### 1AC Plan – with S-PRISM

#### The United States federal government should substantially increase loan guarantees for integral fast reactors using the S-PRISM design.

### Nuclear Leadership

#### Contention 1: Nuclear Leadership

#### Some expansion of nuclear power inevitable globally – new US construction key to nonproliferation

Wallace & Williams, 2-8-12

[Michael, senior adviser with the U.S. Nuclear Energy Project -- CSIS, Sarah, research associate with the project, “NRC Approves Construction and Operating License for Vogtle Nuclear Power Plant,” http://csis.org/publication/nrc-approves-construction-and-operating-license-vogtle-nuclear-power-plant]

Q1: What does the Nuclear Regulatory Commission’s approval of the Combined Construction and Operating License for the Vogtle nuclear power plant in Burke County, Georgia, mean? A1: The Combined Construction and Operating License (COL) issued for the Vogtle nuclear plant in eastern Georgia today by the Nuclear Regulatory Commission (NRC) is the first ever issued—and the first license for new plant construction issued in 32 years. While a new nuclear plant has not come online since 1996, the capacity factor of the civil nuclear reactor fleet went from 58.4 percent in 1989 to 91.2 percent in 2010. This is an efficiency improvement equivalent to bringing 25 large one-gigawatt reactors on line, which makes the U.S. fleet the most productive in the world. Industry-wide improvements have also been made to physical plant infrastructure, operating procedures and standards, emergency response planning, personnel training, and plant security. These drastic strides in production have enabled nuclear energy to keep pace with increasing demand for electricity without new construction. But now that the current fleet is reaching the end of its operational life, new construction is needed to fill the gap in electricity generation created by retiring plants. Improvements have been made to the regulatory process as well. NRC has consistently provided independent, expert oversight and regulation as an autonomous agency, the sole focus of which is to regulate nuclear matters in the United States. The industry also has a robust organization for self-regulation, the Institute of Nuclear Power Operations (INPO). Created in the wake of the accident at Three Mile Island, INPO formulated a process and a set of operational standards that went beyond the stipulated framework of NRC to ensure the highest levels of safety and performance. Together, these bodies enhance industry performance to the point where the United States sets the global benchmark for safe, reliable, and economic operations of a large fleet and provides a stable foundation on which the next generation of nuclear power plants can be built. The Vogtle COL is an important event, certainly, but two—or even four or six—new nuclear power plants will not replace the plants that will retire in the coming decades. The amount of time and degree of challenge it takes to site, license, finance, and construct a nuclear power plant should be considered before asserting that this most recent milestone indicates a significant new construction program is on its way. Q2: Is this the beginning of a nuclear renaissance in the United States? A2: While the progress of the Vogtle build is an encouraging sign for the technological progress in the civil nuclear industry, it is important to be cautious about extrapolating this specific project’s success as an indication that the long talked about nuclear renaissance is upon us.¶ The Vogtle project is indicative of an emerging next generation of technology from the U.S. nuclear industry. The new plants certified and licensed by NRC are built off the experience of the last several decades and should be considered the safest and most efficient in the world. The most recent designs incorporate thousands of reactor years in construction and operating experience. The AP-1000 that is set to be installed at the Vogtle site was the first of several new designs to be reviewed by NRC and the first to emerge from the licensing process. Specifically, four additional reactor designs are currently under consideration for NRC-issued licenses. However, economics and financing are both continuing challenges to the viability of new nuclear plant construction. Finding approaches to successfully address these challenges will be an indicator of whether additional new nuclear builds will follow Vogtle and whether the United States will maintain its status as the global leader in safety, operation, and design. In addition, the financing prospects for new nuclear builds continue to be very challenging. The Vogtle plant and the Virgil C. Summer project in South Carolina represent special cases where utilities enjoy an especially favorable state-regulated electricity market. In most U.S. markets, economic and financing difficulties stem from low energy prices driven by the low price of natural gas. Q3: Why does nuclear energy matter? A3: Given the current economic climate, which challenges broader new nuclear plant development, policymakers should recognize the broad set of benefits provided by a viable commercial nuclear program. A sustained lack of new nuclear construction will jeopardize U.S. global leadership in regulation, operations, emergency response standards, and nonproliferation efforts. Additionally, nuclear energy can play an important role in efforts to meet global carbon emissions targets. The maintenance of a robust domestic industry is absolutely critical in our continued role in setting global standards in all of these areas.

#### Two internal links – first is the international transition

#### Maintaining effective export conditions is contingent on a US lead role – more reactors key to US institutional support

**Bengelsdorf and McGoldrick**, **07** [currently a Principal with the consulting firm of Bengelsdorf, McGoldrick, and Associates, held numerous senior positions in the U.S. government, including the Energy Department and its predecessor agencies, the State Department, and the U.S. Mission to the IAEA. Among his appointments, he served as the director of both key State and Energy Department offices that are concerned with international nuclear and nonproliferation affairs. Throughout his career, Mr. Bengelsdorf contributed significantly to the development and implementation of U.S. international fuel cycle and nonproliferation policies, having participated in several White House and National Security Council studies. He was involved in the negotiation of numerous bilateral and multilateral nuclear and nonproliferation agreements, including the development of full-scope IAEA safeguards (INFCIRC/153) to implement the Nuclear, THE U.S. DOMESTIC CIVIL NUCLEAR INFRASTRUCTURE AND U.S. NONPROLIFERATION POLICY A White Paper Presented by the American Council on Global Nuclear Competitiveness May 2007, <http://www.nuclearcompetitiveness.org/images/COUNCIL_WHITE_PAPER_Final.pdf>]

Consumer countries are likely to turn for support and assistance to those states possessing the **most vigorous** domestic **nuclear power programs** that are placing new power plant orders, extending international fuel cycle services, and maintaining leadership roles in supporting innovative improvements in advanced technologies. This suggests that the influence of the United States internationally could be enhanced significantly if the U.S. is able to achieve success in its Nuclear Power 2010 program and place **several new orders** in the next decade and beyond. Conversely, if the 2010 initiative falters, or if U.S. companies only are given subordinate roles in processing new plant orders, then this can only further weaken the U.S. nuclear infrastructure as well as the stature of the U.S. in the international nuclear community. Experts believe that the U.S. nuclear infrastructure is capable of sustaining the goals of the 2010 program, but this will require the resolution of a number of formidable problems, including arrangements for the acquisition of long lead time components and coping with anticipated shortages of experienced personnel. Maintaining the U.S. as a Significant Global Supplier The health of the U.S. civil nuclear infrastructure will also be crucial to the success of U.S. efforts to play a significant role as a nuclear supplier and to advance its nonproliferation objectives. There is a clear and compelling upsurge of interest in nuclear power in various parts of the world that is independent of U.S. policy and prerogatives. As a consequence, if the U.S. aspires to participate in these programs and to shape them in ways that are **most conducive to** **nonproliferation**, it will need to promote the health and viability of the American nuclear infrastructure. Perhaps more importantly, if it wishes to 23 exert a positive influence in shaping the nonproliferation policies of other countries, it can do so more effectively by being an active supplier to and partner in the evolution of those programs. Concurrent with the prospective growth in the use of nuclear power, the global nonproliferation regime is facing some direct assaults that are unprecedented in nature. International confidence in the effectiveness of nuclear export controls was shaken by the disclosures of the nuclear operations of A.Q. Khan. These developments underscore the importance of maintaining the greatest integrity and effectiveness of the nuclear export conditions applied by the major suppliers. They also underscore the importance of the U.S. maintaining effective policies to achieve these objectives. Constructive U.S. influence will **be best achieved** to the extent that **the U.S. is perceived as a major** technological leader, supplier and partner in the field of nuclear technology. As the sole superpower, the U.S. will have **considerable, on-going influence** on the international nonproliferation regime, regardless of how active and successful it is in the nuclear export market. However, if the U.S. nuclear infrastructure **continues to erode**, it will weaken the ability of the U.S. to participate actively in the international nuclear market. If the U.S. becomes more dependent on foreign nuclear suppliers or if it leaves the international nuclear market to other suppliers, the ability of the U.S. to influence nonproliferation policy will **diminish**. It is, therefore, essential that the United States have vibrant nuclear reactor, uranium enrichment, and spent fuel storage and disposal industries that can not only meet the needs of U.S. utilities but will also enable the United States to **promote effective safeguards** and other nonproliferation controls through close peaceful nuclear cooperation other countries. The U.S. should establish a high priority goal to **rebuild an indigenous nuclear industry** and support its growth in domestic and international markets. U.S. nuclear exports can be used to influence other states’ nuclear programs through the nonproliferation commitments that the U.S. requires. The U.S. has so-called consent rights over the enrichment, reprocessing and alteration in form or content of the nuclear materials that it has provided to other countries, as well as to the nuclear materials that are produced from the nuclear materials and equipment that the U.S. has supplied. 24 The percentage of nuclear materials, including separated plutonium, that are subject to U.S. consent rights will diminish over time as new suppliers of nuclear materials and facilities take a larger share of the international nuclear market. Unless the U.S. is able to **compete effectively** in the international market as a supplier of nuclear fuels, equipment and technology, the quantity of the nuclear materials around the globe that the U.S. has control over will **diminish significantly** in the future. This may not immediately weaken the effectiveness of the nonproliferation regime since all the major suppliers have adopted the export guidelines of the Nuclear Supplier Group. However, only the U.S., Australia and Canada have consent rights over enrichment and reprocessing of the nuclear materials subject to their agreements. Consequently, if there is a major decline in the U.S. share of the international nuclear market, the U.S. may not be as effective as it has been in helping to ensure a rigorous system of export controls. Nuclear R&D Further, the revitalization of the U.S. nuclear infrastructure will depend on the U.S. ability to provide sustained bipartisan support for nuclear R&D programs in order that they can be sustained from one administration to another. The ability of the United States to continue to make significant contributions to the improvement of safeguards, physical protection and proliferation resistance of nuclear systems is dependent, at least in part, on the continued health of the U.S. technological base. This assumes close collaboration between industry and the national laboratories, which could be increased through greater use of Cooperative Agreements between U.S. firms and national laboratories. GNEP contains some important new ideas that could advance U.S. nonproliferation objectives. Envisioned within both GNEP and the U.S.-led Generation IV Initiative is the development and deployment of nextgeneration nuclear power plant designs that, if completed, could help restore a U.S. competitive edge in nuclear system supply. As the U.S. Government expends taxpayer funds on the Nuclear Power 2010 program, the Global Nuclear Energy Partnership, the Generation IV initiative and other programs, it should consider the benefit to the U.S. industrial base and the benefit to U.S. non-proliferation posture as criteria in project design and selection where possible.

#### That institutional support manages global nonproliferation

**Bengelsdorf and McGoldrick**, **07** [currently a Principal with the consulting firm of Bengelsdorf, McGoldrick, and Associates, held numerous senior positions in the U.S. government, including the Energy Department and its predecessor agencies, the State Department, and the U.S. Mission to the IAEA. Among his appointments, he served as the director of both key State and Energy Department offices that are concerned with international nuclear and nonproliferation affairs. Throughout his career, Mr. Bengelsdorf contributed significantly to the development and implementation of U.S. international fuel cycle and nonproliferation policies, having participated in several White House and National Security Council studies. He was involved in the negotiation of numerous bilateral and multilateral nuclear and nonproliferation agreements, including the development of full-scope IAEA safeguards (INFCIRC/153) to implement the Nuclear, THE U.S. DOMESTIC CIVIL NUCLEAR INFRASTRUCTURE AND U.S. NONPROLIFERATION POLICY A White Paper Presented by the American Council on Global Nuclear Competitiveness May 2007, <http://www.nuclearcompetitiveness.org/images/COUNCIL_WHITE_PAPER_Final.pdf>]

