### 1

#### Warming is real and anthropogenic – carbon dioxide increase, polar ice records, melting glaciers, sea level rise

**Prothero 12** [Donald R. Prothero, Professor of Geology at Occidental College and Lecturer in Geobiology at the California Institute of Technology, 3-1-2012, "How We Know Global Warming is Real and Human Caused," Skeptic, vol 17 no 2, EBSCO]

Converging Lines of Evidence¶ How do we know that global warming is real and primarily human caused? There are numerous lines of evidence that converge toward this conclusion.¶ 1. Carbon Dioxide Increase.¶ Carbon dioxide in our atmosphere has increased at an unprecedented rate in the past 200 years. Not one data set collected over a long enough span of time shows otherwise. Mann et al. (1999) compiled the past 900 years' worth of temperature data from tree rings, ice cores, corals, and direct measurements in the past few centuries, and the sudden increase of temperature of the past century stands out like a sore thumb. This famous graph is now known as the "hockey stick" because it is long and straight through most of its length, then bends sharply upward at the end like the blade of a hockey stick. Other graphs show that climate was very stable within a narrow range of variation through the past 1000, 2000, or even 10,000 years since the end of the last Ice Age. There were minor warming events during the Climatic Optimum about 7000 years ago, the Medieval Warm Period, and the slight cooling of the Little Ice Age in die 1700s and 1800s. But the magnitude and rapidity of the warming represented by the last 200 years is simply unmatched in all of human history. More revealing, die timing of this warming coincides with the Industrial Revolution, when humans first began massive deforestation and released carbon dioxide into the atmosphere by burning an unprecedented amount of coal, gas, and oil.¶ 2. Melting Polar Ice Caps.¶ The polar icecaps are thinning and breaking up at an alarming rate. In 2000, my former graduate advisor Malcolm McKenna was one of the first humans to fly over the North Pole in summer time and see no ice, just open water. The Arctic ice cap has been frozen solid for at least the past 3 million years (and maybe longer),4 but now the entire ice sheet is breaking up so fast that by 2030 (and possibly sooner) less than half of the Arctic will be ice covered in the summer.5 As one can see from watching the news, this is an ecological disaster for everything that lives up there, from the polar bears to the seals and walruses to the animals they feed upon, to the 4 million people whose world is melting beneath their feet. The Antarctic is thawing even faster. In February-March 2002, the Larsen B ice shelf - over 3000 square km (the size of Rhode Island) and 220 m (700 feet) thick- broke up in just a few months, a story typical of nearly all the ice shelves in Antarctica. The Larsen B shelf had survived all the previous ice ages and interglacial warming episodes over the past 3 million years, and even the warmest periods of the last 10,000 years- yet it and nearly all the other thick ice sheets on the Arctic, Greenland, and Antarctic are vanishing at a rate never before seen in geologic history.¶ 3. Melting Glaciers.¶ Glaciers are all retreating at the highest rates ever documented. Many of those glaciers, along with snow melt, especially in the Himalayas, Andes, Alps, and Sierras, provide most of the freshwater that the populations below the mountains depend upon - yet this fresh water supply is vanishing. Just think about the percentage of world's population in southern Asia (especially India) that depend on Himalayan snowmelt for their fresh water. The implications are staggering. The permafrost that once remained solidly frozen even in the summer has now Üiawed, damaging the Inuit villages on the Arctic coast and threatening all our pipelines to die North Slope of Alaska. This is catastrophic not only for life on the permafrost, but as it thaws, the permafrost releases huge amounts of greenhouse gases which are one of the major contributors to global warming. Not only is the ice vanishing, but we have seen record heat waves over and over again, killing thousands of people, as each year joins the list of the hottest years on record. (2010 just topped that list as the hottest year, surpassing the previous record in 2009, and we shall know about 2011 soon enough). Natural animal and plant populations are being devastated all over the globe as their environments change.6 Many animals respond by moving their ranges to formerly cold climates, so now places that once did not have to worry about disease-bearing mosquitoes are infested as the climate warms and allows them to breed further north.¶ 4. Sea Level Rise.¶ All that melted ice eventually ends up in the ocean, causing sea levels to rise, as it has many times in the geologic past. At present, the sea level is rising about 3-4 mm per year, more than ten times the rate of 0.10.2 mm/year that has occurred over the past 3000 years. Geological data show Üiat ttie sea level was virtually unchanged over the past 10,000 years since the present interglacial began. A few mm here or there doesn't impress people, until you consider that the rate is accelerating and that most scientists predict sea levels will rise 80-130 cm in just the next century. A sea level rise of 1.3 m (almost 4 feet) would drown many of the world's low-elevation cities, such as Venice and New Orleans, and low-lying countries such as the Netherlands or Bangladesh. A number of tiny island nations such as Vanuatu and the Maldives, which barely poke out above the ocean now, are already vanishing beneath the waves. Eventually their entire population will have to move someplace else.7 Even a small sea level rise might not drown all these areas, but they are much more vulnerable to the large waves of a storm surge (as happened with Hurricane Katrina), which could do much more damage than sea level rise alone. If sea level rose by 6 m (20 feet), most of die world's coastal plains and low-lying areas (such as the Louisiana bayous, Florida, and most of the world's river deltas) would be drowned.¶ Most of the world's population lives in lowelevation coastal cities such as New York, Boston, Philadelphia, Baltimore, Washington, D.C., Miami, and Shanghai. All of those cities would be partially or completely under water with such a sea level rise. If all the glacial ice caps melted completely (as they have several times before during past greenhouse episodes in the geologic past), sea level would rise by 65 m (215 feet)! The entire Mississippi Valley would flood, so you could dock an ocean liner in Cairo, Illinois. Such a sea level rise would drown nearly every coastal region under hundreds of feet of water, and inundate New York City, London and Paris. All that would remain would be the tall landmarks such as the Empire State Building, Big Ben, and the Eiffel Tower. You could tie your boats to these pinnacles, but the rest of these drowned cities would lie deep underwater.

#### Worst-case warming results in extinction

Ahmed 2010 (Nafeez Ahmed, Executive Director of the Institute for Policy Research and Development, professor of International Relations and globalization at Brunel University and the University of Sussex, Spring/Summer 2010, “Globalizing Insecurity: The Convergence of Interdependent Ecological, Energy, and Economic Crises,” Spotlight on Security, Volume 5, Issue 2, online)

Perhaps the most notorious indicator is anthropogenic global warmings warming. The landmark 2007 Fourth Assessment Report of the UN Intergovernmental Panel on Climate Change (IPCC) – which warned that at then-current rates of increase of fossil fuel emissions, the earth’s global average temperature would likely rise by 6°C by the end of the 21st century creating a largely uninhabitable planet – was a wake-up call to the international community.[v] Despite the pretensions of ‘climate sceptics,’ the peer-reviewed scientific literature has continued to produce evidence that the IPCC’s original scenarios were wrong – not because they were too alarmist, but on the contrary, because they were far too conservative. According to a paper in the Proceedings of the National Academy of Sciences, current CO2 emissions are worse than all six scenarios contemplated by the IPCC. This implies that the IPCC’s worst-case six-degree scenario severely underestimates the most probable climate trajectory under current rates of emissions.[vi] It is often presumed that a 2°C rise in global average temperatures under an atmospheric concentration of greenhouse gasses at 400 parts per million (ppm) constitutes a safe upper limit – beyond which further global warming could trigger rapid and abrupt climate changes that, in turn, could tip the whole earth climate system into a process of irreversible, runaway warming.[vii] Unfortunately, we are already well past this limit, with the level of greenhouse gasses as of mid-2005 constituting 445 ppm.[viii] Worse still, cutting-edge scientific data suggests that the safe upper limit is in fact far lower. James Hansen, director of the NASA Goddard Institute for Space Studies, argues that the absolute upper limit for CO2 emissions is 350 ppm: “If the present overshoot of this target CO2 is not brief, there is a possibility of seeding irreversible catastrophic effects.”[ix] A wealth of scientific studies has attempted to explore the role of positive-feedback mechanisms between different climate sub-systems, the operation of which could intensify the warming process. Emissions beyond 350 ppm over decades are likely to lead to the total loss of Arctic sea-ice in the summer triggering magnified absorption of sun radiation, accelerating warming; the melting of Arctic permafrost triggering massive methane injections into the atmosphere, accelerating warming; the loss of half the Amazon rainforest triggering the momentous release of billions of tonnes of stored carbon, accelerating warming; and increased microbial activity in the earth’s soil leading to further huge releases of stored carbon, accelerating warming; to name just a few. Each of these feedback sub-systems alone is sufficient by itself to lead to irreversible, catastrophic effects that could tip the whole earth climate system over the edge.[x] Recent studies now estimate that the continuation of business-as-usual would lead to global warming of three to four degrees Celsius before 2060 with multiple irreversible, catastrophic impacts; and six, even as high as eight, degrees by the end of the century – a situation endangering the survival of all life on earth.[xi]

#### Warming causes extinction

**Sify 2010 –** Sydney newspaper citing Ove Hoegh-Guldberg, professor at University of Queensland and Director of the Global Change Institute, and John Bruno, associate professor of Marine Science at UNC (Sify News, “Could unbridled climate changes lead to human extinction?”, <http://www.sify.com/news/could-unbridled-climate-changes-lead-to-human-extinction-news-international-kgtrOhdaahc.html>, WEA)

The findings of the comprehensive report: 'The impact of climate change on the world's marine ecosystems' emerged from a synthesis of recent research on the world's oceans, carried out by two of the world's leading marine scientists. One of the authors of the report is Ove Hoegh-Guldberg, professor at The University of Queensland and the director of its Global Change Institute (GCI). 'We may see sudden, unexpected changes that have serious ramifications for the overall well-being of humans, including the capacity of the planet to support people. This is further evidence that we are well on the way to the next great extinction event,' says Hoegh-Guldberg. 'The findings have enormous implications for mankind, particularly if the trend continues. The earth's ocean, which produces half of the oxygen we breathe and absorbs 30 per cent of human-generated carbon dioxide, is equivalent to its heart and lungs. This study shows worrying signs of ill-health. It's as if the earth has been smoking two packs of cigarettes a day!,' he added. 'We are entering a period in which the ocean services upon which humanity depends are undergoing massive change and in some cases beginning to fail', he added. The 'fundamental and comprehensive' changes to marine life identified in the report include rapidly warming and acidifying oceans, changes in water circulation and expansion of dead zones within the ocean depths. These are driving major changes in marine ecosystems: less abundant coral reefs, sea grasses and mangroves (important fish nurseries); fewer, smaller fish; a breakdown in food chains; changes in the distribution of marine life; and more frequent diseases and pests among marine organisms. Study co-author John F Bruno, associate professor in marine science at The University of North Carolina, says greenhouse gas emissions are modifying many physical and geochemical aspects of the planet's oceans, in ways 'unprecedented in nearly a million years'. 'This is causing fundamental and comprehensive changes to the way marine ecosystems function,' Bruno warned, according to a GCI release. These findings were published in Science

#### The IFR is the only way to reduce coal emissions sufficiently to avert the worst climate disasters

**Kirsch 9** (Steve Kirsch, Bachelor of Science and a Master of Science in electrical engineering and computer science from the Massachusetts Institute of Technology, American serial entrepreneur who has started six companies: Mouse Systems, Frame Technology, Infoseek, Propel, Abaca, and OneID, "Why We Should Build an Integral Fast Reactor Now," 11/25/9) http://skirsch.wordpress.com/2009/11/25/ifr/

To prevent a climate disaster, we must eliminate virtually all coal plant emissions worldwide in 25 years. The best way and, for all practical purposes, the only way to get all countries off of coal is not with coercion; it is to make them want to replace their coal burners by giving them a plug-compatible technology that is less expensive. The IFR can do this. It is plug-compatible with the burners in a coal plant (see Nuclear Power: Going Fast). No other technology can upgrade a coal plant so it is greenhouse gas free while reducing operating costs at the same time. In fact, no other technology can achieve either of these goals. The IFR can achieve both.¶ The bottom line is that without the IFR (or a yet-to-be-invented technology with similar ability to replace the coal burner with a cheaper alternative), it is unlikely that we’ll be able to keep CO2 under 450 ppm.¶ Today, the IFR is the only technology with the potential to displace the coal burner. That is why restarting the IFR is so critical and why Jim Hansen has listed it as one of the top five things we must do to avert a climate disaster.[4]¶ Without eliminating virtually all coal emissions by 2030, the sum total of all of our other climate mitigation efforts will be inconsequential. Hansen often refers to the near complete phase-out of carbon emissions from coal plants worldwide by 2030 as the sine qua non for climate stabilization (see for example, the top of page 6 in his August 4, 2008 trip report).¶ To stay under 450ppm, we would have to install about 13,000 GWe of new carbon-free power over the next 25 years. That number was calculated by Nathan Lewis of Caltech for the Atlantic, but others such as Saul Griffith have independently derived a very similar number and White House Science Advisor John Holdren used 5,600 GWe to 7,200 GWe in his presentation to the Energy Bar Association Annual Meeting on April 23, 2009. That means that if we want to save the planet, we must install more than 1 GWe per day of clean power every single day for the next 25 years. That is a very, very tough goal. It is equivalent to building one large nuclear reactor per day, or 1,500 huge wind turbines per day, or 80,000 37 foot diameter solar dishes covering 100 square miles every day, or some linear combination of these or other carbon free power generation technologies. Note that the required rate is actually higher than this because Hansen and Rajendra Pachauri, the chair of the IPCC, now both agree that 350ppm is a more realistic “not to exceed” number (and we’ve already exceeded it).¶ Today, we are nowhere close to that installation rate with renewables alone. For example, in 2008, the average power delivered by solar worldwide was only 2 GWe (which is to be distinguished from the peak solar capacity of 13.4GWe). That is why every renewable expert at the 2009 Aspen Institute Environment Forum agreed that nuclear must be part of the solution. Al Gore also acknowledges that nuclear must play an important role.¶ Nuclear has always been the world’s largest source of carbon free power. In the US, for example, even though we haven’t built a new nuclear plant in the US for 30 years, nuclear still supplies 70% of our clean power!¶ Nuclear can be installed very rapidly; much more rapidly than renewables. For example, about two thirds of the currently operating 440 reactors around the world came online during a 10 year period between 1980 and 1990. So our best chance of meeting the required installation of new power goal and saving the planet is with an aggressive nuclear program.¶ Unlike renewables, nuclear generates base load power, reliably, regardless of weather. Nuclear also uses very little land area. It does not require the installation of new power lines since it can be installed where the power is needed. However, even with a very aggressive plan involving nuclear, it will still be extremely difficult to install clean power fast enough.¶ Unfortunately, even in the US, we have no plan to install the clean power we need fast enough to save the planet. Even if every country were to agree tomorrow to completely eliminate their coal plant emissions by 2030, how do we think they are actually going to achieve that? There is no White House plan that explains this. There is no DOE plan. There is no plan or strategy. The deadlines will come and go and most countries will profusely apologize for not meeting their goals, just like we have with most of the signers of the Kyoto Protocol today. Apologies are nice, but they will not restore the environment.¶ We need a strategy that is believable, practical, and affordable for countries to adopt. The IFR offers our best hope of being a centerpiece in such a strategy because it the only technology we know of that can provide an economically compelling reason to change.¶ At a speech at MIT on October 23, 2009, President Obama said “And that’s why the world is now engaged in a peaceful competition to determine the technologies that will power the 21st century. … The nation that wins this competition will be the nation that leads the global economy. I am convinced of that. And I want America to be that nation, it’s that simple.”¶ Nuclear is our best clean power technology and the IFR is our best nuclear technology. The Gen IV International Forum (GIF) did a study in 2001-2002 of 19 different reactor designs on 15 different criteria and 24 metrics. The IFR ranked #1 overall. Over 242 experts from around the world participated in the study. It was the most comprehensive evaluation of competitive nuclear designs ever done. Top DOE nuclear management ignored the study because it didn’t endorse the design the Bush administration wanted.¶ The IFR has been sitting on the shelf for 15 years and the DOE currently has no plans to change that.¶ How does the US expect to be a leader in clean energy by ignoring our best nuclear technology? Nobody I’ve talked to has been able to answer that question.¶ We have the technology (it was running for 30 years before we were ordered to tear it down). And we have the money: The Recovery Act has $80 billion dollars. Why aren’t we building a demo plant?¶ IFRs are better than conventional nuclear in every dimension. Here are a few:¶ Efficiency: IFRs are over 100 times more efficient than conventional nuclear. It extracts nearly 100% of the energy from nuclear material. Today’s nuclear reactors extract less than 1%. So you need only 1 ton of actinides each year to feed an IFR (we can use existing nuclear waste for this), whereas you need 100 tons of freshly mined uranium each year to extract enough material to feed a conventional nuclear plant.¶ Unlimited power forever: IFRs can use virtually any actinide for fuel. Fast reactors with reprocessing are so efficient that even if we restrict ourselves to just our existing uranium resources, we can power the entire planet forever (the Sun will consume the Earth before we run out of material to fuel fast reactors). If we limited ourselves to using just our DU “waste” currently in storage, then using the IFR we can power the US for over 1,500 years without doing any new mining of uranium.[5]¶ Exploits our largest energy resource: In the US, there is 10 times as much energy in the depleted uranium (DU) that is just sitting there as there is coal in the ground. This DU waste is our largest natural energy resource…but only if we have fast reactors. Otherwise, it is just waste. With fast reactors, virtually all our nuclear waste (from nuclear power plants, leftover from enrichment, and from decommissioned nuclear weapons)[6] becomes an energy asset worth about $30 trillion dollars…that’s not a typo…$30 trillion, not billion.[7] An 11 year old child was able to determine this from publicly available information in 2004.

#### Inventing something cheaper is key – alternative methods can’t solve warming

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The ship is sinking slowly and we are quickly running out of time to develop and implement any such plan if we are to have any hope of saving the planet. What we need is a plan we can all believe in. A plan where our country's smartest people all nod their heads in agreement and say, "Yes, this is a solid, viable plan for keeping CO2 levels from touching 425ppm and averting a global climate catastrophe."¶ ¶ At his Senate testimony a few days ago, noted climate scientist James Hansen made it crystal clear once again that the only way to avert an irreversible climate meltdown and save the planet is to phase out virtually all coal plants worldwide over a 20 year period from 2010 to 2030. Indeed, if we don't virtually eliminate the use of coal worldwide, everything else we do will be as effective as re-arranging deck chairs on the Titanic.¶ ¶ Plans that won't work¶ ¶ Unfortunately, nobody has proposed a realistic and practical plan to eliminate coal use worldwide or anywhere close to that. There is no White House URL with such a plan. No environmental group has a workable plan either.¶ ¶ Hoping that everyone will abandon their coal plants and replace them with a renewable power mix isn't a viable strategy -- we've proven that in the U.S. Heck, even if the Waxman-Markey bill passes Congress (a big "if"), it is so weak that it won't do much at all to eliminate coal plants. So even though we have Democrats controlling all three branches of government, it is almost impossible to get even a weak climate bill passed.¶ ¶ If we can't pass strong climate legislation in the U.S. with all the stars aligned, how can we expect anyone else to do it? So expecting all countries to pass a 100% renewable portfolio standard (which is far far beyond that contemplated in the current energy bill) just isn't possible. Secondly, even if you could mandate it politically in every country, from a practical standpoint, you'd never be able to implement it in time. And there are lots of experts in this country, including Secretary Chu, who say it's impossible without nuclear (a point which I am strongly in agreement with).¶ ¶ Hoping that everyone will spontaneously adopt carbon capture and sequestration (CCS) is also a non-starter solution. First of all, CCS doesn't exist at commercial scale. Secondly, even if we could make it work at scale, and even it could be magically retrofitted on every coal plant (which we don't know how to do), it would require all countries to agree to add about 30% in extra cost for no perceivable benefit. At the recent G8 conference, India and China have made it clear yet again that they aren't going to agree to emission goals.¶ ¶ Saying that we'll invent some magical new technology that will rescue us at the last minute is a bad solution. That's at best a poor contingency plan.¶ ¶ The point is this: It should be apparent to us that we aren't going to be able to solve the climate crisis by either "force" (economic coercion or legislation) or by international agreement. And relying on technologies like CCS that may never work is a really bad idea.¶ ¶ The only remaining way to solve the crisis is to make it economically irresistible for countries to "do the right thing." The best way to do that is to give the world a way to generate electric power that is economically more attractive than coal with the same benefits as coal (compact power plants, 24x7 generation, can be sited almost anywhere, etc). Even better is if the new technology can simply replace the existing burner in a coal plant. That way, they'll want to switch. No coercion is required.

