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#### 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 causes extinction

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

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

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

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

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

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

**Kirsch 9** (Steve Kirsch, Bachelor of Science and a Master of Science in electrical engineering and computer science from the Massachusetts Institute of Technology, American serial entrepreneur who has started six companies: Mouse Systems, Frame Technology, Infoseek, Propel, Abaca, and OneID, "How Does Obama Expect to Solve the Climate Crisis Without a Plan?" 7/16/9) [http://www.huffingtonpost.com/steve-kirsch/how-does-obama-expect-to\_b\_236588.html-http://www.huffingtonpost.com/steve-kirsch/how-does-obama-expect-to\_b\_236588.html](http://www.huffingtonpost.com/steve-kirsch/how-does-obama-expect-to_b_236588.html-http%3A//www.huffingtonpost.com/steve-kirsch/how-does-obama-expect-to_b_236588.html)

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

### 3

#### Peak uranium by the end of the decade – fuel recycling key to solve

**Crawford 11** [“Peak Uranium By 2015?”, 6/22/11, Black Swan Insights, Nathaniel Crawford—B.A. from Occidental College, 9 years of experience in financial markets, as stock trader, bonds trader, investor, and analyst]

A new research report says yes. The report goes on to say that short of a complete nuclear phase-out, the world will run out of uranium by the end of the decade. Here are the major conclusions:¶ • A production decline from essentially all mines operating on particular deposits is unavoidable during the present decade.¶ • This decline can only be partially compensated by the planned new mines.¶ • Assuming that all new uranium mines can be opened as planned, annual mining will be increased from the 2010 level of 54 ktons to about 58 ± 4 ktons in 2015.¶ • After 2015 uranium mining will decline by about 0.5 ktons/year up to 2025 and much faster thereafter. The resulting maximal annual production is predicted as 56 ± 5 ktons (2020), 54 ± 5 ktons (2025) and 41 ± 5 ktons (2030).¶ Assuming that the demand side will be increased by 1% annually, we predict both shortages of uranium and (inflation-adjusted) price hikes within the next five years.¶ ........¶ Therefore, assuming that a global slow phase-out scenario will not be chosen on a voluntary basis, we predict that the end of the cheap uranium supply will result in a chaotic phase-out scenario with price explosions, supply shortages and blackouts in many countries.¶ To read the full report: click here¶ The report contends that the only way for supply to keep up with demand would be if the US and Russia recycle their nuclear weapons into low enriched uranium fuel. The Russians have been doing this since 1993 under the Megatons to Megawatts program, but the program is expected to end in 2013. The Russians have indicated that they do not expect to renew the program.

**That will trigger a war over uranium access—escalates to nuclear use**

**Konstantiov 12 –** professor of math at Moscow State and member of numerous scientific/geological councils

(Mihail Konstantiov, Professor of Mathematics with the University of Architecture, Civil Engineering and Geodesy (UACEG), Bulgaria, Vice-Chancellor of UACEG (1999-2003), Member of scientific councils and commissions, Member of the Board of IICREST. He has authored 30 books and over 500 scientific papers. He has participated in international scientific projects of EU and NATO and realized research and lecturing visits in British, German and French universities. Prof. Konstantinov has been Member and Vice Chair of the Central Election Commission of Bulgaria and Voting coordinator of OSCE (1997-) as well as the Bulgarian representative at the Council of Europe on electronic voting. In addition to his scientific publications, he has authored more than 300 articles in Bulgarian editions devoted to social and political issues with emphasis on election practice and legislation., “Uranium time bomb ticking”, Europost, 2-11-2012, http://www.europost.bg/article?id=3763)

In 1945, the US had three nucle­ar bombs - two plu­to­ni­um-based devi­ces and a ura­ni­um-based one. The first one was det­o­nat­ed on a test site in New Mex­i­co, and the sec­ond and third ones over Jap­a­nese ter­ri­to­ry. On 6 August 1945, the then-only ura­ni­um-based bomb was thrown over the Jap­a­nese city of Hiro­shi­ma. What hap­pened is well known and I will not re-tell it. More­over, this sto­ry deals with nucle­ar weap­ons but they are not the main char­ac­ters. Almost 20 years ago, an agree­ment was inked under which the US under­took to help dis­man­tle Rus­sian nucle­ar war­heads and con­vert the ura­ni­um from them into fuel for nucle­ar reac­tors. The rea­son is sim­ple - the pro­ce­dure is expen­sive, Rus­sia was weak and poor at the time, and in addi­tion, Amer­i­can tech­nol­o­gy back then was sig­nif­i­cant­ly ahead of the Rus­sian one. The amounts of con­vert­ed ura­ni­um are mas­sive - more than 500 ton­nes. Thus Rus­sian ura­ni­um turns into fuel for US nucle­ar pow­er plants. At present, this fuel is used to pro­duce 10% of the elec­tri­cal pow­er in the US. This is more than the ener­gy pro­duced from renew­a­ble sour­ces, such as sun, wind and water, there. This idyll, how­e­ver, is com­ing to its end. First, the US-Rus­sia agree­ment for Rus­sian war­heads con­ver­sion expires next year and Rus­sia is high­ly unlike­ly to extend it. More­over, Rus­sians now have good tech­nol­o­gy for that pur­pose and will prob­a­bly want to leave their ura­ni­um for them­selves. And sec­ond, if the agree­ment is extend­ed, the amounts of war­heads sub­ject to dis­man­tling will soon be exhaust­ed any­way as the agreed lim­its are reached. Glob­al mar­kets have already start­ed sus­pect­ing what is going to hap­pen with the expir­ing US-Rus­sia agree­ment for war­head ura­ni­um. And not only with it. Indeed, ura­ni­um oxide pri­ces have gone wild sur­ging to almost $70/lb (1lb is 454 gr.) in Jan­u­ary this year from $40/lb in Sep­tem­ber 2011. Such a 70% ral­ly in ura­ni­um price over just 3-4- months is not sus­tain­a­ble and even a cer­tain edg­ing down can be expect­ed. Still, the **trend** is clear - ura­ni­um dearth is loom­ing, as well as dearth of oth­er stra­te­gic nat­u­ral resour­ces. We have repeat­ed­ly stat­ed this but let us under­score it again. The glob­al cri­sis is **most of all** a resource cri­sis. It is finan­cial inso­far as it has became clear that the sys­tem allow­ing some peo­ple to print mon­ey while oth­ers work and bring them oil and oth­er goods will not last for good. The antic­i­pat­ed ura­ni­um short­age in the com­ing dec­ade is tru­ly strik­ing and is esti­mat­ed at 500m lb! One of the rea­sons is the fast devel­op­ing econ­o­mies of Chi­na and India, along with oth­er coun­tries like Bra­zil and Tur­key. It is where the bulk of the 147 reac­tors expect­ed to become oper­a­tion­al in these 10 years will be locat­ed. **A major consum­er** of ura­ni­um, the US cur­rent­ly has a demand for 60m lb a year but pro­du­ces only 3m lb. Still, this is the way things are at present. And what will hap­pen aft­er the US Nucle­ar Reg­u­la­to­ry Com­mis­sion reviews and poten­tial­ly approves new nucle­ar reac­tor pro­pos­als? They are 26 or so. And more are in the pipe­line. The sit­u­a­tion in India is even more dra­mat­ic - an increase in the share of nucle­ar ener­gy in elec­tric­i­ty pro­duc­tion is expect­ed from 2.5% at present to 25%. In oth­er words, India will need 10 times as much ura­ni­um as it does now if the far-reach­ing plan is put to prac­tice. Chi­na has more hum­ble aspi­ra­tions and is gear­ing to raise the share of nucle­ar facil­i­ties in elec­tric­i­ty pro­duc­tion only ...three times. And Chi­na, much like the US, does not have suf­fi­cient domes­tic sup­ply. We can con­tin­ue with sta­tis­tics, but things are evi­dent any­way. A war is around the cor­ner. In the best-case sce­nar­io, this will be a price war over ura­ni­um and in par­tic­u­lar ura­ni­um oxide. Pri­ces in the order of $100 or even $200/lb no longer seem far-fetched. Price lev­els of $500-$1000-$2000/lb have even been men­tioned and this will have its swift and dras­tic impli­ca­tions. Still, if a reac­tor costs $4bn, why not pay $1000/lb of ura­ni­um? Or else, the 4-bil­lion invest­ment will go down the drain. Anoth­er explod­ing glob­al mar­ket is the one for rare earth ele­ments with hard-to-pro­nounce Lat­in names such as Neo­dym­i­um, Ceri­um, Lan­tha­num, Gal­li­um, Gado­lin­i­um, Thu­li­um… If we have a look at Men­de­leev's peri­od­ic table, they are squeezed some­where at the bot­tom. But then, all the elec­tron­ics around us, all com­put­ers, fibre optics, all sat­el­lites and in gen­er­al every­thing under­ly­ing our high-tech civ­il­i­za­tion would be utter­ly impos­si­ble but for these exot­ic hard-to-extract ele­ments. The price of each of them has dou­bled and tri­pled in a year alone. And the pri­ces of some of them have soared six­fold in the same peri­od. Com­pared with rare earth ele­ments, gold and plat­i­num are like a tame kit­ten. It nat­u­ral­ly eats and swells but at a rate of only up to 40% a year. And what about the lith­i­um under­ly­ing the idea of elec­tric vehi­cles stag­ing a mass entrance into our dai­ly life and econ­o­my if and when oil is exhaust­ed? But it is in rare ele­ments where the secret of future skir­mish­es over resour­ces lies. Because across the world, they are real­ly hard to extract but Chi­na holds 97% of their glob­al pro­duc­tion! No mis­take, Chi­na pro­du­ces 33 times as much rare met­als as the rest of the world. This may as well be changed some day as cur­rent­ly huge efforts and mon­ey are put into look­ing for rare met­als around the globe. Hypo­thet­i­cal­ly, only a third of the res­erves is in Chi­na with the oth­er two thirds lying some­where else. Too bad it is any­one's guess where, although Cana­da, South Afri­ca and some Afri­can coun­tries are con­sid­ered prom­is­ing in this regard. Still, for the time being this is how things are: Chi­na has almost every­thing and the rest of the world hard­ly any­thing. Does any­one have any doubts why Chi­na has the ambi­tion to become the top dog? Of course, the world is by no means tread­ing water in one oth­er respect: sub­sti­tute tech­nol­o­gies are sought for that would not be so crit­i­cal­ly depend­ent on rare earth ele­ments, yet, more in the long rath­er than short run. By the way, why are we dis­cuss­ing ura­ni­um pri­ces along with all oth­er sorts of pri­ces in US dol­lars? The answer is clear: because the dol­lar is the glob­al reserve cur­ren­cy. The rea­son for this, though, is more com­pli­cat­ed. True, the US is the larg­est econ­o­my for the time being. But it is also among the most indebt­ed coun­tries in the world. And its debt is increas­ing­ly sur­ging. Still, this is not the most impor­tant. The most impor­tant thing is that the US has the most pow­er­ful, most mobile and one of the most effect­ive armies in the world. Lit­tle like­ly is it for some­one to reject the US dol­lar as a reserve cur­ren­cy while the 82nd Air­borne Divi­sion of the US Army, based at Fort Bragg North Car­o­li­na, is the holy ter­ror it is at the moment. And there is much more to it than the 82nd Divi­sion. So the time bomb of ura­ni­um and rare earth ele­ments dearth is tick­ing. And lit­tle idea do we have of the time it is set for. Or wheth­er, when it final­ly goes off, some­body might remem­ber the first mas­sive appli­ca­tion of ura­ni­um, which turned thou­sands into ash­es some 67 years ago. **And be temp­ted to use it again**. For 67 years now, we have been show­ing rea­son and sur­viv­ing. Let us hope fierce defi­cien­cy of nat­u­ral resour­ces, food and water that is loom­ing will not take it away from us.