The health of the U.S. civil nuclear infrastructure can have an important bearing in a variety of ways on the ability of the United States to advance its nonproliferation objectives. During the Atoms for Peace Program and until the 1970s, the U.S. was the dominant supplier in the international commercial nuclear power market, and it exercised a strong leadership role in shaping the global nonproliferation regime. In those early days, the U.S. also had what was essentially a monopoly in the nuclear fuel supply market. This capability, among others, allowed the U.S. to promote the widespread acceptance of nonproliferation norms and restraints, including international safeguards and physical protection measures, and, most notably, the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The United States concluded agreements for cooperation in peaceful nuclear energy with other states, which require strict safeguards, physical protection and other nonproliferation controls on their civil nuclear programs. Today due to its political, military and economic position in the world, the United States continues to exercise great weight in nonproliferation matters. However, the ability of the United States to promote its nonproliferation objectives through peaceful nuclear cooperation with other countries has declined**.** The fact that no new nuclear power plant orders have been placed in over three decades has led to erosion in the capabilities of the U.S. civil nuclear infrastructure. Moreover, during the same period, the U.S. share of the global nuclear market has declined significantly, and several other countries have launched their own nuclear power programs and have become major international suppliers in their own right. It is highly significant that all but one of the U.S. nuclear power plant vendors and nuclear fuel designers and manufactures for light water reactors have now been acquired by their non-U.S. based competitors. Thus, while the U.S. remains a participant in the international market for commercial nuclear power, it no longer enjoys a dominant role as it did four decades ago. To the extent that U.S. nuclear plant vendors and nuclear fuel designers 2 and manufacturers are able to reassert themselves on a technical and commercial basis, opportunities for U.S. influence with respect to nuclear nonproliferation can be expected to increase. However, the fact that there are other suppliers that can now provide plants and nuclear fuel technology and services on a competitive commercial basis suggests that the U.S. will have to work especially hard to maintain and, in some cases, rebuild its nuclear infrastructure, if it wishes to exercise its influence in international nuclear affairs. The influence of the United States internationally could be enhanced significantly if the U.S. is able to achieve success in its Nuclear Power 2010 program and place several new orders in the next decade and beyond. There is a clear upsurge of interest in nuclear power in various parts of the world. As a consequence, if the U.S. aspires to participate in these programs and to shape them in ways that are most conducive to nonproliferation, it will need to promote the health and viability of the American nuclear infrastructure. Perhaps more importantly, if it wishes to exert a positive influence in shaping the nonproliferation policies of other countries, it can do so more effectively by being an active supplier to and partner in the evolution of those programs. Concurrent with the prospective growth in the use of nuclear power, the global nonproliferation regime is facing some direct assaults that are unprecedented in nature. International confidence in the effectiveness of nuclear export controls was shaken by the disclosures of the nuclear operations of A.Q. Khan. These developments underscore the importance of maintaining the greatest integrity and effectiveness of the nuclear export conditions applied by the major suppliers. They also underscore the importance of the U.S. maintaining effective policies to achieve these objectives. Constructive U.S. influence will be best achieved to the extent that the U.S. is perceived as a major technological leader, supplier and partner in the field of nuclear technology. As the sole superpower, the U.S. will have considerable, on-going influence on the international nonproliferation regime, regardless of how active and successful it is in the nuclear export market. However, the erosion of the U.S. nuclear infrastructure has begun to weaken the ability of the U.S. to participate actively in the international nuclear market. If the U.S. becomes more dependent on foreign nuclear suppliers or if it leaves the international 3 nuclear market to other suppliers, the ability of the U.S. to influence nonproliferation policy will diminish. It is, therefore, essential that the United States have vibrant nuclear reactor, enrichment services, and spent fuel storage and disposal industries that can not only meet the needs of U.S. utilities but will also enable the United States to promote effective safeguards and other nonproliferation controls through close peaceful nuclear cooperation with other countries. U.S. nuclear exports can be used to influence other states’ nuclear programs through the nonproliferation commitments that the U.S. requires. The U.S. has so-called consent rights over the enrichment, reprocessing and alteration in form or content of the nuclear materials that it has provided to other countries, as well as to the nuclear materials that are produced from the nuclear materials and equipment that the U.S. has supplied. Further, the ability of the U.S. to develop improved and advanced nuclear technologies will depend on its ability to provide consistent and vigorous support for nuclear R&D programs that will enjoy solid bipartisan political support in order that they can be sustained from one administration to another. As the U.S. Government expends taxpayer funds on the Nuclear Power 2010 program, the Global Nuclear Energy Partnership, the Generation IV initiative and other programs, it should consider the benefit to the U.S. industrial base and to U.S. non-proliferation posture as criteria in project design and source selection where possible. Finally, the ability of the United States to resolve its own difficulties in managing its spent fuel and nuclear wastes will be crucial to maintaining the credibility of the U.S. nuclear power program and will be vital to implementing important new nonproliferation initiatives designed to discourage the spread of sensitive nuclear facilities to other countries.

#### Second is reprocessing

#### PUREX-style reprocessing used in France, Japan, and the UK risks proliferation – IFR solves

**Peters 12** [“Recycling Used Nuclear Fuel: Balancing Energy and Waste Management Policies”, Testimony to U.S. House of Representatives, Committee on Foreign Affairs, Subcommittee on Asia and the Pacific, Mark T. Peters, Deputy Laboratory Director for Programs at Argonne, National Laboratory, American Nuclear Society, June 6, 2012, khirn]

PUREX: Current commercial used nuclear fuel reprocessing technologies are based on the PUREX process, a solvent extraction process that separates uranium and plutonium and directs the remaining minor actinides (neptunium, americium, and curium) along with all of the fission products to vitrified waste. The PUREX process has more than 50 years of operational experience. For example, the La Hague reprocessing facility in France treats used fuel from domestic and foreign power reactors. The plutonium recovered is recycled as a mixed-oxide fuel to generate additional electricity. This technology also is used for commercial applications in the United Kingdom and Japan. There are a number of drawbacks to the PUREX process. PUREX does not recover the minor actinides (neptunium, americium, curium, and heavier actinide elements), which compose a significant fraction of the long-term radiotoxicity of used fuel. Advanced fast reactors can transmute and consume minor actinides if they are separated from other fission product elements, but incorporation of minor actinide separations into existing PUREX facilities adds complexity and is outside commercial operating experience. Moreover, existing international facilities do not capture fission gases and tritium; these are discharged to the environment within regulatory limits. Although plutonium is recycled as mixed oxide fuel, this practice actually increases the net discharge of minor actinides. Finally, **the production of pure plutonium through PUREX raises concerns about materials security and proliferation of nuclear weapons-usable materials.** Pyroprocessing: Pyroprocessing is currently being used at the Idaho National Laboratory to treat and stabilize used fuel from the decommissioned EBR-II reactor. The key separation step, electrorefining, recovers uranium (the bulk of the used fuel) in a single compact process operation. Ceramic and metallic waste forms, for active metal and noble metal fission products respectively, are being produced and qualified for disposal in a geologic repository. However, the demonstration equipment used for this treatment campaign has limited scalability. Argonne National Laboratory has developed conceptual designs of scalable, high-throughput equipment as well as an integrated facility for commercial used fuel treatment, but to date only a prototype advanced scalable electrorefiner has been fabricated and successfully tested. Additionally, work is underway at Argonne to refine the fundamental understanding of pyrochemical processes to achieve greater control of the composition of the recovered materials, which will facilitate developing safeguards consistent with U.S. non-proliferation goals.

#### American support of pyroprocessing solves international integration of bad forms of technology

**Peters 12** [“Recycling Used Nuclear Fuel: Balancing Energy and Waste Management Policies”, Testimony to U.S. House of Representatives, Committee on Foreign Affairs, Subcommittee on Asia and the Pacific, Mark T. Peters, Deputy Laboratory Director for Programs at Argonne, National Laboratory, American Nuclear Society, June 6, 2012, khirn]

Pyroprocessing offers several potential benefits over current aqueous recycling techniques, such as the PUREX process being used in France and Japan today. These include the ability to recover minor actinides, which otherwise contribute significantly to the long-term radiotoxicity of used nuclear fuel; fewer releases of fission gases and tritium; and, the lack of production of pure plutonium, which helps to address proliferation concerns. Clearly, there will be engineering challenges inherent in the development of pyroprocessing technology, as there are with any other advanced manufacturing processes. However, these challenges can be addressed through joint research and development activities, and solving these challenges will have important implications for the United States as well as the Republic of Korea. The American Nuclear Society believes that nuclear fuel recycling has the potential to reclaim much of the residual energy in used fuel currently in storage as well as used fuel that will be produced in the future, and that recycling offers a proven alternative to direct disposal of used fuel in a geological repository. In other nations, recycling of nuclear fuel with proper safeguards and material controls, under the auspices of the International Atomic Energy Agency (IAEA), has demonstrated that high-level waste volumes can be reduced safely and securely while improving the sustainability of energy resources. It is the opinion of the ANS that **the United States should begin planning a thoughtful and orderly transition to nuclear fuel recycling** in parallel with the development of a geologic repository. Recycling would enhance the repository’s efficiency, eliminating the need for most complex and expensive engineered barriers and reducing the timeframe of concern from more than 100,000 years to a few hundred years. The ANS also believes that the United States should accelerate development of fast spectrum reactors, which are uniquely capable of generating energy while consuming long-lived waste. Six decades ago, on December 20, 1951, scientists and engineers from Argonne National Laboratory started a small electrical power generator attached to an experimental fast reactor, creating enough energy to power four 200-watt electrical bulbs. That historic achievement demonstrated the peaceful use of nuclear energy and launched today's global commercial nuclear energy industry. But it should not be overlooked that the first electricity generated through nuclear energy was produced using a fast reactor.3 In closing, let me reiterate that the ANS believes that nuclear energy has a significant role to play in meeting the global energy demands of the 21 st century, and that a global expansion of nuclear energy can be achieved safely and securely.

#### Inaction on IFRs is killing US leadership and ability to influence prolif

**Shuster 11** [Joseph Shuster, founder of Minnesota Valley Engineering and Chemical Engineer, 9-8-2011, "Response to Draft Report From Obama’s Blue Ribbon Commission (BRC) on America’s Nuclear Future dated July 29, 2011," Beyond Fossil Fools]

Contrary to the commission’s declarations on the matter, the U.S. is in danger of losing its once ¶ strong nuclear leadership. As a result we would have less to say about how nuclear materials are ¶ to be managed in the world and that could expose the U.S. to some inconvenient if not downright ¶ dangerous consequences. China is now building a large pilot plant said to be identical to our ¶ successful EBR-II plant that proved the design of the IFR. Meanwhile in the U.S. after complete ¶ success, EBR II was shut down, not for technical reasons but for political reasons during the ¶ Clinton administration, a decision destined to be one of the worst in our nation’s history.¶ Much of the world is already committed to a nuclear future with some countries eagerly waiting ¶ to license the American version of Generation IV Fast Reactors—the IFR. We still have the best ¶ IFR technology in the world but have squandered much of our lead, partly by allowing a largely ¶ unqualified commission two years of useless deliberation. What we really did was give our ¶ competitors an additional two years to catch up.

#### We’re on the brink of rapid prolif – access to tech is inevitable and multilateral institutions fail

**CFR 12** [CFR 7-5-2012, "The Global Nuclear Nonproliferation Regime," Council on Foreign Relations]

Nuclear weapons proliferation, whether by state or nonstate actors, poses one of the greatest threats to international security today. Iran's apparent efforts to acquire nuclear weapons, what amounts to North Korean nuclear blackmail, and the revelation of the A.Q. Khan black market nuclear network all underscore the far-from-remote possibility that a terrorist group or a so-called rogue state will acquire weapons of mass destruction or materials for a dirty bomb.¶ The problem of nuclear proliferation is global, and any effective response must also be multilateral. Nine states (China, France, India, Israel, North Korea, Pakistan, Russia, the United Kingdom, and the United States) are known or believed to have nuclear weapons, and more than thirty others (including Japan, Germany, and South Korea) have the technological ability to quickly acquire them. Amid volatile energy costs, the accompanying push to expand nuclear energy, growing concerns about the environmental impact of fossil fuels, and the continued diffusion of scientific and technical knowledge, access to dual-use technologies seems destined to grow.¶ In the background, a nascent global consensus regarding the need for substantial nuclear arms reductions, if not complete nuclear disarmament, has increasingly taken shape. In April 2009, for instance, U.S. president Barack Obama reignited global nonproliferation efforts through a landmark speech in Prague. Subsequently, in September of the same year, the UN Security Council (UNSC) unanimously passed Resolution 1887, which called for accelerated efforts toward total nuclear disarmament. In February 2012, the number of states who have ratified the Comprehensive Test Ban Treaty increased to 157, heightening appeals to countries such as the United States, Israel, and Iran to follow suit.¶ Overall, the existing global nonproliferation regime is a highly developed example of international law. Yet, despite some notable successes, existing multilateral institutions have failed to prevent states such as India, Pakistan, and North Korea from "going nuclear," and seem equally ill-equipped to check Iran as well as potential threats from nonstate, terrorist groups. The current framework must be updated and reinforced if it is to effectively address today's proliferation threats, let alone pave the way for "the peace and security of a world without nuclear weapons."

#### New proliferators will be uniquely destabilizing -- guarantees conflict escalation.

Cimbala, ‘8

[Stephen, Distinguished Prof. Pol. Sci. – Penn. State Brandywine, Comparative Strategy, “Anticipatory Attacks: Nuclear Crisis Stability in Future Asia”, 27, InformaWorld]

If the possibility existed of a mistaken preemption during and immediately after the Cold War, between the experienced nuclear forces and command systems of America and Russia, then it may be a matter of even more concern with regard to states with newer and more opaque forces and command systems. In addition, the Americans and Soviets (and then Russians) had a great deal of experience getting to know one another’s military operational proclivities and doctrinal idiosyncrasies, including those that might influence the decision for or against war. Another consideration, relative to nuclear stability in the present century, is that the Americans and their NATO allies shared with the Soviets and Russians a commonality of culture and historical experience. Future threats to American or Russian security from weapons of mass destruction may be presented by states or nonstate actors motivated by cultural and social predispositions not easily understood by those in the West nor subject to favorable manipulation during a crisis. The spread of nuclear weapons in Asia presents a complicated mosaic of possibilities in this regard. States with nuclear forces of variable force structure, operational experience, and command-control systems will be thrown into a matrix of complex political, social, and cultural crosscurrents contributory to the possibility of war. In addition to the existing nuclear powers in Asia, others may seek nuclear weapons if they feel threatened by regional rivals or hostile alliances. Containment of nuclear proliferation in Asia is a desirable political objective for all of the obvious reasons. Nevertheless, the present century is unlikely to see the nuclear hesitancy or risk aversion that marked the Cold War, in part, because the military and political discipline imposed by the Cold War superpowers no longer exists, but also because states in Asia have new aspirations for regional or global respect.12 The spread of ballistic missiles and other nuclear-capable delivery systems in Asia, or in the Middle East with reach into Asia, is especially dangerous because plausible adversaries live close together and are already engaged in ongoing disputes about territory or other issues.13 The Cold War Americans and Soviets required missiles and airborne delivery systems of intercontinental range to strike at one another’s vitals. But short-range ballistic missiles or fighter-bombers suffice for India and Pakistan to launch attacks at one another with potentially “strategic” effects. China shares borders with Russia, North Korea, India, and Pakistan; Russia, with China and NorthKorea; India, with Pakistan and China; Pakistan, with India and China; and so on. The short flight times of ballistic missiles between the cities or military forces of contiguous states means that very little time will be available for warning and attack assessment by the defender. Conventionally armed missiles could easily be mistaken for a tactical nuclear first use. Fighter-bombers appearing over the horizon could just as easily be carrying nuclear weapons as conventional ordnance. In addition to the challenges posed by shorter flight times and uncertain weapons loads, potential victims of nuclear attack in Asia may also have first strike–vulnerable forces and command-control systems that increase decision pressures for rapid, and possibly mistaken, retaliation. This potpourri of possibilities challenges conventional wisdom about nuclear deterrence and proliferation on the part of policymakers and academic theorists. For policymakers in the United States and NATO, spreading nuclear and other weapons of mass destruction in Asia could profoundly shift the geopolitics of mass destruction from a European center of gravity (in the twentieth century) to an Asian and/or Middle Eastern center of gravity (in the present century).14 This would profoundly shake up prognostications to the effect that wars of mass destruction are now passe, on account of the emergence of the “Revolution in Military Affairs” and its encouragement of information-based warfare.15 Together with this, there has emerged the argument that large-scale war between states or coalitions of states, as opposed to varieties of unconventional warfare and failed states, are exceptional and potentially obsolete.16 The spread of WMD and ballistic missiles in Asia could overturn these expectations for the obsolescence or marginalization of major interstate warfare.

