there are two "main line" approaches. One uses a magnetic containment scheme known as a tokomak, or "magnetic bottle," such as the proposed ITER in France. The other uses laser driven inertial confinement such as NIF at Lawrence Livermore National Labs (click here for a CBS "Sunday Morning" video on NIF.) The two approaches are very different. In all probability the first cost effective commercialized plants will use an approach based on a compromise between these two polar opposites such as that proposed in our paper on Pulsed Jet Magneto Inertial Fusion or PJMIF.

Later as our scientists get more accumulated knowledge based on experiments and operational history with fusion, new generation fusion reactions and reactors will be developed leading to what we call aneutronic fusion meaning fusion using elements such as two isotopes of helium or boron and protons. These schemes have the potential to produce electricity directly through magnetohydrodynamics without the need to heat water and turn an electro-magnetic generator. This eliminates "waste heat" and eliminates any secondary low level radioactive byproducts stemming from neutron bombardment and relaxes certain applied materials considerations.

In short, fusion will undergo huge incremental improvements in efficiency and downsizing scalability. An analogy is the old fashion vacuum tube developed around 1900 which used heaters to "boil" electrons off a cathode. It was later replaced by the solid state transistor which morphed into the integrated circuit, the microprocessor and later the microcomputer system on a chip. This will build a new science and technology based economy in the United States unparalleled since the days of the space program.

Q6: What will it take to develop nuclear fusion as the world's future source of unlimited safe energy? Who will be involved in the project, how long will it take, where will the work be done, what will it cost and who will finance the program?

A6:

That is a complicated multipart question. Let me start with the simple answer and some background and then move toward what is realistic and what can be done to advance this all important cause.

Fusion energy is still an abstract subject and issue because it does not exist on its own on this planet. Unlike oil or coal it cannot be extracted from the ground or otherwise harvested from

nature. The closest analogy is energy produced by nuclear fission. And it is only a rough analogy at best. However, the nuclear fission power industry is based on radioactive heavy metals which either occur in nature or can be bred from other naturally occurring elements as in the case of plutonium.

Man first mastered atomic energy in pursuit of the war efforts in the Second World War. After the atomic bomb was developed, the United States government organized the Atomic Energy Commission to pursue atomic energy for civilian purposes and encouraged industry to work with it. Companies such as General Electric, Westinghouse, General Atomic, Bechtel, and the like received government funded contracts to refine the science and technology to build better power plants.

So based on this history the logical if not ideal answer is the government should fund fusion energy development and allow industry to commercialize it. In this model the "science" of fusion is best conducted by universities and National Laboratories as the capital expense associated with the research equipment is very expensive.

To some extent this was attempted. Some significant fusion research was done in the U.S. and the UK in the 1950s, 1960s, and 70s. In 1976 the Energy Research and Development Administration or ERDA…the predecessor to our current Department of Energy… published a chart showing various policies and funding options for the magnetic fusion energy research program. The most aggressive plan required that $600 million be spent over the course of about 12 to 14 years. This would have produced a demonstrable fusion reactor by 1990 for under $10 billion.

In October 1980 President Jimmy Carter signed the Magnetic Fusion Energy Engineering Act, which was supposed to fund the program leading to fusion production on our power grid by 2005. However for a variety of political reasons the Act was never funded and by 1985 the program was officially scrapped in favor of a proposal suggested by Mikhail Gorbachev which would have led to U.S. and Russian cooperation to complete the science and produce commercially viable technology. That never happened although it did lead to the current ITER program in Southern France. For a complete description of the government's fusion program and the reason for its failure see my article "Who Killed Fusion?" (click here.) Also see the eight article series on this subject I co-authored with Pat Boone as indexed on this site (click here.)

Today the Department of Energy states that it is a "regulatory agency" whose mission is the regulation of energy commerce based on known energy sources. This means that they regulate the business of energy production and distribution based on proven working energy sources. The DOE does not consider fusion to be an energy source today. Rather the DOE considers it to be an interesting scientific discipline with future potential. But to be clear the DOE is not charted to fund science research which is speculative. It leaves that up to National Laboratories and Universities to the extent there is available funding, or to private enterprises willing to assume the risk and invest the needed funds in the science and research.

Since the ability to control fusion in a sustained repeatable manner for energy production has not yet been demonstrated, industry has been unwilling to fund it. The reasons relate to the high cost of the scientific research based on the large facilities needed to study the science and the lack of a solid business plan showing the return on investment based on the perceived risks.