#### Perception key—uranium’s role in nuclear weaponization makes militarization of its insecurity inevitable

**Meierding ’11**

(Emily, “Energy Security and Sub-Saharan Africa”, International Review of Politics and Development (translated from French), 2011, http://poldev.revues.org/744)

However, the economic ease of raw material access is only one aspect of international uranium security concerns. Given uranium’s role in nuclear weapons technology, resource control is also regarded as a military security issue. These concerns can be overblown; raw uranium poses little military threat. In order to ‘weaponise’ the material, it must be mined, milled to create yellowcake, converted into a gas, then enriched to increase its percentage of U-235, the fissile isotope. Usually, only the first two of these steps occur in less developed, uranium-endowed countries. Since enrichment is extremely costly, few states have developed domestic facilities, especially for enriching up to the 90 per cent U-235 threshold required to fuel research reactors and create nuclear weapons. Most enriched uranium is currently produced by only three companies, namely Russia’s Rosatom, Europe’s Enrichment Technology Company and the United States Enrichment Corporation.7 Thus, there is usually a geographic disconnect between suppliers of raw uranium resources and sites of potential military insecurity. Nonetheless, even limited insecurity in uranium-endowed states can have broad political repercussions; in 2003 American officials used reports of the transmission of yellowcake from Niger into Iraq to reinforce their claims that Saddam Hussein posed an imminent threat to international security prior to the US invasion (Hersh, 2003).

#### IFR solves uranium mining globally

**The Energy Collective 11** [“The Integral Fast Reactor (IFR): An Optimized Source for Global Energy Needs”, Charles Archambeau (1), Randolph Ware (2,3), Tom Blees (1), Barry Brook (4), Yoon Chang (5), Jerry Peterson (6), Robert Serafin (3), Joseph Shuster (1), Tom Wigley (3), 1: Science Council for Global Initiatives, 2: Cooperative Institute for Research in Environmental Sciences, 3: National Center for Atmospheric Research, 4: University of Adelaide, 5: Argonne National Laboratory, 6: University of Colorado, You can find a description of many of the co-authors (Archambeau, Blees, Brook, Chang and Shuster) on the Science Council for Global Initiatives website. Others include climatologist Tom Wigley, UCAR radiometrician Randolf Ware, Physics Prof Jerry Peterson and Robert Serafin, past director of the National Center for Atmospheric Research (NCAR) and past president of the AMS. All highly credentialed professionals from a variety of fields relevant to climate change, nuclear engineering and physics, technology development, and business, The Energy Collective, Jan 31, 2011]

Nuclear power, however, is capable of providing all the carbon-free energy that mankind requires, although the prospect of such a massive deployment raises questions of uranium shortages, increased energy and environmental impacts from mining and fuel enrichment, and so on. These potential roadblocks can all be dispensed with, however, through the use of fast neutron reactors and fuel recycling.The Integral Fast Reactor (IFR), developed at U.S. national laboratories in the latter years of the last century, can economically and cleanly supply all the energy the world needs without any further mining or enrichment of uranium. Instead of utilizing a mere 0.6% of the potential energy in uranium, IFRs capture all of it. Capable of utilizing troublesome waste products already at hand, IFRs can solve the thorny spent fuel problem while powering the planet with carbon-free energy for nearly a millennium before any more uranium mining would even have to be considered. Designed from the outset for unparalleled safety and proliferation resistance, with all major features proven out at the engineering scale, this technology is unrivaled in its ability to solve the most difficult energy problems facing humanity in the 21st century.

#### Uranium mining causes massive amounts of structural violence

Gerritson, 09 [“Uranium Mining Poisons Native Americans”, Jeff, Culture Change, <http://www.culturechange.org/cms/content/view/336/1/>]