### 2

#### Nuclear terrorism is extremely likely

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(Zafar Nawaz, “Nuclear/Radiological Terrorism: Myth or Reality?”, Journal of Political Studies, Vol. 19, Issue - 1, 2012, 91:111, dml)

The misperception, miscalculation and above all ignorance of the ruling elite about security puzzles **are perilous** for the national security of a state. Indeed, in an age of transnational terrorism and **unprecedented dissemination of dualuse nuclear technology**, ignoring nuclear terrorism threat is an imprudent policy choice. The incapability of terrorist organizations to engineer fissile material **does not eliminate** completely the possibility of nuclear terrorism. At the same time, the absence of an example or precedent of a nuclear/ radiological terrorism **does not qualify the assertion** that the nuclear/radiological terrorism ought to be remained a myth. Farsighted rationality obligates that one should not miscalculate **transnational terrorist groups** — whose behavior suggests that they have a death wish — of acquiring nuclear, radiological, chemical and biological material producing capabilities. In addition, one could be sensible about the published information that **huge amount of nuclear material** is spread around the globe. According to estimate it is enough to build **more than** 120,000 **Hiroshima-sized nuclear bombs** (Fissile Material Working Group, 2010, April 1). The alarming fact is that a few storage sites of nuclear/radiological materials **are inadequately secured** and continue to be accumulated in unstable regions (Sambaiew, 2010, February). Attempts at stealing fissile material had already been discovered (Din & Zhiwei, 2003: 18). Numerous evidences confirm **that terrorist groups had aspired to acquire fissile material** for their terrorist acts. Late Osama bin Laden, the founder of al Qaeda stated that acquiring nuclear weapons was a“religious duty” (Yusufzai, 1999, January 11). The IAEA also reported that “al-Qaeda was actively seeking an atomic bomb.” Jamal Ahmad al-Fadl, a dissenter of Al Qaeda, in his trial testimony had “revealed his extensive but unsuccessful efforts to acquire enriched uranium for al-Qaeda” (Allison, 2010, January: 11). On November 9, 2001, Osama bin Laden claimed that “we have chemical and nuclear weapons as a deterrent and if America used them against us we reserve the right to use them (Mir, 2001, November 10).” On May 28, 2010, Sultan Bashiruddin Mahmood, a Pakistani nuclear scientist confessed that he met Osama bin Laden. He claimed that “I met Osama bin Laden before 9/11 not to give him nuclear know-how, but to seek funds for establishing a technical college in Kabul (Syed, 2010, May 29).” He was arrested in 2003 and after extensive interrogation by American and Pakistani intelligence agencies he was released (Syed, 2010, May 29). Agreed, Mr. Mahmood did not share nuclear know-how with Al Qaeda, but his meeting with Osama establishes the fact that the terrorist organization was in contact with nuclear scientists. Second, the terrorist group **has sympathizers in the nuclear scientific bureaucracies**. It also authenticates bin Laden’s Deputy Ayman Zawahiri’s claim which he made in December 2001: “If you have $30 million, go to the black market in the central Asia, contact any disgruntled Soviet scientist and a lot of dozens of smart briefcase bombs are available (Allison, 2010, January: 2).” The covert meetings between nuclear scientists and al Qaeda members **could not be interpreted as idle threats** and thereby the threat of nuclear/radiological terrorism is real. The 33Defense Secretary Robert Gates admitted in 2008 that “what keeps every senior government leader awake at night is the thought of a terrorist ending up with a weapon of mass destruction, especially nuclear (Mueller, 2011, August 2).” Indeed, **the nuclear deterrence strategy** cannot deter **the transnational terrorist syndicate** from nuclear/radiological terrorist attacks. Daniel Whiteneck pointed out: “**Evidence suggests**, for example, that al Qaeda might not only use WMD simply to demonstrate the magnitude of its capability but that it might actually welcome **the escalation of a strong U.S. response**, **especially if it included** catalytic effects **on governments** and societies in the Muslim world. An adversary that prefers escalation regardless of the consequences cannot be deterred” (Whiteneck, 2005, Summer: 187) Since taking office, President Obama has been reiterating that “nuclear weapons represent the ‘gravest threat’ to United States and international security.” While realizing that the US could not prevent nuclear/radiological terrorist attacks singlehandedly, he launched 47an international campaign to convince the international community about the increasing threat of nuclear/ radiological terrorism. He stated on April 5, 2009: “Black market trade in nuclear secrets and nuclear materials abound. The technology to build a bomb has spread. Terrorists are determined to buy, build or steal one. Our efforts to contain these dangers are centered on **a global non-proliferation regime**, but as more people and nations break the rules, we could reach the point where **the center cannot hold** (Remarks by President Barack Obama, 2009, April 5).” He added: “One terrorist with one nuclear weapon could unleash massive destruction. Al Qaeda has said it seeks a bomb and that it would have no problem with using it. And we know that there is unsecured nuclear material across the globe” (Remarks by President Barack Obama, 2009, April 5). In July 2009, at the G-8 Summit, President Obama announced the convening of a Nuclear Security Summit in 2010 to deliberate on the mechanism to “secure nuclear materials, combat nuclear smuggling, and prevent nuclear terrorism” (Luongo, 2009, November 10). President Obama’s nuclear/radiological threat perceptions were also accentuated by the United Nations Security Council (UNSC) Resolution 1887 (2009). The UNSC expressed its grave concern regarding ‘the threat of nuclear terrorism.” It also recognized the need for all States “to take effective measures to prevent nuclear material or technical assistance becoming available to terrorists.” The UNSC Resolution called “for universal adherence to the Convention on Physical Protection of Nuclear Materials and its 2005 Amendment, and the Convention for the Suppression of Acts of Nuclear Terrorism.” (UNSC Resolution, 2009) The United States Nuclear Posture Review (NPR) document revealed on April 6, 2010 declared that “terrorism and proliferation are far greater threats **to the United States and international stability**.” (Security of Defence, 2010, April 6: i). The United States declared that it reserved the right to“hold fully accountable” any state or group “that supports or enables terrorist efforts to obtain or use weapons of mass destruction, whether by facilitating, financing, or providing expertise or safe haven for such efforts (Nuclear Posture Review Report, 2010, April: 12)”. This declaration underscores the possibility that terrorist groups could acquire fissile material from the rogue states.

#### the only impediment to escalating terror is access to spent fuel

NTI, 12 [Nuclear Threat Initiative, August 1st,“Why Is Highly Enriched Uranium a Threat?”, <http://www.nti.org/analysis/reports/civilian-heu-reduction-and-elimination/>]

Why Is Highly Enriched Uranium a Threat? The most difficult challenge for a terrorist organization seeking to build a nuclear weapon or [improvised nuclear device](http://www.nti.org/glossary/improvised-nuclear-device-ind/) is obtaining [fissile material](http://www.nti.org/glossary/fissile-material/), either [plutonium](http://www.nti.org/glossary/plutonium-pu/) or [highly enriched uranium (HEU)](http://www.nti.org/glossary/highly-enriched-uranium-heu/). HEU, [uranium](http://www.nti.org/glossary/uranium/) that has been processed to increase the proportion of the U-235 [isotope](http://www.nti.org/glossary/isotope/) to over 20%, is required for the construction of a [gun-type nuclear device](http://www.nti.org/glossary/gun-type-nuclear-weapon/), the simplest type of nuclear weapon. The greater the proportion of U-235 (i.e. the higher the [enrichment](http://www.nti.org/glossary/enriched-uranium/) level), the less material is needed for a nuclear explosive device. [Weapons-grade uranium](http://www.nti.org/glossary/weapons-grade-material/) generally refers to uranium enriched to at least 90%, but material of far lower enrichment levels, found in both fresh and [spent nuclear fuel](http://www.nti.org/glossary/spent-nuclear-fuel/), can be used to create a nuclear explosive device. In 2002, the U.S. National Research Council warned that "crude HEU weapons could be fabricated without state assistance," noting that "the primary impediment that prevents countries or technically competent terrorist groups from developing nuclear weapons is the availability of [nuclear material], especially HEU."[1] Creating a nuclear weapon from HEU is technically easier than building a [plutonium](http://www.nti.org/glossary/plutonium-pu/) weapon. Moreover, current technology is unlikely to detect a shielded nuclear device on a truck or boat. Therefore, securing and eliminating stocks of HEU is the surest way to decrease the risk that terrorist groups could use this material to create a nuclear explosion. Where Is Civilian HEU Located? Experts estimate that approximately 70 tons of HEU are used in civilian applications worldwide. [2] As little as 25 kilograms (kg) of U-235 (which amounts to about 28kg of HEU enriched to 90%) is needed to produce a nuclear weapon; about 40-60kg is needed for a cruder nuclear device. [3] Bomb-grade material can be obtained from HEU that is fresh (unirradiated), and [irradiated](http://www.nti.org/glossary/irradiate/) (also referred to as spent). Fresh and lightly irradiated fuel (such as fuel used in critical assemblies and pulse reactors) is not significantly [radioactive](http://www.nti.org/glossary/radioactivity/), and is therefore relatively safe to handle. Although using nuclear fuel in high-powered reactors initially makes it highly radioactive and thus very difficult to handle safely (often this fuel is referred to as "self-protecting"), [spent fuel](http://www.nti.org/glossary/spent-nuclear-fuel/) loses its radioactivity over time, making it easier to handle and potentially more attractive to terrorists. HEU is currently used in the civilian sphere to fuel [research reactors](http://www.nti.org/glossary/research-reactor/), critical assemblies, pulsed reactors, and a few fast reactors. According to the [International Atomic Energy Agency (IAEA)](http://www.nti.org/glossary/international-atomic-energy-agency/), 244 research reactors are in operation or temporarily shut down across 56 countries. A further 441 reactors have been shut down or decommissioned, while eight are planned or under construction. [4] Many of the research reactors that have been shut down, but not decommissioned, have spent HEU fuel on-site. The IAEA database notes that over 20,000 spent fuel assemblies from research reactors are enriched to levels above 20 percent. Nearly half of these stored fuel assemblies are enriched to levels at or above 90 percent.[5] That said, there is no current comprehensive, authoritative inventory of civil HEU globally, which is a major obstacle to progress in this area. According to the Government Accountability Office, even the [United States](http://www.nti.org/country-profiles/united-states/) has failed to maintain an accurate inventory of the HEU that it has exported over the years as attempts to balance the books could only account for 10 percent of the material. [6] The United States and the [Soviet Union](http://www.nti.org/country-profiles/russia/) supplied much of the HEU fuel used in research reactors world-wide. Other producers include [China](http://www.nti.org/country-profiles/china/) (which sent HEU fuel for research reactors to Nigeria, Ghana, [Iran](http://www.nti.org/country-profiles/iran/), [Pakistan](http://www.nti.org/country-profiles/pakistan/), and [Syria](http://www.nti.org/country-profiles/syria/), as well as enriched uranium to [South Africa](http://www.nti.org/country-profiles/south-africa/), and [Argentina](http://www.nti.org/country-profiles/argentina/)); [France](http://www.nti.org/country-profiles/france/) (to Chile and [India](http://www.nti.org/country-profiles/india/)); the [United Kingdom](http://www.nti.org/country-profiles/united-kingdom/) (to [Australia](http://www.nti.org/country-profiles/australia/), India, and [Japan](http://www.nti.org/country-profiles/japan/)); and South Africa (which did not export this fuel).[7] Before 1978, when Washington and Moscow became concerned about the implications of their exports of highly enriched fuels, most of the fuel supplied by the United States (the bulk of which went to North American and the Asia-Pacific), was of very high enrichment levels (90% and above). The Soviet-supplied fuel, chiefly sent to Eastern Europe, was typically 80% enriched. Under several U.S.-led initiatives, many countries have returned HEU fuel, both fresh and spent, to its country of origin in order to reduce the risk of theft. HEU is also used in targets in reactors that produce [medical isotopes](http://www.nti.org/glossary/medical-isotopes/). HEU is used for this purpose annually in reactors in Belgium, Canada, France, the Netherlands, and Russia.[8] Other countries, including Australia and [Indonesia](http://www.nti.org/country-profiles/indonesia/), have begun producing these isotopes with [LEU](http://www.nti.org/glossary/low-enriched-uranium-leu/) targets, and still other countries, such as [Egypt](http://www.nti.org/country-profiles/egypt/), are currently developing and implementing their LEU target-based production process. [9] In particular, South Africa—a major exporter—converted its Safari-1 reactor to rely on both LEU targets and fuel for the production of [medical isotopes](http://www.nti.org/glossary/radioisotope/). Most of the other major producers of medical isotopes, including Canada, the Netherlands, and France, utilize LEU fuels in their reactors, but continue to rely on HEU targets. However, a number of these countries, particularly in Western Europe, have pledged to convert to LEU targets. Progress towards fuller use of LEU is not universal, however. A Russian project, for example, aims to produce enough molybdenum-99 using HEU fuel and targets to satisfy 20 percent of global demand by 2015. [10] In addition to use in research and test reactors and for medical isotope production, HEU is used in naval propulsion and space propulsion research. The material is also used for testing fast reactor core designs using [mixed oxide (MOX) fuel](http://www.nti.org/glossary/mixed-oxide-mox-fuel/). For further information on HEU in civilian applications, see [Civilian Uses of HEU](http://www.nti.org/analysis/articles/civilian-uses-heu/). Security of Civilian HEU Many civilian facilities with HEU on-site do not have adequate security. The IAEA reported that during one of its missions, it discovered a research reactor with HEU that "was observed to have essentially no physical protection." [11] The IAEA assisted the facility with enhancing its security, but reported that overall, "deficiencies remain in the legal, administrative, and technical arrangements for controlling and protecting nuclear materials ... in many countries." [12] The U.S. Department of Energy has been assisting with physical protection upgrades for 22 foreign research reactors through the Global Research Reactor Program. A September 2009 GAO report found that while most sites that have received upgrades generally met IAEA security guidelines, in some cases, critical security weaknesses remained. [23] It is not a simple matter to upgrade security measures; the majority of the world's research reactors are located in universities or other publicly accessible research centers. While security concerns have dramatically increased since 9/11, it is difficult to reconfigure a site that was not built with physical protection in mind. Storage of spent fuel stocks is generally even less secure than fresh fuel stocks, as until a few years ago spent nuclear fuel was considered "self-protecting" and few facilities wanted to spend money securing a material that was no longer of economic value. It is far more effective to remove this material from vulnerable locations than to attempt to increase security on-site. Programs to Reduce and Eliminate HEU There have been efforts to reduce the amount of HEU at civilian facilities since 1978, when Washington initiated the [Reduced Enrichment for Research and Test Reactors (RERTR) Program](http://www.nti.org/glossary/rertr-program/). Moscow also began its own program to reduce enrichment at Soviet-built research reactors outside of the Soviet Union, and changed its HEU export policies, supplying these reactors with 36% HEU in lieu of 80% HEU. In the past 25 years, many countries have cooperated with the RERTR program or initiated their own, similar programs. In May 2004, the U.S. Department of Energy launched the [Global Threat Reduction Initiative (GTRI](http://www.nti.org/glossary/global-threat-reduction-initiative/)), which the IAEA, Russia, and others have since joined. Among its goals, the GTRI seeks to "minimize and eventually eliminate any reliance on HEU in the civilian fuel cycle, including conversion of research and test reactors worldwide from the use of HEU to the use of LEU fuel and targets." As of early 2012, U.S.-led efforts have converted to LEU or verified the shut down of 88 HEU-fueled facilities.[14] The RERTR program is also working on the conversion of a handful of medical isotope producers that use HEU targets in their reactors. The program includes some of the largest producers of medical isotopes, located in Europe. To date, the RERTR program has helped to successfully convert isotope-producing reactors in Argentina and South Africa. At present, there are no longer any technical barriers to conversion to LEU and only political and financial issues remain. [15] Besides converting facilities to use LEU fuel and targets, there have also been efforts to consolidate fresh and spent HEU fuel at a smaller number of relatively secure locations. This has involved removing the fuel, mostly to the United States and Russia, from other countries, as well as consolidating the fuel within countries. U.S. programs in this area (the Russian Research Reactor Fuel Return program to repatriate fuel to Russia, and the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program to repatriate U.S.-origin fuel), have all been subsumed under the 2004 GTRI initiative. Together, the two programs have returned over 2,735kg of spent and fresh HEU fuel to the United States and Russia as of 2012. [16] According to the IAEA's definition of the quantity of HEU necessary to construct a nuclear explosive device, the amount of repatriated HEU is equivalent to up to 80 weapons. [17] Despite the progress of these efforts, many HEU sites remain worldwide, with a significant portion of them located in Russia. [26] A related program, the Material Consolidation and Conversion (MCC) project, established in 1999, reduces this excess Russian civilian HEU by blending it down into LEU. As of the end of 2011, approximately 13.5 of an estimated 17 tons of U-235 in excess Russian civilian HEU had been blended down. [18] Both the United States and Russia also have large quantities of excess HEU from their defense programs. In Russia, excess HEU from weapons is blended down to LEU within the framework of the Megatons to Megawatts program (also known as the [HEU-LEU program](http://www.nti.org/glossary/heu-deal/)). The resulting LEU is then released for civilian use. The program will end in 2013, at which point 500 tons of HEU will have been downblended. [19] The United States initially declared some 174 metric tons of HEU as excess to military needs, designating this material as civilian. [20] An additional 200 metric tons were officially removed from the U.S. weapons stockpile in November 2005. [21]

#### That’s key to the nuclear taboo – solves nuclear war

Bin ‘9(5-22-09 About the Authors Prof. Li Bin is a leading Chinese expert on arms control and is currently the director of Arms Control Program at the Institute of International Studies, Tsinghua University. He received his Bachelor and Master Degrees in Physics from Peking University before joining China Academy of Engineering Physics (CAEP) to pursue a doctorate in the technical aspects of arms control. He served as a part-time assistant on arms control for the Committee of Science, Technology and Industry for National Defense (COSTIND).Upon graduation Dr. Li entered the Institute of Applied Physics and Computational Mathematics (IAPCM) as a research fellow and joined the COSTIND technical group supporting Chinese negotiation team on Comprehensive Test Ban Treaty (CTBT). He attended the final round of CTBT negotiations as a technical advisor to the Chinese negotiating team. Nie Hongyi is an officer in the People’s Liberation Army with an MA from China’s National Defense University and a Ph.D. in International Studies from Tsinghua University, which he completed in 2009 under Prof. Li Bin. )

The nuclear taboo is a kind of international norm and this type of norm is supported by the promotion of the norm through international social exchange. But at present the increased **threat of nuclear terrorism has lowered people’s confidence that nuclear weapons will not be used**. China and the United States have a broad common interest in combating nuclear terrorism. **Using technical and institutional measures to break the foundation of nuclear terrorism and lessen the possibility of a nuclear terrorist attack can** not only weaken the danger of nuclear terrorism itself but also **strengthen people’s confidence in the nuclear taboo**, and in this way preserve an international environment beneficial to both China and the United States. In this way **even if there is crisis** in China-U.S. relations caused by conflict, **the nuclear taboo can** also help both countries **reduce suspicions** about the nuclear weapons problem, **avoid miscalculation and thereby reduce the danger of a nuclear war.**

#### Causes extinction – retal

**Ayson 10** (Robert, Professor of Strategic Studies, Director of Strategic Studies: New Zealand, Senior Research Associate with Oxford’s Centre for International Studies. “After a Terrorist Nuclear Attack: Envisaging Catalytic Effects. Studies in Conflict and Terrorism, Volume 33, Issue 7, July 2010, pages 571-593)

Washington's early response to a terrorist nuclear attack on its own soil might also raise the possibility of an unwanted (and nuclear aided) confrontation with Russia and/or China. For example, in the noise and confusion during the immediate aftermath of the terrorist nuclear attack, the U.S. president might be expected to place the country's armed forces, including its nuclear arsenal, on a higher stage of alert. In such a tense environment, when careful planning runs up against the friction of reality, it is just possible that Moscow and/or China might mistakenly read this as a sign of U.S. intentions to use force (and possibly nuclear force) against them. In that situation, the temptations to preempt such actions might grow, although it must be admitted that any preemption would probably still meet with a devastating response. As part of its initial response to the act of nuclear terrorism (as discussed earlier) Washington might decide to order a significant conventional (or nuclear) retaliatory or disarming attack against the leadership of the terrorist group and/or states seen to support that group. Depending on the identity and especially the location of these targets, Russia and/or China might interpret such action as being far too close for their comfort, and potentially as an infringement on their spheres of influence and even on their sovereignty. One far-fetched but perhaps not impossible scenario might stem from a judgment in Washington that some of the main aiders and abetters of the terrorist action resided somewhere such as Chechnya, perhaps in connection with what Allison claims is the “Chechen insurgents' … long-standing interest in all things nuclear.”42 American pressure on that part of the world would almost certainly raise alarms in Moscow that …might require a degree of advanced consultation from Washington that the latter found itself unable or unwilling to provide.

#### And, the plan solves unauthorized diversion

**Archambeau et al 11** – Science Council for Global Initiatives

(Charles, with Randolph Ware, Tom Blees, Barry Brook, Yoon Chang, Jerry Peterson, Robert Serafin, Joseph Shuster, Evgeny Velikhov, and Tom Wigley, “The Integral Fast Reactor (IFR): An Optimized Source for Global Energy Needs”, google it, dml)

Pyroprocessing was originally developed for integration with a fast reactor, but it can also be used in a stand-alone mode to **treat spent fuel** from today's commercial reactors with the addition of a front-end step to convert the used oxide fuel to metallic form. **Pyroprocessing** eliminates **the ability to use the reactor's nuclear materials directly in weapons** because it cannot separate out any Plutonium (Pu). Instead, it keeps the major nuclear fuels, Uranium and Plutonium mixed, at all times, with other actinides and fission products. This mixture is protected **against theft or unauthorized diversion** because the mixture is extremely radioactive and must be handled remotely with sophisticated and specialized equipment.

#### IFR key

**Archambeau et al 11** – Science Council for Global Initiatives

(Charles, with Randolph Ware, Tom Blees, Barry Brook, Yoon Chang, Jerry Peterson, Robert Serafin, Joseph Shuster, Evgeny Velikhov, and Tom Wigley, “The Integral Fast Reactor (IFR): An Optimized Source for Global Energy Needs”, google it, dml)

The pyroprocessor unit can be used as a stand-alone system to process LWR waste from any open cycle reactor into fuel for IFR closed cycle reactors. The depleted Uranium produced by the enrichment of Uranium ore can also be processed to generate additional IFR fuel. The current amount of LWR waste, plus the amount of depleted Uranium in stock piles world-wide, is sufficient to supply fuel to all the IFR plants needed and in fact to supply the world's required energy for about 1000 years.3 The problem of storage of current LWR waste and depleted Uranium waste from refining of mined Uranium is therefore solved by pyroprocessor generation of IFR fuel, along with a relatively small mass of short-lived fission products which can be easily and safely stored. Uranium can also be extracted from sea water using IFR power sources (see, for example, Cohen, 1983). Because Uranium is constantly added to seawater by erosion processes, then the IFR fuel source is effectively unlimited. Therefore, IFR power plants do not require fuel from regular mining operations, as does a LWR powered plant, but can use pyroprocessor generated fuel essentially indefinitely. In this sense the IFR is a "renewable" energy source which can be expanded, essentially indefinitely, to meet demand.

### 3

#### The United States Federal Government should initiate a new Manhattan Project in the United States for integral fast reactors using the S-PRISM design.