Unfortunately our government got out of the business of investing in BIG SCIENCE and experimental high energy physics in the early 1990s when it defunded and scrapped the Supper Conductor Collider Center project in Austin Texas; a project later taken over by the Europeans at CERN Switzerland.

Secondly because fusion has some military application in weapons (the Hydrogen bomb or thermonuclear warhead) half of the fusion research based on the laser driven inertial confinement mainline approach has been conducted by the National Nuclear Safety Administration or NNSA which is primarily responsible for nuclear weapons stockpile stewardship. The NNSA operates under the umbrella of the Department of Energy and, in fact, is responsible for almost half of the DOE's annual budget. Yet the "right hand does not talk to the left hand" and most of the experimental work done by the NNSA in fusion, both at Lawrence Livermore National Labs (NIF) and Sandia National Labs MagLIF and Z accelerator projects, is dedicated to military weapons related work. Much of the research is classified. However to NIF's credit at LLNL, a small amount of PR has been gained over the last few years based on fusion's potential to produce civilian energy.

So what we have just said is that fusion is still a complicated science which must be further understood in order for the government or industry to take it seriously and fund it accordingly.

There are other countries in the world such as South Korea and even China who fully appreciate the need to complete the fundamental scientific research and commercialize fusion. China openly says it must have fusion on line by 2050. South Korea is moving ahead on its own with both magnetic confinement and inertial confinement projects as is Japan whose future also depends on fusion. France, of course has the international ITER project which is a magnetic confinement approach as well as the HiPER laser driven inertial confinement project of the EU also in France.

The United States was at one time the world's leader in fusion science advancing towards the ultimate production of fusion electricity generation devices. However over the course of the last ten years we have effectively become a "third world" country in energy production playing games with solar, wind, tidal and the like while cutting the American funding for fusion…the only realistic solution…to virtually zero beyond that needed to fund our ITER obligations which the State Department considers to be important because they are treaty status like. The February 28, 2012 Presentation by Dr. E. J. Synakowski, Associate Director of Science for Fusion Energy Sciences, U.S. DOE clearly states that all civilian related fusion funding in the United States coming from the DOE is directed to ITER related projects and obligations.

We have turned over our future and the future of the world to a project run under the control of the IAEA and the UN. And as said before, the U.S. is only a 9% partner in ITER.

ITER is not a power station reactor. ITER is a 7 country based science fair project whose sole purpose is to demonstrate a sustained fusion reaction in a controlled environment producing a net energy gain greater than 10. ITER is currently scheduled to produce the first set of Deuterium Tritium experiments leading to such a demonstration in the 2027-2028 time frames. And ITER is to be followed by another project, appropriately called DEMO a decade later which should harness fusion power for power grid applications in Europe by 2045.

So here lies the problem.

I have shown how fossil fuels will become in short supply over the next 20 to 30 years. And I have shown beyond discussion that today's green energy myths of solar, wind, bio-fuels, tidal/hydrokinetic, geothermal and traditional hydroelectric are only a drop in the bucket so to speak.

I have also shown how BIG BUSINESS and the government has conveniently worked together to keep citizens from being properly informed on this issue.

And I have shown how BIG BUSINESS and the government has worked together to monitor and control energy in everyone's home and office when supplies tighten and costs rise.

What is the solution? We must inform the citizens of the facts. We cannot expect that everyone will take an interest in physics and even simple science from a detailed standpoint. But these facts are relatively simple and irrefutable once published and widely discussed. Unlike the fuzzy "science" of climate change, it is easy to show the supply sources and demand needs in terms an eighth grader can easily understand.

I have proposed a business model based on a private enterprise approach to revenue creation from the utility industry which can in turn be used to fund a consortium of national laboratories and private companies including major energy companies whose future depends on developing new sources of energy once their petro-chemical based business model is no longer viable.

It is beyond the technical scope of this interview/article to address specific issues of science and how to do fusion. Rather our purpose must remain the proper framing of the problem thereby establishing the need to do fusion research and development consistent with the remaining time we have left to operate on fossil fuels.

Since there are roughly 110 million electrical utility customers in our country, let's develop a solution where some small investment is made by each customer on monthly bases; say fifty cents per month per customer which is matched by other partners in the energy consortium.

There needs to be a management plan with concrete goals and objectives and adequate financial rewards to all the participants including the employees of the business partners based on results.