Nuclear power is often billed as clean base-load electrical energy. However, few if any nuclear power proponents mention the unintended consequences or the externalized costs associated with this technology to support the unsustainable U.S. lifestyle. A crucial part of this story is told by Native Americans. ¶ I have included three shocking, detailed articles outlining these unintended consequences impacting the Native Americans in South Dakota and neighboring states -- in particular the Cheyenne River radiation poisoning from nearby uranium mining impacting the Pine Ridge Indian Reservation.¶ Regarding the nuclear power industry, unfortunately, I have a "horse" in this race -- my daughter and son-in-law, both engineers working on nuclear power plants. As a parent and activist who looks down the road to future generations, I suspect future historians will regard with contempt our ill-conceived and childish foray into nuclear power. I doubt history will judge us favorably. About some of the conversations my family has, as we are polar opposites -- let's just say the discussions are rather lively! ¶ In the first article, Shelly Bluejay Pierce writes about uranium mining poisoning the Cheyenne River on the Pine Ridge Indian Reservation. This 2007 article's issues have not been addressed (see the present-day update at bottom of this report). The uranium mining wastes have not been cleaned up from the river or surrounding countryside. The second article, written by Charmaine White Face, provides a brief outline of uranium mining -- calling it FACT SHEET: America's Secret Chernobyl. ¶ The last article is an impassioned history, full of painful fact, by the Lakota as detailed in their Bring Back The Way campaign. ¶ While uranium mining tailings and wastes are not high graded into pure uranium, they nonetheless pose a significant health risk that will be with us for many hundreds of thousand years. Is this a legacy you want to leave to our future generations? I would think not! Contact your local, state, and federal representatives and demand action. There must be real clean-up and a stop to the mining, production, and use of these radioactive materials altogether. We must question our power "needs." - JG ¶ Radiation Warning Signs Placed on Cheyenne River by Shelley Bluejay Pierce, Native American Times Correspondent, July 29, 2007 ¶ Radiation warning signs were posted on Wednesday, July 18, 2007 in the small town of Red Shirt, South Dakota which lies on the northwest corner of the Pine Ridge Reservation. Several of these signs were placed warning people of the high nuclear radiation levels found in the Cheyenne River. ¶ Several weeks ago Everitt Poor Thunder, a spiritual and community leader in Red Shirt, asked Defenders of the Black Hills, an environmental organization, whether the Cheyenne River water could be used to irrigate a community garden. A local well could not be used as it was found to be radioactive and warning signs surround that structure. The water well taps into the Inyan Kara aquifer that also contains the Lakota and Fall River formations, making up an extremely large aquifer of water supplies for many regions. ¶ Residents of Red Shirt occupy a village site that is thousands of years old to the Oglala Tetuwan (Sioux) people. Many have lived here all of their lives, growing gardens with water taken from the Cheyenne River and fishing for catfish, bass, and turtles. In the summer months, the river is used for swimming and other recreational pursuits. ¶ A water sample taken from the Cheyenne River was sent to a laboratory and the results revealed levels of alpha radiation above the Environmental Protection Agency's (EPA) Maximum Contaminant Level. Alpha radiation causes harm when ingested hence the warning signs were placed to warn people of the dangers in the Cheyenne River. ¶ The portion of the Cheyenne River Basin that lies in southwestern South Dakota drains about 16,500 square miles within the boundaries of the state. The area in this basin includes part of the Black Hills and Badlands, rangeland, irrigated cropland, and mining areas. After traversing the western half of the state from southwest to northeast, the Cheyenne River flows into Lake Oahe, a reservoir on the Missouri River. ¶ Previous efforts remove the radiation in the water at Red Shirt have been unsuccessful. Drinking water is piped in, or residents must drive 25 miles to the little town of Hermosa to buy water. The Cheyenne River has dried up approximately one mile from Red Shirt and tests of the river bottom soil by Defenders of the Black Hills are pending. Initial tests using a Geiger counter revealed more than double the amount of normal background elevations for radiation. ¶ South Dakota news reports recently referred to a DENR report and stated that uranium is naturally occurring in that area which is said to account for the radiation levels in the water. ¶ “If that was the case, there would not have been villages there for thousands of years. There would have been no fish or any aquatic life previously in this river. We sampled the river with nets for aquatic life and found only 2 crayfish and about 10 minnows in more than 100 yards of the river. In essence, it's a dead river. There are two endangered species that use this River: the Sturgeon chubb, a small fish, and the Bald Eagle,” explained Charmaine White Face, founder and Coordinator of Defenders of the Black Hills. ¶ According to published information in the The 2006 South Dakota Integrated Report For Surface Water Quality Assessment the Cheyenne River water quality continues to be generally poor. The lower Cheyenne drainage, in general, contains a high percentage of erodible cropland and rangeland in west central South Dakota. Historical mining records for the state show more than 4,000 exploratory uranium mining holes, some large enough for a man to fall into, in the southwestern Black Hills with an additional 3,000 holes just 10 miles west of the town of Belle Fourche, SD. These mining holes go to depths of 600 feet. ¶ At a meeting for the Defenders of the Black Hills on Feb 26th 2005, discussions centered on the radiation levels in some areas reported at a staggering 1,400 times higher than the ordinary background radiation on the Grand River in the Cave Hills and the adverse affects to the villages on the Standing Rock Indian Reservations. Also discussed was the high proportion of cancer related illnesses and birth defects especially in the small community of Rock Creek. ¶ “There are also hundreds of abandoned uranium mines in Wyoming whose runoff comes down the Cheyenne River, and also 29 abandoned mines in the southwestern Black Hills, all upstream of Red Shirt Village. One of the largest open-pit abandoned uranium mines in the southern Black Hills is a square mile and its runoff goes into the Cheyenne River,” explained Charmaine White Face. ¶ Most recently, a Canadian mining company, Powertech, began drilling uranium exploratory wells in the Dewey Burdock area northwest of Edgemont. Defenders of the Black Hills battled in court against the drilling permit allowing Powertech to drill 155 more exploratory wells at depths of 500-600 feet in the southwestern Black Hills but the Courts allowed the drilling after denying the appeal. Powertech currently has 4,000 uncapped, and unmarked uranium exploratory wells drilled previously. The mining company plans on doing In Situ Recovery (ISR) of uranium from the Lakota and Fall River aquifers. In Situ Recovery was formerly known as In Situ Leach (ISL) mining. ¶ During the ISR process, a solution to dissolve the uranium is poured down the wells and the dissolved uranium brought back up to the surface. The uranium is separated from the remaining radioactive waste solution that is then reinjected into the aquifer after being held in waste ponds on the surface. ¶ According to Powertech's mining application, each exploratory drill hole "will have a small excavated mud pit that will be approximately 12 feet by 5 feet" and 10 feet deep. ¶ Among the concerns of the environmental groups are the possibility of overflow from the mud pits with the sudden rain showers that occur in the Black Hills. One of the aquifers empties directly into the Cheyenne River and is used by many ranchers to water their livestock. Among the deeper aquifers of concern is the Madison that provides water for many western South Dakota communities. ¶ “A list of uranium mining facts provided online by our organization, Defenders of the Black Hills, reveals a long history of abuses regarding uranium and coal mining in the Upper Midwest region. In an area of the USA that has been called “the Bread Basket of the World,” more than forty years of mining have released radioactive polluted dust and water runoff from the hundreds of abandoned open pit uranium mines, processing sites, underground nuclear power stations, and waste dumps. Our grain supplies and our livestock production in this area have used the water and have been exposed to the remainders of this mining. We may be seeing global affects, not just localized affects, to the years of uranium mining” concluded Charmaine White Face. ¶ In another article by Charmaine White Face, she provides a brief outline to uranium mining -- calling it America's Secret Chernobyl [below]. The term Chernobyl has an interesting origin. In Russian, Chernobyl translates to Wormwood. Wormwood relates to several aromatic plants of the genus Artemisia, especially A. absinthium, native to Europe, yielding a bitter extract used in making absinthe and in flavoring certain wines -- that is adds a bitter taste. In classical literature, wormwood was metaphorical for bitter sorrow. When history writes its review of our foray into nuclear power, will we be regarded with "bitter sorrow"? ¶ Abandoned uranium mine in Black Hills National Forest, South Dakota. The Comprehensive Environmental Response, Compensationsation and Liability Act (CERCLA) was used to clean up this site.¶ Uranium Mining and Nuclear Pollution in the Upper Midwest: F A C T S H E E T America's Secret Chernobyl By Charmaine White Face, Coordinator Defenders of the Black Hills ¶ 1. Uranium mining in South Dakota, Wyoming, Montana, and North Dakota began in the middle of the 1960s. World War II, which ended with the nuclear bomb, introduced the use of nuclear energy for the production of electricity and caused the price of uranium to rise. As the economy of the Midwestern states depends primarily on agriculture, when uranium was discovered in the region, many get-rich-quick schemes were adopted. Not only were large mining companies pushing off the tops of bluffs and buttes, but small individual ranchers were also digging in their pastures for the radioactive metal. Mining occurred on both public and private land, although the Great Sioux Nation still maintains a claim to the area through the Fort Laramie Treaties of 1851 and 1868. ¶ 2. In northwestern South Dakota, for example, the Cave Hills area is managed by the US Forest Service. The area currently contains 89 abandoned open-pit uranium mines. Studies by the USFS show that one mine alone has 1400 mR/hr of exposed radiation, a level of radiation that is 120,000 times higher than normal background of 100 mR/yr. There are no warning signs posted for the general public anywhere near this site! It is estimated that more than 1,000 open-pit uranium mines and prospects can be found in the four state region from a map developed by the US Forest Service. ¶ 3. The water runoff from the Cave Hills abandoned uranium mines empties into the Grand River which flows through the Standing Rock Indian Reservation. Three villages are located on the Grand River and their residents have used the water for drinking and other domestic purposes for generations. One village still uses the water for drinking and domestic purposes. The water runoff from the Slim Buttes abandoned uranium mines empty into the Morreau River which flows through the Cheyenne River Indian Reservation. Four villages are located on the Morreau River; however no data is currently available about their use of the Morreau River water. Both of these rivers empty into the Missouri River which empties into the Mississippi River. ¶ 4. The following agencies are aware of these abandoned uranium mines and prospects: US Forest Service, US Environmental Protection Agency, US Bureau of Land Management, SD Department of Environment and Natural Resources, the Bureau of Indian Affairs and the US Indian Health Service. Only after public concern about these mines was raised two years ago did the USFS and the EPA pay for a study of one mine this year, 2006. ¶ 5. In Southwestern South Dakota, the southern Black Hills also contain many abandoned uranium mines. Nuclear radiation near Edgemont, SD, has already polluted the underground water of the Pine Ridge Indian Reservation according to a study completed in 1980 by Women of All Red Nations. The US Air Force also used small nuclear power plants in their remote radar stations and missile silos which number in the hundreds in this four State region. No data is available on the current status or disposal of these small nuclear power sources. ¶ 6. More than 7,000 exploration holes for uranium have been drilled in the southwestern and northwestern Black Hills. More are being planned in Wyoming. These holes go to depths of 800 feet. The exploratory process itself allows radioactive pollutants to contaminate underground water sources. South Dakota currently has no regulations for In Situ Leach mining of uranium. ¶ 7. In Wyoming, hundreds of abandoned open-pit uranium mines and prospects can be found in or near the coal in the Powder River Basin. Yet plans are being made to ship more of that coal to power plants in the Eastern part of the United States. Radioactive dust and particles will be released into the air at the power plants as well as locally in the strip mining process. Federal tax dollars totaling more than $2.3 billion dollars as a loan are planned to be given to a private business, the Dakota, Minnesota and Eastern Railroad, to increase the amount of coal hauled to the power plants. Two other railroads currently haul coal out of this area. ¶ 8. In 1972, President Richard Nixon signed a secret Executive Order declaring this four State region to be a 'National Sacrifice Area’ for the mining and production of uranium and nuclear energy. This is the same area of the 1868 Fort Laramie Treaty territory, the final home of the Great Sioux Nation. ¶ Summary This Fact Sheet regarding the past uranium mining and small underground nuclear power plants in the Upper Midwest region should give cause for alarm to all thinking people in the United States. This is the area that has been called “the Bread Basket of the World.” It is for this reason that we are bringing this issue to your attention. For more than forty years, the people of South Dakota and beyond have been subjected to radioactive polluted dust and water runoff from the hundreds of abandoned open pit uranium mines, processing sites, underground nuclear power stations, and waste dumps. Pollution does not stop at State boundaries so these places generating radioactive pollution to the air and water are also impacting the rest of the United States. Coal tainted with uranium and radiation that has gone and is going to Eastern power plants adds to the total amount of radioactive pollution. There needs to be a concerted effort to determine the extent of the radioactive pollution in the environment, and the health damage that has been and is currently being inflicted upon the people of the United States. ¶ It is imperative that a federal bill be passed in Congress appropriating enough funds for the cleanup of ALL the abandoned uranium mines in this four State region. This harmful situation must not be placed on the end of the Superfund list of hazardous sites to be addressed in twenty years. The health of the nation is threatened. The cleanup of all of these mines and underground sites must occur now! Those responsible for this disaster must face the consequences, but the cleanup and health concerns of the nation need to be addressed first. We hope you will consider our request for concerted actions to be taken at the national level regarding these grave concerns. This problem of radiation pollution spreading throughout the United States has been allowed to quietly continue for much too long.

#### Moreover, aff is a broader internal link to structural violence – IFRs transform economic and geopolitical paradigms – eliminating gross inequality.

Tom Blees, 2008, the president of the Science Council for Global Initiatives, member of the selection committee for the Global Energy Prize, Prescription for the Planet, p. 335-6

When the material comforts of existence are seen as being limited, then consumption beyond one’s needs does indeed carry an undeniable ethical weight. As Ralph Waldo Emerson put it lo those many years ago, “Superfluity is theft.” Even when the energy and raw materials involved are plentiful, there remains the often conveniently ignored issue of the conditions under which goods have been produced, be they agricultural or manufactured commodities. It is disingenuous in the extreme to point to the abolition of slavery as evidence of the social evolution of mankind when millions of desperately poor people labor under conditions that can still honestly be considered as slavery. The fact that we don’t335have slaves in our home is hardly confirmation of our benevolence. The moral questions of economic fairness will not be settled by availing ourselves of the technologies promoted in this book, but should command our attention and concern indefinitely. My point is not to justify exploitation of either human or material resources, but to point out that a transformation of energy and raw material technologies as proposed herein will present a radically transformed palette upon which to paint the picture of humanity’s future. Our new course will remove the limitations by which finite natural resources and energy supplies have circumscribed our existence. Unlimited energy coupled with virtually complete recycling of materials and the production of consumer goods from plentiful or renewable resources will finally allow humanity to be unshackled from the zero-sum mentality. Raising the living standards of our billions of disadvantaged brethren will be seen as a positive development by even the most voracious consumer societies, rather than perceived with foreboding as somehow detrimental to their way of life. Admittedly this will take some getting used to. The revolution will be not just technological and political, but psychological. The passion with which consumerism is pursued is frequently grotesque in its extremes, yet the revulsion it engenders may not be so strong when it can be viewed more as shallow foolishness than callous selfishness. Much of what is considered virtuous today will be seen more as simply a matter of personal preference in a world where creature comforts are no longer in limited supply. The concept of self-denial will have to be looked at anew. Rather than concentrating on husbanding limited resources, our attention can be turned to welcoming the rest of our fellow humans into a new reality where creature comforts are the universal norm. Abundant energy and wise336use of basic resources are the keys. Clearly the technologies are already within our grasp. This won’t happen overnight, but it would be foolish to dally. The conversion of primary power systems to fast reactors will necessarily be a gradual process, which in the best-case scenario will take a few decades. Conversion of the vehicle industry to boron, however, is another story. It is entirely conceivable that boron fueled vehicles could be driving on our highways within five years. Ironically the first boron recycling plants that would be a corollary of the conversion may end up operating with natural gas for their heat requirements, since the IFR program simply won’t be able to be implemented as quickly as the boron system, and it’s questionable whether existing electrical generation systems would be able to handle the increased demand of electrically powered boron recycling plants. This would, however, be only an interim fix, and would allow the vehicle fleets to get off to a quick start. If the plasma conversion method proves feasible, though, then garbage alone will provide all the energy we need for boron recycling. Long before the conversion to boron is complete, the demand for oil will have dropped to the point where the USA, one of the world’s thirstiest countries when it comes to oil, will be able to rely solely on North American supplies, resulting in geopolitical and economic realignments that will be a harbinger of things to come. Even though oil prices will surely plummet worldwide, and while the temporary price of boron recycling may well be higher than it will be once IFRs are able to provide all the power necessary to support the system, the price disparity will easily be great enough and the environmental benefits so overwhelming that boron vehicles will surely carry the day even in the near term.