#### Next advantage is the Manhattan project

#### The plan ensures SPRISM expansion - market approaches fail to catalyze investment – Manhattan approach key to solidify a US lead role

Kirsch, 09 [Steve Kirsch, “The Integral Fast Reactor (IFR) project: Q&A” Bachelor of Science and a Master of Science in electrical engineering and computer science from the Massachusetts Institute of Technology, <http://skirsch.com/politics/globalwarming/ifrQandA.htm>]

Q. If this is really so good, how come GE isn't building S-PRISM on their own nickel? Nobody wants to risk it since it isn't a slam dunk. You don't get a reward if you solve global warming. And government funding doesn't seem to be so easy. DOE tried to get funding for GNEP (which included IFR technology) and got shot down (so far). GE is a large conservative corporation. They already service a fleet of lightwater reactors, are building more of them around the world, and have the promise of yet more. It's hard enough in this country to move into new levels of reactor technology without trying to leapfrog straight into the 4th generation. Their 3rd generation ESBWR is in the 5th round of NRC certification, whereas the S-PRISM (a souped up and more developed version of the PRISM) isn't at the starting gate. These things take years at the glacial pace of the NRC, though of course if President Obama decided to go all Manhattan project on it we could most definitely get there quickly enough. If GE started pushing 4th generation breeder reactors, can you imagine the hue and cry from the antie groups? What's their incentive to do that? If they're convinced that ultimately we'll end up at 4th generation reactors anyway and they can make plenty of dough and keep a low profile just taking the go slow approach, don't you imagine that's exactly what they'll do? Besides, conceivably another country with whom we have nuclear technology sharing agreements might very well certify and build it before the NRC ever gets out of the starting gate, which would make it much easier for the eventual NRC certification. Q. If this is really so good, how come someone in government isn't trying to get it restarted? The DOE is attempting to resuscitate fast-reactor technology, as part of the GNEP (Global Nuclear Energy Partnership) initiative. See <http://www.gnep.energy.gov/gnepPRs/gnepPR011007.html>, and <http://www.gnep.energy.gov/>. The IFR is one form of fast-reactor technology (metallic fuel with pyroprocessing), but there are others -- inferior, according to the IFR scientists. The important thing these days is to get the U.S. back into a leadership role in the development and management of nuclear power, recognizing that recycling in fast reactors is necessary if the long-lived waste is to be consumed, and if the full energy potential of the uranium is to be exploited. The GNEP would resuscitate fast-reactor technology in this country. Q. Critics claim fast reactors are “expensive to build, complex to operate, susceptible to prolonged shutdown as a result of even minor malfunctions, and difficult and time-consuming to repair.” I'm not aware of anyone who is an expert on Integral Fast Reactor technology (who actually really understands the science) who has this view. One Nobel prize winning physicist who was recently briefed on the IFR (Burton Richter, former Director of SLAC) told me that, at best, there is insufficient scientific evidence to make such a statement. Is there someone who knows the fast reactor science as well as Dr. Chang or Dr. Till who holds that view? Certainly not the MIT study (as they admitted up front). So whose expert opinion are you relying on here? Secondly, if your statement was true, then aren't these statements directly in direct conflict with the facts? If the critics are to be relied upon, then none of the following would have been possible at all: – The Monju reactor was undamaged by the fire (rated 1 on a scale of 0 to 7, with 7 being the most serious accident), and has been kept shut down for political reasons. I think it has been given the go-ahead to start up. – The EBR-II fast reactor worked flawlessly for many years (<http://www.world-nuclear.org/info/inf98.html> 31 years from 1963-1994) – The Phenix fast reactor in France has been on-line for decades. – The Superphenix reactor was shut down for political reasons, after it finally had its problems behind it and was working well. – The Russian BN-600 has been working well for decades. Ray Hunter was for the past 29 years as the former Deputy Director of the Office of Nuclear Energy, Science and Technology in the U.S. Department of Energy (DOE). Should his view count? Here's what he wrote to me: My name is Ray Hunter. I am the former Deputy Director of the Office of Nuclear Energy, Science and Technology in the U.S. Department of Energy (DOE). I spent more than 29 years in DOE and the predecessor agencies working on developing advanced nuclear reactors for civilian nuclear power applications. After evaluating several alternatives, I came to the conclusion that a sodium cooled fast reactor using metal fuel and non aqueous reprocessing offered the best option to compliment and eventually replace Light Water Reactors (LWR’s). The basis for my conclusion was the successful proof of principle demonstration work completed by Argonne National Laboratory. It is important to understand that there were had two versions of the IFR concept; the second version involved a sodium cooled reactor using mixed uranium oxide and plutonium oxide fuel and aqueous reprocessing. The second version required separating Plutonium-239 for fabrication into new fuel which was considered to be a major proliferation issue. Unfortunately, the Clinton administration considered all fast reactors concepts as too much of a proliferation risk and cancelled all work on fast reactors. Actually, the decision to forgo processing of LWR fuel as enacted into law by 1982 Radioactive Waste Management Policy Act was the precursor for ending fast reactor technology development. The Department did continue to support in corporation with industry advanced LWR designs for future use. These advanced designs have been approved by the Nuclear Regulatory Commissions but none have been ordered in the U.S. because of the unresolved waste issue and the economic risk of trying to build and license a nuclear power plant in the U.S. Versions of these advanced LWR designs have already been built and are operating in Japan and South Korea. The ill conceived U.S. policy of a once through LWR fuel cycle has never been adopted by any other nuclear power nation. According to Senator Reid, Yucca Mountain will not proceed as long as his any say in the matter. Until there is a path forward on LWR spent fuel, it is unlikely any new nuclear plant will be built in the U.S. The technical facts clearly show that the most cost effective and environmentally sound way to deal with LWR spent fuel is use the IFR concept with metal fuel and non aqueous reprocessing. While the proposed GNEP concept does not require plutonium separation, it is still based on oxide fuel and aqueous reprocessing which does allay proliferation concerns. Also, the GNEP concept is being offered as global solution for minimizing nuclear proliferation based on certain countries doing reprocessing including the U.S. but our current law precludes it. I am attaching [a recent letter I sent to Senator Reid](http://skirsch.com/politics/ifr/RayHunterLetterToSenatorReid.doc). In my judgment, we need to focus on the waste issue to break the logjam on nuclear power in the U.S. We don’t need to deploy the IFR in the private sector for the foreseeable future to get the benefits of expanded nuclear power use. If inviting the IAEA to oversee IFR facilities at government sites would promote acceptance of reprocessing, then we should proceed accordingly. Any thoughts you have on this matter would be appreciated. Q. A lot of critics claim the plants will be too expensive to build. The cost of a power plant is often expressed in terms of dollars per kilowatt of capacity. Every $1,000/kWe in initial cost adds, very roughly, one cent per kilowatt-hour to the cost of the electricity (assuming a 40-year write-off period and an interest rate of 8.5% per year). The cost of a nuclear plant is very hard to predict these days, because it depends heavily on the regulatory climate. In more detail, here's something Eric Loewen (GE) has written on the subject of cost: . . . This is not to say that PRISM or any other nuclear reactor will be inexpensive when built in the United States. The same GE Hitachi reactors that were built in Japan in the late 90s for about $1,400/kW are estimated to cost several times that much in the USA. Considering that the actual cost of raw materials is an insignificant portion of that price (about $35/kW), and that interest rates are at record low levels, the significantly higher price tags being bandied about by private utility companies reflects a regulatory/corporate/governmental environment that needs fixing. Part of the problem could be solved by a commitment to nuclear power from the federal government, streamlined licensing procedures for standardized designs, and shielding from interminable lawsuits like those that crippled the nuclear power industry in the 70s and 80s. There is nothing inherently uneconomical about nuclear power. Japan imports virtually all their building materials and has high labor costs. If they can build GE ABWR plants for a very reasonable price, there is no reason why the USA shouldn't be able to do the same. Q. How many IFR plants do we need to replace all the coal plants in the US? There are 200 nuclear plants now supplying 20% of our power. Coal provides about half our power. So you'd need about 400 new nuclear plants to displace all the coal plants. Q. Can you convert existing coal plants to be IFR plants? One nice thing about the S-PRISM is that they're modular units and of relatively low output (one power block of two will provide 760 MW). They could be emplaced in excavations at existing coal plants and utilize the same turbines, condensers (towers or others), and grid infrastructure as the coal plants currently use, and the proper number of reactor vessels could be used to match the capabilities of those facilities. Essentially all you'd be replacing is the burner (and you'd have to build a new control room, of course, or drastically modify the current one). Thus you avoid most of the stranded costs. If stranded costs can thus be kept to a minimum, both here and, more importantly, in China, we'll be able to talk realistically not just about stopping to build new coal plants but replacing the existing ones, even the newest ones. Q. What about waste? George Stanford wrote the following in response to a [WSJ article](http://online.wsj.com/article/SB123690627522614525.html): In saying that "There Is No Such Thing as Nuclear Waste" (March 13), William Tucker is even more correct than he realizes. He talks about putting the "plain old U-238" back in the ground, because he thinks it's "non-fissionable." True, U-238 is not as fissionable as U-235 (which is called "fissile"), but all you have to do is put another neutron into a U-238 nucleus, and you soon have fissile Pu-239. In fact, some 30% of the power from today's reactors comes from the fissioning of Pu-239 atoms that used to be U-238. But that's not the half of it. Today's reactors are called "thermal" because their neutrons are slowed down to low ("thermal") speeds. That kind of reactor cannot extract even one percent of the energy in the uranium that was mined to make the fuel. "Fast" reactors, in which the neutrons are not slowed down, have the ability to utilize the remaining 99% -- thereby getting a hundred time as much energy from the uranium that we have dug up. Other countries (India, China, France, Japan, Russia, South Korea) are working to implement fast reactors. The United States used to be the leader in the field, but no longer is, because development of our fast reactor -- the IFR -- was terminated in 1994, for non-technical reasons. However, General Electric continued a low-level effort, and now stands ready to build a commercial-scale demonstration plant, given the needed seed money. With IFRs we could power the nation for centuries without mining another ounce of uranium. The only waste from an IFR is about a ton of fission products (broken uranium atoms) per year for every moderately big (1000 MW) power plant -- and many of those elements have commercial value. Moreover, their radioactivity decays to insignificance within 500 years.

#### And, the plan causes rapid tech commercialization – scalability and scope key

Barton, 09 [Charles, writing at the Energy Collective, “A Second Manhattan Project?”, <http://theenergycollective.com/charlesbarton/31802/second-manhattan-project>]

The conventional view is that it would take a long time to develop Generation IV nuclear technology. This is mistaken because the Indians expect to complete a commercial Generation IV Fast Breeder Prototype Reactor in 2011, and then begin to build standard production reactors immediately after. They currently expect to complete at least 4 commercial fast breeders by 2020, and more later. The long gestation period view assumes that the development of Generation IV technology would be conducted with business as usual approaches. But if we think that the fate of human society would rest on the pace of a Generation IV development project, would a business as usual approach make sense? Alternatives would be a simi-Manhatten project model and a mini-Manhattan project approach. The difference would have to do with time scale, with the Simi-Manhattan project approach trying to bring in everything in a two to three year time range, while the mini approach might take 5 years. The mini approach might cost $20 billion, perhaps twice the cost of the business as usual approach, but at the end of the five years a saleable product, and a factory to build it would be ready. Let me illustrate what I mean by the Manhattan Project approach. The Mahnattan Project was a massive research, development and production project conducted during World War II. The aim of the project was the development of deliverable nuclear weapons. That goal was meet. Rather than develop one single approach to the project, and perfect it, project scientists undertook to develop parallel approaches to project goals. Scientists identified two fissionable materials that could be used in Nuclear Weapons, U-235 and Pu-239. Rather than settle on one approach, they decided to develop two weapons, each using one of the fissionable matereials. The method of producing Pu-239 was deemed very dangerous, and the production facility was located in a desert in Washington State. Production at the Washington State site was to be accomplished through the use of 3 large, experimental reactors of a type never built before. Construction of the reactors began in August 1943, The first was finished in September 1944, and the final reactor was completed by February 1945. The entire 3 reactor project was completed in 18 months. Despite questions about the safety of their design, the Hanford reactors never had a serious accident. Their designer, Eugene Wigner was trained by a chemical engineer who had done notable chemistry research in the 1930's. A further research reactor was build in Oak Ridge with an overlapping time schedule to the Hanford Reactors. The X-10 Graphite Reactor, was intended to produce plutonium for the research required to waponize it. The designer of the Graphite Reactor was a young scientist, who had recently acquired a PhD in biophysics from the University of Chicago. Despite the fact that the youthful Alvin Weinberg had more training in biology and mathamatics than in physics, and had no engineering training at all, he was able to design a reactor that was built in 10 months, and performed flawlessly, and proved a valuable research tool. Thus from December 1942, when Enrico Fermi's Chicago pile went critical, and November 1944, the design of reactors leaped forward by would have required a business as usual approach a generation to accomplish. Further more, the designers of these reactors would have been viewed as completely unqualified to perform this task, because they lacked the proper educational background. In addition to the development of reactors to facilitate the production of a plutonium based nuclear weapon, the project to develop a uranium based weapon had an equally remarkable history. Three separate uranium enrichment projects were developed in Oak Ridge. The Y-12 project developed and used electro-magnets in devices called calutrons to seperate the uranium isotopes. The calutrons required a huge amount of copper wire, and when copper was in short supply, the Manhattan project borrowed 14,700 tons of another electrical conductive metal, silver, from the United States Treasury to wire the magnets. A second uranium separation process was housed at K-25, which when finished was the largest building under one roof in the world. The K-25 project would have cost $8 billion today. While it was being built, scientists and engineers did not know if they could make the [gaseous diffusion](http://en.wikipedia.org/wiki/Gaseous_diffusion) method work. Again, a huge investment produced in months what a business as usual approach would have required years to accomplish. I would argue that given the dual crises of CO2 emissions/Anthropogenic Global Warming and Peak Oil, and the potential for Generation IV nuclear technology, a rapid nuclear development program is demanded. If a Manhattan project type endeavor were undertaken, regulation would be expedited but safety not compromised. The NRC would work alongside reactor researchers, establishing reasonable safety standards, and passing them on. During the development period the NRC should determin that reactor developments are meeting all NRC safety goals. The complete design should already have an NRC license, even before the prototype is built. In the Simi-Manhattan project alternative design approaches would be researched in parallel, while in the mini approach they might be investigated sequentially. Both would involve spending at a robust level. There are shortcuts to development including licensing sucessful technology. This might include licensing Russian BN-600 technology, Indian Fast Breeder Prototype Reactor technology, in addition too drawing on American **Experimental Breeder Reactor-II** (EBR-II) technology and experience. I am not a big fan of the LMFBR type, but it is probably inevitable that we are going to build some, and if we do, we might as well develop and build them fast. As it was being forced by the Ford administration to wind down LFTR/MSR research, [Oak Ridge National Laboratory MSR project leaders prepared a detailed developmental program for LFTR technology that would lead to solving all known developmental problems that might impeded the construction of LFTR prototype](http://www.energyfromthorium.com/pdf/ORNL-5018.pdf) (ORNL-5018). That document assumed a business as usual approach, and suggested development plans that would take a generation to realize. How much would it cost? According to [ORNL-4812](http://www.energyfromthorium.com/pdf/ORNL-4812.pdf), up to 1972 ORNL had spent $130 million dollars on MSR development. In 2009 terms this was less than than one billion dollars, In 1980 the ORNL staff estimated that a commercial DMSR could be developed for $700 million (about 2.5 billion in 2009 dollars). Given another 2.5 billion for the development of the LFTR prototype we would have a total investment of between 5 and 6 Billion 2009 dollars investment. At that point there would be a product ready to go on the assembly line. Thus the total investment in the LFTR would be comparable to the Federal investment into the LWR. It would be one fourth the investment made so far in unsuccessful American LMFBR technology. My analysis suggests that with factory production and by recycling coal fired power plants, modular LFTRs can come online for an investment as small as a dollar a watt. Let us assume that the actual cost is twice that. We still have a price for LFTRs that is lower than the 2009 price for windmills, even with a capacity factor no better than the windmills, the LFTR would be a far better buy because of its superior flexibility. It would be nice to imagine a private enterprice investing in the LFTR. Is it possible? $5 billion would not be unreasonable for a private business invest in LFTR development. There are American businesses that are capable of writing a$5 billion check for LFTR development today. Consider the €11 billion plus that Airbus invested in the development of the A380 aircraft. At a cost of $327 million, the A380 would be, if anything, more expensive than the modular LFTR. In fact it is doubtful that Airbus will ever recover the Airbus 380 development cost, while the LFTR potentially could be quite profitable. Compaired to the cost of renewables.the Manhatten project approach would be an incredible bargan. For example, the German newspaper [*Die Zeit*](http://www.expatica.com/de/news/german-news/Germany_s-solar-panel-firms-in-trouble-_56897.html) recently reported that the costs of photovoltaic instalations built in Germanyup to 2008 will amount to even more than 30 billion Euros. And how much electricity will German consumers get for their investment? A recent estimate reported that [in 2008. German PVs produced 4,300 GWh,](http://www.volker-quaschning.de/datserv/ren-Strom-D/index_e.php) about half the power output of one conventional nuclear reactor. 30 billion Euros would pay the development of both [Sandia's "Right Size" Reactor](http://atomic.thepodcastnetwork.com/2009/09/25/the-atomic-show-142-american-right-sized-reactors/), a small, factory built Fast Breeder Reactor, and the the Liquid Fluoride Thorium Reactor, a very safe, factory build reactor. Eventually, the LFTR will prove to have significant advantages over the Fast Breeder Reactors. First the core of the LFTR is smaller, hense the structure ment to house the LFTR core will be smaller, and lower cost. Secondly the LFTR has safety abvantages over the fast reactor. Even if the fast reactor proves in practice to be as safe as the LFTR, that safety is not entirely inherent, and will come at a cost. Finally, fuel reprocessing with the fast reactor, will be far more expensive than with the LFTR. Given the very great importance of a rapid, and massive world wide deployment of low cost nuclear technology capable of safely meeting human energy needs. a Manhattan Project type approach to facilitate the development of promising nuclear technology seems more than warranted. Indeed given the potentially disastrous consequences of failing to safely meet human energy needs, the rapid development of promising technology, is an imperative, not an option. - Charles

#### And, that influences global reactor adoption – forces investments that are key to competitiveness

Alexander, 08 [Lamar Alexander is the senior U.S. senator from Tennessee and chair of the Senate Republican Conference. He served as Tennessee’s governor from 1979 to 1987 and as U.S. Secretary of Education from 1991 to 1993. Tennessee’s Business | BERC, A New Manhattan Project for Clean Energy Independence, <http://frank.mtsu.edu/~berc/tnbiz/economy/pdfs/alexander.pdf>]

I propose that the United States launch a new Manhattan project: a five-year project to put America firmly on the path to clean energy independence. Instead of ending a war, the goal will be clean energy independence — so that we can deal with rising gasoline prices, electricity prices, clean air, climate change, and national security — for our country first, and, because other countries have the same urgent needs and therefore will adopt our ideas, for the rest of the world. The overwhelming challenge today . . . is to discover ways to satisfy the human demand for and use of energy in an environmentally satisfactory and affordable way so that we are not overly dependent on overseas sources. By independence I do not mean that the United States would never buy oil from Mexico or Canada or Saudi Arabia. By independence I mean that the United States could never be held hostage by any country for our energy needs. In 1942, many were afraid that the first country to build an atomic bomb could blackmail the rest of the world. Today, countries that supply oil and natural gas can blackmail the rest of the world. Not a New Idea A new Manhattan Project is not a new idea, but it is a good idea and fits the goal of clean energy independence. The Apollo Program to send men to the moon in the 1960s was a kind of Manhattan Project. Presidential candidates John McCain and Barack Obama have called for a Manhattan Project for new energy sources. So have former House Speaker Newt Gingrich, Democratic National Committee Chairman Howard Dean, and Senators Susan Collins of Maine and Kit Bond of Missouri, among others. And, throughout the two years of discussion that led to the passage in 2007 of the America COMPETES Act, several participants suggested that focusing on energy independence would force the kind of investments in the physical sciences and research that the United States needs to maintain its competitiveness.

#### And, the spillover effects bolster all major US industries

Leopold, 12 [9 Kick-Ass Things Obama Should Do In a Second Term

The chances are rising for an Obama second term. But what do we really want him to do?, http://www.alternet.org/story/154123/9\_kick-ass\_things\_obama\_should\_do\_in\_a\_second\_term?page=0%2C1&paging=off]

4. Manhattan Project for renewable energy. To help win WWII, America created the massive Manhattan Project to build the first atomic weapons. To help win the Cold War, American created NASA and won the race to the moon. To win the battle against climate change, we’ll need a similar effort to create the next generation of renewable energy technologies to replace fossil fuels. Not only would such a project lead to a new, clean energy infrastructure, but the knowledge gained along the way would invigorate nearly every industry in our economy.

#### The impact is great power war

Baru 9 - Visiting Professor at the Lee Kuan Yew School of Public Policy in Singapore (Sanjaya, “Year of the power shift?,”

http://www.india-seminar.com/2009/593/593\_sanjaya\_baru.htm

 **T**here is no doubt that economics alone will not determine the balance of global power, but there is no doubt either that economics has come to matter for more. The management of the economy, and of the treasury, has been a vital aspect of statecraft from time immemorial. Kautilya’s *Arthashastra* says, ‘From the strength of the treasury the army is born. …men without wealth do not attain their objectives even after hundreds of trials… Only through wealth can material gains be acquired, as elephants (wild) can be captured only by elephants (tamed)… A state with depleted resources, even if acquired, becomes only a liability.’4 Hence, economic policies and performance do have strategic consequences.5 In the modern era, the idea that strong economic performance is the foundation of power was argued most persuasively by historian Paul Kennedy. ‘Victory (in war),’ Kennedy claimed, ‘has repeatedly gone to the side with more flourishing productive base.’6 Drawing attention to the interrelationships between economic wealth, technological innovation, and the ability of states to efficiently mobilize economic and technological resources for power projection and national defence, Kennedy argued that nations that were able to better combine military and economic strength scored over others. ‘The fact remains,’ Kennedy argued, ‘that all of the major shifts in the world’s *military-power* balance have followed alterations in the *productive* balances; and further, that the rising and falling of the various empires and states in the international system has been confirmed by the outcomes of the major Great Power wars, where victory has always gone to the side with the greatest material resources.’7 **I**n Kennedy’s view the geopolitical consequences of an economic crisis or even decline would be transmitted through a nation’s inability to find adequate financial resources to simultaneously sustain economic growth and military power – the classic ‘guns vs butter’ dilemma.