#### Extinction.

Krieger, ‘9

[David, Pres. Nuclear Age Peace Foundation and Councilor – World Future Council, “Still Loving the Bomb After All These Years”, 9-4, https://www.wagingpeace.org/articles/2009/09/04\_krieger\_newsweek\_response.php?krieger]

Jonathan Tepperman’s article in the September 7, 2009 issue of Newsweek, “Why Obama Should Learn to Love the Bomb,” provides a novel but frivolous argument that nuclear weapons “may not, in fact, make the world more dangerous….” Rather, in Tepperman’s world, “The bomb may actually make us safer.” Tepperman shares this world with Kenneth Waltz, a University of California professor emeritus of political science, who Tepperman describes as “the leading ‘nuclear optimist.’” Waltz expresses his optimism in this way: “We’ve now had 64 years of experience since Hiroshima. It’s striking and against all historical precedent that for that substantial period, there has not been any war among nuclear states.” Actually, there were a number of proxy wars between nuclear weapons states, such as those in Korea, Vietnam and Afghanistan, and some near disasters, the most notable being the 1962 Cuban Missile Crisis. Waltz’s logic is akin to observing a man falling from a high rise building, and noting that he had already fallen for 64 floors without anything bad happening to him, and concluding that so far it looked so good that others should try it. Dangerous logic! Tepperman builds upon Waltz’s logic, and concludes “that all states are rational,” even though their leaders may have a lot of bad qualities, including being “stupid, petty, venal, even evil….” He asks us to trust that rationality will always prevail when there is a risk of nuclear retaliation, because these weapons make “the costs of war obvious, inevitable, and unacceptable.” Actually, he is asking us to do more than trust in the rationality of leaders; he is asking us to gamble the future on this proposition. “The iron logic of deterrence and mutually assured destruction is so compelling,” Tepperman argues, “it’s led to what’s known as the nuclear peace….” But if this is a peace worthy of the name, which it isn’t, it certainly is not one on which to risk the future of civilization. One irrational leader with control over a nuclear arsenal could start a nuclear conflagration, resulting in a global Hiroshima. Tepperman celebrates “the iron logic of deterrence,” but deterrence is a theory that is far from rooted in “iron logic.” It is a theory based upon threats that must be effectively communicated and believed. Leaders of Country A with nuclear weapons must communicate to other countries (B, C, etc.) the conditions under which A will retaliate with nuclear weapons. The leaders of the other countries must understand and believe the threat from Country A will, in fact, be carried out. The longer that nuclear weapons are not used, the more other countries may come to believe that they can challenge Country A with impunity from nuclear retaliation. The more that Country A bullies other countries, the greater the incentive for these countries to develop their own nuclear arsenals. Deterrence is unstable and therefore precarious. Most of the countries in the world reject the argument, made most prominently by Kenneth Waltz, that the spread of nuclear weapons makes the world safer. These countries joined together in the Nuclear Non-Proliferation Treaty (NPT) to prevent the spread of nuclear weapons, but they never agreed to maintain indefinitely a system of nuclear apartheid in which some states possess nuclear weapons and others are prohibited from doing so. The principal bargain of the NPT requires the five NPT nuclear weapons states (US, Russia, UK, France and China) to engage in good faith negotiations for nuclear disarmament, and the International Court of Justice interpreted this to mean complete nuclear disarmament in all its aspects. Tepperman seems to be arguing that seeking to prevent the proliferation of nuclear weapons is bad policy, and that nuclear weapons, because of their threat, make efforts at non-proliferation unnecessary and even unwise. If some additional states, including Iran, developed nuclear arsenals, he concludes that wouldn’t be so bad “given the way that bombs tend to mellow behavior.” Those who oppose Tepperman’s favorable disposition toward the bomb, he refers to as “nuclear pessimists.” These would be the people, and I would certainly be one of them, who see nuclear weapons as presenting an urgent danger to our security, our species and our future. Tepperman finds that when viewed from his “nuclear optimist” perspective, “nuclear weapons start to seem a lot less frightening.” “Nuclear peace,” he tells us, “rests on a scary bargain: you accept a small chance that something extremely bad will happen in exchange for a much bigger chance that something very bad – conventional war – won’t happen.” But the “extremely bad” thing he asks us to accept is the end of the human species. Yes, that would be serious. He also doesn’t make the case that in a world without nuclear weapons, the prospects of conventional war would increase dramatically. After all, it is only an unproven supposition that nuclear weapons have prevented wars, or would do so in the future. We have certainly come far too close to the precipice of catastrophic nuclear war. As an ultimate celebration of the faulty logic of deterrence, Tepperman calls for providing any nuclear weapons state with a “survivable second strike option.” Thus, he not only favors nuclear weapons, but finds the security of these weapons to trump human security. Presumably he would have President Obama providing new and secure nuclear weapons to North Korea, Pakistan and any other nuclear weapons states that come along so that they will feel secure enough not to use their weapons in a first-strike attack. Do we really want to bet the human future that Kim Jong-Il and his successors are more rational than Mr. Tepperman?

### Warming

#### 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.

#### Warming is real and causes extinction

**Morgan 9 –** Professor of Current Affairs @ Hankuk University of Foreign Studies, South Korea(Dennis Ray, “World on fire: two scenarios of the destruction of human civilization and possible extinction of the human race”, Futures, Volume 41, Issue 10, December 2009, Pages 683-693, ScienceDirect)

As horrifying as the scenario of human extinction by sudden, fast-burning nuclear fire may seem, the one consolation is that this future can be avoided within a relatively short period of time if responsible world leaders change Cold War thinking to move away from aggressive wars over natural resources and towards the eventual dismantlement of most if not all nuclear weapons. On the other hand, another scenario of human extinction by fire is one that may not so easily be reversed within a short period of time because it is not a fast-burning fire; rather, a slow burning fire is gradually heating up the planet as industrial civilization progresses and develops globally. This gradual process and course is long-lasting; thus it cannot easily be changed, even if responsible world leaders change their thinking about ‘‘progress’’ and industrial development based on the burning of fossil fuels. The way that global warming will impact humanity in the future has often been depicted through the analogy of the proverbial frog in a pot of water who does not realize that the temperature of the water is gradually rising. Instead of trying to escape, the frog tries to adjust to the gradual temperature change; finally, the heat of the water sneaks up on it until it is debilitated. Though it finally realizes its predicament and attempts to escape, it is too late; its feeble attempt is to no avail— and the frog dies. Whether this fable can actually be applied to frogs in heated water or not is irrelevant; it still serves as a comparable scenario of how the slow burning fire of global warming may eventually lead to a runaway condition and take humanity by surprise. Unfortunately, by the time the politicians finally all agree with the scientific consensus that global warming is indeed human caused, its development could be too advanced to arrest; the poor frog has become too weak and enfeebled to get himself out of hot water. The Intergovernmental Panel of Climate Change (IPCC) was established in 1988 by the WorldMeteorological Organization (WMO) and the United Nations Environmental Programme to ‘‘assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of humaninduced climate change, its potential impacts and options for adaptation and mitigation.’’[16]. Since then, it has given assessments and reports every six or seven years. Thus far, it has given four assessments.13 With all prior assessments came attacks fromsome parts of the scientific community, especially by industry scientists, to attempt to prove that the theory had no basis in planetary history and present-day reality; nevertheless, as more andmore research continually provided concrete and empirical evidence to confirm the global warming hypothesis, that it is indeed human-caused, mostly due to the burning of fossil fuels, the scientific consensus grew stronger that human induced global warming is verifiable. As a matter of fact, according to Bill McKibben [17], 12 years of ‘‘impressive scientific research’’ strongly confirms the 1995 report ‘‘that humans had grown so large in numbers and especially in appetite for energy that they were now damaging the most basic of the earth’s systems—the balance between incoming and outgoing solar energy’’; ‘‘. . . their findings have essentially been complementary to the 1995 report – a constant strengthening of the simple basic truth that humans were burning too much fossil fuel.’’ [17]. Indeed, 12 years later, the 2007 report not only confirms global warming, with a stronger scientific consensus that the slow burn is ‘‘very likely’’ human caused, but it also finds that the ‘‘amount of carbon in the atmosphere is now increasing at a faster rate even than before’’ and the temperature increases would be ‘‘considerably higher than they have been so far were it not for the blanket of soot and other pollution that is temporarily helping to cool the planet.’’ [17]. Furthermore, almost ‘‘everything frozen on earth is melting. Heavy rainfalls are becoming more common since the air is warmer and therefore holds more water than cold air, and ‘cold days, cold nights and frost have become less frequent, while hot days, hot nights, and heat waves have become more frequent.’’ [17]. Unless drastic action is taken soon, the average global temperature is predicted to rise about 5 degrees this century, but it could rise as much as 8 degrees. As has already been evidenced in recent years, the rise in global temperature is melting the Arctic sheets. This runaway polar melting will inflict great damage upon coastal areas, which could be much greater than what has been previously forecasted. However, what is missing in the IPCC report, as dire as it may seem, is sufficient emphasis on the less likely but still plausible worst case scenarios, which could prove to have the most devastating, catastrophic consequences for the long-term future of human civilization. In other words, the IPCC report places too much emphasis on a linear progression that does not take sufficient account of the dynamics of systems theory, which leads to a fundamentally different premise regarding the relationship between industrial civilization and nature. As a matter of fact, as early as the 1950s, Hannah Arendt [18] observed this radical shift of emphasis in the human-nature relationship, which starkly contrasts with previous times because the very distinction between nature and man as ‘‘Homo faber’’ has become blurred, as man no longer merely takes from nature what is needed for fabrication; instead, he now acts into nature to augment and transform natural processes, which are then directed into the evolution of human civilization itself such that we become a part of the very processes that we make. The more human civilization becomes an integral part of this dynamic system, the more difficult it becomes to extricate ourselves from it. As Arendt pointed out, this dynamism is dangerous because of its unpredictability. Acting into nature to transform natural processes brings about an . . . endless new change of happenings whose eventual outcome the actor is entirely incapable of knowing or controlling beforehand. The moment we started natural processes of our own - and the splitting of the atom is precisely such a man-made natural process -we not only increased our power over nature, or became more aggressive in our dealings with the given forces of the earth, but for the first time have taken nature into the human world as such and obliterated the defensive boundaries between natural elements and the human artifice by which all previous civilizations were hedged in’’ [18]. So, in as much as we act into nature, we carry our own unpredictability into our world; thus, Nature can no longer be thought of as having absolute or iron-clad laws. We no longer know what the laws of nature are because the unpredictability of Nature increases in proportion to the degree by which industrial civilization injects its own processes into it; through selfcreated, dynamic, transformative processes, we carry human unpredictability into the future with a precarious recklessness that may indeed end in human catastrophe or extinction, for elemental forces that we have yet to understand may be unleashed upon us by the very environment that we experiment with. Nature may yet have her revenge and the last word, as the Earth and its delicate ecosystems, environment, and atmosphere reach a tipping point, which could turn out to be a point of no return. This is exactly the conclusion reached by the scientist, inventor, and author, James Lovelock. The creator of the wellknown yet controversial Gaia Theory, Lovelock has recently written that it may be already too late for humanity to change course since climate centers around the world, . . . which are the equivalent of the pathology lab of a hospital, have reported the Earth’s physical condition, and the climate specialists see it as seriously ill, and soon to pass into a morbid fever that may last as long as 100,000 years. I have to tell you, as members of the Earth’s family and an intimate part of it, that you and especially civilisation are in grave danger. It was ill luck that we started polluting at a time when the sun is too hot for comfort. We have given Gaia a fever and soon her condition will worsen to a state like a coma. She has been there before and recovered, but it took more than 100,000 years. We are responsible and will suffer the consequences: as the century progresses, the temperature will rise 8 degrees centigrade in temperate regions and 5 degrees in the tropics. Much of the tropical land mass will become scrub and desert, and will no longer serve for regulation; this adds to the 40 per cent of the Earth’s surface we have depleted to feed ourselves. . . . Curiously, aerosol pollution of the northern hemisphere reduces global warming by reflecting sunlight back to space. This ‘global dimming’ is transient and could disappear in a few days like the smoke that it is, leaving us fully exposed to the heat of the global greenhouse. We are in a fool’s climate, accidentally kept cool by smoke, and before this century is over billions of us will die and the few breeding pairs of people that survive will be in the Arctic where the climate remains tolerable. [19] Moreover, Lovelock states that the task of trying to correct our course is hopelessly impossible, for we are not in charge. It is foolish and arrogant to think that we can regulate the atmosphere, oceans and land surface in order to maintain the conditions right for life. It is as impossible as trying to regulate your own temperature and the composition of your blood, for those with ‘‘failing kidneys know the never-ending daily difficulty of adjusting water, salt and protein intake. The technological fix of dialysis helps, but is no replacement for living healthy kidneys’’ [19]. Lovelock concludes his analysis on the fate of human civilization and Gaia by saying that we will do ‘‘our best to survive, but sadly I cannot see the United States or the emerging economies of China and India cutting back in time, and they are the main source of emissions. The worst will happen and survivors will have to adapt to a hell of a climate’’ [19]. Lovelock’s forecast for climate change is based on a systems dynamics analysis of the interaction between humancreated processes and natural processes. It is a multidimensional model that appropriately reflects the dynamism of industrial civilization responsible for climate change. For one thing, it takes into account positive feedback loops that lead to ‘‘runaway’’ conditions. This mode of analysis is consistent  with recent research on how ecosystems suddenly disappear. A 2001 article in Nature, based on a scientific study by an international consortium, reported that changes in ecosystems are not just gradual but are often sudden and catastrophic [20]. Thus, a scientific consensus is emerging (after repeated studies of ecological change) that ‘‘stressed ecosystems, given the right nudge, are capable of slipping rapidly from a seemingly steady state to something entirely different,’’ according to Stephen Carpenter, a limnologist at the University of Wisconsin-Madison (who is also a co-author of the report). Carpenter continues, ‘‘We realize that there is a common pattern we’re seeing in ecosystems around the world, . . . Gradual changes in vulnerability accumulate and eventually you get a shock to the system - a flood or a drought - and, boom, you’re over into another regime. It becomes a self-sustaining collapse.’’ [20]. If ecosystems are in fact mini-models of the system of the Earth, as Lovelock maintains, then we can expect the same kind of behavior. As Jonathon Foley, a UW-Madison climatologist and another co-author of the Nature report, puts it, ‘‘Nature isn’t linear. Sometimes you can push on a system and push on a system and, finally, you have the straw that breaks the camel’s back.’’ Also, once the ‘‘flip’’ occurs, as Foley maintains, then the catastrophic change is ‘‘irreversible.’’ [20]. When we expand this analysis of ecosystems to the Earth itself, it’s frightening. What could be the final push on a stressed system that could ‘‘break the camel’s back?’’ Recently, another factor has been discovered in some areas of the arctic regions, which will surely compound the problem of global ‘‘heating’’ (as Lovelock calls it) in unpredictable and perhaps catastrophic ways. This disturbing development, also reported in Nature, concerns the permafrost that has locked up who knows how many tons of the greenhouse gasses, methane and carbon dioxide. Scientists are particularly worried about permafrost because, as it thaws, it releases these gases into the atmosphere, thus, contributing and accelerating global heating. It is a vicious positive feedback loop that compounds the prognosis of global warming in ways that could very well prove to be the tipping point of no return. Seth Borenstein of the Associated Press describes this disturbing positive feedback loop of permafrost greenhouse gasses, as when warming ‘‘. already under way thaws permafrost, soil that has been continuously frozen for thousands of years. Thawed permafrost releases methane and carbon dioxide. Those gases reach the atmosphere and help trap heat on Earth in the greenhouse effect. The trapped heat thaws more permafrost and so on.’’ [21]. The significance and severity of this problem cannot be understated since scientists have discovered that ‘‘the amount of carbon trapped in this type of permafrost called ‘‘yedoma’’ is much more prevalent than originally thought and may be 100 times [my emphasis] the amount of carbon released into the air each year by the burning of fossil fuels’’ [21]. Of course, it won’t come out all at once, at least by time as we commonly reckon it, but in terms of geological time, the ‘‘several decades’’ that scientists say it will probably take to come out can just as well be considered ‘‘all at once.’’ Surely, within the next 100 years, much of the world we live in will be quite hot and may be unlivable, as Lovelock has predicted. Professor Ted Schuur, a professor of ecosystem ecology at the University of Florida and co-author of the study that appeared in Science, describes it as a ‘‘slow motion time bomb.’’ [21]. Permafrost under lakes will be released as methane while that which is under dry ground will be released as carbon dioxide. Scientists aren’t sure which is worse. Whereas methane is a much more powerful agent to trap heat, it only lasts for about 10 years before it dissipates into carbon dioxide or other chemicals. The less powerful heat-trapping agent, carbon dioxide, lasts for 100 years [21]. Both of the greenhouse gasses present in permafrost represent a global dilemma and challenge that compounds the effects of global warming and runaway climate change. The scary thing about it, as one researcher put it, is that there are ‘‘lots of mechanisms that tend to be self-perpetuating and relatively few that tend to shut it off’’ [21].14 In an accompanying AP article, Katey Walters of the University of Alaska at Fairbanks describes the effects as ‘‘huge’’ and, unless we have a ‘‘major cooling,’’ - unstoppable [22]. Also, there’s so much more that has not even been discovered yet, she writes: ‘‘It’s coming out a lot and there’s a lot more to come out.’’ [22]. 4. Is it the end of human civilization and possible extinction of humankind? What Jonathon Schell wrote concerning death by the fire of nuclear holocaust also applies to the slow burning death of global warming: Once we learn that a holocaust might lead to extinction**, we have no right to gamble**, because if we lose, the game will be over, and neither we nor anyone else will ever get another chance. Therefore, although, scientifically speaking, there is all the difference in the world between the mere possibility that a holocaust will bring about extinction and the certainty of it, morally they are the same, and we have no choice but to address the issue of nuclear weapons as though we knew for a certainty that their use would put an end to our species [23].15 When we consider that beyond the horror of nuclear war, another horror is set into motion to interact with the subsequent nuclear winter to produce a poisonous and super heated planet, the chances of human survival seem even smaller. Who knows, even if some small remnant does manage to survive, what the poisonous environmental conditions would have on human evolution in the future. A remnant of mutated, sub-human creatures might survive such harsh conditions, but for all purposes, human civilization has been destroyed, and the question concerning human extinction becomes moot. Thus, **we have no other choice but to consider the finality of it all**, as Schell does: ‘‘Death lies at the core of each person’s private existence, but part of death’s meaning is to be found in the fact that it occurs in a biological and social world that survives.’’ [23].16 But what if the world itself were to perish, Schell asks. Would not it bring about a sort of ‘‘second death’’ – the death of the species – a possibility that the vast majority of the human race is in denial about? Talbot writes in the review of Schell’s book that it is not only the ‘‘death of the species, not just of the earth’s population on doomsday, but of countless unborn generations. They would be spared literal death but would nonetheless be victims . . .’’ [23]. That is the ‘‘second death’’ of humanity – the horrifying, unthinkable prospect that there are no prospects – that there will be no future. In the second chapter of Schell’s book, he writes that since we have not made a positive decision to exterminate ourselves but instead have ‘‘chosen to live on the edge of extinction, periodically lunging toward the abyss only to draw back at the last second, our situation is one of uncertainty and nervous insecurity rather than of absolute hopelessness.’’ [23].17 In other words, the fate of the Earth and its inhabitants has not yet been determined. Yet time is not on our side. Will we relinquish the fire and our use of it to dominate the Earth and each other, or will we continue to gamble with our future at this game of Russian roulette while **time** increasingly **stacks the cards against** our chances of **survival**?