### 2

#### Advantage 2: Russia

#### IFNEC is faltering - without U.S. participation in advanced reprocessing technologies, an international fuel bank tying together the US, Russia, and Japan falls apart

Tim Gitzel, July 2012, senior vice-president and chief operating officer and was appointed president, President and CEO of Cameco, extensive experience in Canadian and international uranium mining activities, executive vice-president, mining business unit for AREVA, College of Law at the University of Saskatchewan, serves as vice-chair on both the Mining Association of Canada and the Canadian Nuclear Association boards of directors, past president of the Saskatchewan Mining Association, and has served on the boards of Sask Energy, co-chair of the Royal Care campaign, a recipient of the Centennial Medal, World Nuclear Association (WNA), “International Framework for Nuclear Energy Cooperation (formerly Global Nuclear Energy Partnership),” <http://www.world-nuclear.org/info/inf117_international_framework_nuclear_energy_cooperation.html>

The International Framework for Nuclear Energy Cooperation (IFNEC), formerly the Global Nuclear Energy Partnership (GNEP), aims to accelerate the development and deployment of advanced nuclear fuel cycle technologies while providing greater disincentives to the proliferation of nuclear weapons. GNEP was initiated by the USA early in 2006, but picked up on concerns and proposals from the International Atomic Energy Agency (IAEA) and Russia. The vision was for a global network of nuclear fuel cycle facilities all under IAEA control or at least supervision. Domestically in the USA, the Global Nuclear Energy Partnership (GNEP) was based on the Advanced Fuel Cycle Initiative (AFCI), and while GNEP faltered with the advent of the Barack Obama administration in Washington from 2008, the AFCI is being funded at higher levels than before for R&D "on proliferation-resistant fuel cycles and waste reduction strategies." Two significant new elements in the strategy are new reprocessing technologies which separate all transuranic elements together (and not plutonium on its own), and advanced burner (fast) reactors to consume the result of this while generating power. GNEP was set up as both a research and technology development initiative and an international policy initiative. It addresses the questions of how to use sensitive technologies responsibly in a way that protects global security, and also how to manage and recycle wastes more effectively and securely. The USA had a policy in place since 1977 which ruled out reprocessing used fuel, on non-proliferation grounds. Under GNEP, reprocessing is to be a means of avoiding proliferation, as well as addressing problems concerning high-level wastes. Accordingly, the US Department of Energy set out to develop advanced fuel cycle technologies on a commercial scale. As more countries consider nuclear power, it is important that they develop the infrastructure capabilities necessary for such an undertaking. As with GNEP, IFNEC partners are working with the IAEA to provide guidance for assessing countries' infrastructure needs and for helping to meet those needs. For countries that have no existing nuclear power infrastructure, IFNEC partners can share knowledge and experience to enable developing countries to make informed policy decisions on whether, when, and how to pursue nuclear power without any need to establish sensitive fuel cycle facilities themselves. With the USA taking a lower profile in GNEP from 2009, the partners are focused on collaboration to make nuclear energy more widely accessible in accordance with safety, security and non-proliferation objectives, as an effective measure to counter global warming, and to improve global energy security. A change of name to International Framework for Nuclear Energy Cooperation was adopted in June 2010, along with a new draft vision statement, which read: "The Framework provides a forum for cooperation among participating states to explore mutually beneficial approaches to ensure the use of nuclear energy for peaceful purposes proceeds in a manner that is efficient, safe, secure, and supports non-proliferation and safeguards." By some accounts, this envisages "cradle to grave" fuel management as central, along with assurance of fuel supply. IFNEC agenda Broadly, IFNEC's mission is the global expansion of nuclear power in a safe and secure manner. A major rationale is reducing the threat of proliferation of nuclear materials and the spread of sensitive nuclear technology for non-peaceful purposes. With greater use of nuclear energy worldwide the possibility of the spread of nuclear material and technology for the development of weapons of mass destruction must be countered to avoid increasing the present threat to global security. A second issue addressed by IFNEC is the efficiency of the current nuclear fuel cycle. The USA, the largest producer of nuclear power, has employed a 'once through' fuel cycle. This practice only uses a part of the potential energy in the fuel, while effectively wasting substantial amounts of useable energy that could be tapped through recycling. The remaining fissionable material can be used to create additional power, rather than treating it as waste requiring long-term storage. Others, notably Europe and Japan, recover the residual uranium and plutonium from the used fuel to recycle at least the plutonium in light water reactors. However, no-one has yet employed a comprehensive technology that includes full actinidea recycle. In the USA, this question is pressing since significant amounts of used nuclear fuel are stored in different locations around the country awaiting shipment to a planned geological repository which was to be at Yucca Mountain in Nevada. This project is delayed, and in any case will fill very rapidly if it is used simply for used fuel rather than the separated wastes after reprocessing it. IFNEC also aims to address cost issues associated with the development and expansion of nuclear power in developing countries. Nuclear programs require a high degree of technical and industrial expertise. This is a serious obstacle for emerging countries attempting to develop nuclear power, although efforts are underway to increase the number of indigenously-trained nuclear experts through a variety of education and training initiatives. Internationally, the countries identified by the US Department of Energy (DOE) as likely participants at both enrichment and recycling ends are the USA, UK, France, Russia and Japan. The USA and Japan agreed to develop a nuclear energy cooperation plan centered on GNEP and the construction of new nuclear power plants. (Japan also intended to participate in the DOE's FutureGen clean coal project, which was abandoned but may possibly be revived.) Several bilateral agreements centered on GNEP/IFNEC have been developed. IFNEC parties and rationale At the first ministerial meeting in May 2007, the USA, China, France, Japan and Russia became formally the founding members of GNEP. Four of the five are nuclear weapons states and have developed full fuel cycle facilities arising from that; the non-nuclear weapons state, Japan, has developed similar facilities to support its extensive nuclear power program. To date, 31 nationsb are participants in IFNEC. Most of these signed the GNEP Statement of Principles1, which established broad guidelines for participation and incorporates seven objectives that touch on each element of GNEP. Under GNEP, so-called 'fuel cycle nations' would provide assured supplies of enriched nuclear fuel to client nations, which would generate electricity before returning the used fuel. The used fuel would then undergo advanced reprocessing so that the uranium and plutonium it contained, plus long-lived minor actinides, could be recycled in advanced nuclear power reactors. Waste volumes and radiological longevity would be greatly reduced by this process, and the wastes would end up either in the fuel cycle or user countries. Nuclear materials would never be outside the strictest controls, overseen by the IAEA. Two sensitive processes in particular would not need to be employed in most countries: enrichment and reprocessing. The limitation on these, by commercial dissuasion rather than outright prohibition, is at the heart of GNEP strategy. A corollary of this dissuasion is that GNEP/IFNEC member nations would be assured of reliable and economic fuel supply under some IAEA arrangement yet to be specified. GNEP/IFNEC work plan The GNEP members set up two principal working groups: The reliable nuclear fuel services working group (RNFS WG) is addressing nuclear fuel leasing and other considerations around comprehensive nuclear fuel supply goals, and includes evaluation of back-end fuel cycle options. The nuclear infrastructure development working group (ID WG) is addressing human resource development, radioactive waste management, small modular reactors, financing options, engagement with specialist organizations and identifying infrastructure requirements for an international nuclear fuel services framework enabling nuclear power deployment in many countries. An early priority was seen to be the development of new reprocessing technologies to enable recycling of most of the used fuel. One of the concerns when reprocessing used nuclear fuel is ensuring that separated fissile material is not used to create a weapon. One chemical reprocessing technology – PUREX – has been employed for over half a century, having been developed in wartime for military use (see page on Processing of Used Nuclear Fuel). This has resulted in the accumulation of 240 tonnes of separated reactor-grade plutonium around the world (though some has been used in the fabrication of mixed oxide fuel). While this is not suitable for weapons use, it is still regarded as a proliferation concern. New reprocessing technologies are designed to combine the plutonium with some uranium and possibly with minor actinides (neptunium, americium and curium), rendering it impractical to use the plutonium in the manufacture of weapons. GNEP/IFNEC creates a framework where states that currently employ reprocessing technologies can collaborate to design and deploy advanced separations and fuel fabrication techniques that do not result in the accumulation of separated pure plutonium. Several developments of PUREX which fit the GNEP/IFNEC concept are being trialled: NUEX separates uranium and then all transuranics (including plutonium) together, with fission products separately (USA). UREX+ separates uranium and then either all transuranics together or simply neptunium with the plutonium, with fission products separately (USA). COEX separates uranium and plutonium (and possibly neptunium) together as well as a pure uranium stream, leaving other minor actinides with the fission products. A variation of this separates americium and curium from the fission products (France). GANEX separates uranium and plutonium as in COEX, then separates the minor actinides plus some lanthanides from the short-lived fission products (France). The central feature of all these variants is to keep the plutonium either with some uranium or with other transuranics which can be destroyed by burning in a fast neutron reactor – the plutonium being the main fuel constituent. Trials of some fuels arising from UREX+ reprocessing in USA are being undertaken in the French Phenix fast reactor. An associated need is to develop the required fuel fabrication plant. That for plutonium with only some uranium and neptunium is relatively straightforward and similar to today's MOX fuel fabrication plants. A plant for fuel including americium and curium would be more complex (due to americium being volatile and curium a neutron emitter). The second main technological development originally envisaged under GNEP is the advanced recycling reactor – basically a fast reactor capable of burning minor actinides. Thus used fuel from light water reactors would be transported to a recycling centre, where it would be reprocessed and the transuranic product (including plutonium) transferred to a fast reactor on site. This reactor, which would destroy the actinides, would have a power capacity of perhaps 1000 MWe. The areas of development for fast reactor technology centre on the need for fast reactors to be cost competitive with current light water reactors. Countries such as France, Russia and Japan have experience in the design and operation of fast reactors and the USA is working with them to accelerate the development of advanced fast reactors that are cost competitive, incorporate advanced safeguards features, and are efficient and reliable. The advent of such fast reactors would mean that reprocessing technology could and should step from the aqueous processes derived from PUREX described above to electrometallurgical processes in a molten salt bath. Separating the actinides then is by electrodeposition on a cathode, without chemical separation of heavy elements as occurs in the Purex and related processes. This cathode product can then be used in a fast reactor, since it is not sensitive to small amounts of impurities. GE Hitachi Nuclear Energy (GEH) is developing this 'Advanced Recycling Center' concept which combines electrometallurgical separation and burning the final product in one or more of its PRISM fast reactors on the same site.2 The separation process would remove uranium, which is recycled to light water reactors; then fission products, which are waste; and finally the actinides including plutonium. With respect to the ultimate disposition of nuclear waste from recycling, three options exist conceptually: User responsibility.