#### And, the mechanism of the plan ensures international cooperation centered on a US lead role

Norris, 08 [Lessons of the Manhattan Project By Robert S. Norris Natural Resources Defense Council A presentation to the National Academies’ Committee on Science, Engineering and Public Policy (COSEPUP) September 5, 2008. <http://docs.nrdc.org/nuclear/files/nuc_08100901A.pdf>]

Modern large-scale R&D efforts to address national problems such as climate change are much more complex. There are certain programs that address the climate change challenge that may well profit from Manhattan Project-like approaches. There is a clear need for large-scale, governmentled efforts to develop “transformational technologies,” such as solar and wind power. It is the technical problems that can most benefit from applying Manhattan Project lessons. A reallocation of resources is also essential. The $10 billion dollars we spend each month in Iraq could fund multiple climate change Manhattan Projects.The social, political, and economic dimensions of the problem are much more difficult to solve. The forecasts about climate change are dire. According to one prominent environmentalist, contemporary capitalism and a habitable planet cannot coexist. I should add that James “Gus” Speth, who writes about this in his recent book, The Bridge at the End of the World is a founder of my organization and is on our Board. The causes of global warming and climate change go to the heart of how our society and economy operates. Any remedies must go to similar deep levels to realistically confront the challenges. Can corporations and Wall Street adjust to such dramatic changes? Are there political forces strong enough to inspire the nation to join together, to sacrifice, and work diligently to solve the problem? A major difference from World War II is that the threat to our way of life and possibly survival is now worldwide and not just national in scope. Climate change is not just an American problem. Addressing it on a global scale could be an opportunity for international cooperation—one where the United States, under the right conditions might organize and lead an effort on the necessary scale required for a solution. As I understand it the Academy is considering undertaking a study on designing crash R&D projects and what the appropriate terms of reference for such a study should be. There is no lack of challenges before us. At the outset it seems a valuable exercise to examine past crash efforts to see what has worked and perhaps equally valid what hasn’t worked. I hope that my comments here this morning may have helped that process.

#### And, collaboration attracts scientists and causes international development of nuclear technology – independently solves global nuclear war and unforeseen problems

Kuonqi, 08 [Responding to Clear and Present Dangers: A New Manhattan Project for Climate Change?, Christopher Kuonqui UNDP, Human Development Report 2007/2008, <http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/kuonqui_christopher.pdf>]

Events moved forward rapidly. Chief engineer J. Robert Oppenheimer hosted a conference on nuclear fission in summer 1942, and walked through the gates of the Los Alamos National Laboratories, New Mexico, USA, on 25 November 1942. Roosevelt and Winston Churchill signed the Quebec Agreement on 19 August 1943, bringing a team of British physicists on board. On 16 July 1945, the first nuclear explosion was tested, with wartime use of two of the four bombs constructed by the Project on 9 and 12 August in Japan. Officially dismantled on 1 January 1947, with the creation of the civilian Atomic Energy Commission, the Manhattan Project proved an overwhelming triumph and the paradigmatic exemplar of technological achievement for the decades that followed. Within a short period of time, one of the greatest technologies in human history went from the germs of an idea to successful fruition. The challenges of meeting carbon emissions to counter the threats of climate change demand no less an effort. What made the Manhattan Project work? Political will was converted into financial capital: the project spent over $20 billion (in 1996 dollars), employing over 130,000 people. Great scientific leadership took charge, with many of the best scientific minds of the 20th century working together against the threat of the Axis powers developing the atomic bomb first. And a powerful coalescence of scientific and intensive administration skill facilitated the coordination of over 30 separate research facilities, across three countries and two continents. These elements—cocktailed with the appropriate caveats and exceptions—serve as powerful parallels to the possibilities of developing technology to curb carbon emissions. The three central sites, at first maintained secretly, included the Los Alamos National Laboratory where the final assembly of the bombs took place, costing over $845 million; the Oak Ridge facilities, billed at nearly $14 billion, was the site for uranium production, at one point consuming more than 1/6th of the electrical power produced in the USA, greater than New York City at the time; and the Hanford Engineer Works, over 2,600 square kilometers, was the plutonium production center, at over $4 billion. The total cost 2 of WWII for the United States was approximately $3.3 trillion with the majority of funding going to conventional weaponry including $31.5 billion on bombs, mines and grenades, and $64 billion on tanks. By comparison, despite its overwhelming power to decide the outcome of the Second World War, the core funds spent on other wartime expenditures dwarf the costs of the Manhattan Project. The specifics of the costs for climate change technology need not bear any similarity to these figures. Tying budgetary strings to political and social will, however, does – it serves as the pivotal first step towards getting onto the path of technological innovation at the scale needed to fight the impending calamities of climate change. One unique element of the Manhattan Project continues to riddle historians of science today: how could the period leading up to WWII have been such a flood shed moment for science? Niel Bohr’s working out the structure of the atom and Enrico Fermi’s fission experiments, to name only two of the scientific innovations towards the atomic bomb, are paramount achievements unto themselves. The political acumen of many of these great scientific minds, as exemplified in the Szilárd-Einstein letter to Roosevelt, underscores the importance of a nuanced joining of forces of the scientific and political communities. Further, the possibility of the atomic bomb being developed by the Axis powers fixed the nature of the danger to overcome. The coordination of scientific, political and military strengths and interests is perhaps the most enduring lesson of the Manhattan Project, embodied in the figures of General Leslie Grove and J. Robert Oppenheimer. Groves’s leadership, recognized in overseeing largescale, multi-billion dollar construction projects during the 1940-1942 mobilization period, transformed the theoretical and laboratory research effort of a few universities into a fast moving, highly coordinated project including thousands of scientists, engineers, technicians, workmen, and soldiers, as well as hundreds of companies and governmental organizations. The administrative skill to undertake the Project was paramount for its success. Groves also had the vision to appoint Oppenheimer to head the key think-tank of the Project at Los Alamos. Oppenheimer is today seen as a pivotal figure in the 20th century evolution of science and government. He was noted for his mastery of the scientific aspects of the Manhattan Project and for his management of the sensitive interaction between scientists and the military. Oppenheimer was involved in most aspects of the Project from recruiting scientists, many his former students, to helping engineers purify uranium. While today some may look backward on his contributions to the Project through the lens of his postwar political fallout, Oppenheimer remains a key figure for understanding the pivotal nexus for the Project’s quick and effective conclusion: a statesmen and a scientist rolled into one. Bridging together the divides between military, political and scientific leadership as Groves and Oppenheimer achieved, is a critical element of the success of the Manhattan Project. 3 The parallels to the threat of climate change are striking. In many ways the challenges of building technology to manage the impending doom of climate change mirror those of the construction of the atomic bomb. While the scales and natures of these individual threats belie detailed comparison, the organizational structure of the urgency to combat global climate catastrophe exhibits some parallels to the threat of the Axis powers acquiring the bomb before the Allied states. Most commentators agree that the threats of war and the atomic arms race were the driving forces for the indefatigable push for the Manhattan Project. Similarly, the certainty of the threats of climate change provides impetus for the exigency of carbon emissions reducing technology. It serves as a rallying point for the scientific community to join hands together with the business, non-governmental and international communities to ward off the negative impact of climate change. While many parallels between the two projects function well enough, some aspects of the analogy merit caution. The greatest difficulty in pursuing the Manhattan Project comparison is the choosing of technology. When the Manhattan Project itself was set running in 1942, the technological pursuit—nuclear bombs—was already fixed. The project was not set up to find new technologies but to reach the more limited goal of how to make a specific technology work. Without that certainty, we may quickly get bogged down into what some skeptics on the need for a Manhattan Project for climate change suggest amounts to government interference with market mechanisms for technological innovation. However, a well-harrowed area of development economics proposes correcting inefficient technologies with “big push” technologies. The Manhattan Project rationale extends this basic principle only to a larger scale for greening economic growth. Some ethical problems, nevertheless, abound with the comparison to the production of the most potent weapon of war known to mankind. Even in the specific case of climate change science, post-WWII government funding for climatological warfare spurred the rise of scientific knowledge on climate change, when questions such as how to unleash a devastating storm unto one’s military enemies were posed. The issue, however, of finding cleaner energy for carbon emissions reduction jettisons these ethical warfare troubles. Other difficulties give greater cause for caution with the analogy to the Manhattan Project. One, for instance, moving beyond the potential irony, would be the immense task of cleaning up the environmental remains of such a large-scale project, as troubles proliferate till today with the mop up after the Manhattan Project and decades of nuclear weaponry production. The Hanford Site in Washington State, for example, displaced several farming communities. But the details of the search for cleaner energy technology cause the analogy to hiccup: the multiple sites requiring clean up are due to the toxic nature of atomic energy; these worries are not credible ones for the question of a Climate Change Manhattan Project. Another spot where the comparison must depart from the Manhattan Project is the secrecy with which the original was undertaken, given the security concerns over the latent power of the atomic bomb. This would need to be done away with in the efforts of new energy technology towards a broader fulfillment of rights to intellectual property consistent with the need to combat climate change. The benefits 4 of cleaner technology belie the heart of the moral problematic of the first Manhattan Project; the dangers of nuclear war and the clean up costs, in social and economic hazardous terms, do not exist. Some will suggest that calling for a new Climate Change Manhattan Project distracts attention from carbon emissions mitigations strategies, betraying a cornucopian view of human ability—the answer to the carbon emissions problem, they argue, does not lie in the search for new technology. For these skeptics, pursuit of a Climate Change Manhattan Project will at best only fill the fluff of castles built in the skies, and at worst raise and dash hopes at once. Yet it is clear enough that the Kyoto emissions targets cannot be led by mitigation alone, technological innovation has become essential to meet the challenge. Recent research and political movement in the fields of innovation in and access to medical drugs provide at least one powerful anchor for how to strategize development of low-carbon technology. The current intellectual property rights (IPR) regime, as enshrined in the 1995 World Trade Organization’s Trade-related Intellectual Property Rights (TRIPS) agreement, many increasingly argue, fails on both efficiency and equity grounds to incentivize drug innovation for the world’s poor. Over the last several years, a flurry of analysis has unfurled a growing body of proposals to reform the TRIPS regime, crystallizing the need to develop economically and ethically grounded principles on which to stand a new global deal for advancing public health and access to essential medicines. An overlapping consensus centers on prize funds for medical innovation. One set of significant proposals includes rewarding drug and pharmaceutical researchers for innovation based on the actual impact on the global burden of disease: each increase in a year of healthy life lived receives a proportional increment in financial reward. The same concept may be fruitfully applied to incentivizing technological innovation for lowcarbon economic growth and human lifestyle. Similarly then, a prize fund can be constructed to incentivize the development of lowcarbon technology, including carbon storage and sequestration, as well as technology transfer to developing countries, especially China and India. A key challenge hampering this policy in medical drug innovation is the technical difficulty in translation human lives gained into a substantive financial amount. This, however, does not riddle the proposal for a low-carbon innovation fund: the measurements for carbon and impact already exist. The carbon prices developed in carbon taxation and cap-and-trade schemes, building on – although going beyond – some of the groundwork already accomplished by the European Union’s Emissions Trading Scheme, constitutes work needed in tandem with this proposal. All the market and public policy tools available must be employed at once to meet the challenge of what some call the greatest and widest-ranging market failure, ever. The Manhattan Project accorded the world a new view of science, reaching what was perhaps its zenith in the popular imagination in the 1969 Apollo landing on the moon. President John F. Kennedy stirred the American people and the world at large with references to the successes of the Manhattan Project. The contours and content of a 5 significant push for technology—following the conversion of political will into financial capital, scientific expertise united to combat a unified threat, and scientific and administrative leadership—are obviously desirably replicable. The hope will be that a new Climate Change Manhattan Project will surpass the vision and achievement of the first Manhattan Project. Instead of dividing nations via technological saber rattling, it would be a force tying humanity together. Instead of the perverse effect of bringing the world to the brink of foremost anthropogenic interference—a global nuclear disaster, despite the power of atomic energy and benefits—a new Climate Change Manhattan Project could pave the way for greater prosperity and sustainable development. The new Climate Change Manhattan Project could replace the atomic project as a greater exemplar of the opportunities of human achievement. It could be the new inspiration from which future generations draw impetus to tackle the unforeseen problems of their times, and to meet the further challenges of science.

#### Unforeseen problems cause extinction having a sufficient technological base is key

Bostrom, 12 [Nick, We're Underestimating the Risk of Human Extinction

Professor Oxford, March, http://www.theatlantic.com/technology/archive/2012/03/could-people-go-extinct/253821/]