#### Co2 causes ocean acidification which destroys biodiversity

**Stern 7 –** Head of the British Government Economic Service, Former Head Economist for the World Bank, I.G. Patel Chair at the London School of Economics and Political Science, (Nicholas, “The Economics of Climate Change: The Stern Review”, The report of a team commissioned by the British Government to study the economics of climate change led by Siobhan Peters, Head of G8 and International Climate Change Policy Unit, Cambridge University Press, p. 72)

Ocean acidification, a direct result of rising carbon dioxide levels, will have major effects on marine ecosystems, with possible adverse consequences on fish stocks. For fisheries, information on the likely impacts of climate change is very limited – a major gap in knowledge considering that about one billion people worldwide (one-sixth of the world’s population) rely on fish as their primary source of animal protein. While higher ocean temperatures may increase growth rates of some fish, reduced nutrient supplies due to warming may limit growth. Ocean acidification is likely to be particularly damaging. The oceans have become more acidic in the past 200 years, because of chemical changes caused by increasing amounts of carbon dioxide dissolving in seawater.44 If global emissions continue to rise on current trends, ocean acidity is likely to increase further, with pH declining by an additional 0.15 units if carbon dioxide levels double (to 560 ppm) relative to pre-industrial and an additional 0.3 units if carbon dioxide levels treble (to 840 ppm).45 Changes on this scale have not been experienced for hundreds of thousands of years and are occurring at an extremely rapid rate. Increasing ocean acidity makes it harder for many ocean creatures to form shells and skeletons from calcium carbonate. These chemical changes have the potential to disrupt marine ecosystems irreversibly - at the very least halting the growth of corals, which provide important nursery grounds for commercial fish, and damaging molluscs and certain types of plankton at the base of the food chain. Plankton and marine snails are critical to sustaining species such as salmon, mackerel and baleen whales, and such changes are expected to have serious but as-yet-unquantified wider impacts.

#### Ocean biodiversity key to solve extinction

**Craig 03** – Associate Prof Law, Indiana U School Law (McGeorge Law Review, 34 McGeorge L. Rev. 155 Lexis)

Biodiversity and ecosystem function arguments for conserving marine ecosystems also exist, just as they do for terrestrial ecosystems, but these arguments have thus far rarely been raised in political debates. For example, besides significant tourism values - the most economically valuable ecosystem service coral reefs provide, worldwide - coral reefs protect against storms and dampen other environmental fluctuations, services worth more than ten times the reefs' value for food production. n856 Waste treatment is another significant, non-extractive ecosystem function that intact coral reef ecosystems provide. n857 More generally, "ocean ecosystems play a major role in the global geochemical cycling of all the elements that represent the basic building blocks of living organisms, carbon, nitrogen, oxygen, phosphorus, and sulfur, as well as other less abundant but necessary elements." n858 In a very real and direct sense, therefore, human degradation of marine ecosystems impairs the planet's ability to support life. Maintaining biodiversity is often critical to maintaining the functions of marine ecosystems. Current evidence shows that, in general, an ecosystem's ability to keep functioning in the face of disturbance is strongly dependent on its biodiversity, "indicating that more diverse ecosystems are more stable." n859 Coral reef ecosystems are particularly dependent on their biodiversity.  [\*265]   Most ecologists agree that the complexity of interactions and degree of interrelatedness among component species is higher on coral reefs than in any other marine environment. This implies that the ecosystem functioning that produces the most highly valued components is also complex and that many otherwise insignificant species have strong effects on sustaining the rest of the reef system. n860 Thus, maintaining and restoring the biodiversity of marine ecosystems is critical to maintaining and restoring the ecosystem services that they provide. Non-use biodiversity values for marine ecosystems have been calculated in the wake of marine disasters, like the Exxon Valdez oil spill in Alaska. n861 Similar calculations could derive preservation values for marine wilderness. However, economic value, or economic value equivalents, should not be "the sole or even primary justification for conservation of ocean ecosystems. Ethical arguments also have considerable force and merit." n862 At the forefront of such arguments should be a recognition of how little we know about the sea - and about the actual effect of human activities on marine ecosystems. The United States has traditionally failed to protect marine ecosystems because it was difficult to detect anthropogenic harm to the oceans, but we now know that such harm is occurring - even though we are not completely sure about causation or about how to fix every problem. Ecosystems like the NWHI coral reef ecosystem should inspire lawmakers and policymakers to admit that most of the time we really do not know what we are doing to the sea and hence should be preserving marine wilderness whenever we can - especially when the United States has within its territory relatively pristine marine ecosystems that may be unique in the world. We may not know much about the sea, but we do know this much: if we kill the ocean we kill ourselves, and we will take most of the biosphere with us.

#### IFR’s solve warming

Archambeauet all 11 [The Integral Fast Reactor (IFR): An Optimized Source for Global Energy Needs, Charles Archambeau, Science Council for Global Initiatives, Randolph Ware, Cooperative Institute for Research in Environmental Sciences, Tom Blees, National Center for Atmospheric Research, Barry Brook, University of Adelaide, Jerry Peterson, Argonne National Laboratory,¶ Yoon Chang, University of Colorado, February 2011]

The threat of global warming and climate change has become a polarizing social issue, especially¶ in the USA. The vast majority of informed scientists, however, are in agreement that the potential¶ consequences of inaction are dire. Yet even those who dismiss concerns about global warming and¶ climate change cannot discount an array of global challenges facing humanity that absolutely must¶ be solved if wars, dislocations, and social chaos are to be avoided.¶ Human population growth exacerbates a wide range of problems, and with most demographic¶ projections predicting an increase of about 50% by mid-century, we are confronted with a social¶ and logistical dilemma of staggering proportions. The most basic human morality dictates that we¶ attempt to solve these problems without resorting to draconian methods of human culling. At the¶ same time, simple social justice demands that the developed world accept the premise that the¶ billions who live today in poverty deserve a drastic improvement in their standard of living, an¶ improvement that is increasingly being demanded throughout developing countries. This will¶ require a global revolution in energy and technology deployment fully as transformative as that¶ during the Industrial Revolution but, unlike that gradual process, we now find ourselves under¶ extreme time pressure, especially if one considers global warming and climate change to be¶ immediate threats requiring immediate action.¶ It is beyond the purview of this paper to address the question of the social transformations that will¶ necessarily be involved in confronting the challenges of the next several decades (however, see¶ Blees, “Prescription for the Planet,” for a discussion which is helpful). But the question of energy¶ supply is inextricably bound up with the global solution to our coming crises, and it may certainly¶ be argued that energy production is the most crucial element of any proposed course of action. Our¶ purpose here is to demonstrate that the provision of all the energy that will be required to meet the¶ challenges of the coming decades and centuries is a challenge that already has a realistic solution¶ using fourth generation nuclear reactors which are currently available, affordable and safe1.¶ Our description of these new reactors will make heavy use of previous work on fast reactors and¶ electrochemical processing ("pyroprocessing") by General Electric (see, for example, Lineberry et¶ al., 2004) and Argonne National Laboratory, Department of Energy (see, for example, Y.E.¶ Chang, 2002) and our summary incorporates results from this work which was completed during¶ the period from about 1980 to the present. The books by Blees (Prescription for the Planet, 2008)¶ and Shuster (Beyond Fossil Fools, 2008) discuss the role of the new Generation IV nuclear power¶ systems in addressing the urgent global need for abundant/renewable and clean low-carbon¶ sources to replace the current hydrocarbon sources. Their analysis includes comparisons among¶ the variety of renewable energy sources that can contribute to future energy needs. We do not¶ consider detailed comparisons with other sources in the present discussion, but confine our¶ attention to nuclear systems alone. Therefore the reader may want to refer to these two books in¶ particular, to get a wider comparative view of what mix of energy sources might best address both¶ global warming and global energy needs.¶ Our objective here is to describe how the new Generation IV nuclear power reactor (IFR-Integral¶ Fast Reactor) will be able to replace fossil energy sources as the principal global energy source¶ and to also be able to supply the increasing energy demands of the future. The characteristics and¶ capabilities of the IFR power systems which make it possible to expand the nuclear component of¶ the global energy supply to such an extent include the following:

#### And, uranium mining independently ensures devastating warming

Rincon, 08 [Paul, BBC Broadcasting, “Nuclear's CO2 cost 'will climb'”, <http://news.bbc.co.uk/2/hi/science/nature/7371645.stm>]

The case for nuclear power as a low carbon energy source to replace fossil fuels has been challenged in a new report by Australian academics. It suggests **greenhouse emissions from the mining of uranium** - on which nuclear power relies - are on the rise. Availability of high-grade uranium ore is set **to decline** with time, it says, making the fuel less environmentally friendly and more costly to extract. The findings appear in the journal Environmental Science & Technology. A significant proportion of greenhouse emissions from nuclear power stem from the fuel supply stage, which includes uranium mining, milling, enrichment and fuel manufacturing. Others sources of carbon include construction of the plant - including the manufacturing of steel and concrete materials - and decomissioning. The authors based their analysis on **historical records**, contemporary financial and technical reports, and analyses of CO2 emissions. Experts say it is the first such report to draw together such detailed information on the environmental costs incurred at this point in the nuclear energy chain. Nuclear impact The report is likely to come under close scrutiny at a time when governments around the world are considering the nuclear option to meet future energy demands and reduce greenhouse gas emissions. Lead author Gavin Mudd, from Monash University in Australia, told BBC News: "Yes, we can probably find new uranium deposits, but to me that's not the real issue. The real issue is: 'what are the environmental and sustainability costs?' New uranium deposits are likely to be deeper underground and therefore more difficult to extract than at currently exploited sites, said Dr Mudd. In addition, he said, the average grade of uranium ore - a measure of its uranium oxide content and a key economic factor in mining - is likely to fall. Getting uranium from lower-quality deposits involves digging up and refining more ore. Transporting a greater amount of ore will in turn require more diesel-powered vehicles - a principal source of greenhouse emissions in uranium mining. "The rate at which [the average grade of uranium ore] goes down depends on demand, technology, exploration and other factors. But, especially if there is going to be a nuclear resurgence, it will go down and that will entail a higher CO2 cost," Dr Mudd explained. Overall, the report suggests that uranium mining could require more energy and water in future, **releasing greenhouse gases in greater quantities**. New technology Thierry Dujardin, deputy director for science and development at the Nuclear Energy Agency (NEA), said the analysis made an important contribution to clarifying the impact of nuclear energy on CO2 emissions.

**IFR’s solve the need for uranium mining**

**Kirsch 9** [Steve Kirsch, founder and CEO of multiple tech companies collectively worth over %241 billion and MS in Electrical Engineering and Computer Science from MIT, November 2009, "Why We Should Build an Integral Fast Reactor Now,"]

Q. How clean is an IFR plant? Does it emit any CO2?¶ IFRs don't put out any CO2 (although the employees exhale some). Usually people who make these arguments talk about how much¶ CO2 is released during uranium mining (none with IFRs), how much is released during construction (primarily from concrete production, which is responsible for 2-3% of CO2 emissions around the world but around 1% in the USA because we use less than most other countries compared to our other emitters), and how much is emitted from the vehicles used in the excavations, etc, as well as the amount emitted in the fabrication of the components. Of course these also apply to solar and wind generation facilities as well, don't they? Once our manufacturing facilities start running on electricity, and our vehicles start running on boron or, at the very least, carbon-neutral biofuels, then it'll be completely moot. This is one of those straw men tossed out there by anti-nuke people that doesn't hold water. The fact that we don't have to mine uranium at all for IFR plants kind of shoots it down in flames.

#### IFR tech will be modeled internationally

**Stanford 06** [George, PhD, a physicist, retired from Argonne National Laboratory. B.Sc. with Honours, Acadia University; M.A.,Wesleyan University; Ph.D. in experimental nuclear physics, Yale University, interview with Ann Curtis (Washburn University nuclear technology), August 8]

6. If the US were to embrace the IFR, would other countries follow the lead? Only if the U.S.-developed technology were shown convincingly to be superior (which I think it is). Already India, China, France, Japan, and other countries are proceeding with their own development programs. We abandoned leadership in the field with the termination of the IFR program in 1994, and are now starting to feel the consequences.

### ANL Leadership

#### Argonne National Lab is losing a generation of scientists

**Merrion 11** [Paul, Washington Bureau Chief, Crain’s Chicago Business, Feb 18, 2011, “Argonne, Fermi funding cuts threaten labs & research, Durbin warns”]

Proposed federal spending cuts by House Republicans would force Argonne National Laboratory to shut down much of its research facilities and lay off a third of its workforce, or about 1,000 employees, including more than 700 scientists, the lab said.¶ Another 2,000 jobs at contractors and subcontractors for the Darien-area lab also would be lost. The Advanced Photon Source, supercomputer labs and other research facilities used by academics and companies such as Boeing Co., Abbott Laboratories Inc. and Caterpillar Inc. would have to shut down for months.¶ “The real issue is, in all likelihood we will lose a whole generation of scientists and engineers,” said Argonne Director Eric Isaacs. “They go find something else to do. You don't get those people back.”¶ As part of an effort to cut current spending by at least $61 billion, House Republicans are proposing an immediate 50% cut in energy efficiency programs that fund a large part of Argonne's $556-million budget, as well as a 20% cut in the Energy Department's Office of Science, which funds Argonne and Fermi National Accelerator Laboratory, near Batavia.¶ Applying those cuts to the remaining half of the federal fiscal year essentially doubles their impact.¶ “This mindless cut is a clear signal that the House bill is not the product of a thoughtful effort,” said U.S. Sen. Richard Durbin, D-Ill., late Friday in a letter to Senate energy and water appropriations subcommittee leaders. “America must cut spending, but it cannot abandon its leadership in research and innovation.”¶ Fermilab Director Pier Oddone warned staff earlier this week that the cuts would be “catastrophic,” forcing an immediate shutdown of its particle accelerator and at least 400 layoffs.¶ The cuts would fall even heavier on Argonne than Fermilab, the Chicago area's other national lab, because its budget is bigger and it gets much of its funding from energy efficiency programs.¶ “Significant cuts to the labs will be devastating to the local communities surrounding the labs in Batavia and DuPage County,” Mr. Durbin added. “Suppliers and contractors for the labs, as well as the private companies that use the facilities, also would be adversely affected by the closures and layoffs.”

#### It’s too late to merely restore funding – successful project demonstration is key to future recruitment and retention

Grossenbacher 08[CQ Congressional Testimony, April 23, 2008, John, Laboratory Director Idaho National Laboratory, “NUCLEAR POWER,” SECTION: CAPITOL HILL HEARING TESTIMONY, Statement of John J. Grossenbacher Laboratory Director Idaho National Laboratory, Committee on House Science and Technology, Lexis]

While all of the programs I've highlighted for you individually and collectively do much to advance the state of the art in nuclear science and technology, and enable the continued global expansion of nuclear power, there is a great area of challenge confronting nuclear energy's future. As with most other technologically intensive U.S. industries - it has to do with human capital and sustaining critical science and technology infrastructure. My laboratory, its fellow labs and the commercial nuclear power sector all face a troubling reality - a significant portion of our work force is nearing retirement age and the pipeline of qualified potential replacements is not sufficiently full. Since I'm well aware of this committee's interests in science education, I'd like to update you on what the Department and its labs are doing to inspire our next generation of nuclear scientists, engineers and technicians. Fundamentally, the Office of Nuclear Energy has made the decision to invite direct university partnership in the shared execution of all its R&D programs and will set aside a significant amount of its funds for that purpose. Already, nuclear science and engineering programs at U.S. universities are involved in the Office of Nuclear Energy's R&D, but this move will enable and encourage even greater participation in DOE's nuclear R&D programs. In addition, all NE-supported labs annually bring hundreds of our nation's best and brightest undergraduate and graduate students on as interns or through other mechanisms to conduct real research. For example, at INL we offer internships, fellowships, joint faculty appointments and summer workshops that focus on specific research topics or issues that pertain to maintaining a qualified workforce. This year, we are offering a fuels and materials workshop for researchers and a 10-week training course for engineers interested in the field of reactor operations. Last year, DOE designated INL's Advanced Test Reactor as a national scientific user facility, enabling us to open the facility to greater use by universities and industry and to supporting more educational opportunities. ATR is a unique test reactor that offers the ability to test fuels and materials in nine different prototypic environments operated simultaneously. With this initiative, we join other national labs such as Argonne National Laboratory and Oak Ridge National Laboratory in offering nuclear science and engineering assets to universities, industry and the broader nuclear energy research community. Finally, national laboratories face their own set of challenges in sustaining nuclear science and technology infrastructure - the test reactors, hot cells, accelerators, laboratories and other research facilities that were developed largely in support of prior missions. To obtain a more complete understanding of the status of these assets, the Office of Nuclear Energy commissioned a review by Battelle to examine the nuclear science and technology infrastructure at the national laboratories and report back later this year on findings and recommendations on a strategy for future resource allocation that will enable a balanced, yet sufficient approach to future investment in infrastructure.

#### Successful recruitment of high-quality scientists is needed to restore ANL credibility and Nanomaterials programs

Van 08 [Jon Van, Chicago Tribune, January 20, 2008 “Argonne, Fermilab lick wounds after fierce federal budget fight” <http://archives.chicagotribune.com/2008/jan/20/business/chi-sun_argonne_0120jan20>]

Argonne National Laboratory arguably is where the hot new nanotechnology industries were born and without Fermilab, the MRI machines that are common in hospitals across the nation might not have been possible. Together, Illinois’ two national laboratories are local economic powerhouses that employ almost 5,000 people and spend more than $800 million a year to operate. Nationally, they are part of the scientific and technical foundation upon which the United States economy has prospered for more than 60years. But just before Christmas, Fermi and Argonne were gravely injured by the budget hammered out by a feuding President Bush and Congress. Argonne faces the closing of one facility, downtime at another and an uncertain number of layoffs. Fermi was hit even harder, facing 200 immediate layoffs, unpaid days off for remaining workers and the prospect of being closed altogether sometime in the future. America’s high-tech industrial facilities and jobs are likely to go abroad because U.S. companies can no longer count on support from the government, a major corporate chairman warned Congress. This harsh fate was totally unforeseen. Only last summer the president and Congress passed a law endorsing the notion that America’s economic competitiveness rests squarely upon the back of basic research financed by federal dollars. A bipartisan majority pledged to raise appropriations for national labs and academic researchers. The sudden turnabout was rooted in political infighting between the two houses of Congress, as well as President Bush’s line in the sand for Democratic lawmakers. “This wasn’t done to punish Fermilab or physics,” said Pier Oddone, Fermilab’s director. But lack of intent doesn’t lessen the damage from a $52million budget cut, which stops all planning for a new physics machine that Fermilab hopes to land. Failing to win that machine puts Fermilab on the road to closing down as its current facility, the Tevatron, will soon become obsolete. Competitiveness lost The budget cuts that enraged and demoralized lab employees also caught the attention of America’s corporate technocracy leadership, which is concerned that this country is already letting its long-standing leadership in science innovation slip away. Noting that Congress passed a $250 billion farm bill “to support industries of the 19th Century,” Craig Barrett, chairman of Intel Corp., asked in letters to congressional leaders “isn’t it time we pull our political leadership together to start supporting the industries of the 21st Century?” Looking at budget cuts for science, Barrett warned that “industry is listening carefully to your deliberations. If there is no government support to these areas that will dictate our competitiveness for the next century, then we might as well just accept that and make our investments elsewhere.” Argonne’s advanced photon source provides dozens of superbright X-ray beams that enable researchers to see how chemistry unfolds, how pathogens work, helping pharmaceutical scientists design new drugs. The X-ray beams also explore how smaller electronic circuitry may work. Faced with budget cuts, the photon source must reduce its operations by 20percent, said Robert Rosner, Argonne’s director, which means researchers will wait longer to do their experiments. Academic scientists will just have to wait, but folks from Intel, Abbott Laboratories or Motorola who have commercial competition to consider may go elsewhere, said Michael Lubell, public affairs director for the American Physical Society. U.S. capacity at X-ray facilities such as Argonne’s is already tight, while similar facilities built abroad have capacity and welcome American researchers, he said. “In the electronics industry, they have quick turnaround times for new products,” Lubell said. “If a researcher has to wait six months to get the beam time he needs in this country, he’s tempted to go abroad. “Once your R&D goes offshore, your manufacturing will follow. Cutting back Argonne’s operation only compounds the problem.” Argonne’s relationship to industry goes back a long way. Early work at the lab on nanotechnology led to the founding in 1989 of Nanophase Technologies Corp., now based in Romeoville, among the country’s first commercial nanotech concerns. While Fermilab’s research focuses on how matter and energy interact and how the universe works, the technology it develops has significant economic impact. Advancing supercold, superconducting magnetic technology to build the Tevatron broke the technological ground necessary to make MRI machines a practical reality. For scientists, it is especially frustrating to see deep cuts in programs that have wide backing as being important while more parochial projects were untouched. \Favorites inserted In this budget, like those before it, many projects favored by individual lawmakers were inserted into funding bills with no outside review. Sometimes costing millions of dollars, these projects, usually called “pork,” are funded through earmarks, which are proposals members of Congress agree to fund, often in return for favors from one another.