#### The plan would cause quick U.S.-Russia IFR commercialization and fissile material oversight.

Tom Blees, 6-4-2011, is the author of Prescription for the Planet, the president of the Science Council for Global Initiatives, member of the selection committee for the Global Energy Prize, BraveNewClimate,”Disposal of UK plutonium stocks with a climate change focus,” <http://bravenewclimate.com/2011/06/04/uk-pu-cc/>

While the scientists and engineers were perfecting the many revolutionary features of the IFR at the EBR-II site in the Eighties and early Nineties, a consortium of major American firms collaborated with them to design a commercial-scale fast reactor based on that research. General Electric led that group, which included companies like Bechtel, Raytheon and Westinghouse, among others. The result was a modular reactor design intended for mass production in factories, called the PRISM (Power Reactor Innovative Small Module). A later iteration, the S-PRISM, would be slightly larger at about 300 MWe, while still retaining the features of the somewhat smaller PRISM. For purposes of simplicity I will refer hereinafter to the S-PRISM as simply the PRISM. After the closure of the IFR project, GE continued to refine the PRISM design and is in a position to pursue the building of these advanced reactors as soon as the necessary political will can be found. Unfortunately for those who would like to see America’s fast reactor be built in America, nuclear politics in the USA is nearly as dysfunctional as it is in Germany. The incident at Fukushima has only made matters worse. The suggestion in this report that fast reactors are thirty years away is far from accurate. GE-Hitachi plans to submit the PRISM design to the Nuclear Regulatory Commission (NRC) next year for certification. But that time-consuming process, while certainly not taking thirty years, may well be in process even as the first PRISM is built in another country. This is far from unprecedented. In the early Nineties, GE submitted its Advanced Boiling Water Reactor (ABWR) design to the NRC for certification. GE then approached Toshiba and Hitachi and arranged for each of those companies to build one in Japan. Those two companies proceeded to get the design approved by their own NRC counterpart, built the first two ABWRs in just 36 and 39 months, fueled and tested them, then operated them for a year before the NRC in the US finally certified the design. International partners On March 24th an event was held at the Russian embassy in Washington, D.C., attended by a small number of members of the nuclear industry and its regulatory agencies, both foreign and domestic, as well as representatives of NGOs concerned with nuclear issues. Sergei Kirienko, the director-general of Rosatom, Russia’s nuclear power agency, was joined by Dan Poneman, the deputy secretary of the U.S. Dept. of Energy. This was shortly after the Fukushima earthquake and tsunami, at a time when the nuclear power reactors at Fukushima Daiichi were still in a very uncertain condition. Mr. Kirienko and Mr. Poneman first spoke about the ways in which the USA and Russia have been cooperating in tightening control over fissile material around the world. Then Mr. Kirienko addressed what was on the minds of all of us: the situation in Japan and what that portends for nuclear power deployment in the USA and around the world. He rightly pointed out that the Chernobyl accident almost exactly 25 years ago, and the Fukushima problems now, clearly demonstrate that nuclear power transcends national boundaries, for any major accident can quickly become an international problem. For this reason Kirienko proposed that an international body be organized that would oversee nuclear power development around the world, not just in terms of monitoring fissile material for purposes of preventing proliferation (much as the IAEA does today), but to bring international expertise and oversight to bear on the construction and operation of nuclear power plants as these systems begin to be built in ever more countries. Kirienko also pointed out that the power plants at risk in Japan were old reactor designs. He said that this accident demonstrates the need to move nuclear power into the modern age. For this reason, he said, Russia is committed to the rapid development and deployment of metal-fueled fast neutron reactor systems. His ensuing remarks specifically reiterated not only a fast reactor program (where he might have been expected to speak about Gen III or III+ light water reactor systems), but the development of metal fuel for these systems. This is precisely the technology that was developed at Argonne National Laboratory with the Integral Fast Reactor (IFR) program, but then prematurely terminated in 1994 in its final stages. For the past two years I’ve been working with Dr. Evgeny Velikhov (director of Russia’s Kurchatov Institute and probably Russia’s leading scientist/political advisor) to develop a partnership between the USA and Russia to build metal-fueled fast reactors; or to be more precise, to facilitate a cooperative effort between GE-Hitachi and Rosatom to build the first PRISM reactor in Russia as soon as possible. During those two years there have been several meetings in Washington to put the pieces in place for such a bilateral agreement. The Obama administration, at several levels, seems to be willingly participating in and even encouraging this effort. Dr Evgeny Velikhov, SCGI member Dr. Velikhov and I (and other members of the Science Council for Global Initiatives) have also been discussing the idea of including nuclear engineers from other countries in this project, countries which have expressed a desire to obtain or develop this technology, some of which have active R&D programs underway (India, South Korea, China). Japan was very interested in this technology during the years of the IFR project, and although their fast reactor development is currently focused on their oxide-fueled Monju reactor there is little doubt that they would jump at the chance to participate in this project. Dr. Velikhov has long been an advocate of international cooperation in advanced nuclear power research, having launched the ITER project about a quarter-century ago. He fully comprehends the impact that international standardization and deployment of IFR-type reactors would have on the well-being of humanity at large. Yet if Russia and the USA were to embark upon a project to build the first PRISM reactor(s) in Russia, one might presume that the Russians would prefer to make it a bilateral project that would put them at the cutting edge of this technology and open up golden opportunities to develop an industry to export it. It was thus somewhat surprising when Mr. Kirienko, in response to a question from one of the attendees, said that Russia would be open to inviting Japan, South Korea and India to participate in the project. One might well question whether his failure to include China in this statement was merely an oversight or whether that nation’s notorious reputation for economic competition often based on reverse-engineering new technologies was the reason. I took the opportunity, in the short Q&A session, to point out to Mr. Poneman that the Science Council for Global Initiatives includes not just Dr. Velikhov but most of the main players in the development of the IFR, and that our organization would be happy to act as a coordinating body to assure that our Russian friends will have the benefit of our most experienced scientists in the pursuit of this project. Mr. Poneman expressed his gratitude for this information and assured the audience that the USA would certainly want to make sure that our Russian colleagues had access to our best and brightest specialists in this field. Enter the United Kingdom Sergei Kirienko was very clear in his emphasis on rapid construction and deployment of fast reactors. If the United States moves ahead with supporting a GE-Rosatom partnership, the first PRISM reactor could well be built within the space of the next five years. The estimated cost of the project will be in the range of three to four billion dollars (USD), since it will be the first of its kind. The more international partners share in this project, the less will be the cost for each, of course. And future copies of the PRISM have been estimated by GE-Hitachi to cost in the range of $1,700/kW. Work is under way on gram samples of civil plutonium According to this consultation document, the UK is looking at spending £5-6 billion or more in dealing with its plutonium. Yet if the plutonium were to simply be secured as it currently is for a short time longer and the UK involved itself in the USA/Russia project, the cost would be a small fraction of that amount, and when the project is completed the UK will have the technology in hand to begin mass-production of PRISM reactors. The plutonium stocks of the UK could be converted into metal fuel using the pyroprocessing techniques developed by the IFR project (and which, as noted above, are ready to be utilized by South Korea). The Science Council for Global Initiatives is currently working on arranging for the building of the first commercial-scale facility in the USA for conversion of spent LWR fuel into metal fuel for fast reactors. By the time the first PRISM is finished in Russia, that project will also likely be complete. What this would mean for the UK would be that its stores of plutonium would become the fast reactor fuel envisioned by earlier policymakers. After a couple years in the reactor the spent fuel would be ready for recycling via pyroprocessing, then either stored for future use or used to start up even more PRISM reactors. In this way not only would the plutonium be used up but the UK would painlessly transition to fast reactors, obviating any need for future mining or enrichment of uranium for centuries, since once the plutonium is used up the current inventories of depleted uranium could be used as fuel. Conclusion Far from being decades away, a fully-developed fast reactor design is ready to be built. While I’m quite certain that GE-Hitachi would be happy to sell a PRISM to the UK, the cost and risk could be reduced to an absolute minimum by the happy expedient of joining in the international project with the USA, Russia, and whichever other nations are ultimately involved. The Science Council for Global Initiatives will continue to play a role in this project and would be happy to engage the UK government in initial discussions to further explore this possibility. There is little doubt that Russia will move forward with fast reactor construction and deployment in the very near future, even if the PRISM project runs into an unforeseen roadblock. It would be in the best interests of all of us to cooperate in this effort. Not only will the deployment of a standardized modular fast reactor design facilitate the disposition of plutonium that is currently the driving force for the UK, but it would enable every nation on the planet to avail itself of virtually unlimited clean energy. Such an international cooperative effort would also provide the rationale for the sort of multinational nuclear power oversight agency envisioned by Mr. Kirienko and others who are concerned not only about providing abundant energy but also in maintaining control over fissile materials.

#### The plan jumpstarts cooperation on nuclear security and spillover to broader relations

**Khlopkov ’11** (A Peaceful Atom 27 march 2011 Anton Khlopkov Nuclear Rapprochement Between Moscow and Washington Anton Khlopkov is Director of the Center for Energy and Security Studies in Moscow; Editor-in-Chief of Nuclear Club journal.