Major milestones with huge financial incentives should include:

- First successful demonstration of a sustainable net energy gain consistent with the criteria established by the National Academy of Sciences. How this is achieved…be it magnetic, inertial, or magnetized target inertial is not important.
- First successful demonstration of a sustained materially significant energy converted to electricity placed on a power grid resulting from fusion in a controlled environment.
- First commercially viable fusion reactor and power plant system with a greater than 10 year life cycle and a positive ROI realized in three years based on capital costs not including the amortization of R&D.

If our past American scientific achievements are any indication, such an incentive based managerially focused publically transparent program would result in the first of the above milestones being achieved by the end of this decade with a power plant on line by 2025, several years before the international science fair project called ITER is scheduled for startup.

The first steps in this approach is the completion of the scientific data showing that the current green energy movement is indeed a myth and that only financial corruption can result from it. Some of this has been started by our group and will be done in Israel and the United States.

The actual consortium for the development of fusion needs to be based in the United States and as much of the work as possible needs to be done here. This creates jobs. This creates national pride. And this creates a new sense of national purpose not seen in our country for several decades. Education will be addressed and overhauled. And the consortium will be the financial beneficiary of the intellectual property; patents, scientific know how, and the like.

The principal role of the federal government in all this is that of cheerleader, protector, and the possible grantor of some preferential IP treatment in terms of extended life due to the long term nature of the project. Additionally there needs to be some relaxation of government red tape, OSHA rules, and liability issues given the national security consequences of the project and the inherent risks based on yet to be understood science. Legions of anti-this and anti-that protestors and their symbiotic lawyers must be kept away.

To begin this process we have set up an entire Web site on Fusion power and the need to get it done. The site is: http://www.fusion4freedom.us The following section of that site conceptually describes this vision: http://fusion4freedom.us/determined-to-bring-a-future-of-hope/

Q7: Why is it important that we focus our resources and talents on a worldwide effort to develop fusion power now? Is it really necessary to start today on a program the size of another Apollo moon project when we still have plenty of oil left, and we can always fall back on nuclear fission until we develop more advanced alternative energy technology or someone discovers an entirely new form of power?

A7:

I believe the future of mankind and the future of our children and grandchildren is very much a function of America rising to the challenge of correctly solving energy through fusion development. It is of paramount importance that America take this task on because there is no

other nation who can and will rise to the worldwide imperative to get this done without using it to take unfair advantage in the world military or territorially. Remember: "He who controls energy, controls the world." What we are talking about here is controlling energy and the science, intellectual property, and the economic engines behind it.

The Apollo project in the 1960s and 70s was based on asserting our scientific, technical and moral superiority over the Russian government after the Russian launch of their sputnik satellite. At the time it was a noble ambition. An ambition which directly resulted in a myriad of new technologies; everything from the microwave oven to the solid state electronics used inside today's computers, tablets and smart phones resulted from that program.

The launching of a fusion energy development project has an even more noble purpose than the race to the moon. What this will mean to America and the world is that we address and solve the world's biggest problem…providing an inexpensive, inexhaustible source of energy enabling mankind to thrive in the future and without the need for endless conflicts and wars. And without a doubt, this is a major contribution to Middle East peace. As the U.S. takes this on we must announce to the world that we will get this done over the next 20 years and that countries now using oil revenues to finance Jihad and terrorism will be infinitely better off spending that money on educating their citizens and providing freedoms and new degrees of tolerance within their antiquated societies.

If this is not done, billions of people will perish in the future and the world's population will contract to less than a 1/10 of today's population.

There is no other source of energy to be discovered. Nuclear fission can be ramped up but it can only be used to generate electricity using the thermal conversion process we know today. It can never produce liquid fuels in any quantity. And the problems associated with the transportation and storage of nuclear waste will be greatly compounded if we increase nuclear power production as we must do absent the fusion solution. Additionally the legal and financial constraints associated with nuclear fission power today will delay any needed ramp up beyond the point of no return.

From an engineering standpoint some argue that it is possible to launch giant solar panels into orbit around the Earth and "beam" power down for collection at receiver stations. The advantage is that the concentration of solar energy per square meter is much higher above the atmosphere and the panels can point to the Sun 24 hours a day. However, the latter is not possible while at the same time "beaming" high amounts of power to Earth bound collection stations. The costs associated with such a program are astronomical…no pun intended. The maintenance costs are also prohibitively expensive. And despite the claims to the contrary, we simply do not have a means to "beam" these high power levels through space and air. See the orbiting solar section of this paper (click here.)

Beyond fusion, we can envision, perhaps, the ultimate source of energy which is the annihilation of mater and anti-matter which theoretically produces a near 100% conversion of matter into energy. Can that be done on Earth? Perhaps; but it may be 500 years away…minimum…if not a thousand.