#### Restarting IFR project at ANL spurs R+D in all sectors – collaborative research utilizing nuclear science insight key to effective programs

Blees 8 [Tom Blees 2008 “Prescription for the Planet: The painless remedy for our energy and environmental crises” Pg. 367]

21. Restart nuclear power development research at national labs like Argonne, concentrating on small reactor designs like the nuclear battery ideas discussed earlier. Given the cost and difficulty of extending power grids over millions of square miles of developing countries, the advantages of distributed generation in transforming the energy environment of such countries can hardly be exaggerated. It is a great pity that many of the physicists and engineers who were scattered when the Argonne IFR project was peremptorily terminated chose to retire. Rebuilding that brain trust should be, well, a no-brainer. If one but looks at the incredible challenges those talented people were able to meet, it seems perfectly reasonable to suppose that a focus on small sealed reactor development could likewise result in similar success. Some of those working on the AHTR and other seemingly unneeded projects could well transition to R&D that fits into the new paradigm. Japanese companies are already eager to build nuclear batteries, and there should be every effort to work in concert with them and other researchers as we develop these new technologies. The options this sort of collaborative research would open up for the many varied types of energy needs around the world would be incalculable.

#### Argonne is key – other labs lack key catalyst infrastructure like the APS

**Fischetti** et all **9** [“Proceedings of the¶ Advanced Photon Source Renewal Workshop”¶ Hickory Ridge Marriott Conference Hotel¶ Presentation to Department of Energy¶ October 20-21, 2008¶ February 2009¶ Robert F. Fischetti Argonne National Laboratory, Biosciences Division;¶ APS Life Sciences Council representative¶ Paul H. Fuoss Argonne National Laboratory, Materials Science Division;¶ APS Users Organization representative¶ Rodney E. Gerig Argonne National Laboratory, Photon Sciences, Denis T. Keane Northwestern University;¶ DuPont-Northwestern-Dow Collaborative Access Team;¶ APS Partner User Council representative¶ John F. Maclean Argonne National Laboratory, APS Engineering Division¶ Dennis M. Mills, Chair Argonne National Laboratory, Photon Sciences, Dan A. Neumann National Institute of Standards and Technology; APS Scientific Advisory Committee representative¶ George Srajer Argonne National Laboratory, X-ray Science Division]

Scientific Community¶ An enhanced catalyst research beamline with capabilities for in situ XAFS, powder¶ diffraction, and kinetics measurements would benefit the entire catalysis community,¶ i.e., government research laboratories, academia, and industry. The beamline and its¶ staff would also serve as a focal point for expanding catalyst research to other APS¶ beamlines using advanced techniques not routinely applied to catalyst systems, e.g.,¶ SAXS, XES, RIXS, and HERF spectroscopy. Development of these latter methods¶ would position the APS as a leader in this area and attract leading scientists from all¶ over the world. It is expected that new users would initially characterize their materials and identify appropriate systems for specialized techniques.¶ Fig. 4. Cell for in situ x-ray absorption studies of fuel cell¶ catalysts. Standard Fuel Cell Technologies cell hardware¶ was machined to allow x-ray fluorescence studies of cathode electrocatalysts in an operating membrane-electrode¶ assembly (fuel cell). (Argonne National Laboratory photograph)Throughout the U.S. and the world, there are countless research groups working to¶ develop the enabling material in fuel cell catalysis: an oxygen reduction electrocatalyst that is less expensive and more durable than platinum [36-38]. A few of these¶ groups utilize synchrotron-based x-ray techniques to characterize their electrocatalysts; however, these studies are almost exclusively in environments mimicking the¶ reactive environment or are ex situ. A notable exception is the catalyst development¶ effort being led by Los Alamos National Laboratory, which encompasses many approaches and involves many university and national laboratories. As part of this project, Argonne researchers have developed the capability to characterize catalysts¶ containing low-atomic-number elements in an operating fuel cell using XAFS at the¶ APS. Utilizing this cell (Fig. 4), Argonne scientists have determined the active site in¶ a cobalt-containing catalyst. This capability would be extremely useful to other catalyst development teams around the country and the world, and it is envisioned that a¶ dedicated APS electrocatalysis beamline could be designed and made available to¶ these teams. The neutron source at the National Institute of Standards and Technology (NIST) has a beamline dedicated to studies of water transport in fuel cells, which¶ has provided invaluable information for fuel cell materials design. The APS beamline¶ would be the catalyst counterpart to the NIST beamline.¶ A molecular-level understanding of the interactions and correlations that occur in solution and between solution phases is essential to building a predictive capability of a¶ metal ion’s solubility, reactivity, kinetics, and energetics. Until the recent availability¶ of tunable, high-energy x-rays this understanding has been significantly limited by¶ the absence of structural probes. The APS, with its high flux of high-energy x-rays, is¶ the ideal synchrotron source to provide this new information, which is critical to the¶ advancement of solution chemistry. The utility of high-energy x-rays is currently¶ being demonstrated as part of an APS Partner User Proposal (PUP-52), and has received high visibility, including an Inorganic Chemistry feature cover [34]. This effort¶ is interesting a cadre of solution chemists that, to date, have not been part of the user¶ base at synchrotron facilities. The extension of high-energy capabilities from simple¶ PDF experiments to more complex liquid-liquid interfaces is expected to significantly¶ broaden this new interest group into areas including soft-matter studies.

#### APS key to nanotech development

**Lindsey 12** [“Scientist Uses Advance Photon Source to Study Nano-Scale Materials”, Laura, Director of Communications and Marketing, The College of Arts and Science, ¶ University of Missouri Columbia, Department of Physics and Astronomy, Jan 25, 2012]

Emerging new technologies utilize advanced materials that are assembled on exceedingly small scales of length. Because of their small size, these nano-scale materials often exhibit unique properties that can potentially be harnessed for applications and new science. In order to do this however, one needs a comprehensive understanding and characterization of their physical behavior on the atomic scale. Professor Paul Miceli is doing just that with the Advanced Photon Source (APS) at Argonne National Laboratory in Argonne, Ill. The APS is the brightest source of x-rays in North America. This machine, which is one kilometer in circumference, allows scientists to collect data with unprecedented detail and in short time frames.¶ “The Advanced Photon Source’s x-ray beam is a billion times more intense than what I can see in my lab,” says Miceli.¶ He deposits thin layers, typically one atom thick, onto a surface from a vapor and then studies the structures by scattering the intense x-ray beam. By doing this, Miceli can determine how the atoms rearrange themselves on the surface so he can develop a better understanding of how nano-structures grow. Because of the unprecedented brightness of the x-ray beam, he is able to observe the materials as they grow in real time. In addition to the unique aspect of the x-ray beam, these studies are facilitated by an extensive ultra-high-vacuum growth-and-analysis chamber residing at the APS that was designed and developed by Miceli.¶ “My findings pertain to basic science about how atoms organize themselves,” says Miceli.¶ Because the x-ray beam can probe both the surface and the subsurface of the materials, Miceli’s research has made discoveries that could not be achieved by other techniques. For example, his research found that nano-clusters of missing atoms become incorporated into metallic crystals as they grow. This discovery is important because it brings new insight to theories of crystal growth, and it forces scientists to think abou**t how atomic-scale mechanisms might lead to the missing atoms.** Such effects, which also have practical implications for technological applications of nano-materials, have not been considered in current theories.¶ Other studies by Miceli have shown that the growth of some metallic nano-crystals cannot be explained by conventional theories of crystal growth. For example, quantum-mechanical effects on the conduction electrons in very small nano-crystals can change the energy of the crystal, and Miceli showed that the statistical mechanics of coarsening — when large crystals become larger while small crystals get smaller and vanish — does not follow the conventional theories that have worked successfully in materials science over the past 50 years. In fact, he has found that atoms can move over metallic nano-crystalline surfaces thousands of times faster than normal crystals, illustrating the many surprises and challenges that nano-scale materials present to scientists.

#### ANL’s nanoscale materials prevent biowarfare agents – and safety of ANL Nanomaterials solves all Nanotech Bad impacts

Brown 5 [Evelyn Brown, National Institute of Standards and Technology (NIST). 5/5/2005]

Federal and state officials will visit Argonne National Laboratory May 6 to participate in a cornerstone-laying ceremony for the Center for Nanoscale Materials (CNM). The CNM, which is currently under construction, is a joint DOE-State of Illinois project to provide basic nanoscale research that will lead to industrial and commercial applications that can benefit Illinois and the country. “Nano” refers to the scale used to measure these materials – a nanometer is 1 billionth of a meter, or about 70,000 times smaller than the width of a human hair. Materials at the nanoscale differ from conventional materials because traditional physics does not apply at this scale. “Intentionally building materials at the nanoscale,” said CNM Director Eric Isaacs, “allows us to explore and develop entirely new ways to tailor a material's response to temperature, electrical or magnetic fields, or chemical environments. The basic research to be conducted at the CNM is critical so that novel, environmentally safe products and applications can be effectively developed based on nanomaterials.” Industry will be able to use research revealed by CNM researchers to understand what can be expected from nanoscale materials. They will be able to create new products that will impact the fields of energy, medicine, information technology and homeland security, and to maintain the United States' leading role in science. The center's mission includes supporting basic research and development of advanced instrumentation for creating novel materials that provide new insights at the nanoscale level. The challenges involve fabricating and exploring novel nanoscale materials and, ultimately, employing unique synthesis and characterization methods to control and tailor nanoscale phenomena. The CNM will be open to academia, industry and other government laboratories through a peer-reviewed process. CNM's research facilities The facility is being built adjacent to the Advanced Photon Source, the most brilliant source of research X-rays in the Western Hemisphere. The 85,000-square foot CNM building will house research instruments, laboratories, clean rooms and work space to assist in fabricating and understanding these tiny materials. CNM's first dedicated instrument will be the pioneering nanoprobe beam line now under construction. The nanoprobe will be a hard X-ray microscopy beamline with the highest spatial resolution in the world. With its combination of fluorescence, diffraction and transmission imaging at a spatial resolution of 30 nanometers or better in a single tool, the nanoprobe will be able to penetrate samples in situ and provide information about their internal structures.

An electron-beam lithography facility will provide fabrication support to CNM users, including a 100-kilovolt electron-beam lithography tool – one of a handful of such devices in the country. The center will also feature an Argonne-developed nanopositioning system for precision motion and measurement. The CNM is a joint partnership between the Department of Energy and the State of Illinois. The State of Illinois is providing $36 million to construct the building, and DOE is providing an additional $36 million to develop and build the facility's advanced instrumentation. Argonne's CNM is one of five centers being built at national laboratories across the country as part of DOE's Nanoscale Science Research Center program under the Office of Basic Energy Sciences. The basic scientific research to be conducted at the CNM is predicted to lead to novel, environmentally safe products and applications that can be effectively developed based on nanomaterials. Research includes: Nanomaterials that could lead to 400 percent improvement in the efficiency of direct conversion of heat to electricity, and conversely in thermoelectric cooling. New materials to efficiently harvest light for energy generation, and for novel purposes such as selective chemical reactivity. The means to synthesize and understand new nanostructured materials that are potentially stronger, lighter, harder, safer and self-repairing such as nanocarbon, which has led to coatings for implantable biomedical devices such as an artificial retina. Developing advanced, adaptive biosensors, for instance, to monitor blood sugar levels and inject insulin directly into the blood stream. Fundamental understanding and design of novel nanoscale materials and chemical processes capable of capturing, converting and storing energy as electrical or chemical equivalents. These developments could lead to using energy to manipulate biological materials in processes such as gene surgery or cell repair, and facilitating conversion of light energy into therapeutic processes. New ways to manipulate photons and electrons, making possible a whole new class of devices, including those based on the spin of the electron. Nanomagnetic and nanostructured ferroelectric materials for semiconductors will provide a path that goes beyond current technology for information processing and storage. New materials and devices will be developed at the CNM that are capable of much higher storage densities that use less power and dissipate less heat. Nanophotonics research is poised to manipulate light at length scales much smaller than is possible using traditional optical elements, firmly placing light within the realm of the integrated circuit. Sensors to detect the presence of biowarfare agents, such as anthrax, in real time.