 Unthinkable as it may be, humanity, every last person, could someday be wiped from the face of the Earth. We have learned to worry about asteroids and supervolcanoes, but the more-likely scenario, according to Nick Bostrom, a professor of philosophy at Oxford, is that we humans will destroy ourselves. Bostrom, who directs Oxford's Future of Humanity Institute, has argued [over the course of several papers](http://www.fhi.ox.ac.uk/) that human extinction risks are poorly understood and, worse still, severely underestimated by society. Some of these existential risks are fairly well known, especially the natural ones. But others are obscure or even exotic. Most worrying to Bostrom is the subset of existential risks that arise from human technology, a subset that he expects to grow in number and potency over the next century. Despite his concerns about the risks posed to humans by technological progress, Bostrom is no luddite. In fact, he is a longtime advocate of transhumanism---the effort to improve the human condition, and even human nature itself, through technological means. In the long run he sees technology as a bridge, a bridge we humans must cross with great care, in order to reach new and better modes of being. In his work, Bostrom uses the tools of philosophy and mathematics, in particular probability theory, to try and determine how we as a species might achieve this safe passage. What follows is my conversation with Bostrom about some of the most interesting and worrying existential risks that humanity might encounter in the decades and centuries to come, and about what we can do to make sure we outlast them. Some have argued that we ought to be directing our resources toward humanity's existing problems, rather than future existential risks, because many of the latter are highly improbable. You have responded by suggesting that existential risk mitigation may in fact be a dominant moral priority over the alleviation of present suffering. Can you explain why? Bostrom: Well suppose you have a moral view that counts future people as being worth as much as present people. You might say that fundamentally it doesn't matter whether someone exists at the current time or at some future time, just as many people think that from a fundamental moral point of view, it doesn't matter where somebody is spatially---somebody isn't automatically worth less because you move them to the moon or to Africa or something. A human life is a human life. If you have that moral point of view that future generations matter in proportion to their population numbers, then you get this very stark implication that existential risk mitigation has a much higher utility than pretty much anything else that you could do. There are so many people that could come into existence in the future if humanity survives this critical period of time---we might live for billions of years, our descendants might colonize billions of solar systems, and there could be billions and billions times more people than exist currently. Therefore, even a very small reduction in the probability of realizing this enormous good will tend to outweigh even immense benefits like eliminating poverty or curing malaria, which would be tremendous under ordinary standards. In the short term you don't seem especially worried about existential risks that originate in nature like asteroid strikes, supervolcanoes and so forth. Instead you have argued that the majority of future existential risks to humanity are anthropogenic, meaning that they arise from human activity. Nuclear war springs to mind as an obvious example of this kind of risk, but that's been with us for some time now. What are some of the more futuristic or counterintuitive ways that we might bring about our own extinction? Bostrom: I think the biggest existential risks relate to certain future technological capabilities that we might develop, perhaps later this century. For example, machine intelligence or advanced molecular nanotechnology could lead to the development of certain kinds of weapons systems. You could also have risks associated with certain advancements in synthetic biology. Of course there are also existential risks that are not extinction risks. The concept of an existential risk certainly includes extinction, but it also includes risks that could permanently destroy our potential for desirable human development. One could imagine certain scenarios where there might be a permanent global totalitarian dystopia. Once again that's related to the possibility of the development of technologies that could make it a lot easier for oppressive regimes to weed out dissidents or to perform surveillance on their populations, so that you could have a permanently stable tyranny, rather than the ones we have seen throughout history, which have eventually been overthrown. And why shouldn't we be as worried about natural existential risks in the short term? Bostrom: One way of making that argument is to say that we've survived for over 100 thousand years, so it seems prima facie unlikely that any natural existential risks would do us in here in the short term, in the next hundred years for instance. Whereas, by contrast we are going to introduce entirely new risk factors in this century through our technological innovations and we don't have any track record of surviving those. Now another way of arriving at this is to look at these particular risks from nature and to notice that the probability of them occurring is small. For instance we can estimate asteroid risks by looking at the distribution of craters that we find on Earth or on the moon in order to give us an idea of how frequent impacts of certain magnitudes are, and they seem to indicate that the risk there is quite small. We can also study asteroids through telescopes and see if any are on a collision course with Earth, and so far we haven't found any large asteroids on a collision course with Earth and we have looked at the majority of the big ones already. You have argued that we underrate existential risks because of a particular kind of bias called observation selection effect. Can you explain a bit more about that? Bostrom: The idea of an observation selection effect is maybe best explained by first considering the simpler concept of a selection effect. Let's say you're trying to estimate how large the largest fish in a given pond is, and you use a net to catch a hundred fish and the biggest fish you find is three inches long. You might be tempted to infer that the biggest fish in this pond is not much bigger than three inches, because you've caught a hundred of them and none of them are bigger than three inches. But if it turns out that your net could only catch fish up to a certain length, then the measuring instrument that you used would introduce a selection effect: it would only select from a subset of the domain you were trying to sample. Now that's a kind of standard fact of statistics, and there are methods for trying to correct for it and you obviously have to take that into account when considering the fish distribution in your pond. An observation selection effect is a selection effect introduced not by limitations in our measurement instrument, but rather by the fact that all observations require the existence of an observer. This becomes important, for instance, in evolutionary biology. For instance, we know that intelligent life evolved on Earth. Naively, one might think that this piece of evidence suggests that life is likely to evolve on most Earth-like planets. But that would be to overlook an observation selection effect. For no matter how small the proportion of all Earth-like planets that evolve intelligent life, we will find ourselves on a planet that did. Our data point-that intelligent life arose on our planet-is predicted equally well by the hypothesis that intelligent life is very improbable even on Earth-like planets as by the hypothesis that intelligent life is highly probable on Earth-like planets. When it comes to human extinction and existential risk, there are certain controversial ways that observation selection effects might be relevant. How so? Bostrom: Well, one principle for how to reason when there are these observation selection effects is called the self-sampling assumption, which says roughly that you should think of yourself as if you were a randomly selected observer of some larger reference class of observers. This assumption has a particular application to thinking about the future through the doomsday argument, which attempts to show that we have systematically underestimated the probability that the human species will perish relatively soon. The basic idea involves comparing two different hypotheses about how long the human species will last in terms of how many total people have existed and will come to exist. You could for instance have two hypothesis: to pick an easy example imagine that one hypothesis is that a total of 200 billion humans will have ever existed at the end of time, and the other hypothesis is that 200 trillion humans will have ever existed. Let's say that initially you think that each of these hypotheses is equally likely, you then have to take into account the self-sampling assumption and your own birth rank, your position in the sequence of people who have lived and who will ever live. We estimate currently that there have, to date, been 100 billion humans. Taking that into account, you then get a probability shift in favor of the smaller hypothesis, the hypothesis that only 200 billion humans will ever have existed. That's because you have to reason that if you are a random sample of all the people who will ever have existed, the chance that you will come up with a birth rank of 100 billion is much larger if there are only 200 billion in total than if there are 200 trillion in total. If there are going to be 200 billion total human beings, then as the 100 billionth of those human beings, I am somewhere in the middle, which is not so surprising. But if there are going to be 200 trillion people eventually, then you might think that it's sort of surprising that you're among the earliest 0.05% of the people who will ever exist. So you can see how reasoning with an observation selection effect can have these surprising and counterintuitive results. Now I want to emphasize that I'm not at all sure this kind of argument is valid; there are some deep methodological questions about this argument that haven't been resolved, questions that I have written a lot about. See I had understood observation selection effects in this context to work somewhat differently. I had thought that it had more to do with trying to observe the kinds of events that might cause extinction level events, things that by their nature would not be the sort of things that you could have observed before, because you'd cease to exist after the initial observation. Is there a line of thinking to that effect? Bostrom: Well, there's another line of thinking that's very similar to what you're describing that speaks to how much weight we should give to our track record of survival. Human beings have been around for roughly a hundred thousand years on this planet, so how much should that count in determining whether we're going to be around another hundred thousand years? Now there are a number of different factors that come into that discussion, the most important of which is whether there are going to be new kinds of risks that haven't existed to this point in human history---in particular risks of our own making, new technologies that we might develop this century, those that might give us the means to create new kinds of weapons or new kinds of accidents. The fact that we've been around for a hundred thousand years wouldn't give us much confidence with respect to those risks. But, to the extent that one were focusing on risks from nature, from asteroid attacks or risks from say vacuum decay in space itself, or something like that, one might ask what we can infer from this long track record of survival. And one might think that any species anywhere will think of themselves as having survived up to the current time because of this observation selection effect. You don't observe yourself after you've gone extinct, and so that complicates the analysis for certain kinds of risks. A few years ago I wrote a paper together with a physicist at MIT named Max Tegmark, where we looked at particular risks like vacuum decay, which is this hypothetical phenomena where space decays into a lower energy state, which would then cause this bubble propagating at the speed of light that would destroy all structures in its path, and would cause a catastrophe that no observer could ever see because it would come at you at the speed of light, without warning. We were noting that it's somewhat problematic to apply our observations to develop a probability for something like that, given this observation selection effect. But we found an indirect way of looking at evidence having to do with the formation date of our planet, and comparing it to the formation date of other earthlike planets and then using that as a kind of indirect way of putting a bound on that kind of risk. So that's another way in which observation selection effects become important when you're trying to estimate the odds of humanity having a long future. Nick Bostrom is the director of the Future of Humanity Institute at Oxford. One possible strategic response to human-created risks is the slowing or halting of our technological evolution, but you have been a critic of that view, arguing that the permanent failure to develop advanced technology would itself constitute an existential risk. Why is that? Bostrom: Well, again I think the definition of an existential risk goes beyond just extinction, in that it also includes the permanent destruction of our potential for desirable future development. Our permanent failure to develop the sort of technologies that would fundamentally improve the quality of human life would count as an existential catastrophe. I think there are vastly better ways of being than we humans can currently reach and experience. We have fundamental biological limitations, which limit the kinds of values that we can instantiate in our life---our lifespans are limited, our cognitive abilities are limited, our emotional constitution is such that even under very good conditions we might not be completely happy. And even at the more mundane level, the world today contains a lot of avoidable misery and suffering and poverty and disease, and I think the world could be a lot better, both in the transhuman way, but also in this more economic way. The failure to ever realize those much better modes of being would count as an existential risk if it were permanent. Another reason I haven't emphasized or advocated the retardation of technological progress as a means of mitigating existential risk is that it's a very hard lever to pull. There are so many strong forces pushing for scientific and technological progress in so many different domains---there are economic pressures, there is curiosity, there are all kinds of institutions and individuals that are invested in technology, so shutting it down is a very hard thing to do. What technology, or potential technology, worries you the most? Bostrom: Well, I can mention a few. In the nearer term I think various developments in biotechnology and synthetic biology are quite disconcerting. We are gaining the ability to create designer pathogens and there are these blueprints of various disease organisms that are in the public domain---you can download the gene sequence for smallpox or the 1918 flu virus from the Internet. So far the ordinary person will only have a digital representation of it on their computer screen, but we're also developing better and better DNA synthesis machines, which are machines that can take one of these digital blueprints as an input, and then print out the actual RNA string or DNA string. Soon they will become powerful enough that they can actually print out these kinds of viruses. So already there you have a kind of predictable risk, and then once you can start modifying these organisms in certain kinds of ways, there is a whole additional frontier of danger that you can foresee. In the longer run, I think artificial intelligence---once it gains human and then superhuman capabilities---will present us with a major risk area. There are also different kinds of population control that worry me, things like surveillance and psychological manipulation pharmaceuticals. In one of your papers on this topic you note that experts have estimated our total existential risk for this century to be somewhere around 10-20%. I know I can't be alone in thinking that is high. What's driving that? Bostrom: I think what's driving it is the sense that humans are developing these very potent capabilities---we are doing unprecedented things, and there is a risk that something could go wrong. Even with nuclear weapons, if you rewind the tape you notice that it turned out that in order to make a nuclear weapon you had to have these very rare raw materials like highly enriched uranium or plutonium, which are very difficult to get. But suppose it had turned out that there was some technological technique that allowed you to make a nuclear weapon by baking sand in a microwave oven or something like that. If it had turned out that way then where would we be now? Presumably once that discovery had been made civilization would have been doomed. Each time we make one of these new discoveries we are putting our hand into a big urn of balls and pulling up a new ball---so far we've pulled up white balls and grey balls, but maybe next time we will pull out a black ball, a discovery that spells disaster. At the moment we have no good way of putting the ball back into the urn if we don't like it. Once a discovery has been published there is no way of un-publishing it. Even with nuclear weapons there were close calls. According to some people we came quite close to all out nuclear war and that was only in the first few decades of having discovered the new technology, and again it's a technology that only a few large states had, and that requires a lot of resources to control---individuals can't really have a nuclear arsenal. Can you explain the simulation argument, and how it presents a very particular existential risk? Bostrom: The simulation argument addresses whether we are in fact living in a simulation as opposed to some basement level physical reality. It tries to show that at least one of three propositions is true, but it doesn't tell us which one. Those three are: 1) Almost all civilizations like ours go extinct before reaching technological maturity. 2) Almost all technologically mature civilizations lose interest in creating ancestor simulations: computer simulations detailed enough that the simulated minds within them would be conscious. 3) We're almost certainly living in a computer simulation. The full argument requires sophisticated probabilistic reasoning, but the basic argument is fairly easy to grasp without resorting to mathematics. Suppose that the first proposition is false, which would mean that some significant portion of civilizations at our stage eventually reach technological maturity. Suppose that the second proposition is also false, which would mean that some significant fraction of those (technologically mature) civilizations retain an interest in using some non-negligible fraction of their resources for the purpose of creating these ancestor simulations. You can then show that it would be possible for a technologically mature civilization to create astronomical numbers of these simulations. So if this significant fraction of civilizations made it through to this stage where they decided to use their capabilities to create these ancestor simulations, then there would be many more simulations created than there are original histories, meaning that almost all observers with our types of experiences would be living in simulations. Going back to the observation selection effect, if almost all kinds of observers with our kinds of experiences are living in simulations, then we should think that we are living in a simulation, that we are one of the typical observers, rather than one of the rare, exceptional basic level reality observers. The connection to existential risk is twofold. First, the first of those three possibilities, that almost all civilizations like ours go extinct before reaching technological maturity obviously bears directly on how much existential risk we face. If proposition 1 is true then the obvious implication is that we will succumb to an existential catastrophe before reaching technological maturity. The other relationship with existential risk has to do with proposition 3: if we are living in a computer simulation then there are certain exotic ways in which we might experience an existential catastrophe which we wouldn't fear if we are living in basement level physical reality. The simulation could be shut off, for instance. Or there might be other kinds of interventions in our simulated reality. Now that does seem to assume that a technologically mature civilization would have an interest in creating these simulations in the first place. To say that these civilizations might "lose interest" implies some interest to begin with. Bostrom: Right now there are certainly a lot of people that, if they could, would be very happy to do this for all kinds of reasons---people might do it as a sort of scientific study, they might do it for entertainment, for art. Already you have people building these virtual worlds in computer games, and the more realistic they can make them the happier they are. You could have people pursuing virtual historical tourism, or people who want to do this just because it could be done. So I think it's safe to say that people today, had they the capabilities, would do it, but perhaps with a certain level of technological maturity people may lose interest in this for one reason or another. Your work reminds me a little bit of the film 'Children of Men,' which depicted a very particular existential risk: species-wide infertility. What are some of the more novel treatments you've seen of this subject in mainstream culture? Bostrom: Well, the Hollywood renditions of existential risk scenarios are usually quite bad. For instance, the artificial intelligence risk is usually represented by an invasion of a robot army that is fought off by some muscular human hero wielding a machine gun or something like that. If we are going to go extinct because of artificial intelligence, it's not going to be because there's this battle between humans and robots with laser eyes. A lot of the stories you see in fiction or in films are subject to the good story bias; there are constraints on what makes for a good story. Usually there has to be a protagonist and the thing you're battling has to be evil, and there are going to be ups and downs, and the humans prevail in the end. So there's a filter for the scenarios that you're going to see in media representations. Aldous Huxley's Brave New World is interesting in that it created a vivid depiction of a scenario in which humans have been biologically and socially engineered to fit into a dystopian social structure, and it shows how that could be very bad. But on the whole I think the general point I would make is that there isn't a lot of good literature on existential risk, and that one needs to think of these things not in terms of vivid scenarios, but rather in more abstract terms. Last week I interviewed Cary Fowler with the [Svalbard Global Seed Vault](http://www.theatlantic.com/technology/archive/2012/02/after-4-years-checking-up-on-the-svalbard-global-seed-vault/253458/). His project is a technology that might be interpreted as looking to limit existential risk. Are there other technological (as opposed to social or political) solutions that you see on the horizon? Bostrom: Well there are things that one can do, some that would apply to particular risks and others that would apply to a broader spectrum of risk. With particular risks, for instance, one could invest in technologies to hasten the time it takes to develop a new vaccine, which would also be very valuable to have for other reasons unrelated to existential risk. With regard to existential risk stemming from artificial intelligence, there is some work that we are doing now to try and think about different ways of solving the control problem. If one day you have the ability to create a machine intelligence that is greater than human intelligence, how would you control it, how would you make sure it was human-friendly and safe? There is work that can be done there. With asteroids there has been this [Spaceguard](http://www.spaceguarduk.com/) project that maps out different asteroids and their trajectories, that project is certainly motivated by concerns about existential risks, and it costs only a couple of million dollars per year, with most of the funding coming from NASA. Then there are more general-purpose things you can do. You could imagine building some refuge, some bunker with a very large supply of food, where humans could survive for a decade or several decades if there were a large impact of some kind. It would be a lot cheaper and easier to do that on Earth than it would be to build a space colony, which some people have proposed. But to me the most important thing to do is more analysis, specifically analysis to identify the biggest existential risks and the types of interventions that would be most likely to mitigate those risks. A telescope used to track asteroids at the Spaceguard Centre in the United Kingdom. I noticed that you define an existential risk as potentially bringing about the premature extinction of Earth-originating intelligent life. I wondered what you mean by premature? What would count as a mature extinction? Bostrom: Well, you might think that an extinction occurring at the time of the heat death of the universe would be in some sense mature. There might be fundamental physical limits to how long information processing can continue in this universe of ours, and if we reached that level there would be extinction, but it would be the best possible scenario that could have been achieved. I wouldn't count that as an existential catastrophe, rather it would be a kind of success scenario. So it's not necessary to survive infinitely long, which after all might be physically impossible, in order to have successfully avoided existential risk. In considering the long-term development of humanity, do you put much stock in specific schemes like the [Kardashev Scale](http://en.wikipedia.org/wiki/Kardashev_scale), which plots the advancement of a civilization according to its ability to harness energy, specifically the energy of its planet, its star, and then finally the galaxy? Might there be more to human flourishing than just increasing mastery of energy sources? Bostrom: Certainly there would be more to human flourishing. In fact I don't even think that particular scale is very useful. There is a discontinuity between the stage where we are now, where we are harnessing a lot of the energy resources of our home planet, and a stage where we can harness the energy of some increasing fraction of the universe like a galaxy. There is no particular reason to think that we might reach some intermediate stage where we would harness the energy of one star like our sun. By the time we can do that I suspect we'll be able to engage in large-scale space colonization, to spread into the galaxy and then beyond, so I don't think harnessing the single star is a relevant step on the ladder. If I wanted some sort of scheme that laid out the stages of civilization, the period before machine super intelligence and the period after super machine intelligence would be a more relevant dichotomy. When you look at what's valuable or interesting in examining these stages, it's going to be what is done with these future resources and technologies, as opposed to their structure. It's possible that the long-term future of humanity, if things go well, would from the outside look very simple. You might have Earth at the center, and then you might have a growing sphere of technological infrastructure that expands in all directions at some significant fraction of the speed of light, occupying larger and larger volumes of the universe---first in our galaxy, and then beyond as far as is physically possible. And then all that ever happens is just this continued increase in the spherical volume of matter colonized by human descendants, a growing bubble of infrastructure. Everything would then depend on what was happening inside this infrastructure, what kinds of lives people were being led there, what kinds of experiences people were having. You couldn't infer that from the large-scale structure, so you'd have to sort of zoom in and see what kind of information processing occurred within this infrastructure. It's hard to know what that might look like, because our human experience might be just a small little crumb of what's possible. If you think of all the different modes of being, different kinds of feeling and experiencing, different ways of thinking and relating, it might be that human nature constrains us to a very narrow little corner of the space of possible modes of being. If we think of the space of possible modes of being as a large cathedral, then humanity in its current stage might be like a little cowering infant sitting in the corner of that cathedral having only the most limited sense of what is possible.

#### The impact is extinction

Bearden, 2k [The Unnecessary Energy Crisis: How to Solve It Quickly T. E. Bearden, LTC, U.S. Army (Retired)

CEO, CTEC Inc. Director, Association of Distinguished American Scientists (ADAS) Fellow Emeritus, Alpha Foundation's Institute for Advanced Study (AIAS) June 12, 2000, [www.cheniere.org/.../Unnecessary%20**Energy**%20Crisis.doc](http://www.cheniere.org/.../Unnecessary%20Energy%20Crisis.doc)]

History bears out that desperate nations take desperate actions. Prior to the final economic collapse, the stress on nations will have increased the intensity and number of their conflicts, to the point where the arsenals of weapons of mass destruction (WMD) now possessed by some 25 nations, are almost certain to be released. As an example, suppose a starving North Korea[[1]](#endnote-1)} launches nuclear weapons upon Japan and South Korea, including U.S. forces there, in a spasmodic suicidal response. Or suppose a desperate China — whose long range nuclear missiles can reach the United States — attacks Taiwan. In addition to immediate responses, the mutual treaties involved in such scenarios will quickly draw other nations into the conflict, escalating it significantly. Strategic nuclear studies have shown for decades that, under such extreme stress conditions, once a few nukes are launched, adversaries and potential adversaries are then compelled to launch on perception of preparations by one's adversary. The real legacy of the MAD concept is this side of the MAD coin that is almost never discussed. Without effective defense, the only chance a nation has to survive at all, is to launch immediate full-bore pre-emptive strikes and try to take out its perceived foes as rapidly and massively as possible. As the studies showed, rapid escalation to full WMD exchange occurs, with a great percent of the WMD arsenals being unleashed . The resulting great Armageddon will destroy civilization as we know it, and perhaps most of the biosphere, at least for many decades. My personal estimate is that, beginning about 2007, on our present energy course we will have reached an 80% probability of this "final destruction of civilization itself" scenario occurring at any time, with the probability slowly increasing as time passes. One may argue about the timing, slide the dates a year or two, etc., but the basic premise and general time frame holds. We face not only a world economic crisis, but also a world destruction crisis. So unless we dramatically and quickly solve the energy crisis — rapidly replacing a substantial part of the "electrical power derived from oil" by "electrical power freely derived from the vacuum" — we are going to incur the final "Great Armageddon" the nations of the world have been fearing for so long. I personally regard this as the greatest strategic threat of all times — to the United States, the Western World, all the rest of the nations of the world, and civilization itself {[[2]](#endnote-2)} {[[3]](#endnote-3)}. To avoid the impending collapse of the world economy and/or the destruction of civilization and the biosphere, we must quickly replace much of the "electrical energy from oil" heart of the crisis at great speed, and simultaneously replace a significant part of the "transportation using oil products" factor also. The technical basis for that solution and part of the prototype technology required, are now at hand. We discuss that solution in this paper. To finish the task in time, the Government must be galvanized into a new Manhattan Project {[[4]](#endnote-4)} to rapidly complete the new system hardware developments and deploy the technology worldwide at an immense pace.

#### And, scope and centralized leadership makes federal investment necessary

Woolner, 11 [[David Woolner](http://www.newdeal20.org/author/david-woolner/) is a Senior Fellow and Hyde Park Resident Historian for the Roosevelt Institute, “Time for a New Manhattan Project?” http://www.nextnewdeal.net/time-new-manhattan-project]

In a [speech](http://www.youtube.com/watch?v=qfeKFulcPSM&feature=player_embedded) before students at George Washington University this week, President Obama insisted that it was time for the United States to develop a new national energy policy that would reduce our nation's dependence on oil. "We've known about the dangers of our oil dependence for decades," he said, with presidents and politicians having promised time and time again to secure America's "energy dependence." But so far, "that promise has gone unmet." He then went on to say that we "cannot keep going from shock to trance on the issue of energy security, rushing to propose action when gas prices rise, then hitting the snooze button when they fall again." To solve our energy challenge, the president then announced that his administration was releasing a "[Blueprint for a Secure Energy Future](http://www.whitehouse.gov/blog/2011/03/30/obama-administration-s-blueprint-secure-energy-future)," which provides the framework for a comprehensive national energy policy. The new framework includes a number of ideas and programs, from setting a goal to cut our dependence on foreign oil by one third over the next decade, to ensuring America's homes and offices are more energy efficient. The plan also calls for an enhanced effort to secure domestic supplies of energy -- including oil, natural gas, clean coal and nuclear power -- as well as the development of alternative sources of energy, such as wind, solar power and biofuels. In the long run, however, the president insisted that the best way for the United States to secure its energy future would be for the country to tap into its most valuable commodity: American ingenuity. The notion that the United States can use its scientific, intellectual and entrepreneurial power to solve its most complex and pressing problems is not a new one. But to a large extent, President Obama's call for the research and development of new sources of energy relies on the encouragement of the private sector to do so through the establishment of a Clean Energy Standard. He does observe that government funding in R&D will be critical to this effort and notes with pride the investments his administration has already made in renewable energy research under funds provided by the 2009 stimulus act. But his calls for additional federal support of this effort -- characterized as one of his "budget priorities" in an age of fiscal austerity -- may lack the dynamism and inspiration needed to get the American people behind it. It is true that the Americans are remarkably ingenious. But it is also true that some of our most important technical and scientific advancements have come about not through the profit-seeking initiative of the private sector, but rather through the marshaling of intellectual, scientific and financial resources under the direction of the federal government. One example is the creation of the National Aeronautics and Space Administration (NASA), established by Congress in 1958 under the leadership of President Dwight David Eisenhower. A second, and far more significant example, can be found in the launch of FDR's [Manhattan Project](http://en.wikipedia.org/wiki/Manhattan_Project) -- the wartime effort to develop the atomic bomb. [Sign up to have the Daily Digest, a witty take on the morning’s most important headlines, delivered straight to your inbox.](http://rooseveltinstitute.us1.list-manage2.com/subscribe?u=5044841afea7ba83dc11db61f&id=e4428ba350) The Manhattan Project was inspired to a large extent by a letter that President Roosevelt received in the fall of 1939 from Albert Einstein and a small group of international scientists. The letter took note of the recent discovery of nuclear fission and warned the president of the possibility that this discovery might lead to the creation of extremely powerful weapons. It also alluded to the fact that German scientists were working in this area. In response to this news, FDR immediately established an Advisory Committee on Uranium, while a similar effort was launched in Great Britain. By 1942, the two efforts had merged into what was called the Manhattan Project. Centered in the United States, it involved scientists working at labs in a number of leading universities in the U.S., Britain and Canada. It also led to the creation of a number of significant federal facilities, such as the Oak Ridge National Laboratory and Oak Ridge City, which grew from empty Tennessee farmland to a city and scientific facility of over 75,000 people between 1943 and 1945; the Hanford Engineering Works, located in south-central Washington, which employed over 50,000 workers in the construction of the world's first full-scale nuclear reactor; and the Los Alamos National Laboratory, which employed over 5,000 scientists and engineers. Employing more than 130,000 people at a cost of roughly $2 billion in 1940s dollars, the Manhattan Project was one of the largest scientific endeavors ever undertaken. Its successful development of atomic weapons and the US decision to use them will forever remain controversial, but the project also ushered in the nuclear age, which brought us a host of scientific advances above and beyond the development of nuclear energy. These include significant developments in medicine, electronics and nanotechnology, all of which have had an enormous impact on our quality of life and our understandings of the workings of the universe. Establishing a [Clean Energy Standard](http://www.washingtonpost.com/blogs/ezra-klein/post/what-a-clean-energy-standard-is-and-why-were-talking-about-it/2011/03/10/AFuTzMBC_blog.html) that will require the private sector to reduce our greenhouse gas emissions and our dependence on foreign oil is an important first step in our effort to secure what the president calls our "energy independence." But if we wish to use our innate ingenuity to truly wean ourselves off our dependence on fossil fuels and the internal combustion engine, then something more than marginal support for basic scientific and technical research will be required. President Obama alluded to this when he said we need "to dream big;" to summon the same spirit of unbridled optimism and bold willingness that allowed "previous generations to rise to greatness -- to save democracy, to touch the moon, to connect the world with our own science and imagination." As we look to the past for inspiration, it is important to remember that many of the accomplishments the president refers to would not have been achieved without the strong financial support of the federal government. To "dream big" means trying to achieve not the greatest profit, but the greatest good for all Americans. This requires much more than faith in science; it also requires faith in our collective wisdom and the benefits that can accrue from a government that is truly dedicated to the common good of all.

#### And, centralized leadership is the only means of fast deployment

Alexander, 08 [Lamar Alexander is the senior U.S. senator from Tennessee and chair of the Senate Republican Conference. He served as Tennessee’s governor from 1979 to 1987 and as U.S. Secretary of Education from 1991 to 1993. Tennessee’s Business | BERC, A New Manhattan Project for Clean Energy Independence, <http://frank.mtsu.edu/~berc/tnbiz/economy/pdfs/alexander.pdf>]

In addition to the need to meet an overwhelming challenge, other characteristics of the original Manhattan Project are suited to this new challenge: It needs to proceed as fast as possible along several tracks to reach the goal. According to Don Gillespie, a young engineer at Los Alamos during World War II, the “entire project was being conducted using a shotgun approach, trying all possible approaches simultaneously, without regard to cost, to speed toward a conclusion.” It needs presidential focus and bipartisan support in Congress. It needs the kind of centralized, gruff leadership that General Leslie R. Groves of the Army Corps of Engineers gave the first Manhattan Project. It needs to “break the mold.” To borrow the words of Dr. J. Robert Oppenheimer in a speech to Los Alamos scientists in November of 1945, the challenge of clean energy independence is “too revolutionary to consider in the framework of old ideas.”