The United States is in a state of rapid decline fueled by the corruption of its leaders principally based on the "green energy myth." Embarking on this grand project in a fully transparent way with the support of the people will turn America's political landscape upside down once and for all. Corruption based on misinformation and bogus facts will no longer be tolerated and a rededication to the pursuit of science and freedom will result in the rebirth of America and all our partners worldwide who work with us on this project.

If we do not address the looming energy crisis over the next 10 to 15 years, a series of catastrophic energy wars will breakout as developing countries like China, India, and those of Africa fight to capture energy supplies to sustain and protect their citizens.

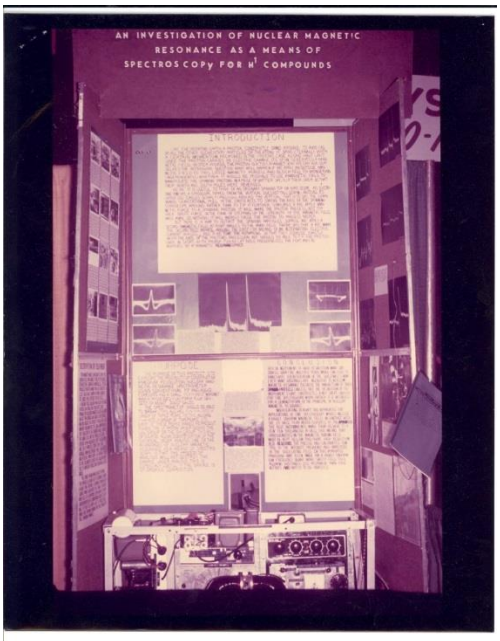
For us not to pursue this given the knowledge set forth in this interview/article would be criminal beyond comprehension.

Now, Wolff, as to your question about my background and why I am taking this on, let me say this:

I was born at a very exciting time in America; during the 1950s when science was valued by the general population as we developed a whole host of technological marvels from television to space travel to low cost transistors, leading to advanced semiconductors, digital communications technology and now our now ubiquitous smart phones, tablets and worldwide interconnectivity via the Internet. I was fortunate in having a father with a Ph.D. in physics and an Ed.D. in secondary education. At a very young age I was reading high school level science and math books and I participated in my father's activities when he worked with co-authors Drs. Holton, Rutherford and Watson developing the "Harvard Project Physics" which became the most popular high school physics curriculum during the mid-60s to the late 70s. In those days "physics was phun…"

I was taught at a young age that atomic energy was the solution for mankind's energy needs. First we developed atomic fission based on World War II weapons research. By 1960 we were taught fission was only an interim step in energy production which would be replaced by much more efficient and safer fusion using light non-radioactive elements like hydrogen and helium as examples. This was taught in 7^{th} and 8^{th} grade science books at the conceptual level.

As a senior in high school I took top honors in the 1971 International Science and Engineering Fair for research I did in **Nuclear Magnetic Resonance and Electron Paramagnetic Resonance Spectroscopy** and spent that summer at Argonne National Labs and the Fermi National Accelerator Laboratory courtesy of the U.S. Atomic Energy Commission (since disbanded.)



This photo was the official photo taken at the 1971 International Science and Engineering Fair held in Kansas City MO where this project received top honors in the field of physics. Below the Director of Argonne National Laboratory in Argonne, IL presents Tom with an award in August, 1971 for his achievements at the lab that summer.

As a physics major with an applied mathematics and chemistry minor in college, I was taught that although fossil fuels were finite as explained in a freshman geology course; energy would be solved for eternity by the turn of the century through large scale commercialization of fusion.

With that knowledge I pursued a career in the microcomputer and technology industry as opposed to the pure sciences. By 1980 Congress overwhelming approved the bipartisan Magnetic Fusion Energy Engineering Act which was signed by President Carter on October 12, 1980 just prior to his leaving office. The act was to have funded fusion science leading to demonstrations by the early 1990s and the operation of a demonstration plant at the turn of the 21st century. I assumed progress was being made and things would be well under way. After all we wrapped up the Manhattan Project during WW II in less than 5 years and developed and built the U2 spy plane in less than one year when the cold war pressure was on.