#### Bioterror is inevitable – they have the means and motive

**Center for Nonproliferation Studies 11** [Bioterrorism and Threat Assessment PREPARED FOR THE WEAPONS OF MASS DESTRUCTION COMMISSION BY: Gary A. Ackerman and Kevin S. Moran Weapons of Mass Destruction Terrorism Research Program Center for Nonproliferation Studies Monterey Institute of International Studies March 2011]

Regarding the capability of terrorists to engage in mass-casualty biological attack 10 , several authors contend that previous technical obstacles to obtaining or developing biological weapons have eroded, and that a biological weapons capability is most likely within the reach of at least a certain subset of terrorist groups. The group most commonly cited as being likely to “overcome the technical, organizational and logistical obstacles to WMD” 11 is the al-Qa`ida network, which is reported to be pursuing several types of WMD, including biological weapons. Other commentators are more sanguine about current terrorist capabilities, believing that they have been exaggerated and that technical hurdles still prevent terrorists from engaging in anything more than small to medium-sized attacks using biological weapons (which would not constitute true WMD events). For example, at the more conservative end of the spectrum, a renowned expert like Donald Henderson believes that it is unlikely that more than a few terrorist groups would be able to succeed in procuring any of the agents of highest concern in a form that could be dispensed by aerosol in a manner that would result in mass casualties. 12 Yet even the most conservative of these authors do not unequivocally dismiss the prospect of a group currently (or in the near future) being able to field a biological weapon. Indeed, the only discernible area of agreement between analysts seems to be that there exists at least a minimal possibility of a technologically and organizationally adept terrorist organization succeeding in acquiring a biological weapon capable of causing mass casualties. One remarkable feature within the broader discussion about terrorist capabilities for bioterrorism is that hardly any of those who believe terrorists currently lack this capacity mention anything about future developments. If recent trends in terrorism have taught us anything, it is that terrorists are nimble, highly adaptive actors who can be innovative when necessary. Terrorist capabilities in general display an upward trend and one must bear in mind that even though a terrorist group’s ideology may seem in the eyes of their opponents to be archaic and obscurantist, this does not mean that the group lacks a solid grasp of the most modern technology. At the same time, general advances in several areas of biotechnology and the rapid commercialization and diffusion of this technology mean that equipment and techniques that once resided within the sole purview of a state’s military apparatus (such as the ability to synthesize complex chemicals or identify single nucleotide polymorphisms) can now be found in off-the-shelf commercial applications. One of the negative externalities of this technological dynamism is the opportunities it can provide for malefactors. Consequently, even if terrorist groups may lack the capability to engage in bioterrorist attacks today, it is necessary to consider the prospects 8for them gaining this capability in the future, with special attention paid to both the direction and pace of change. We have thus highlighted an examination of the rate of change of terrorist capabilities for bioterrorism (i.e., are terrorists likely to acquire these capabilities within five years? Or fifteen? Or fifty?) as an urgent research need.

#### Bioterror causes extinction

**Ochs ‘2**

 [Richard, MA Natural Resource Management at Rutgers University , Naturalist at Grand Teton National Park, June 9th, immediately," http://www.freefromterror.net/other\_articles/abolish.html" target="\_blank">"Biological Weapons must be abolished >immediately,")

Of all the weapons of mass destruction, the genetically engineered biological weapons, many without a known cure or vaccine, are an extreme danger to the continued survival of life on earth. Any perceived military value or deterrence pales in comparison to the great risk these weapons pose just sitting in vials in laboratories. While a "nuclear winter” resulting from a massive exchange of nuclear weapons, could also kill off most of life on earth and severely compromise the health of future generations, they are easier to control. Biological weapons, on the other hand, can get out of control very easily, as the recent anthrax attacks has demonstrated. There is no way to guarantee the security of these doomsday weapons because very tiny amounts can be stolen or accidentally released and then grow or be grown to horrendous proportions. The Black Death of the Middle Ages would be small in comparison to the potential damage bioweapons could cause. Abolition of chemical weapons is less of a priority because, while they can also kill millions of people outright, their persistence in the environment would be less than nuclear or biological agents or more localized. Hence, chemical weapons would have a lesser effect on future generations of innocent people and the natural environment. Like the Holocaust, once a localized chemical extermination is over, it is over. With nuclear and biological weapons, the killing will probably never end. Radioactive elements last tens of thousands of years and will keep causing cancers virtually forever. Potentially worse than that, bio-engineered agents by the hundreds with no known cure could wreck even greater calamity on the human race than could persistent radiation. AIDS and ebola viruses are just a small example of recently emerging plagues with no known cure or vaccine. Can we imagine hundreds of such plagues? HUMAN EXTINCTION IS NOW POSSIBLE. Ironically, the Bush administration has just changed the U.S. nuclear doctrine to allow nuclear retaliation against threats upon allies by conventional weapons. The past doctrine allowed such use only as a last resort when our nation’s survival was at stake. Will the new policy also allow easier use of US bioweapons? How slippery is this slope? Against this tendency can be posed a rational alternative policy. To preclude possibilities of human extinction, "patriotism" needs to be redefined to make humanity’s survival primary and absolute. Even if we lose our cherished freedom, our sovereignty, our government or our Constitution, where there is life, there is hope. What good is anything else if humanity is extinguished This concept should be promoted to the center of national debate.. For example, for sake of argument, suppose the ancient Israelites developed defensive bioweapons of mass destruction when they were enslaved by Egypt. Then suppose these weapons were released by design or accident and wiped everybody out? As bad as slavery is, extinction is worse Our generation, our century, our epoch needs to take the long view. We truly hold in our hands the precious gift of all future life. Empires may come and go, but who are the honored custodians of life on earth? Temporal politicians? Corporate competitors? Strategic brinksmen? Military gamers? Inflated egos dripping with testosterone? How can any sane person believe that national sovereignty is more important than survival of the species? Now that extinction is possible, our slogan should be "Where there is life, there is hope." No government, no economic system, no national pride, no religion, no political system can be placed above human survival. The egos of leaders must not blind us. The adrenaline and vengeance of a fight must not blind us. The game is over. If patriotism would extinguish humanity, then patriotism is the highest of all crimes.

#### Nanotech is inevitable – safe stewardship prevents extinction

John Robert **Marlow,** (Nanotech Columnist, nominated for the 2004 Foresight Institute Prize in Communication), **2004** (no date, but most recent reference is 2004), NANOVEAU #002, “The Sound of Inevitability—Why Nanotech Will Happen,” <http://nanoveau.com/sa__nvc--002.html> [Bapodra]

Unlike previous advances, however, nanotech has the capability to swiftly—and irrevocably—tip the scales one way or the other. "Nanotechnology could be our salvation or our destruction," Cameron confirms, and goes on to make what is perhaps the best argument of all for nanodevelopment: "But it's absolutely necessary as our salvation. We've put ourselves in a role of stewardship of a biosphere which is already compromised by our technology—and the only solution to that will be a technology solution because of the burden of six billion, probably going on ten billion people by the end of this decade. So the only real salvation for the biosphere, to that kind of burden and to the things we've done to it already, will be a technological solution. We're already committed; we have to play the hand technologically. There's no going back to the Garden." Indeed, though it has not yet been released, it is already too late to put the nanogenie back in the bottle.

### Solvency

#### Contention 4: Solvency

#### Current loan guarantees aren’t enough – more on new reactor types are key to catalyze nuclear construction and solve nuclear leadership

**Belogolova 12** [National Journal Daily, July 19, 2012, “U.S. Nuclear Industry Seen Needing a Boost”, Olga Belogolova, lexis, khirn]

A robust nuclear-energy industry should be a high priority for the country's energy and national-security policy given the importance of the sector to global nonproliferation, according to a new report released on Thursday by the Bipartisan Policy Center's Nuclear Initiative . Specifically, the United States needs to lead in the licensing and development **of new reactors** and on safety reforms, management of spent nuclear fuel, the nuclear-export market, and research and development in the nuclear sector, according to the report led by former Sen. Pete Domenici, R-N.M., and former Energy Department Assistant Secretary for Nuclear Energy Warren (Pete) Miller. But leadership on nuclear issues could prove to be a challenge for the United States. Although the country has long led the charge on civilian nuclear power, the combination of a slowed electricity market, the lack of sweeping climate legislation, a natural-gas boom, and last year's Fukushima Daiichi nuclear accident in Japan have created obstacles for the development of new nuclear power in the United States in recent years. While the Nuclear Regulatory Commission this year has approved four new reactors for the Vogtle and Summer nuclear plants in Georgia and South Carolina, respectively, there are likely to only be a few more plants licensed in the United States in the near future. The story is very different on the international level. After Fukushima, countries such as Germany, Italy, Switzerland, and of course Japan have paused or slowed down their nuclear-energy development, but that hasn't stopped the rest of the world. Many other nations such as China, India, South Korea, and Russia have reaffirmed plans to expand their fleets of nuclear reactors, while some countries in the Middle East have even announced plans to develop nuclear energy for the first time. China alone, which has 26 new reactors under development, is expected to account for 40 percent of planned nuclear construction globally. The United States might be a leader now, accounting for nearly one-third of global nuclear generation, but it won't be long before others come out ahead of us, especially given how long it takes to construct new reactors, Domenici and Miller explained. "It will be increasingly difficult for the United States to maintain its technological leadership without some near-term domestic demand for new construction," they write in the report. In order to control the proliferation of nuclear weapons, the United States **needs to remain involved in everything** that happens to nuclear materials, from the export of nuclear fuel for energy use to the disposal of spent fuel. Given the global picture, Domenici and Miller suggest a shift in U.S. policies in order to ensure that the U.S. nuclear energy program is not stuck at a near-standstill. "Market signals alone are unlikely to result in a diverse fuel mix, so helping to maintain and improve a range of electricity supply options remains a role for federal policy," the two write in the report. "In particular, U.S. policy should be aimed at helping to preserve nuclear energy as an important technology option for near- or longer-term deployment." The vast shale-gas reserves in the United States and new technology to tap them will probably keep natural-gas prices low for the foreseeable future, making financing of more expensive nuclear power more difficult. **Federal loan guarantees have long been viewed as crucial to growing the nuclear industry**, but the Energy Department has dragged its feet on these conditional loans, especially after the bankruptcy of the federally funded solar firm Solyndra so much so that some companies have decided not to wait around and see what happens. Southern Company, which is building the first two new reactors to be approved in decades at its Vogtle nuclear plant in Georgia, on Thursday said that it is now considering doing so without federal support. The company had been waiting for an $8.33 billion loan guarantee to build the two new reactors, but Southern CEO Tom Fanning told Reuters on Thursday that talks with DOE were going slowly and they might not be willing to wait any longer.

#### Loan guarantees attract private capital – increases are key

**Peskoe 12** [Ari Peskoe, associate in the law firm of McDermott Will and Emery LLP and focuses his practice on regulatory, legislative, compliance, and transactional issues related to energy markets, 4-20-2012, "A Solution Looking For a Problem: Building More Nuclear Reactors after Vogtle," The Electricty Journal, vol 25 issue 3, Science Direct]

Given the checkered history of reactor construction projects,56 private lenders are understandably skittish about lending billions of dollars to develop a new reactor. Construction of the Vogtle and SCANA reactors will be a critical test, and significant cost overruns on these two projects could doom the prospects for construction of additional reactors. Even if the construction of Vogtle and SCANA are on budget, it will likely still be difficult for future project developers to raise enough debt financing without government support.57 Federal loan guarantees shift “a large part of the learning costs and construction risks” from private lenders to the federal government by ensuring that lenders receive payment in the event that the developer defaults on repayments.58 Appropriations for the guarantees authorized by the Energy Policy Act of 2005 will soon run out, so future guarantees will require congressional action.59¶ Loan guarantees cost the federal government little or nothing unless there is an event of default.60 Creating a long-term guarantee program would be entirely consistent with the government's historic role in accepting risks and liabilities of nuclear power. Although it has not been implemented effectively, the Nuclear Waste Policy Act (NWPA) of 1982 requires the DOE to transport nuclear waste from privately owned reactors to permanent government storage facilities.61 Concerned about a “cloud of bankruptcy” hanging over its operations,62 the nascent nuclear industry pushed Congress to pass the Price-Anderson Act in 1957, which indemnifies the industry against claims arising from a nuclear incident. Both the NWPA and the Price-Anderson Act socialize costs of nuclear energy. In the case of the NWPA, the industry pays the DOE a tenth of a penny for each kilowatt-hour of nuclear energy sold to fund waste disposal activities.63 The Price-Anderson Act also requires generators to contribute to a fund, but the federal treasury would likely cover much of the liabilities associate with a nuclear disaster.64

#### Manhattan Project approach key to catalyze quick investment in IFRs – perception is non-unique, there is government investment now

**Kirsch 9** [Steve Kirsch, founder and CEO of multiple tech companies collectively worth over %241 billion and MS in Electrical Engineering and Computer Science from MIT, November 2009, "Why We Should Build an Integral Fast Reactor Now,"]

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.

#### **IFR’s are really cheap – existing coal plants can be retrofitted – solves warming**

Archambeauet all 11 [The Integral Fast Reactor (IFR): An Optimized Source for Global Energy Needs, Charles Archambeau, Science Council for Global Initiatives, Randolph Ware, Cooperative Institute for Research in Environmental Sciences, Tom Blees, National Center for Atmospheric Research, Barry Brook, University of Adelaide, Jerry Peterson, Argonne National Laboratory,¶ Yoon Chang, University of Colorado, February 2011]

The new features of the IFR systems with pyroprocessing are such that the cost of¶ electrical energy production is estimated to be quite low, in the range below $.01 per¶ kilowatt-hour for an IFR. (For comparison, natural gas fuel cost was at $.05 per kilowatthour,¶ and coal was at about $.03 per kilowatt-hour, while LWR nuclear power was at $.02¶ per kilowatt-hour.) The G.E. estimated building cost of the S-Prism reactor (Fletcher,¶ 2006) is $1300/kw, where this cost assumes some cost savings due to mass production and¶ modular construction. For a commercial level gigawatt reactor (using 3 modular S-Prism¶ reactors with 380 MW of power from each) the cost would total $1.3 billion dollars per¶ one gigawatt plant. These nuclear plants are essentially carbon dioxide emissions free, and¶ in general produce no atmospheric pollution. Further, all the Uranium fuel can be provided¶ from processing the stock piles of spent and depleted Uranium fuel. Therefore, no Uranium¶ mining and associated pollution will occur. Likewise, IFR waste material is minimal and¶ short-lived so that no pollution will occur from this source. Consequently, significant¶ reduction in greenhouse gases, and a variety of other dangerous pollutants, can be¶ immediately achieved if these IFR plants are used to replace the furnaces in coal burning¶ power plants which exist in profusion world-wide. Here the infrastructure at existing coal fueled plants, such as electric power lines, water sources and conduits, steam turbines, etc.,¶ can all be simply converted and used in the nuclear powered plant. Hence, costs of¶ building complete power plants and their electrical connections to the grid can be¶ minimized while the impact on global warming and pollution related diseases can be¶ maximized by replacing the worst of the polluters. Further, it is urgent that we move¶ quickly to strongly and immediately control CO2 gas emissions to drastically slow global¶ warming. Clearly, the costs are not prohibitive since construction of one large stand-alone¶ pyroprocessing plant, at about 6 billion dollars, and only about 10 of the large IFR¶ powered plants, costing under 20 billion dollars, will go a long way toward strongly¶ dampening the massive production of CO2 emissions from existing electricity power plants¶ in the U.S.