And, federal guidance for nuclear expansion is the sole conduit for coordination with federal labs – solves tech deployment

ORNL, 08 [Oak Ridge National Labs News Letter, Manhattan Project for Clean Energy Independence”, <http://www.ornl.gov/info/ornlreview/v41_2_08/article02.shtml>]

Dana Christensen, ORNL's associate laboratory director for energy and engineering sciences, emphasized the importance of closing the fuel cycle to enable the expansion of carbon-free nuclear energy in the United States. "By independence I do not mean that the United States would never buy oil from Mexico or Canada or Saudi Arabia," Alexander said. "By independence I do mean that the United States could never be held hostage by any country for our energy supplies." During the discussion that led to the passage of the America COMPETES Act of 2007, the senator noted several participants suggested that "focusing on energy independence would force the kind of investments in the physical sciences and research that the United States needs to maintain its competitiveness." The growing demand for oil worldwide and corn-fed ethanol in the United States is driving up gasoline and food prices, motivating the public to address the availability and cost of energy with a greater sense of urgency. This challenge comes as Americans are increasingly aware that burning more coal for electricity is contributing to sustained global warming. Alexander noted that characteristics of the Manhattan Project 65 years ago could be applied to the current initiative for clean energy independence. Foremost is the urgent need to proceed quickly along several tracks toward a common goal. Alexander added that long-term success would also require Presidential leadership and bipartisan support from Congress. Alexander said a contemporary Manhattan Project for energy should undertake "seven grand challenges" that would put America on the path toward clean energy independence within a generation. Alexander's seven grand challenges are: 1. Make plug-in hybrid vehicles commonplace 2. Make carbon capture and storage a reality for coal-burning power plants 3. Make solar power cost competitive with power from fossil fuels 4. Safely reprocess and store nuclear waste 5. Make advanced biofuels cost-competitive with gasoline 6. Make new buildings green buildings by using known technologies to reduce energy waste 7. Provide energy from fusion "Despite 'the gathering storm' of concern about American competitiveness, no other country approaches our brainpower advantage—the collection of research universities, national laboratories and private-sector companies we have," Alexander said. "And this is still the only country where people say with a straight face that anything is possible—and really believe it." Alexander's comments were echoed by Congressman Wamp, who asserted that nuclear power—if managed safely and efficiently—holds a key to the region's ability to provide adequate energy in a way that does not contribute to carbon emissions. Wamp stressed his belief that Oak Ridge, as it did once before, will play a key role in developing new technologies to increase America's security. Congressman Gordon stressed the need to fund the Advanced Research Projects Agency—Energy (ARPA-E), an agency modeled after the Department of Defense's DARPA that will provide aggressive funding for innovative research projects carried out by science and technology experts from industry, universities and federal laboratories. Gordon believes the program will give researchers unprecedented flexibility and resources to develop new technologies through high-risk, high-return research that can provide breakthroughs to meet the nation's most pressing energy challenges. ORNL Director Mason said the original Manhattan Project, which spent 60% of its $2 billion in Oak Ridge, illustrated the importance of parallel paths of research to determine which approaches work best and which simply do not work.

#### And, that solves science diplomacy

Pritchard, 10 [[Ambrose Evans-Pritchard](http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/), International Business Editor, “Obama could kill fossil fuels overnight with a nuclear dash for thorium”, http://www.telegraph.co.uk/finance/comment/7970619/Obama-could-kill-fossil-fuels-overnight-with-a-nuclear-dash-for-thorium.html

Roosevelt initially fobbed him off. He listened more closely at a second meeting over breakfast the next day, then made up his mind within minutes. "This needs action," he told his military aide. It was the birth of the Manhattan Project. As a result, the US had an atomic weapon early enough to deter Stalin from going too far in Europe. The global energy crunch needs equal "action". If it works, Manhattan II could restore American optimism and strategic leadership at a stroke: if not, it is a boost for US science and surely a more fruitful way to pull the US out of perma-slump than scattershot stimulus.

#### Nuke power key – independently solves war

BRC 12—The Reactor and Fuel Cycle Technology Subcommittee of the Blue Ribbon Commission on America’s Nuclear Future; co-chaired by the Honorable Pete Domenici and Dr. Per Peterson and included the following Commissioners:  Dr. Albert Carnesale, Susan Eisenhower, Dr. Allison MacFarlane, Dr. Richard  Meserve, Dr. Ernest Moniz, and the Honorable Phil Sharp. (Reactor and Fuel Cycle Technology SubcommitteeReport to the Full Commission, cybercemetery.unt.edu/archive/brc/20120620220054/http://brc.gov/sites/default/files/documents/updated\_rfct\_report\_final.pdf

In contrast, there is much less uncertainty about the underlying energy and nuclear technology challenges we face in the next few decades. Even in the aftermath of the Fukushima incident, which has caused some rethinking about reactor safety issues, there is far more consensus, reflected in comments on the Subcommittee’s draft report, about what would constitute desirable outcomes. The safety, cost, resource utilization and sustainability, security and nonproliferation, and waste management of nuclear energy systems are sure to remain paramount concerns that—together with broader questions of public acceptance and overall competitiveness with other energy resources—will be key to the nuclear industry’s long-term prospects, not only in the United States but worldwide. Looking beyond nuclear power to the larger set of energy issues, the challenges are well-identified and even more daunting. At a global level, the central question is how to reconcile overall energy demand, including rapidly rising energy consumption in the developing world, with emerging environmental and resource constraints and without impeding economic development, exacerbating geopolitical tensions, or increasing the potential for national and regional conflicts. At a national level, the challenge for the United States is to position itself to meet future energy needs in ways that are also congruent with re-establishing and sustaining a vigorous domestic economy, maintaining global technological and scientific leadership, protecting public health and the environment, mitigating the impacts of climate change, and reducing energy-related national security risks and terrorism threats.

#### And, deescalates every transnational threat

Fertel 11—35 years of experience consulting for electric utilities on issues related to designing, siting, licensing and managing both fossil and nuclear plants. Worked in executive positions with such organizations as Ebasco, Management Analysis Company and Tenera. In November 1990, he joined the U.S. Council for Energy Awareness as vice president of Technical Programs (Marvin, Measured Reactions Warranted, http:~/~/energy.nationaljournal.com/2011/07/[php)](http://68.233.253.124/xwiki/bin/create///energy.nationaljournal.com/2011/07/should-america-follow-europes/php%29?parent=Northwestern.Kirshon%2DMiles+Aff)

The strength of America’s energy portfolio is the diversity of supply that is the result of diverse natural resources and technology leadership. While countries like France and Japan have limited energy options, our nation has myriad options at hand. Despite this, we have been challenged to define a long-term energy policy that takes full advantage of our domestic resources and technological leadership to make us more energy independent. We should continue to learn from international experience in energy and foster global relationships that will enhance issues that are inextricably linked to energy—issues such as environmental preservation, economic growth, eradication of poverty, expanding access to clean water and transforming our transportation sector. But we should take a measured approach to global events based on what’s right for America. Nuclear energy development is one such area. For more than a half-century, nuclear energy has been a source of safe, carbon-free electricity. Here in America, 104 nuclear plants provide 20 percent of the nation’s electricity. Contrary to the premise of this week’s question, nearly half of the U.S. nuclear energy facilities producing electricity today have come on line in the past 30 years, including the most recent in 1996. The United States produces more electricity at nuclear energy plants than France and Japan combined—and operates about one-quarter of all commercial reactors in the world. U.S. companies invented this technology and we continue to set the gold standard globally—both in technology and in the development of a regulatory system that ensures oversight of safety and security at the facilities. In planning its energy future, every nation must consider the energy resources and technologies that are available to achieve its energy and environmental goals. As is the case in Germany and Italy with nuclear energy, political forces are the overriding factor in a country’s energy decisions despite more significant societal benefits that accrue to their citizens. Like many, economist Ferdinand Banks questions whether the nuclear energy phaseout in Germany will stand the test of time. He writes: “It needs to be appreciated that if the German nuclear retreat were a reality instead of a politically motivated and bizarre fantasy, the French nuclear sector might have already started to expand in order to receive the hundreds of billions in export income that would become available when German nuclear facilities begin to close their doors.” Today’s energy landscape is complex and no energy source is free of blemishes. Moreover, many are concerned about the absence of a sustained energy research and development program that will lead to the next big discoveries in energy. Absent these, it is clear we need to use energy efficiency and all available clean energy resources, including renewable sources and nuclear energy, to enhance our energy independence, protect the environment and meet the 24 percent increase in electricity demand by 2035. This approach is supported by the National Academies of Science, U.S. Department of Energy, International Energy Agency, Intergovernmental Panel on Climate Change and the Electric Power Research Institute. President Obama and bipartisan leaders in the Congress, support both the development of renewable energy sources and the expansion of safe, carbon-free nuclear energy. Despite the accident in Japan in March, citizens that live closest to America’s nuclear energy facilities support them the strongest. Eighty percent favor the use of the nuclear energy in a June survey by Bisconti Research and 83% gave the reactor nearest to where they live high safety ratings. Recent events in Japan confirm that safety must be the top priority of any nation utilizing nuclear energy. The U.S. nuclear industry and independent regulators at the Nuclear Regulatory Commission continue to triple check the safety of all reactors and will ensure that the lessons learned in Japan will be applied here. In this way, employing international experience to American facilities is invaluable. These measures far exceed the so-called “stress tests” that European reactors are undertaking over the coming months. Our total commitment to safety demands that every U.S. nuclear facility is fully prepared to effectively respond to the most extraordinary natural and man-made events. Continuous improvement means we exceed government regulations, not just meet them. There are many international forums where policymakers, regulators and energy executives share policy, technology and regulatory insights. They are valuable exchanges for building the energy platform that will power the world into the 21st Century while protecting the environment and enhancing the standard of living for all. Rather than emulating isolated, policy positions, these collaborative forums will produce common-sense energy strategies that stand the test of time.

#### Science diplomacy solves every extinction risk

**Fedoroff, 08 -** Science and Technology Adviser to the Secretary of State and the Administrator of USAID (Nina, Testimony Before the House Science Subcommittee on Research and Science Education, 4/2, <http://www.state.gov/g/oes/rls/rm/102996.htm>

Science by its nature facilitates diplomacy because it strengthens political relationships, embodies powerful ideals, and creates opportunities for all. The global scientific community embraces principles Americans cherish: transparency, meritocracy, accountability, the objective evaluation of evidence, and broad and frequently democratic participation. Science is inherently democratic, respecting evidence and truth above all.

Science is also a common global language, able to bridge deep political and religious divides. Scientists share a common language. Scientific interactions serve to keep open lines of communication and cultural understanding. As scientists everywhere have a common evidentiary external reference system, members of ideologically divergent societies can use the common language of science to cooperatively address both domestic and the increasingly trans-national and global problems confronting humanity in the 21st century. There is a growing recognition that science and technology will increasingly drive the successful economies of the 21st century.

Science and technology provide an immeasurable benefit to the U.S. by bringing scientists and students here, especially from developing countries, where they see democracy in action, make friends in the international scientific community, become familiar with American technology, and contribute to the U.S. and global economy. For example, in 2005, over 50% of physical science and engineering graduate students and postdoctoral researchers trained in the U.S. have been foreign nationals. Moreover, many foreign-born scientists who were educated and have worked in the U.S. eventually progress in their careers to hold influential positions in ministries and institutions both in this country and in their home countries. They also contribute to U.S. scientific and technologic development: According to the National Science Board’s 2008 Science and Engineering Indicators, 47% of full-time doctoral science and engineering faculty in U.S. research institutions were foreign-born.

Finally, some types of science – particularly those that address the grand challenges in science and technology – are inherently international in scope and collaborative by necessity. The ITER Project, an international fusion research and development collaboration, is a product of the thaw in superpower relations between Soviet President Mikhail Gorbachev and U.S. President Ronald Reagan. This reactor will harness the power of nuclear fusion as a possible new and viable energy source by bringing a star to earth. ITER serves as a symbol of international scientific cooperation among key scientific leaders in the developed and developing world – Japan, Korea, China, E.U., India, Russia, and United States – representing 70% of the world’s current population..

The recent elimination of funding for FY08 U.S. contributions to the ITER project comes at an inopportune time as the Agreement on the Establishment of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project had entered into force only on October 2007. The elimination of the promised U.S. contribution drew our allies to question our commitment and credibility in international cooperative ventures. More problematically, it jeopardizes a platform for reaffirming U.S. relations with key states. It should be noted that even at the height of the cold war, the United States used science diplomacy as a means to maintain communications and avoid misunderstanding between the world’s two nuclear powers – the Soviet Union and the United States. In a complex multi-polar world, relations are more challenging, the threats perhaps greater, and the need for engagement more paramount.

*Using Science Diplomacy to Achieve National Security Objectives*

The welfare and stability of countries and regions in many parts of the globe require a concerted effort by the developed world to address the causal factors that render countries fragile and cause states to fail. Countries that are unable to defend their people against starvation, or fail to provide economic opportunity, are susceptible to extremist ideologies, autocratic rule, and abuses of human rights. As well, the world faces common threats, among them climate change, energy and water shortages, public health emergencies, environmental degradation, poverty, food insecurity, and religious extremism. These threats can undermine the national security of the United States, both directly and indirectly. Many are blind to political boundaries, becoming regional or global threats.

The United States has no monopoly on knowledge in a globalizing world and the scientific challenges facing humankind

are enormous. Addressing these common challenges demands common solutions and necessitates scientific cooperation, common standards, and common goals. We must increasingly harness the power of American ingenuity in science and technology through strong partnerships with the science community in both academia and the private sector, in the U.S. and abroad among our allies, to advance U.S. interests in foreign policy.

There are also important challenges to the ability of states to supply their populations with sufficient food. The still-growing human population, rising affluence in emerging economies, and other factors have combined to create unprecedented pressures on global prices of staples such as edible oils and grains. Encouraging and promoting the use of contemporary molecular techniques in crop improvement is an essential goal for US science diplomacy.

An essential part of the war on terrorism is a war of ideas. The creation of economic opportunity can do much more to combat the rise of fanaticism than can any weapon. The war of ideas is a war about rationalism as opposed to irrationalism. Science and technology put us firmly on the side of rationalism by providing ideas and opportunities that improve people’s lives. We may use the recognition and the goodwill that science still generates for the United States to achieve our diplomatic and developmental goals. Additionally, the Department continues to use science as a means to reduce the proliferation of the weapons’ of mass destruction and prevent what has been dubbed ‘brain drain’. Through cooperative threat reduction activities, former weapons scientists redirect their skills to participate in peaceful, collaborative international research in a large variety of scientific fields. In addition, new global efforts focus on improving biological, chemical, and nuclear security by promoting and implementing best scientific practices as a means to enhance security, increase global partnerships, and create *sustainability.*

#### And, It’s the best way to solve war

Krasnodebska 12—Former Contributing Researcher for the USC Center for Conflict Prevention. Master of Public Diplomacy, USC (Molly, Conflict Prevention, <http://uscpublicdiplomacy.org/index.php/newswire/media_monitor_reports_detail/science_diplomacy/>

Science diplomacy can function as a tool for conflict prevention and be understood as fostering cooperation between the scientific communities of hostile countries. Cooperation in the field of scientific research can help bridge the gap between the countries by creating a forum of mutual support and common interests. In recent years, there have been numerous examples of scientific cooperation between countries that otherwise have no official diplomatic relations. One such example is the ["inter-Korean cooperation"](http://www.csmonitor.com/World/Asia-Pacific/2010/0216/Former-prisoner-of-North-Korea-builds-university-for-his-former-captors) in the chemistry, biotech and nano-science arenas, which was first proposed in March 2010. Science diplomacy between the two Koreas is also exemplified by the foundation of the first privately funded university in communist North Korea, the Pyongyang University of Science and Technology by Dr. Kim Chin-Kyung, a former war prisoner in North Korea. "Educating people is a way to share what they love, and share their values," said the South Korean [in an interview](http://www.csmonitor.com/World/Asia-Pacific/2010/0216/Former-prisoner-of-North-Korea-builds-university-for-his-former-captors). Another example is the [earthquake research cooperation](http://www.monstersandcritics.com/news/asiapacific/news/article_1527746.php/Taiwan-China-to-cooperate-in-earthquake-science-research) between China and Taiwan initiated in January 2010. Chen Cheng-hung, vice chairman of the National Science Council in Taipei calls the initiative the “biggest scientific cooperation program between the two sides of the Taiwan Straits so far.” The United States launched a science diplomacy campaign toward Iran. The two countries, which have had no formal relations since 1980, have re-launched their ‘broken dialogue” though science. In the summer of 2009, the American Association for the Advancement of Science established a new Center for Science Diplomacy in Iran. [According to *Miller-McCune*](http://www.miller-mccune.com/politics/science-diplomacy-trading-frock-coats-for-lab-coats-3953/), this “scientist-to scientist exchange” is more effective that governmental public diplomacy initiatives. The two countries instead of trying to “influence each other’s behavior…will learn something in the process.” In addition, science diplomacy for conflict prevention can also be understood as the use of science and technology to enhance global or regional security. Solving regional problems and advancing peoples’ well-being though technology by providing them with access to water, clean energy, food, and information can prevent the rise of conflicts. The United States had been the leading country in the use of science and technology diplomacy for the purpose of advancing security. This kind of public diplomacy is particularly directed towards the Muslim world. One example of this is ["vaccine diplomacy."](http://www.scidev.net/en/opinions/vaccine-research-for-peace-1.html) In an interview for SciDevNet in March 2010, Peter J. Hotez, president of the Sabin Vaccine Institute in Washington D.C. [stated](http://www.scidev.net/en/opinions/vaccine-research-for-peace-1.html): “the United States could help reduce the burden of neglected diseases and promote peace by engaging Islamic nations in collaborative vaccine research and development.” This would “improve vaccine development for neglected diseases” in countries such as Indonesia, Malaysia and Pakistan where vaccine diplomacy is currently being implemented.

#### IFR’s S-PRISM design is really safe

**Blees et al 11** (Tom Blees1, Yoon Chang2, Robert Serafin3, Jerry Peterson4, Joe Shuster1, Charles Archambeau5, Randolph Ware3, 6, Tom Wigley3,7, Barry W. Brook7, 1Science Council for Global Initiatives, 2Argonne National Laboratory, 3National Center for Atmospheric Research, 4University of Colorado, 5Technology Research Associates, 6Cooperative Institute for Research in the Environmental Sciences, 7(climate professor) University of Adelaide, "Advanced nuclear power systems to mitigate climate change (Part III)," 2/24/11) http://bravenewclimate.com/2011/02/24/advanced-nuclear-power-systems-to-mitigate-climate-change/-http://bravenewclimate.com/2011/02/24/advanced-nuclear-power-systems-to-mitigate-climate-change/

Metal Fuel: The Ultimate Safety Valve¶ One of the most important of the many superlatives of the IFR is its use of a metal fuel comprised of uranium, plutonium and zirconium, and the ingenious manner in which the Argonne team solved the problems of fuel expansion and fuel fabrication, as well as the potentially dangerous overheating scenario. Unlike the fuel fabrication of oxide-fueled reactors that requires the dimensions of the fuel pellets to be uniform to very exacting tolerances, the metal fuel for the IFR can be simply injected into molds and then cooled and inserted into metal tubes (cladding) with a great deal of dimensional tolerance, with a sodium bond filling any voids. If an accident situation occurs that would cause the core to overheat, such as a loss of coolant flow accident, the metal fuel itself will expand, causing neutron leakage to terminate the chain reaction, relying on nothing but the laws of physics.¶ The passive safety characteristics of the IFR were tested in EBR-II on April 3, 1986, against two of the most severe accident events postulated for nuclear power plants. The first test (the Loss of Flow Test) simulated a complete station blackout, so that power was lost to all cooling systems. The second test (the Loss of Heat Sink Test) simulated the loss of ability to remove heat from the plant by shutting off power to the secondary cooling system. In both of these tests, the normal safety systems were not allowed to function and the operators did not interfere. The tests were run with the reactor initially at full power.¶ In both tests, the passive safety features simply shut down the reactor with no damage. The fuel and coolant remained within safe temperature limits as the reactor quickly shut itself down in both cases. Relying only on passive characteristics, EBR-II smoothly returned to a safe condition without activation of any control rods and without action by the reactor operators. The same features responsible for this remarkable performance in EBR-II will be incorporated into the design of future IFR plants, regardless of how large they may be [xi].¶ While the IFR was under development, a consortium of prominent American companies led by General Electric collaborated with the IFR team to design a commercial-scale reactor based upon the EBR-II research. This design, currently in the hands of GE, is called the PRISM (Power Reactor Innovative Small Module). A somewhat larger version (with a power rating of 380 MWe) is called the S-PRISM. As with all new nuclear reactor designs (and many other potentially hazardous industrial projects), probabilistic risk assessment studies were conducted for the S-PRISM. Among other parameters, the PRA study estimated the frequency with which one could expect a core meltdown. This occurrence was so statistically improbable as to defy imagination. Of course such a number must be divided by the number of reactors in service in order to convey the actual frequency of a hypothetical meltdown. Even so, if one posits that all the energy humanity requires were to be supplies solely by IFRs (an unlikely scenario but one that is entirely possible), the world could expect a core meltdown about once every 435,000 years [xii]. Even if the risk assessment understated the odds by a factor of a thousand, this would still be a reactor design that even the most paranoid could feel good about.