In the mid-1980s I became involved with the electrical utility generation business and specifically with products and technologies used to control particle emissions called electrostatic precipitators and gaseous scrubbers. Later I became involved in the data acquisition and control aspects of utility companies and systems used to read utility meters and bill customers. By 1989 I had formed a company which invented the first "smart meters" in the United States which brought utility billing information inside the house directly to the consumer (click here.) Thus I

have been very involved with the utility industry meaning electric, gas and water for almost three decades.

My interest was always in bringing consumers the tools and information allowing them to both understand energy as well as conserve it thereby allowing them to save money while at the same time giving our country additional time to correctly solve energy by developing fusion and future fusion based technologies like the creation of synthetic liquid and gaseous fuels for transportation, agriculture, potable water, and the like. Admittedly I lost track of the fusion science and the progress that was…or was not…being made.

In early 2001 California made national headlines with a series of blackouts and brownouts throughout the state…in the winter. The winter is not the time of year associated with peak power demand. So I got to work and redesigned some of our technology and products which allowed consumers to monitor and control their power. We held an open-house in Sacramento and invited a number of State politicians and in that open house I said to the audience that we needed to give all electricity and natural gas users…even water customers…real time usage and price data and showed how it could be done. I also said to that audience that it was critical that we responsibly conserve energy until we have fusion power on line and noted that it appeared we were late in doing that. And I was very surprised that none of the politicians, investors, and the general public attending that open-house had ever heard of fusion power, let alone had any detailed knowledge of it.

So literally at that meeting I made the commitment to bring to the public products which would, 1) help people manage and control their power use, and, 2) more importantly be used as a private media communications channel to educate people with regard to real science and energy as opposed to the "party line" green energy nonsense propagated by the government and media. Happily State of CA Senator, Tom Torlakson, attended that open-house and wrote a CA bill which became law which led to the analysis of advanced power monitoring techniques and price signals to consumers which resulted in over 13 million old fashion power meters in California being replaced with modern digital power meters which should…but do not yet…communicate directly with the consumer.

Over the next decade I devoted a portion of my time to the advancement of the power meter and consumer tools and the balance of my time researching at a very detailed level just what happened to the fusion power development program which so obviously failed…but not due to the fundamental science. From 2007 to the present day I have become a recognized worldwide expert in why fusion power has not yet been demonstrated, although as a matter of disclosure, I am not a practicing nuclear physicist. I have traveled around the world and interviewed countless experts in the field and have visited all the major laboratories doing fusion related work and I have written extensively on the subject.

Why have I taken this on? It goes back to my early upbringing and my parents drilling into me a sense of responsibility; when you see and understand a problem affecting others, you have a responsibility to try and remedy the problem. Today that problem is the fact that, 1) mankind is blindly burning up all of his fossil fuel reserves without regard to the future, and, 2) our country has gone from the greatest country on Earth in terms of hard science and math contributions to the world to becoming almost a third world country in the pure hard sciences; certainly high energy experimental physics which is the heart and core needed to solve energy through fusion development. At the same time our country has taken on so much debt and has declined so much in world prestige that we are on the tipping point of great financial instability and losing our American preeminence and exceptionalism. It seems the whole world is screaming at America to wake up and do something to save mankind yet we are asleep. Therefore I have taken steps to try and get this enormous need for fusion development moving again, and hopefully demonstrated in the United States and in my lifetime.

Contrary to the Department of Energy's official statements on fusion development, very little work is actually being done on it in this country and by our current administration's edict, all of our non-military (NNSA) fusion development efforts have been put into the international ITER basket. ITER is a reincarnation of the old 1980 Magnetic Fusion Energy Engineering Act which was hijacked by Mikhail Gorbachev and the then Soviet Union in 1985 and now put in the hands of the IAEA run by the UN. Imagine putting the UN in charge of energy programs to potentially get us off fossil fuels!

Please feel free to email comments and questions to: tt@usclcorp.com

See our Web sites at: http://www.fusion4freedom.us & http://www.usclcorp.com

http://www.facebook.com/tomer.tamarkin

Tom Tamarkin is the founder & CEO of USCL and EnergyCite®.

In the 1970s Tom was an undergraduate student at Northern Arizona University, majoring in physics with a dual minor of chemistry and applied mathematics. Tom is credited with inventing the electrical utility smart grid-Smart Meter in 1991 . . . well before the concept of the smart grid became popular. In 1992, Public Power Magazine published an article which has become the basis for the "smart meter" which is now the cornerstone of the current U.S. Department of

Energy utility stimulus grants program with emphasis on energy conservation and awareness. Tom holds six granted patents on the smart meter system and has numerous patents pending. Tom lives with his wife of 31 years, Emily, in Carmichael, California.