Another promising area for cooperation is developing innovative nuclear power reactor technologies, including fast reactors, high-temperature gas-cooled reactors and low-power reactors. The Nuclear Energy and Nuclear Security working group set up as part of the U.S.-Russian presidential commission in July 2009 has the potential to foster closer cooperation between the two countries. But for that to happen**, Moscow and Washington would have to find the right balance** between the two key areas reflected in the working group’s name. Up to now nuclear security and nonproliferation have dominated the U.S.-Russian nuclear agenda, sidelining cooperation on civilian nuclear energy. For example, the 11 practical steps agreed on at the working group’s third meeting on December 6-7 are all related to various non-proliferation projects. The working group has **a nuclear energy subgroup, which should become an important facilitator of closer cooperation** between the two countries in civilian nuclear technology. As a first step, the subgroup could agree to a list of priority civilian nuclear energy projects for the short and mid-term. The 123 Agreement has another promising consequence for the Russian nuclear industry – it removes one of the barriers to nuclear energy cooperation with Tokyo. Japan’s Toshiba and Hitachi corporations maintain a close partnership with U.S. companies Westinghouse and General Electric. For that reason they have been very cautious about pursuing cooperation with Russia, so as not to jeopardize their business in the United States. Japanese officials have said unambiguously that the nuclear energy cooperation agreement signed by Moscow and Tokyo on May 12, 2009 will not be ratified by the Diet, the Japanese parliament, until the U.S.-Russian 123 Agreement has entered into force. The list of potential areas for nuclear energy cooperation between Russia and Japan is quite extensive. It includes the outsourcing of components for Russian-designed nuclear power plants to Japanese subcontractors and a proposed uranium enrichment joint venture. Obviously, in light of the recent disaster at the Fukushima nuclear power plant, Russian-U.S. **nuclear cooperation must focus on** efforts to enhance the **safety** of the nuclear power industry, including working out new requirements and standards for nuclear power plant construction sites. The coordinated efforts of key players in the nuclear field, including Russia and the United States, would help the nuclear power industry overcome the current crisis with fewer losses and costs. **Another important outcome that will** hopefully **result from broader contacts between the U.S. and Russian nuclear industries is a better reputation for Russia on nuclear security, export controls and nonproliferation.** Russia’s negative image in these areas dates back to the early 1990s; it is based on a combination of real problems that existed at the time and Hollywood-like stories in the media. Until recently, that image has often stood in the way of practical contacts and politicized nuclear energy cooperation between Russia and the United States, especially during Congressional debates.

#### Tensions now- only advanced nuclear power cooperation can resolve tensions and create resiliency in relations

**Weitz ’12** (Richard Weitz is a senior fellow at the Hudson Institute and a World Politics Review senior editor. His weekly WPR column, Global Insights, appears every Tuesday. World Politics Review Senior Editor, “Global Insights: U.S.-Russia Arms Control Prospects Under Putin”, World Politics Review, 3-6-2012, http://www.worldpoliticsreview.com/articles/11681/global-insights-u-s-russia-arms-control-prospects-under-putin)

This weekend’s election in Russia has unsurprisingly returned Vladimir Putin to the country’s presidency. In contrast to the preordained outcome of the Russian voting, the winner of this November’s U.S. presidential election is not yet known. But **whoever occupies the White House** in 2013 will need to consider the bilateral arms control relationship with Russia in coming years. And although the implementation of the New START agreement is going well, **there are sharp differences** in Washington and Moscow over where to go next. Moscow’s main concerns focus on U.S. missile defense and U.S. superiority in conventional forces. Both conditions work against Russia’s willingness to cut its offensive nuclear forces even further, which is the U.S. priority, especially with regard to the issue of Russian tactical nuclear weapons. In his recent Moscow News article on Russian foreign policy, Putin railed against what he called the U.S. quest for “absolute security.” In his words, the problem is that “absolute invulnerability for one country would in theory require absolute vulnerability for all others.” Instead, Putin again insisted on the right of all states to equal security, as well as Russia’s right to maintain the capacity to attack the United States with nuclear weapons if necessary. Putin argued that faced with U.S. plans for deploying a European-based missile defense system, Russia had two options: a symmetrical response of creating its own system or an asymmetrical strategy of strengthening Russia’s offensive strategic weapons to ensure that they are capable of overcoming any NATO system and thereby preserving mutual deterrence. The first choice being too costly and technically challenging, he said Russia would follow the second course. In Moscow’s view, the problem of equal security also applies to the imbalance in conventional forces in Europe. The United States recently followed Russia’s lead in ending implementation of the original Conventional Forces in Europe (CFE) Treaty. Russian officials have also given up on the idea of ratifying the Adapted CFE Treaty, since NATO insists that Russia withdraw its military forces from Georgia as part of its Istanbul Commitments. Given these complications, Russians are uninterested in various U.S. proposals for a “grand bargain” that would seek to address the CFE and tactical nuclear weapons in Europe simultaneously. Russian policymakers have also expressed a new complaint in the form of their open doubt over the United States’ ability to ratify the kinds of binding legal agreements that Moscow demands. They note the difficulties that the Obama administration had in securing U.S. Senate ratification of New START, which required a White House commitment to modernize the U.S. nuclear arsenal, even if that is now falling victim to budgetary pressures. Russians insist that they want another legally binding agreement to constrain U.S. missile defenses. The Obama administration has been offering a politically binding agreement on missile defense, but **has refused to accept legally binding constraints on how the missile defense program might develop.** Although U.S. officials stress that they will not try to negate Russia’s nuclear deterrent, whose massive size and great sophistication would make such an effort impossible in any case, Congress would never accept a legally binding agreement that commits the United States to deliberately constrain its ability to protect Americans and their allies from foreign missile attacks. At best, the administration is willing to offer nonbinding political guarantees that they will not seek to negate Russia’s strategic nuclear deterrent. Russian officials refuse to accept mere political declarations on such important issues. They claim the United States earlier violated such agreements when it enlarged NATO after the Cold War and moved NATO forces into former Soviet-bloc states. In contrast, they note that even when the United States withdrew from the Anti-Ballistic Missile Treaty in 2001, the predictable and legal manner in which the withdrawal was carried out reassured Putin and others in Moscow who opposed the U.S. decision. Russians also point out that political agreements lend themselves to different interpretations depending on who is viewing the issue. Although they do not seem to worry about another Obama presidency, they claim to fear that some future U.S. administration will try to expand U.S. missile defenses to be able to intercept Russian strategic missiles. **These differences highlight the uncertain climate surrounding** the **nuclear arms control** agenda, which is compounded by Russian concerns about U.S. space, cyber and other weapons. **But progress could be possible in several other areas.** First, Russians are eager to help counter nuclear terrorism through the mechanisms of the Nuclear Security Summit forums and the Global Initiative to Combat Nuclear Terrorism. Both countries want to revive the civilian use of nuclear power under safe and secure conditions, making sure that those countries now considering starting nuclear energy programs receive training and guidance on how to avoid accidents and protect the nuclear material at their facilities. Second, Russian-U.S. collaboration on regional proliferation challenges is important, since both countries are veto-wielding members of the U.N. Security Council. Russian officials are unlikely to accept any more U.N. sanctions on Iran given their different assessment of Iranian motives, unless incontrovertible evidence that Tehran is seeking a nuclear weapon emerges. But cooperation is possible regarding North Korea, where Russia and the United States share the goal of stabilizing the Korean Peninsula. Third, the Carnegie Endowment and other institutions have been developing a number of potential informal confidence and transparency-building measures that the two sides could pursue. These would help to lead toward a new strategic arms control treaty in a few years if the bilateral relationship improves, but could serve a valuable stabilizing function even without one. These measures include renewed efforts to expand the application of restrictions in the Intermediate Nuclear Forces Treaty and other bilateral arms control agreements to other countries, as well as measures to increase transparency regarding the capacity of each sides’ nuclear weapons-production complexes to construct new nuclear forces in any attempt to rapidly break out of a strategic arms control agreement. Finally, **Russians are eager to work on civilian nuclear energy cooperation with the United States.** The two sides’ recently ratified 123 **agreement allows Russian and U.S. firms to cooperate to produce new** types of civilian power **reactors that would be less prone to proliferation than existing models**. **Such collaboration could prove very useful in helping develop new commercial stakeholders in both countries that have an interest in maintaining good Russian-U.S. relations.** **The economic relationship between Russia and the United States remains relatively undeveloped,** since Americans buy Russia’s main exports -- oil, gas and weapons -- elsewhere, while various impediments hobble mutual investments. **At present, the constituencies favoring strong bilateral ties in both countries are small**, consisting mainly of arms control advocates and foreign policy experts. As **a result, the Russian-U.S. agenda is still dominated by Cold War-type issues, including nuclear arms control, which position the two parties in an adversarial relationship.** **Only by moving away from this orientation can both sides begin to overcome the mutual confidence gap that exacerbates many of their other differences**. **Though Putin’s return to the presidency could augur a hard line** on a number of issues **where** the U.S. and Russian **positions diverge**, **his pragmatism and opportunism could lead to progress in the areas where the two sides’ interests overlap.**

#### Russian relations are critical to prevent major power conflict in every global hotspot

**Nixon Center ‘3** (“Advancing American Interests and the U.S.-Russian Relationship: INTERIM REPORT,” SEPTEMBER 2K3 HTTP://WWW.NIXONCENTER.ORG/PUBLICATIONS/MONOGRAPHS/FR.HTM)