#### Plan is modeled internationally

**Blees et al** 11 (Tom Blees1, Yoon Chang2, Robert Serafin3, Jerry Peterson4, Joe Shuster1, Charles Archambeau5, Randolph Ware3, 6, Tom Wigley3,7, Barry W. Brook7, 1Science Council for Global Initiatives, 2Argonne National Laboratory, 3National Center for Atmospheric Research, 4University of Colorado, 5Technology Research Associates, 6Cooperative Institute for Research in the Environmental Sciences, 7(climate professor) University of Adelaide, "Advanced nuclear power systems to mitigate climate change (Part III)," 2/24/11) [http://bravenewclimate.com/2011/02/24/advanced-nuclear-power-systems-to-mitigate-climate-change/-http://bravenewclimate.com/2011/02/24/advanced-nuclear-power-systems-to-mitigate-climate-change/](http://bravenewclimate.com/2011/02/24/advanced-nuclear-power-systems-to-mitigate-climate-change/-http%3A//bravenewclimate.com/2011/02/24/advanced-nuclear-power-systems-to-mitigate-climate-change/)

There are many compelling reasons to pursue the rapid demonstration of a full-scale IFR, as a lead-in to a subsequent global deployment of this technology within a relatively short time frame. Certainly the urgency of climate change can be a potent tool in winning over environmentalists to this idea. Yet political expediency—due to widespread skepticism of anthropogenic causes for climate change—suggests that the arguments for rolling out IFRs can be effectively tailored to their audience. Energy security—especially with favorable economics—is a primary interest of every nation.¶ The impressive safety features of new nuclear power plant designs should encourage a rapid uptick in construction without concern for the spent fuel they will produce, for all of it will quickly be used up once IFRs begin to be deployed. It is certainly manageable until that time. Burying spent fuel in non-retrievable geologic depositories should be avoided, since it represents a valuable clean energy resource that can last for centuries even if used on a grand scale.¶ Many countries are now beginning to pursue fast reactor technology without the cooperation of the United States, laboriously (and expensively) re-learning the lessons of what does and doesn’t work. If this continues, we will see a variety of different fast reactor designs, some of which will be less safe than others. Why are we forcing other nations to reinvent the wheel? Since the USA invested years of effort and billions of dollars to develop what is arguably the world’s safest and most efficient fast reactor system in the IFR, and since several nations have asked us to share this technology with them (Russia, China, South Korea, Japan, India), there is a golden opportunity here to develop a common goal—a standardized design, and a framework for international control of fast reactor technology and the fissile material that fuels them. This opportunity should be a top priority in the coming decade, if we are serious about replacing fossil fuels worldwide with sufficient pace to effectively mitigate climate change and other environmental and geopolitical crises of the 21st century.

#### IFRs are ready for commercial application – solves tech leadership and coal plants

**Kirsh 11** (Steven T. Kirsh, Bachelor of Science and a Master of Science in electrical engineering and computer science from the Massachusetts Institute of Technology, “Why Obama should meet Till,” 9/28/11) http://bravenewclimate.com/2011/09/28/why-obama-should-meet-till/¶ I will tell you the story of an amazing clean power technology that can use nuclear waste for fuel and emit no long-lived nuclear waste; that can supply clean power at low cost for our planet, 24×7, for millions of years without running out of fuel. I will tell you why this technology is our best bet to reduce the impact of global warming on our planet. And finally, I will tell you why nobody is doing anything about it and why this needs to be corrected.¶ If you act on this letter, you will save our country billions of dollars and allow us to become leaders in clean energy. If you delegate it downward, nothing will happen.¶ I have no vested interest in this; I am writing because I care about the future of our planet¶ First, since we met only briefly during the Obama campaign, let me provide a little background about myself. I am a high-tech entrepreneur and philanthropist based in Silicon Valley. I have received numerous awards for my philanthropy. For example, in 2003, I was honored to receive a National Caring Award presented by then Senator Clinton. The largest engineering auditorium at MIT is named in my honor. The first community college LEED platinum building in the nation is also named in my honor.¶ I am also active in Democratic politics. In the 2000 election, for example, I was the single largest political donor in the United States, donating over $10 million dollars to help Al Gore get elected. Unfortunately, we lost that one by one vote (on the Supreme Court).¶ I have no vested interest in nuclear power or anything else that is described below. I write only as someone who cares about our nation, the environment, and our planet. I am trying to do everything I can so my kids have a habitable world to live in. Nothing more.¶ Dr. James Hansen first made me aware of fast reactors in his letter to Obama in 2009¶ As an environmentalist, I have been a fan of Jim Hansen’s work for nearly two decades. Many consider Dr. Hansen to be the world’s leading expert on global warming. For example, Hansen was the first person to make Congress aware of global warming in his Senate testimony in 1988. Hansen is also Al Gore’s science advisor.¶ In 2009, Dr. Hansen wrote a letter to President Obama urging him to do just three things that are critical to stop global warming: 1) phase out coal plants, 2) impose a feebate on carbon emissions with a 100% rebate to consumers and 3) re-start fourth generation nuclear plants, which can use nuclear waste as fuel. Hansen’s letter to Obama is documented here: http://www.guardian.co.uk/environment/2009/jan/02/obama-climate-change-james-hansen¶ Upon reading Hansen’s recommendations, I was fascinated by the last recommendation. The fourth-generation power plants Hansen advocated sounded too good to be true. If what Hansen was saying was true, then why wasn’t our nation jumping on that technology? It made no sense to me.¶ Lack of knowledge, misinformation, and the complexity of nuclear technology have hampered efforts to get a fast reactor built in the US¶ I spent the next two years finding out the answer to that question. The short answer is three-fold: (1) most people know absolutely nothing about the amazing fourth generation nuclear power plant that we safely ran for 30 years in the US and (2) there is a lot of misleading information being spread by seemingly respectable people (some of whom are in the White House) who never worked on a fourth generation reactor that is totally false. It’s not that they are misleading people deliberately; it’s just that they were either listening to the wrong sources or they are jumping to erroneous conclusions. For example, the most popular misconception is that “reprocessing is a proliferation risk.” That statement fails to distinguish between available reprocessing techniques. It is absolutely true for the French method but it is absolutely not true for the technology described in this letter! The third reason is that the technology is complicated. Most people don’t know the difference between oxide fuel and metal fuel. Most people don’t know what a fast reactor is. Most people can’t tell you the difference between PUREX, UREX, and pyroprocessing. So people with an agenda can happily trot out arguments that support their beliefs and it all sounds perfectly credible. They simply leave out the critical details.¶ We don’t need more R&D. We already have a technology in hand to help us solve global warming and safely get rid of our nuclear waste at low cost. But we aren’t doing anything with it. That’s a serious mistake.¶ Today, our nation faces many serious challenges such as:¶ How can we avert global warming?¶ How can we dispose of our existing nuclear waste safely?¶ How can we generate base-load carbon-free power at very low cost?¶ How can we avoid creating any additional long-lived nuclear waste?¶ How can we grow our economy and create jobs?¶ How can we become the world leader in clean energy?¶ How can we do all of the above while at the same time spending billions less than we are now?¶ The good news is that we already have a proven technology that can address all of these problems. It is a technology that has enjoyed over 30 years of bi-partisan Congressional and Presidential support. It is an advanced nuclear technology that was invented in 1951 by the legendary Walter Zinn and then refined and perfected over a 30 year period, from 1964 to 1994 by Dr. Charles Till who led a team of 1,200 people at the Argonne National Laboratory. Till’s reactor was known as the Integral Fast Reactor (IFR) because it both produced power and recycled its own waste back into the reactor. This is the technology that Hansen referenced in his letter to the President.¶ The IFR is a fourth-generation nuclear design that has several unique and valuable characteristics:¶ It can use our existing nuclear waste (from power plants and weapons) as fuel; we have over 1,000 years of power available by just using today’s nuclear waste. Instead of trying to bury that “waste” in Yucca Mountain, we could be using it for fuel in fast reactors.¶ It generates no long-lived nuclear waste.¶ It is safer than today’s light water reactor (LWR) nuclear power plants. Unlike the Fukushima LWR reactors (a second generation nuclear technology invented 50 years ago), the IFR does NOT require electricity to shut down safely. The IFR shuts down passively if a mishap occurs; no operator intervention or active safety systems are required. They ran the Three Mile Island and Chernobyl scenarios on a live reactor and the reactor shut itself down safely, no operator intervention required, just as predicted. In addition, unlike with LWRs, the IFR runs at low pressure which adds to the safety profile.¶ It reduces the risk of nuclear proliferation because: (1) it eliminates the need for enrichment facilities (which can be used for making nuclear bomb material), (2) the nuclear material that is used in the IFR is not suitable for making bombs and (2) because the nuclear material in the reactor and in the reprocessing hot cell is too “hot” to be stolen or used in a weapon.¶ Experts at General Electric (GE) believe that the IFR has the potential to produce power for less than the price of coal. Dr. Loewen can confirm that if you have any doubts.¶ GE already has an IFR design on the table that they would like to build as soon as possible. Dr. Loewen can confirm that as well.¶ The US Nuclear Regulatory Commission, in January 1994, issued a pre-application safety evaluation report in which they found no objections or impediments to licensing the IFR. You can see the NRC report in the 8 minute video.¶ The design is proven. It produced electric power without mishap for 30 years before the project was abruptly cancelled.¶ Dr Charles Till¶ The IFR’s ability to solve the nuclear waste problem should not be underestimated. As respected nuclear experts have pointed out, a practical solution to the nuclear waste problem is required if we are to revive nuclear power in the United States. The Blue Ribbon Commission (BRC) on America’s Nuclear Future basically concluded this: “continue doing the same thing we are doing today and keep doing R&D.” That was predictable because it was a consensus report; everyone had to agree. So nothing happened. And because there was no consensus from the BRC , there is less money for nuclear because there is no solution to the waste problem. It’s a downward death spiral.¶ Please pardon me for a second and allow me to rant about consensus reports. In my 30 year career as an entrepreneur, I’ve raised tens of millions of millions of dollars in investment capital from venture capitalists all over the world. I always ask them how they make investment decisions. They always tell me, “If we had to get all partners to agree on an investment, we’d never make any investments. If you can get two partners to champion your company, that is sufficient to drive an investment decision.” Therefore, if you want to get nothing done, ask for a consensus report. If you want to actually solve problems, you should listen to what the people most knowledgeable about the problem are saying.¶ Dr Yoon I. Chang¶ Had President Obama asked the Commissioners on the Nuclear Regulatory Commission (NRC) who have the most knowledge of fast reactors the same question that he tasked the BRC with, he would have gotten a completely different answer. They would have told President Obama that fast reactors and pyroprocessing are the way to go and we better get started immediately with something that we already know works because there is still a ten year time if we were to start the reactor building process today. Their advice leads to a viable solution that we know will work and it will make the US a leader in clean nuclear power. Following the BRC’s consensus advice will lead to decades of inaction. Totally predictable.¶ If we put a national focus on developing and cost reducing the IFR, we’d have a killer product and lead the world in being a clean energy leader¶ It would be great if we had a long-term strategy and vision for how we become energy independent and solve the global warming problem and help our economy at the same time. The IFR can play a key role in that vision. If we put a national focus on developing and commercializing the IFR technology we invented, we can create jobs, help our trade balance, mitigate global warming, become energy independent, show the world a safe way to get rid of nuclear waste, and become the leaders in clean power technology.¶ Nuclear power is the elephant in the room. Even though we haven’t built a new nuclear plant in 30 years, nuclear still supplies 70% of the clean energy in America today. That feat was largely accomplished in a single ten year period. Renewables have had 3 decades to “catch up” and they aren’t anywhere close. Nuclear’s continued dominance shows that nuclear power is indeed the elephant in the room when it comes to being able to install clean energy quickly and affordably.¶ The bad news is that President Clinton decided that this technology, which would have produced unlimited amounts of base-load carbon-free power for a price as low as anything else available today, was not needed and cancelled the project in 1994.¶ Cancelling the IFR was a big mistake. It’s still the world’s best fast nuclear technology according to an independent study by the Gen IV International Forum.¶ Many top scientists all over the world believe that President Clinton’s decision was a huge mistake. The Senate had voted to continue to fund it. The project had been supported by six US Presidents; Republicans and Democrats. In fact, the project’s biggest proponent was Republican President Richard Nixon who said in 1971, “Our best hope today for meeting the Nation’s growing demand for economical clean energy lies with the fast breeder reactor.”¶ Republican Senator Kempthorne said of the IFR cancellation:¶ Unfortunately, this program was canceled just 2 short years before the proof of concept. I assure my colleagues someday our Nation will regret and reverse this shortsighted decision. But complete or not, the concept and the work done to prove it remain genius and a great contribution to the world.¶ While I am not a big fan of Senator Kempthorne, I couldn’t agree more with what he said in this particular case.¶ The IFR remains the single best advanced nuclear power design ever invented. That fact was made clear when in 2002, over 240 leading nuclear scientists from all over the world (in a Gen IV International Forum sponsored study) independently evaluated all fourth-generation nuclear designs and ranked the IFR the #1 best overall advanced nuclear design.¶ The IFR was cancelled in 1994 without so much as a phone call to anyone who worked on the project. They didn’t call then. They haven’t called since. They simply pulled the plug and told people not to talk about the technology.¶ The US government invested over $5 billion dollars in the IFR. Fast reactor R&D is largest single technology investment DOE has ever made. According to a top DOE nuclear official (Ray Hunter, the former NE2 at DOE), the “IFR became the preferred path because of waste management, safety, and economics.” The reactor produced power for 30 years without incident. Despite that track record, before it was cancelled, nobody from the White House ever met with anyone who worked on the project to discuss whether it should be terminated or not. It was simply unilaterally terminated by the White House for political reasons. Technical experts were never consulted. To this day, no one from the White House has met with Dr. Till to understand the benefits of the project. The technical merits simply did not matter.¶ I urge you to recommend to President Obama that he meet personally with Dr. Charles Till so that the President can hear first hand why it is so critical for the health of our nation and our planet that this project, known as the Integral Fast Reactor (IFR), be restarted. Dr. Till headed the project at Argonne National Laboratory until his retirement in 1997. He is, without a doubt, the world’s leading expert on IFR technology.¶ Want to solve global warming? Easy. Just create a 24×7 clean power source that costs the same as coal. Prominent scientists believe that the IFR can achieve this.¶ Dr. Hansen has pointed out many times that it is imperative to eliminate all coal plants worldwide since otherwise, we will never win the battle against global warming. But we know from experience that treaties and agreements do not work. Here’s a quote from an article (“The Most Important Investment that We Aren’t Making to Mitigate the Climate Crisis”) that I wrote in December 2009 published in the Huffington Post:¶ If you want to get emissions reductions, you must make the alternatives for electric power generation cheaper than coal. It’s that simple. If you don’t do that, you lose.¶ The billions we invest in R&D now in building a clean and cheaper alternative to coal power will pay off in spades later. We have a really great option now — the IFR is on the verge of commercial readiness — and potential competitors such as the Liquid Fluoride Thorium Reactor (LFTR) are in the wings. But the US government isn’t investing in developing any of these breakthrough new base-load power generation technologies. Not a single one.¶ I found it really amazing that global leaders were promising billions, even hundreds of billions in Copenhagen for “fighting climate change” when they weren’t investing one cent in the nuclear technologies that can stop coal and replace it with something cheaper.¶ [ Note: 6 days ago, on September 22, 2011, DOE agreed to give $7.5M to MIT to do R&D on a molten-salt reactor. That’s good, but we should be building the technology we already have proven in 30 years of operational experience before we invest in unproven new technologies. ]¶ Dr. Loewen has personally looked at the costs for the building the IFR in detail and believes the IFR can generate power at a cost comparable to a coal plant. So it’s arguably our best shot at displacing coal plants. This is precisely why Dr. Hansen believes that the IFR should be a top priority if we want to save our planet.¶ It isn’t just nuclear experts that support the IFR¶ US Congressman John Garamendi (D-CA) is also a major IFR supporter. When he was Lt. Governor of California, Congressman Garamendi convened a panel of over a dozen our nation’s top scientists to discuss the IFR technology. As a result of that meeting, Garamendi became convinced that the IFR is critically important and he is currently trying very hard to get a bill passed in the House to restart it. Unfortunately, virtually everyone in Congress seems to have forgotten about this project even though in the 1970’s it was the President’s top energy priority. Nothing has changed since then. No other clean energy technology has been invented that is superior to the IFR for generating low-cost carbon-free base-load electric power.¶ Bill Gates also found exactly the same thing when he looked at how to solve the global warming problem. As he explained in a recent TED talk, renewables will never solve the climate crisis. The only viable technology is fourth-generation nuclear power and the best advanced nuclear technology is the IFR. That is why this is Gate’s only clean energy investment. Gates’ TerraPower Travelling Wave Reactor (TWR) is a variant of the IFR design. When Gates approached DOE to try to build his reactor in the US, he was told to build it outside of the US.¶ Nobel prize winner Hans Bethe (now deceased) was an enthusiastic supporter. Freeman Dyson called Bethe the “supreme problem solver of the 20th century. Chuck Till told me the following story of Bethe’s support for the IFR:¶ A tale from the past: A year or two before the events I’ll describe, Hans Bethe had been contacted by the Argonne Lab Director for his recommendation on who to seek to replace the existing head of Argonne’s reactor program.¶ Bethe told him the best choice was already there in the Lab, so it was in this way that I was put in charge. I had had quite a few sessions with him in the years leading up to it, as we were able to do a lot of calculations on the effects of reactor types on resources that he didn’t have the capability at his disposal to do himself.¶ So when I wanted to initiate the IFR thrust, the first outside person I went to was Bethe at Cornell. After a full day of briefing from all the specialists I had taken with me, he suggested a brief private meeting with me. He was direct. He said “All the pieces fit. I am prepared to write a letter stating this. Who do you want me to address it to? I think the President’s Science Advisor, don’t you?” I said the obvious – that his opinion would be given great weight, and would give instant respectability.¶ He went on, “I know him quite well. Who else?” I said I was sure that Senator McClure (who was chairman of Senate Energy and Resources at the time) would be relieved to hear from him. That the Senator would be inclined to support us, as we were fairly prominent in the economy of the state of Idaho, and for that reason I had easy access to him. But to know that Hans Bethe, a man renowned for his common sense in nuclear and all energy matters, supported such an effort would give him the Senator solid and quotable reason for his own support, not dismissible as parochial politics, that the Senator would want if he was to lead the congressional efforts. “Yes,” he said in that way he had, “I agree.”¶ I’ve always thought that the President’s Science Advisor’s intervention with DOE, to give us a start, was not the result of our meeting him, but rather it was because of the gravitas Hans Bethe provided with a one page letter.¶ How do we lead the world in clean energy if we put our most powerful clean energy technology on the shelf?!?¶ President Obama has stated that he wants the US to be a leader in clean energy. I do not see how we achieve that if we allow our most advanced clean energy technology to sit on the shelf collecting dust and we tell one of America’s most respected businessmen that he should build his clean energy technology in another country. We have an opportunity here to export energy technology to China instead of importing it. But due to Clinton’s decision, we are allowing the Russians to sell similar fast reactor technology to the Chinese. It should have been us.¶ Re-starting the IFR will allow us to cancel a $10 billion stupid expenditure. The IFR only costs $3B to build. We’d get more, pay less. On pure economics alone, it’s a no brainer.¶ Finally, even if you find none of the arguments above to be compelling, there is one more reason to restart the IFR project: it will save billions of dollars. Today, we are contracting with the French to build a MOX reprocessing plant in Savannah River. The cost of that project is $10 billion dollars. We are doing it to meet our treaty obligations with the Russians. Former top DOE nuclear managers agree this is a huge waste of money because we can build an IFR which can reprocess 10 times at much weapons waste per year for a fraction of that cost.¶ The Russians are laughing at our stupidity. They are going to be disposing of their weapons waste in fast reactors, just like we should be. The Russians are also exporting their fast reactors to the Chinese. Had the US not cancelled our fast reactor program, we would be the world leader in this technology because our technology remains better than any other fourth generation technology in the world.¶ If you delegate this to someone else, nothing will happen. Here’s why.¶ Delegating this letter downward from the White House to someone in DOE to evaluate will result in inaction and no follow up. I know this from past attempts that have been made. It just gets lost and there is no follow up. Every time. The guys at DOE want to do it, but they know that they will get completely stopped by OMB and OSTP. Both Carol Browner and Steven Chu asked former DOE nuclear management what to do about nuclear waste. They were told that using fast reactors and reprocessing was the way to go. But nothing happened. So Chu has given up trying. According to knowledgeable sources, the White House has told DOE in no uncertain terms, “do not build anything nuclear in the US.” It’s not clear who is making these decisions, but many people believe it is being driven by Steven Fetter in OSTP.¶ Dr. Till knows all of this. He knows that unless he personally meets with the President to tell the story of this amazing technology, nothing will happen.¶ I’ve discussed the IFR with Steve Fetter and he has his facts wrong. Fetter is basically a Frank von Hippel disciple: they have written at least 14 papers together! It was von Hippel who was largely responsible for killing the IFR under Clinton.¶ So von Hippel’s misguided thought process is driving White House policy today. That’s a big mistake. Professor von Hippel twists the facts to support his point of view and fails to bring up compelling counter arguments that he knows are true but would not support his position. He’s not being intellectually honest. I’ve experienced this myself, firsthand. For example, von Hippel often writes that fast reactors are unreliable. When I pointed out to him that there are several examples of reliable fast reactors, including the EBR-II which ran for decades without incident, he said, that these were the “exceptions that prove the rule.” I was floored by that. That’s crazy. It only proves that it is complicated to build a fast reactor, but that it can easily be done very reliably if you know what you are doing. There is nothing inherent to the technology that makes it “unreliable.” You just have to figure out the secrets. When von Hippel heard that Congressman Garamendi was supporting the IFR, he demanded a meeting with Garamendi to “set him straight.” But what happened was just the opposite: Garamendi pointed out to von Hippel that von Hippel’s “facts” were wrong. Von Hippel left that meeting with Garamendi with his tail between his legs muttering something about that being the first time he’s ever spoken with anyone in Congress who knew anything about fast nuclear reactors. In short, if you watch a debate between von Hippel and Garamendi (who is not a scientist), Garamendi easily wins on the facts. If you put von Hippel up against someone who knows the technology like Till, Till would crush von Hippel on both the facts and the arguments. But the Clinton White House never invited Till to debate the arguments with von Hippel. They simply trusted what von Hippel told them. Big mistake.¶ There are lots of problems with von Hippel’s arguments. For example, von Hippel ignores reality believing that if the USA doesn’t do something then it will not happen. That’s incredibly naieve and he’s been proven wrong. The USA invented a safe way to reprocess nuclear waste that isn’t a proliferation risk called pyroprocessing. The nuclear material is not suitable for making a bomb at any time in the process. But we never commercialized it because von Hippel convinced Clinton to cancel it. The French commercialized their reprocessing process (PUREX) which separates out pure plutonium and makes it trivial to make bomb material. So because countries need to reprocess, they pick the unsafe technology because they have no alternative. Similarly, because von Hippel had our fast reactor program cancelled, the Russians are the leaders in fast reactor technology. They’ve been using fast reactor technology for over 30 years to generate power commercially. But we know the Russians have a terrible nuclear safety record (e.g., Chernobyl). The fact is that the Chinese are buying fast reactors from the Russians because there is no US alternative. The problem with von Hippel’s arguments are that the genie is out of the bottle. We can either lead the world in showing how we can do this safely, or the world will choose the less safe alternatives. Today, von Hippel’s decisions have made the world less safe. I could go on and on about how bad von Hippel’s advice is, but this letter is already way too long.¶ MIT was wrong in their report about “The Future of the Nuclear Fuel Cycle”¶ The only other seemingly credible argument against building fast reactors now comes from MIT. The report’s recommendation that we have plenty of time to do R&D appears largely to be driven by one person, co-chair Ernie Moniz.¶ Four world-famous experts on nuclear power and/or climate change and one Congressman challenged Moniz to a debate on the MIT campus on his report. Moniz declined.¶ The report has several major problems. Here are a few of them.¶ The MIT report is inconsistent. On the one hand it says, “To enable an expansion of nuclear power, it must overcome critical challenges in cost, waste disposal, and proliferation concerns while maintaining its currently excellent safety and reliability record.” We agree with that! But then it inexplicably says, “… there are many more viable fuel cycle options and that the optimum choice among them faces great uncertainty…. Greater clarity should emerge over the next few decades… A key message from our work is that we can and should preserve our options for fuel cycle choices by …[continuing doing what we are doing today] … and researching technology alternatives appropriate to a range of nuclear energy futures.” So even though we have a solution now that can be deployed so we can enable an expansion of nuclear power as soon as possible, MIT advises that we should spend a few more decades because we might find something better than the IFR. This is just about the dumbest thing I’ve ever heard coming from MIT. If you ask any scientist who knows anything about global warming, they will tell you we are decades late in deploying carbon-free power. Had we aggressively ramped fast nuclear closed-cycle reactors decades ago and promoted them worldwide, we wouldn’t be anywhere close to the disastrous situation we are in today. So we are decades too late in ramping up nuclear power, and Moniz wants us to spend decades doing more R&D to get a solution that might be lower cost than the IFR. That’s insane.¶ The report looks at the market price of uranium, but the market price completely ignores the environmental impacts of uranium mining. Shouldn’t that be taken into account? It’s like the cost of gas is cheap because the market price doesn’t include the hidden costs: the impact on the environment and on our health.¶ Do you really think that people are going to embrace expansion of uranium mining in the US? The MIT report is silent on that. So then we are back to being dependent on other countries for uranium. Wasn’t the whole point to be energy independent? The IFR provides that now. We wouldn’t have to do any uranium mining ever again. After a thousand years, when we’ve used all our existing nuclear waste as fuel, we can extract the additional fuel we need from seawater, making our seas less radioactive. We can do that for millions of years.¶ The MIT report ignores what other countries are doing. Obama wants the US to be a leader in clean energy technology. You do that by building the most advanced nuclear designs and refining them. That’s the way you learn and improve. MIT would have us stuck on old LWR technology for a few decades. Does anyone seriously think that is the way to be the world leader? There is virtually no room for improvement in LWR technology. IFR technology is nearly 100 times more efficient, and it emits no long term nuclear waste. If you are a buyer of nuclear power in China, which nuclear reactor are you going to pick? The one that is 100 times more efficient and generates no waste? Or the one that is 100 times less efficient and generates waste that you better store for a million years? Wow. Now that’s a real tough question, isn’t it. Gotta ponder that one. I’m sure Apple Computer isn’t taking advice from Moniz. If they were, they’d still be building the Apple I. Ernie should get a clue. The reason Apple is a market leader is because they bring the latest technology to market before anyone else, not because they keep producing old stuff and spend decades doing R&D to see if they can come up with something better. Other countries are not hampered by MIT’s report. France and Japan recently entered into an agreement with the US DOE whereby we’re giving them the IFR technology for them to exploit. Even though we are stupid, they aren’t stupid. The Chinese are ordering inferior oxide fueled fast reactors from Russia. If the US were building metal-fueled fast reactors with pyroprocessing, it’s a good bet the Chinese would be buying from us