#### The IFR is chemically incapable of proliferation

**Stanford 01** [George S. Stanford, Ph.D., nuclear reactor physicist, writer for the National Center of Public Policy Research, December 2001, “Integral Fast Reactors: Source of Safe, Abundant, Non-Polluting Power”]

*What is* the best argument for it? Proliferation prevention. Near-term, the IFR makes PUREX illegitimate and plutonium inaccessible. Long term, it relieves future generations of the responsibility to guard the plutonium mines, and of the risks of not guarding them adequately. There's another huge benefit, of course. If nothing better comes along, the IFR can supply the world with pollution-free energy for thousands of years. *What's so important about plutonium?* High-quality plutonium is the preferred bomb material for a sophisticated nuclear weapons program. It is even possible to make a nuclear explosive with low-quality plutonium, such as is found in power reactors. It's a chemical process developed for the nuclear weapons program, to separate plutonium from everything else that comes out of a reactor. Weapons require very pure plutonium, and that's what PUREX delivers. The pyroprocess used in the IFR is very different. It not only does not, it cannot, produce plutonium with the chemical purity needed for weapons.

#### **IFR’s are safe and meltdown-proof** [sodium coolant, passive shut-down]

Archambeauet all 11 [The Integral Fast Reactor (IFR): An Optimized Source for Global Energy Needs, Charles Archambeau, Science Council for Global Initiatives, Randolph Ware, Cooperative Institute for Research in Environmental Sciences, Tom Blees, National Center for Atmospheric Research, Barry Brook, University of Adelaide, Jerry Peterson, Argonne National Laboratory,¶ Yoon Chang, University of Colorado, February 2011]

The IFR fast reactor uses metal fuel rather than one of the oxide fuels which are used in¶ LWR and other Generation II and III reactors. The metal fuel expands when heated, so in¶ the event of accidental reactor core over-heating, the density of the metal fuel will rapidly¶ decrease and cause a rapid drop in the number of neutron collisions with Uranium atoms¶ per unit volume of fuel. This drop will result in a termination of the nuclear chain reaction.¶ Hence reactor core overheating from any cause will result in a fuel density decrease¶ followed by a termination of the chain reaction and the automatic shut down of the reactor.¶ This whole reaction chain is called a passive shut-down because no operator action, or¶ automatic electronic sensor driven feed-back system, is needed. This passive safety feature¶ is an important and robust addition to fast reactor operational safety which is not found in¶ LWR and other open cycle reactors. Consequently, the resistance to core melt-down in¶ these IFR reactors is extremely high, with near vanishing probability of such an event¶ occurring in the life-time of the reactor. As well as metal fuel use, the IFR uses metal¶ coolant (sodium preferred) which allows safe operation at high output temperatures leading¶ to greater efficiency and lower reactor fabrication costs. The IFR metal coolant pool is also¶ a large heat sink which safely absorbs the excess heat in the reactor core after passive shutdown.

#### Meltdowns once ever 400,000 years

**Kirsch 9** [Steve Kirsch, founder and CEO of multiple tech companies collectively worth over %241 billion and MS in Electrical Engineering and Computer Science from MIT, November 2009, "Why We Should Build an Integral Fast Reactor Now,"]

¶ Q. Is it safe? How often can we expect to see a meltdown?¶ ¶ For the GE S-PRISM design, if the entire planet used IFRs, we can reasonably expect an accident once every 380,000 years according to the probabilistic risk scenarios calculated by GE.

#### IFR fuel can be obtained from seawater – makes energy infinite

Archambeauet all 11 [The Integral Fast Reactor (IFR): An Optimized Source for Global Energy Needs, Charles Archambeau, Science Council for Global Initiatives, Randolph Ware, Cooperative Institute for Research in Environmental Sciences, Tom Blees, National Center for Atmospheric Research, Barry Brook, University of Adelaide, Jerry Peterson, Argonne National Laboratory,¶ Yoon Chang, University of Colorado, February 2011]

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.

#### Substantially expanding federal loan guarantees is critical -- investors are watching closely -- only the aff reassures them and jumpstarts the nuclear industry.

**Lyash, ‘7**

[Jeffrey, President and CEO -- Progress Energy Florida, 6-19, “DEPARTMENT OF ENERGY OFFICE OF THE CHIEF FINANCIAL OFFICER HOLDS A MEETING TO PROPOSE POLICIES AND PROCEDURES APPLICABLE TO THE DEPARTMENT OF ENERGY'S LOAN GUARANTEE PROGRAM AUTHORIZED BY TITLE XVII OF THE ENERGY POLICY ACT OF 2005,” Political Transcript Wire, Lexis]

In my comments today, I want to emphasize the critical importance of having a workable federal Loan Guarantee Program for new nuclear power projects and for the Department of Energy to send a strong, clear signal that the federal government supports commercial nuclear operations as a part of our solution. Given the growth our region faces and the obligation our utilities have to provide for future power needs of the population, I feel a keen sense of urgency on this topic. So do many of our state and federal policy-makers. And Wall Street is watching very closely. Progress Energy is a member of the Nuclear Energy Institute, which has already made comments this morning. And we fully support the seven principles that NEI calls for to guide in the design of the energy Loan Guarantee Program. As NEI states in its comments, this loan program is the most important part of the Energy Policy Act incentives to address the major challenge facing nuclear power expansion, that is the challenge of construction financing for these very large and long lead-time capital projects. Progress Energy has been safely operating nuclear power plants for more than 35 years. Much of my own career has been in the nuclear field. We now have five nuclear reactors currently in operation and we are working on license applications for two more nuclear projects, two units each, one project in Florida and one in North Carolina. In fact, for our Florida project, we've selected a site and a technology. We're I the process of developing the necessary permitting and license applications. And we are driving toward 2016 in-service date for that first unit. This is an active project. I want to make three points. First, population and economic growth are driving the demand for electricity and forcing utilities and states to make near-term decisions about how to meet that growth. At Progress Energy Florida alone, we are adding 40,000 new customers each year. And we project that will continue and that the demand for electricity will grow by 25 percent in the next 10 years in our service territory. Second, in our state and nation, nuclear power is an essential part of a balanced solution to meeting these growing energy needs in a way that is environmentally responsible. The issues of climate change and energy security reinforce the case for increased nuclear-powered generation. That was true when Congress enacted the Energy Policy Act of 2005. And it is even more true today. At Progress Energy, our balanced approach to growth includes increased energy efficiency, alternative and renewable energy, but they're not enough. So is includes construction of state-of-the-art power plants. Regarding that last element, our company, as I said, is actively pursuing the possibility of building two nuclear projects. The first unit for Florida nuclear project would need to be in service around 2016. And what that means is that we must make decisions in the next year or so about whether to go forward If we cannot prudently proceed with a nuclear unit, we will need to change course. And that course will be back toward fossil-based generation -- gas or coal. Several folks have pointed out the policy and energy security implications of continuation of that trend. That leads me to my third point, the one most important for the matter at hand. While I am encouraged by the momentum that is building in favor of new nuclear plants in this country, especially in Florida, a critical missing piece is having a realistic, workable Loan Guarantee Program, one that is large enough and structured in a commercially reasonable way such that it will make a difference. Absent that tangible support, it will be difficult for the new nuclear plants now being considered to go forward because of the financial strain on the companies involved. Congress did its part in 2005 by establishing the broad framework for U.S. energy policy, with nuclear power as an important element. Concerned about fuel diversity and price stability, the Florida legislature and the governor did their part last year by approving legislation specifically and directly supportive of new nuclear plants, including greater assurance of cost recovery. Then, earlier this year, the Florida Public Service Commission also did its part by adopting the implementation rules in support of that legislation. Also, week by week, we are seeing more and more support for nuclear energy from community leaders, the news media and others throughout Florida and beyond. Moreover, just last week in Florida, the Public Service Commission took action that discouraged new pulverized coal plants while reinforcing the need for new nuclear plants to increase the state's fuel diversity. All of that positive momentum for nuclear expansion is good. It's very good, but it is not sufficient. The magnitude of these nuclear capital projects is such that it requires a workable federal Loan Guarantee Program, especially for the initial plants. The $9 billion being considered for the entire energy loan program is hardly enough, much less the $4 billion of that set aside for nuclear projects. Consider that the cost of one nuclear project would be 30 percent to 40 percent of the total market capitalization of Progress Energy, one, and would roughly double the size of the utility assets we own in Progress Energy Florida. You can begin to see the significant financial risk involved and the reason there's such a strong need for a federal Loan Guarantee Program. On behalf of Progress Energy, I'd like to ask the Department of Energy to do its part to support commercial nuclear expansion as one element of a balanced approach to meeting our nation's energy future. The demand for energy is driving the need for new generation and near-term decisions. Nuclear power is an essential part of a diverse energy mix. And a realistic federal Loan Guarantee Program is a critical missing piece we need as soon as possible.

#### State action is already happening and insufficient -- unequivocal federal support through loan guarantees are critical to reinvigorate nuclear power industry

Bowman, ‘8

[Frank, President and Chief Executive Officer Nuclear Energy Institute, CQ Congressional Testimony, 6-19, “Greenhouse Gas Emission Reduction,” Lexis]

In terms of new nuclear plant construction, one of the most significant financing challenges is the cost of these projects relative to the size, market value and financing capability of the companies that will build them. New nuclear power plants are expected to cost at least $6 to 7 billion. U.S. electric power companies do not have the size, financing capability or financial strength to finance new nuclear power projects on balance sheet, on their own-particularly at a time when they are investing heavily in other generating capacity, transmission and distribution infrastructure, and environmental controls. These first projects must have financing support-either loan guarantees from the federal government or assurance of investment recovery from state governments, or both. The states are doing their part. Throughout the South and Southeast, state governments have enacted legislation or implemented new regulations to encourage new nuclear plant construction. Comparable federal government commitment is essential. The modest loan guarantee program authorized by the 2005 Energy Policy Act was a small step in the right direction, but it does not represent a sufficient response to the urgent need to rebuild our critical electric power infrastructure. We believe the United States will need something similar to the Clean Energy Bank concept now under consideration by a number of members of Congress-a government corporation, modeled on the Export-Import Bank and the Overseas Private Investment Corporation, to provide loan guarantees and other forms of financing support to ensure that capital flows to clean technology deployment in the electric sector. Creation of such a financing entity should be an integral component of any climate change legislation. Such a concept serves at least two national imperatives. First, it addresses the challenge mentioned earlier-the disparity between the size of these projects relative to the size of the companies that will build them. In the absence of a concept like a Clean Energy Bank, new nuclear plants and other clean energy projects will certainly be built, but in smaller numbers over a longer period of time. Second, federal loan guarantees provide a substantial consumer benefit. A loan guarantee allows more leverage in a project's capital structure, which reduces the cost of capital, in turn reducing the cost of electricity from the project. Electricity consumers-residential, commercial and industrial-are already struggling with increases in oil, natural gas and electricity prices. The high cost of energy and fuel price volatility has already compromised the competitive position of American industry. We know that the next generation of clean energy technologies will be more costly than the capital stock in place today. In this environment, we see a compelling case for federal financing support that would reduce consumer costs. If it is structured like the loan guarantee program authorized by Title XVII of the 2005 Energy Policy Act, in which project sponsors are expected to pay the cost of the loan guarantee, such a program would be revenue-neutral and would not represent a subsidy. The public benefits associated with a robust energy loan guarantee program-lower cost electricity, deployment of clean energy technologies at the scale necessary to reduce carbon emissions-are significant. That is why the U.S. government routinely uses loan guarantee programs to support activities that serve the public good and the national interest-including shipbuilding, steelmaking, student loans, rural electrification, affordable housing, construction of critical transportation infrastructure, and for many other purposes. Achieving significant expansion of nuclear power in the United States will require stable and sustained federal and state government policies relating to nuclear energy. The new nuclear power projects now in the early stages of development will not enter service until the 2016-2020. Like all other advanced energy technologies, continued progress requires sustained policy and political support. In closing let me assure you that the U.S. nuclear industry is moving forward as quickly as we are able to license, finance and build new nuclear plants in the United States. Seventeen companies or groups of companies are preparing license applications for as many as 31 new reactors. Nine applications for construction and operating licenses are currently under review by the Nuclear Regulatory Commission for a total of 15 new plants. We expect four to eight new U.S. nuclear plants in operation by 2016 or so. Assuming those first plants are meeting their construction schedules and cost estimates, the rate of construction would accelerate thereafter. With the necessary investment stimulus and financing support, we could see approximately 20,000 MW of new nuclear capacity (that would be about 15 plants) on line in the 2020 to 2022 time frame, and 65,000 to 70,000 megawatts (or 45 to 50 plants) by 2030. These plants will produce clean, safe, reliable electricity, around the clock, at a stable price, immune to price volatility in the oil and natural gas markets.