The proper starting point in thinking about American national interests and Russia—or any other country—is the candid question: why does Russia matter?  How can Russia affect vital American interests and how much should the United States care about Russia?  Where does it rank in the hierarchy of American national interests?  As the Report of the *Commission on American National Interests* (2000) concluded, **Russia** **ranks among the few countries whose actions powerfully affect American vital interests**.  Why? § First, **Russia is a very large country linking several strategically important regions**.  **By virtue of its size and location**, **Russia is a key player** **in Europe** as well as **the Middle East** **and** **Central, South and East Asia**.  Accordingly, Moscow can substantially contribute to, or detract from, **U.S. efforts to deal with** such **urgent challenges as North Korea and Iran,** as well as important longer term problems like **Iraq and Afghanistan**.  In addition, Russia shares the world’s longest land border with **China**, **an emerging great power that can have a major impact** on both U.S. and Russian interests.  The bottom line is that notwithstanding its significant loss of power after the end of the Cold War, Moscow’s geopolitical weight still exceeds that of London or Paris. § Second, as a result of its Soviet legacy, Russia has relationships with and information about **countries that remain comparatively inaccessible to the American government**, **in the Middle East, Central Asia and elsewhere**.  Russian intelligence and/or leverage in these areas **could significantly aid the United States** in its efforts to deal with current, emerging and still unforeseen strategic challenges, including in the war on terrorism. § Third, today and for the foreseeable future Russia’s nuclear arsenal will be capable of inflicting vast damage on the United States.  Fortunately, the likelihood of such scenarios has declined dramatically since the Cold War.  But today and as far as any eye can see the U.S. will have an enduring vital interest in these weapons not being used against America or our allies. § Fourth, reliable Russian stewardship and control of the largest arsenal of nuclear warheads and stockpile of nuclear materials from which nuclear weapons could be made is essential in combating the threat of “loose nukes.”  The United States has a vital interest in effective Russian programs to prevent weapons being stolen by criminals, sold to terrorists and used to kill Americans. § Fifth, Russian stockpiles, technologies and knowledge for creating biological and chemical weapons make cooperation with Moscow very important to U.S. efforts to prevent proliferation of these weapons.  Working with Russia may similarly help to prevent states hostile to the United States from obtaining sophisticated conventional weapons systems, such as missiles and submarines. § Sixth, as the world’s largest producer and exporter of hydrocarbons (oil and gas), Russia offers America an opportunity to diversify and increase supplies of non-OPEC, non-Mid-Eastern energy. § Seventh, as a veto-wielding permanent member of the United Nations Security Council, Russia can substantially ease, or complicate, American attempts to work through the UN and other international institutions to advance other vital and extremely important U.S. interests.  In a world in which many are already concerned about the use of U.S. power, this can have a real impact on America’s success at providing global leadership.  More broadly, **a close U.S.-Russian relationship can limit other states’ behavior by effectively eliminating Moscow as a potential source of political support.**

#### American perceptions of Russia vacillate between extremes of cultural relativism and economic universalism. Current attitudes towards Russian technological projects stems from an unresolved mix of contempt and fascination – plan’s engagement of Russian tech cooperation solves

**ENGERMAN 2003** (David, Engerman is Assistant Professor of History at Brandeis University, Modernization from the Other Shore: American Intellectuals and the Romance of Russian Development, p. 7-11)

American ideas about Russia's predominantly peasant population also built on indigenous Russian ones. Especially in the nineteenth century, which saw the spread of industrialization in western Europe and the rise of Romanticism, images of the peasant played an important role in arguments about Russia's present conditions and future trajectory.'3 Slavophiles, conservatives who emphasized Russia's differences from the west, celebrated the peasant commune and the autocracy as cornerstones of Russian rule and incarnations of Russian character. To them, the special qualities of Russia and its peasantry deserved conservation and protection from western materialism and industrialism. Yet admiration was at a distance. Throughout the nineteenth century, educated Russians described the sharp contrasts between themselves (collectively, obshchestvo, or society) and the bulk of the population {narod, or the people). With a combination of condescension and sympathy, intellectuals saw the narod as an undistinguished mass of simple people who required the help of the obshchestvo if they ever hoped to emerge from their noble suffering. As one member of the Populists (a group of radical heirs to the Slavophiles) put it in 1880, a Populist "does not love the narod only because they are unfortunate ... He respects the narod as a collective whole, constituting in itself the highest level of justice and humanity in our time." Love for the narod. however deep and sincere, was directed not at actual individuals but at an abstraction.

Within two decades, though, such positive sentiments were drowned out by critical ones. Russian intellectuals in the last decades of the nineteenth century depicted peasants as savage, helpless, and hopeless—not to mention unresponsive to (and even ungrateful for) the obshchestvo's best efforts. Russian intellectuals1 experiences with the peasantry are perhaps best illustrated by the Populists' effort to bring education and enlightenment "to the people" in 1874. "The people" were so uninspired by the message of the radicals that they frequently reported them to police officials. The ensuing disenchantment with the narod was hardly limited to radicals, however. In Russian art, literature, and theater of the late nineteenth century, peasants were no longer repositories of rural virtue. The figurative countryside was instead populated by kulaks, "peasant bloodsucker(s]," and baby, vulgar peasant women who symbolized the moral crisis of the peasantry. Peasants previously lauded as an abstract collective fared much worse (in the minds of educated Russians) as actual individuals. Russian intellectuals' views of their rural compatriots suggest that no great geographic distances are required to turn the subjects of observation into "others." Although they lived close to the peasants, members of the Russian obshchestvo nevertheless remained outside the lives of those they described with such contempt. America's Russia watchers, without local knowledge, found their suspicions about the peasantry confirmed by Russian writers.

Recent scholarship on such exterior perceptions has been aided—and, more problematically, defined around—Edward Said's elegant work Orientalism. Said documents a range of assumptions that European scholars, writers, and artists held about the "Orient" and "Orientals." Amid his insightful readings of Flaubert and his broad generalizations about French and British policy in the Near East, Said offers a convincing criticism of European depictions of the Orient. Europeans, he writes, homogenized the Orient's inhabitants and placed them outside historical time. But Said himself pays minimal attention to the differences among depictions of the Orient, and to the ways they changed over time. Ironically enough, then, his critique of homogenization and hypostatization applies equally well to his own analysis of Orientalist discourse. Nevertheless, Said's insights about perceptions as a form of social power—and their intimate connections to imperatives of government rule—are applicable to American views of Russia.16

Modernization from the Other Shore invokes Herzen's metaphor of distant shores to emphasize the exteriority upon which Said built his argument. But the metaphor applied across time as well as space. The "far shore" represented not just Herzen's distance from Russia but also the safe haven he reached as the revolutionary storms of 1848 ebbed. Like Herzen's, this book is also written from a far shore—following not the flash-floods of 1848 but the decades-long storm of Soviet rule. The Soviet collapse brings both practical and intellectual changes to the study of Russia's past, and thus to those who interpret it. The opening of once-locked archives and the desire to understand the Soviet past without Cold War blinders have led to a flourishing debate. Once-secret Soviet documents have forced reconsiderations of crucial events in modern history. Russians' discussions of their country's past are all the more striking for the decrepit physical and desperate financial circumstances in which they take place.

Writing after the Cold War also offers an opportunity to reflect on American enthusiasm for the USSR in a new and less rancorous political context. To take one example: previous historians have blamed intellectuals' fascination with the Soviet Union in the 1930s on misguided leftists, or on misguided leftism in general. Yet the romance of economic development swayed American observers across the political spectrum. Partisan politics—that is, devotion or opposition to the Communist Party—cannot fully explain this important episode in American intellectual history. Impressed by grandiose Soviet plans and dismissive of backward Russians, many American intellectuals enthusiastically observed Soviet efforts at modernization. And western enthusiasms for the Soviet Union reverberated long after the Depression decade. They helped define McCarthyism and the early Cold War, as a generation of intellectuals viewed their own— and their friends'—Soviet enchantment with increasing disdain.17

Enthusiasm for Soviet industrialization did not require a Party card, either in the United States or in the Soviet Union. Many Russians who praised rapid modernization were not Bolsheviks. So-called bourgeois agricultural experts, engineers, and economists in Russia all found reasons to endorse Soviet goals of collectivization and industrialization. Other Russians leapt at the chance to turn their motherland into a modern great power, meaning an industrial one.18 Western observers, too, appreciated the Bolsheviks' claims about a rationally organized society under the guidance of specialists like themselves.

Such enthusiasm also existed outside Russia. James Scott's recent synthesis. Seeing Like a State, suggests parallels between Soviet collectivization and other projects of what he calls "authoritarian high modernism."19 The idea of creating a new kind of society, organized around production and easily controlled, Scott shows, found adherents around the world and all along the political spectrum. The demise of the USSR and the Cold War has already opened new inquiries into the common mindsets behind these projects, past and present.

Widespread excitement about universal progress still incorporates regional variations. Recent debates about "Asian values," for instance, reveal the persistence of a troubled relationship between universalist and particu-larist models of development. Since the 1980s, leaders in Malaysia and Singapore have defended their combination of industrialization and political repression with references to particular Asian values. "Each nation " one argues, "must find its own best social and political arrangements"; there are no universal theories or forms of social organization. Western critics, meanwhile, base their arguments on the notion of human rights—that is, a set of rights that applies universally, transcending culture or government.20 The Asian values debate scrambles political alliances among Americans. Multiculturalists, generally on the left, see their claims of cultural particularism deployed by right-wing dictatorships. Meanwhile universalists, often accused of denigrating other nations and cultures, take the side of oppressed populations.

Similarly, scholars still argue about the relationship between Russian character and economic development in the post-Soviet era. The Soviet collapse, which might have brought down with it the edifice of universalist theories of human behavior, has instead unleashed a potent universalism in which all varieties of humankind are known only as homo oeconomicus. This is evident in recent debates about Russian economic policy. Taking great pride that they had conquered the "prejudice that 'Russia is different,'" the economists Maxim Boycko, Robert Vishny, and Andrei Shleifer celebrated their own universalism. "The Russian people," they preached in a widely read monograph, "like the rest of the people in the world, were 'economic men' who rationally responded to incentives." Russia, therefore, did not require a special form of economic organization "to compensate for its alleged cultural specificities and deficiencies."21 These economists promoted the immediate establishment of free-market institutions, creating a capitalist Russia with a single big bang. Supremely confident that economic laws applied equally well in all times and places, they were, ironically enough, heirs to Marx's universalism.

As economic "shock therapy" created new ailments in Russia, particu-larist critics blamed the economists' failure to account for Russia's differences from the west. Russians, argued the longtime Russia-watcher Marshall Goldman, "have almost always seemed more comfortable in a collective or communal, as opposed to an entrepreneurial, environment." Even before the anti-capitalist slogans of the Soviet era, he continued, "the market ethic was never . .. deeply entrenched in the psyche" of Russian peasants. Particularists with a conservative bent, meanwhile, suggested that the problem was not in the economists' methods but in their very aims. Historian Richard Pipes, for instance, lists multiple reasons that Russia has never developed the key institutions of western capitalism and democracy. While explicitly rejecting a national character argument, Pipes leaves little opportunity for Russia to evolve toward the west. In making such claims, he comes all too close to condemning Russia to its own past.22 We have yet to resolve the tensions between universal progress and national difference that Herzen observed a century and a half ago.

The questions addressed in this book parallel many of the age-old concerns that preoccupied Herzen. Chief among them is the question of difference. What do cultural differences mean? Are they innate or historical? How do they shape our understandings of human behavior and social change? Related to these are concerns about the universality of progress. How can each society find its own path of progress? Can a nation overcome its historical particularities? Should it? Finally, there is the balance between present and future. Under what conditions can individuals call for collective sacrifices in the name of future welfare? And with what consequences? Russian history provided the answers to these questions—or so American experts believed.