 instead of the Russians. But if we take Moniz’s advice to not build the world’s best advanced nuclear technology we already have, then there is no chance of that happening. By the time we get to market with a fast reactor, it will be all over. We’ll arrive to the market decades late. Another great American invention that we blew it on.¶ There will always be new technologies that people will propose. But the IFR is a bird in the hand and we really need a solution now we can depend on. If something comes along later that is better, that’s great. But if it doesn’t, we will have a viable technology. We can’t afford to get this wrong. We have already run out of time. Any new nuclear designs are decades away from deployment.¶ On September 22, 2011, DOE agreed to give MIT $7.5 millions of dollars on starting R&D on a fourth generation molten salt reactor design that have never been proven. While it might work, the very smart scientists at Oak Ridge National Laboratory spent well over a decade on this and were never able to make it work. So DOE is spending millions on an unproven design while spending nothing on the “sure thing” fourth generation reactor that we already know how to build and that ran flawlessly for 30 years. We are all scratching our heads on that one. It makes no sense. But the reason for this is clear: the mandate from the White House that nothing is to built means that DOE can only initiate research, and then cancel the project right before anything would be built. This is an excellent plan for demoralizing scientists and allowing other countries to lead the world in clean energy. Is that really what we want?? If so, then there are much less expensive ways to accomplish that.¶ At a minimum we should be investing in commercializing our “bird in the hand.” That way, if the new molten salt reactor experiments don’t work out, we’ll still have a viable solution to the nuclear waste problem. If we keep cancelling successful projects right before they are done, hoping for the next big thing, we will forever be in R&D mode and get nothing done. That’s where we are today with fourth generation nuclear.¶ I know this is an unusual request, but I also know that if the President is allowed to evaluate the facts first hand, I am absolutely convinced that he will come to the same conclusion as we all have.¶ I urge you to view an 8 minute video narrated by former CBS Morning News anchor Bill Kurtis that explains all of this in a way that anyone can understand. This video can be found at:¶ The video will amaze you.¶ If you would like an independent assessment of what I wrote above from a neutral , trustworthy, and knowledgeable expert, Bill Magwood would be an excellent choice. Magwood was head of nuclear at DOE under Clinton and Bush, and was the longest serving head of nuclear at DOE in US history. He served under both Clinton and Bush administrations. Magwood is familiar with the IFR, but the IFR was cancelled before he was appointed to head civilian nuclear at DOE. So Magwood has no vested interest in the IFR at all. More recently, Magwood was appointed by President Obama to serve on the NRC and is currently serving in that role. Of the current five NRC Commissioners, Magwood is by far, the person most knowledgeable (PMK) about fast reactors.¶ Thank you for your help in bringing this important matter to the President’s attention.¶ Summary¶ Nuclear power is needed. Renewables alone won’t do it.¶ In order to revive nuclear in the US, you must have a viable solution to the nuclear waste problem.¶ The French reprocess their nuclear waste, but their process is expensive, environmentally unfriendly, and has proliferation problems.¶ The USA developed an inexpensive, environmentally friendly, and proliferation resistant method to reprocess our waste (the IFR), but we cancelled it. That decision was a mistake.¶ We should restart the IFR in the US. It will cost $3B to build, but we can cancel the Areva MOX plant and save $10B to pay for it. So we’ll save money, save the planet from an environmental catastrophe, create jobs, get rid of our nuclear waste, and become the world leader in clean energy technology.¶ President Obama should meet personally with Dr. Charles Till, the world’s leading expert on fast reactor technology. Dr. Till will not waste his time meeting with anyone other than the President because he knows that without personal support of the President, nothing will happen. He’s right.¶ Supporters of this technology include Nobel prize winner Hans Bethe (now deceased), Steven Chu, Dr. James Hansen, Dr. Charles Till, Dr. Eric Loewen, Congressman John Garamendi, Bill Gates, and even the President of MIT. Even the board of directors of the historically anti-nuclear Sierra Club has agreed that they will not oppose building an IFR!¶ Opposition is from OSTP and OMB. We don’t know who or why. It’s a mystery to all my sources. Frank von Hippel thinks you cannot make fast reactors cheaply or reliably and maintains that stance even when the facts show that not to be the case. Ernie Moniz at MIT thinks we shouldn’t build anything now, but do more R&D for the next several decades hoping we can find something better.¶ Bill Magwood, an Obama appointee to the NRC, would be a reasonable choice to provide an objective assessment of the IFR. He has no vested interested in the IFR, but having been the longest serving head of DOE civilian nuclear in history, is familiar with the pros and cons of the technology.¶ Should OSTP and OMB be making these key decisions behind closed doors? Is this really reflective of what the President wants? He’s stated publicly he wants the US to be a world leader in clean energy. Is putting our best technology on the shelf, but licensing the French and Japanese to build it (Joint Statement on Trilateral Cooperation in the area of Sodium-cooled Fast Reactors signed on October 4, 2010 by DOE), the best way for the US to achieve the leadership that Obama said he wanted?¶ I am happy to provide you with additional information.

#### IFRs are technologically ready – we just have to decide to build them

**Brook 11** (Barry Brook, Professor of Climate Change University of Adelaide, “Nuclear power and climate change – what now?” 5/28/11) <http://bravenewclimate.com/2011/05/28/np-cc-what-now/>

But detractors will nevertheless complain that reactors like the ESBWR still produce long-lived radioactive waste products that will have to be safely watched over for what is, for all intents and purposes, forever (from a human standpoint). Another objection frequently raised is the risk of nuclear proliferation, the fear that nuclear material will be misdirected from power plants and made into nuclear weapons. Fuel supply is also an issue when the prospect of a burgeoning nuclear renaissance is considered, with demand for uranium expected to skyrocket. And over all this looms the capital cost of building nuclear power plants, which many consider a deal-breaker even if all the other issues could be resolved. Back in the early Eighties a group of talented nuclear physicists and engineers realized that if there was to be any reasonable expectation of widespread public acceptance of nuclear power, all these problems would have to be solved. So they set out to solve them. Under the leadership of Dr. Charles Till at Argonne National Laboratory’s western branch in the state of Idaho, a virtual army of nuclear professionals designed an energy system that many expect will soon power the planet, if only we can muster the political will to deploy it. Their test reactor operated virtually flawlessly for thirty years as they identified and solved one potential obstacle after another, proceeding methodically until they were ready to demonstrate the commercial-scale viability of their revolutionary fuel recycling system that would complete what had been a spectacularly successful project. What they had accomplished during those years was, without exaggeration, probably the most important energy system ever invented, one that promises virtually unlimited safe, clean energy for the entire planet. Unfortunately, an almost unbelievable shortsightedness on the part of politicians in Washington D.C. pulled the plug on the project just as it reached its final stage in 1994, and the promise of the Integral Fast Reactor (IFR) languished virtually unnoticed for the next fifteen years. Figure 1: A simplified version of an IFR reactor. Illustration courtesy of Andrew Arthur The Integral Fast Reactor But the IFR is such a grand invention that it couldn’t stay buried any longer, and people around the world are now clamoring for it to be deployed. The looming threat of climate change has prompted many to take a fresh look at nuclear power. Some have considered the problem of so-called “nuclear waste” (not waste at all, as we shall soon see) an acceptable price to pay in order to curtail greenhouse gas emissions. In the wake of the Japan accident, safety will also be prominent in the debate. The IFR, though, is so impressive in its qualifications that even previously hard-core anti-nuclear activists have touted it as the ultimate answer. And the fact that over 300 reactor-years of experience have been accumulated with fast reactors around the world means that such technology is no pipe dream, but a mature technology ripe for commercial deployment. The term Integral Fast Reactor denotes two distinct parts: A sodium-cooled fast neutron fission reactor and a recycling facility to process the spent fuel. A single recycling facility would be co-located with a cluster of reactors. Figure 1 shows a simplified version of such a reactor. It consists of a stainless steel tub of sodium, a metal that liquifies at about the boiling point of water. Sodium is used both as a completely non-corrosive coolant and, in a separate non-radioactive loop, as the heat transfer agent to transport the heat to a steam generator in a separate structure (thus avoiding any possible sodium-water interaction in the reactor structure). The system is unpressurized, and the pumps are electromagnetic pumps with no moving parts. In the event of a loss of flow, natural convection and the large amount of sodium will be sufficient to dissipate the heat from the fission products in the core, unlike the situation in the Japanese reactors at Fukushima, which required constant cooling even though the reactors had been shut off. The commercial-scale iteration of the IFR’s reactor component is called the PRISM (or its slightly larger successor, the S-PRISM, though for the sake of brevity I’ll hereafter call it simply the PRISM, which stands for Power Reactor Innovative Small Module). It was designed by a consortium of American companies in conjunction with Argonne Lab, and is now being further refined by GE/Hitachi Nuclear. From a safety standpoint it is unparalleled. If the risk assessment studies for the ESBWR mentioned above sound impressive, those of the IFR are even better. In my book Prescription for the Planet, I did a thought experiment based on the risk assessment studies for the PRISM that have already gotten a preliminary nod from the NRC. The likelihood of a core meltdown was so improbable that I figured out how often we could expect one if thousands of PRISMs were providing all the energy (not just electricity) that humanity will require a few decades hence (according to most estimates). Remember, the occurrence of one meltdown would require dividing the total number of reactors into the probability for a single reactor. Even so, the probable core meltdown frequency came to once every 435,000 years! Even if that risk assessment was exaggerated by ten thousand times, it would still mean we could expect a meltdown about once every half-century for all the energy humanity needs. Reactors and Natural Disasters The crisis at Fukushima’s power plant has stoked fears that existing nuclear sites may be incapable of withstanding quakes in excess of their design specifications. Whereas many lightwater reactors are designed to withstand G forces of about 0.3, the PRISM is rated at 1.0. This G rating is different than a Richter scale rating because the Richter scale represents the total energy released in an earthquake, which is dependent on many factors (duration, depth, etc.). When designing a structure or piece of equipment to withstand earthquakes, the degree of ground acceleration is what matters. If one were to stand directly on a geological fault line during the most severe earthquake imaginable, the G forces caused by ground acceleration would almost certainly not exceed 1.0. (The maximum ground motion at the Fukushima complex during the earthquake measuring 9.0 on the Richter scale was 0.56 G) So the PRISM reactor, designed for that level of motion, could safely be built in any seismically active area. Of course it goes without saying that no power plant should be built at a low elevation in a zone that is vulnerable to tsunamis, or for that matter on a flood plain. But with the PRISM, seismic shocks are not an issue. As for proliferation risk, it should be pointed out that the risk of proliferation from any sort of power reactor has been substantially mischaracterized and generally overblown. The reason is that the isotopic composition of the uranium and plutonium in power reactors is lousy for making weapons. Any country that wishes to pursue a weapons program covertly is far better served by using a small research reactor operated in a specific manner to produce high-grade weapons material, and even then it requires a quite complex reprocessing system to separate it. That being said, the IFR system uses a unique metal fuel that can not only be easily and cheaply recycled on-site and then fabricated into new fuel elements, but at no stage of the fuel cycle is any sort of weapons-grade material isolated. All the isotopes of uranium and plutonium are not only left mixed with their various cousins, but there is always at least a bit of highly radioactive fission product elements, making the fuel impossible to handle except by remote systems. Figure 2: The fission products will only be radioactive beyond the level of natural ore for a few hundred years. The buildup of such fission products in the fuel, though, is what eventually necessitates pulling fuel elements out of the reactor for recycling. In the pyroprocessing system—a type of electrorefining common in the metallurgical industry but unique to the IFR among reactor systems—the majority of the fission products are isolated. The rest of the fuel is reincorporated into new fuel elements. The fission products, representing only a small percentage of the fuel, are entombed in borosilicate glass that can’t leach any of them into the environment for thousands of years. Yet the fission products will only be radioactive beyond the level of natural ore for a few hundred years (see Figure 2). Thus the so-called “million year waste problem” is neatly solved. As for the question of uranium supply, that issue is moot once we begin to build IFRs. First we’ll use up all the spent fuel that’s been generated over the years by LWRs, plus all the weapons-grade uranium and plutonium from decommissioned nuclear weapons. It’s all perfect for fuel in IFRs. But then when that’s all gone we can fuel them with depleted uranium. There is already so much of it out of the ground from years of nuclear power use that even if we were to supply all the energy humanity is likely to need from just IFRs alone, we’ve got enough fuel already at hand for nearly a thousand years. As efficient as LWRs are in squeezing a huge amount of energy out of a small amount of fuel, fast reactors like the PRISM are about 150 times more efficient. In fact, all the energy a profligate American would be likely to use in a lifetime could be extracted from a piece of depleted uranium the size of half a ping-pong ball. Finally we come to the clincher: the cost. For some reason it supposedly is going to cost anywhere from two to five times as much to build a nuclear power plant in the USA than exactly the same design being built in the Far East. This comparison applies not just to countries with low labor costs but to Japan too, where labor costs are high and nearly all the materials are imported. It’s an American societal and political problem, not an inherent flaw of nuclear power. Utility companies fear that a group of protesters with signs and lawyers might shut down construction midway through a multi-billion-dollar project, or prevent a built reactor from operating. So they prudently try to build that uncertainty into their cost estimates (with maybe a little padding to boot). A golf ball of uranium would provide more than enough energy for your entire lifetime, including electricity for homes, vehicles and mobile devices, synthetic fuels for vehicles (including tractors to produce your food and jet fuel for your flights). Your legacy? A soda can of fission product was, that would be less radioactive than natural uranium ore in 300 years. The new reactor designs, both the Gen III+ designs mentioned earlier and the PRISM, are designed to be mass-produced in modules, then assembled at the power plant site. The PRISM has the added advantage of operating at atmospheric pressure, so no pressure vessel or high-pressure pumps are needed. The passive safety principles mean that multiple redundancy is unnecessary, allowing such reactors to have far fewer pumps, valves, controls, and other components than their older Gen II predecessors. Based on both industry estimates and actual experience of building these reactors since the Nineties, there is every reason to believe that the price can be kept well below $2,000/kW, though the Chinese plan to produce them for half that price once their mass production supply lines are in place. There is virtually no doubt that with these new nuclear technologies available, the shift to predominantly nuclear power is virtually inevitable in the long term. Over sixty new plants are under construction around the world with many more to come, even if some nations are temporarily deterred by political and social pressures. If we’re serious about solving the climate change problem before it’s too late, we’ll have to get serious about the only zero-emission baseload power source that can easily supply all the energy the world needs. We shouldn’t consider this a Faustian bargain. These new designs—particularly the IFR—are clean, safe, economical, and able to convert waste products that we desperately want to get rid of into abundant energy for the entire planet. Anyone serious about protecting the environment can safely embrace them with enthusiasm.

1. The recent historic meetings of North and South Korean leaders, with proclamations of cooperation etc., are a healthy sign for the better. With the former implacable North Korean dictator now dead, the new and younger leader may have less hostile outlook. However, progress can be made only very slowly, since the Communist apparatus is still in power in the armed forces and the nation. Only as more of the old die-hard Communist leaders die off, will real progress start to be made in materially lessening the threat posed by North Korea. That is a process requiring a generation, but at least a start has been made. For our thesis, that progress is likely to be sufficiently slow that, while it damps the stress curves a little, it has no appreciable effect on the overall thesis of the eruption within the decade of a great conflagration involving weapons of mass destruction. [↑](#endnote-ref-1)
2. . Also involved, there are clandestine weapons of far greater power than nuclear weapons, but most of that subject is beyond the scope of this presentation. For some time we have informed the U.S. government of these developments, the evidence, the events, etc. An example — current at its time of preparation — is T. E. Bearden, Energetics: Extensions to Physics and Advanced Technology for Medical and Military Applications, CTEC Proprietary, May 1, 1998, 200+ page inclosure to CTEC Letter, “Saving the Lives of mass BW Casualties from Terrorist BW Strikes on U.S. Population Centers,” to Major General Thomas H. Neary, Director of Nuclear and Counterproliferation, Office of the Deputy Chief of Staff, Air and Space Operations, HQ USAF, May. 4, 1998. Copies of a similar presentation were furnished the DoD, Senator Shelby as head of the Senate's Intelligence subcommittee, and Congressman Weldon as head of the House's Intelligence subcommittee efforts, as well as other U.S. government agencies. [↑](#endnote-ref-2)
3. . The earlier clandestine asymmetrical strategic weapons developed by the former USSR under rigid KGB control, were longitudinal EM wave interferometers, which are the weapons obliquely referred to by Defense Secretary Cohen in this statement: "*"Others [terrorists] are engaging even in an eco-type of terrorism whereby they can alter the climate, set off earthquakes, volcanoes remotely through the use of electromagnetic waves… So there are plenty of ingenious minds out there that are at work finding ways in which they can wreak terror upon other nations…It's real, and that's the reason why we have to intensify our [counterterrorism] efforts."* Secretary of Defense William Cohen at an April 1997 counterterrorism conference sponsored by former Senator Sam Nunn. Quoted from DoD News Briefing, Secretary of Defense William S. Cohen, Q&A at the *Conference on Terrorism, Weapons of Mass Destruction, and U.S. Strategy*, University of Georgia, Athens, Apr. 28, 1997. The present author has been briefing these weapons to DoD and other government agencies for many years. Most major weapons laboratories in various nations have now discovered longitudinal EM waves and either have such weapons or are furiously developing them. At least seven nations now possess them. [↑](#endnote-ref-3)
4. . Proceeding conventionally as at present, it will be 50 years before the organized scientific community will permit these emerging solutions to actually be developed and produced. This is senseless; as the Manhattan Project in WW II showed, a newly emerging technology can go to production in four years. Given only that neutron fission of the proper uranium isotope produced more neutrons than were input, the Manhattan Project developed fully operational atomic bombs of two major types in four years. An appreciable number of other "waiting areas for such development" exist in science in the literature, but are not usually pushed forward into development for decades due to the continuing resistance of the scientific community to all innovations which threaten the favored projects (such as hot fusion) and favored theories. Any "scientist in the trenches" is well-aware that the progress of science is by means of a continuing massive cat and dog fight, not at all by sweet scientific reason and logic. [↑](#endnote-ref-4)