Ideas about the peculiarities of Russian character, belief in economic development, and the reconfiguration of international expertise all shaped American conceptions of Russia and the Soviet Union between 1870 and 1940. This book's organization underscores the pervasiveness as well as the significance of these themes. Chronological chapters emphasize the persistence of national-character stereotypes as well as the growing romance of economic development and the evolving structure of expertise. Within most chapters, biographical sections highlight the ubiquity of these beliefs, even among experts with discordant political views and divergent personal experiences.

#### Depicting Russia as a foreign Other located in a distant Asia apart from the West and incapable of technological transformation encourages violence and constructs an enemy relationship

**ENGERMAN 2003** (David, Engerman is Assistant Professor of History at Brandeis University, Modernization from the Other Shore: American Intellectuals and the Romance of Russian Development, p. 2-4)

These questions redounded around the world in the twentieth century. Under the spell of modernization, American intellectuals endorsed radical forms of social change everywhere except in the United States. They placed at the pinnacle of human achievement a society much like they imagined their own to be: industrial, urban, cosmopolitan, rational, and democratic. Backward nations, they argued, could progress toward modernity only by implementing rapid and violent changes. Modern America, however, would be exempt from such turmoil. With America's expanding global role and intellectuals' increasingly close connections to the centers of power, these ideas shaped nations all over the world. New ideas of social change and national character also shaped notions of American national identity, which itself underwent significant changes after 1870—from scientific racism and assimilationist theory before World War II to celebrations of common humanity in the 1950s and the valorization of cultural differ-ences since the 1980s. The way Americans understood the process of social change shaped the way they envisioned their own nation. Finally, the tensions between accepting cultural differences and promoting modernization underpinned American-Soviet conflict during the Cold War. At the same time that scholars analyzed the conflict as one between two industrial powers with opposing ideologies, American diplomats construed the Cold War enemy as an inherently and irredeemably different nation. These conceptions, supported by America's global reach, made—and continue to make—the American century.

American writings on Russia and the Soviet Union were shaped by three forces, which constitute the three main themes of this book: a longstanding belief that every nation had its own unique character; a growing enthusiasm for modernization; and the appearance of new professional institutions and norms for interpreting other nations. First, American experts used national-character stereotypes to explain Russian and Soviet events. Building on centuries-old notions of Russian peculiarity, western experts enumerated traits that supposedly limited the Russians' ability to function in a modern world. Americans repeated the claims of European commentators who argued that national character emerged from geography and topography: long winters made Russians passive, and endless plains made them melancholy. Russians, in these writings, exhibited instinctual behavior, extreme passivity, and a lethargy shaken only by violence.4 Americans argued that these characteristics—accentuating the negative—affected Russia's economic prospects. Reliance on these notions of national character crossed political boundaries; Russia's avowed enemies and ardent defenders in the United States agreed on what made Russians different.

Herzen himself illustrated the double-edged nature of such characterizations. Living in France and Italy in the 1850s, he gained new perspective on Russian character. He frequently mentioned the "Slavic genius" that set his compatriots apart from Europeans, focusing especially on Russians' soulful and communal natures. Yet he also took for granted that Russians^—especially the peasants who constituted the vast majority of the population—were "improvident and indolent," better at "passive obedience" than political or economic activity.5 Difference did not necessarily mean superiority.

Americans' notions of Russian character often contained within them the idea that Russians were Asian—"Asiatic" in the language of the day. The claim, stated as often in racial as in geographic terms, further legiti-mated violence in Russia. According to an oft-repeated refrain, life meant less to Asians, and therefore to Russians. Personal traits also held political implications. Asians, the argument went, could be ruled only through "Oriental despotism." Writers from Baron Charles de Montesquieu to Karl Marx depicted Asia as an unchanging—even unchangeable—morass of poverty, insularity, and despotism.6 Whether understood as Asian or Slavic, Russians consistently faced claims that they were unready to join the modern world. Particularist views of Russia, which emphasized the nations unique traditions and character traits, dominated American writings until the 1920s.

#### Otherization of Russia results in real hostility

**LIEVEN 2001** (Anatol, Senior Associate for Foreign and Security policy at Carnegie Endowment for International Peace, “Against Russophobia,” World Policy Journal, Winter, http://www.worldpolicy.newschool.edu/journal/lieven.html)

Russophobia today is therefore rooted not in ideological differences but in national hatred of a kind that is sadly too common. In these architectures of hatred, selected or invented historical "facts" about the "enemy" nation, its culture, and its racial nature are taken out of context and slotted into prearranged intellectual structures to arraign the unchanging wickedness of the other side. Meanwhile, any counterarguments, or memories of the crimes of one's own are suppressed. This is no more legitimate when directed by Russophobes against Russia than when it is directed by Serb, Greek, or Armenian chauvinists against Turkey, Arabs against Jews, or Jews against Arabs. The most worrying aspect of Western Russophobia is that it demonstrates the capacity of too many Western journalists and intellectuals to betray their own professed standards and behave like Victorian jingoists or Balkan nationalists when their own national loyalties and hatreds are involved. And these tendencies in turn serve wider needs. Overall, we are living in an exceptionally benign period in human history so far as our own interests are concerned. Yet one cannot live in Washington without becoming aware of the desperate need of certain members of Western elites for new enemies, or resuscitated old ones. This is certainly not the wish of most Americans-nor of any other Westerners-and it is dangerous. For of one thing we can be sure: a country that is **seen to need enemies** will sooner or later **find them everywhere**.

### Plan

#### The United States federal government should provide initial funding for integral fast reactors using the S-PRISM design in the United States.

### Solvency

#### Private industry ready to support IFR’s – but initial funding is key

**Lovering 12** [Jessica Lovering is a policy analyst, and Max Luke is a policy associate, in the Breakthrough Institute’s Energy & Climate program. Barry Brook is a Breakthrough Senior Fellow, November 16, 2012, “How U.S.-European Cooperation Can Deliver Cheaper, Safer Nuclear Energy”, Breakthrough Institute]

Yet despite international agreement on the necessity of next generation nuclear systems, there is a dearth of support at the national level. In the US, annual federal RD&D spending for advanced fission reactors has not exceeded $200 million in the last 10 years, following much larger budgets through the 1970s to mid-1990s. The majority of research and investment in advanced nuclear systems today comes from Asia, and most new nuclear is constructed in developing nations. Yet many of the countries most interested in building more nuclear are largely stuck with old Generation II designs.¶ Private industry appears ready to take a leadership role in the development and deployment of advanced nuclear builds, but the right government incentives, international agreements and support structures must be in place for this to occur. GE-Hitachi, for example, submitted a proposal last year to build a pair of next generation modular fast reactors in the UK, the first commercial advanced nuclear plant. These “PRISM” reactors are based on an Integral Fast Reactor (IFR) design that is widely considered one of the most promising next generation models (see this white paper by Breakthrough Senior Fellow Barry Brook and Tom Blees of the Science Council for Global Initiatives). In addition to providing clean electricity, PRISM reactors would burn weapons material, offering a cost-effective solution to the UK’s plutonium disposal problem. If built, the reactors would be able to process all of the UK’s stockpiled plutonium within five years and then generate decades of clean energy, in addition to providing a full commercial demonstration of the technology. Other European countries and the United States should seek out and support these win-win scenarios, where an advanced clean technology can be demonstrated while also solving a separate policy problem.

#### That facilitates global expansion of the IFR

**Kirsch et all 9** [Steve Kirsch, Bachelor of Science and a Master of Science in electrical engineering and computer science from the Massachusetts Institute of Technology, “The Integral Fast Reactor (IFR) project: Q&A”, collaborative attempt to answer questions regarding the integral fast reactor, contribution material, peer editing and review by George Stanford, 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, Tom Blees, Science Council for Global Initiatives, Carl Page, computer science professor at MSU, page last modified 2013]

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

#### The plan solves cost-competitiveness and international adaptation –

#### a. Gradual upsizing of demonstration plants

**Till 11** [“PLENTIFUL ENERGY ¶ The Story of the Integral Fast Reactor¶ The complex history of a ¶ simple reactor technology, ¶ with emphasis on its ¶ scientific basis for non-specialists¶ CHARLES E. TILL, Nuclear physicist and associate lab director at Argonne National Laboratory West, and YOON IL CHANG”]

Some notion of likely cost competitiveness can be gained from past fast reactor ¶ construction experience, but the information available is limited. It can be said that ¶ the capital costs per MWe of the early fast reactors built around the world were ¶ much higher than those of LWRs. But the comparisons are not by any means direct ¶ and unambiguous. In comparison to the LWR, every difference between the two ¶ adds a cost increment to the fast reactor. With one significant exception, they were ¶ much smaller in size and electrical capacity than the LWRs built for commercial ¶ electricity generation. There were only a few of them. They were built as ¶ demonstration plants, by governments underwriting fast reactor development. There ¶ was basically one demonstration per country, with no follow-on to take advantage ¶ of the experience and lessons learned. Nor were they scaled up and replicated. The ¶ LWR had long since passed the stage where first-of-a-kind costs were involved, and ¶ had the advantage of economies of scale as well. Further, their purpose was ¶ commercial, with the attendant incentive to keep costs down. None of this has ¶ applied to fast reactors built to the present time.¶ Experience with thermal reactor types, as well as other large-scale construction, ¶ has shown that capital cost reduction follows naturally through a series of demonstration plants of increasing size once feasibility is proven. This has been ¶ true in every country, with exceptions only in the periods when construction ¶ undergoes lengthy delays due to organized anti-nuclear legal challenges. But this ¶ phased approach of multiple demonstration plants is no longer likely to be ¶ affordable, and in any case, with the experience worldwide now, it is probably ¶ unnecessary for a fast reactor plant today. Estimating the ―settled down‖ capital ¶ cost potential is not an easy task without such experience. Nevertheless, as the ¶ economic competitiveness of the fast reactor is taken to be a prerequisite to ¶ commercial deployment, we do need to understand the capital cost potential of the ¶ fast reactor and what factors influence it. 275

#### b. Retrofitting and government support

**Salmon 9** [Reuters, “Nuclear power: Going fast”, Felix Salmon, finance editor for Reuters, graduate of University of Glasgow, winner of 2010 Excellence in Statistical Reporting Award presented by the American Statistical Association, over a decade of financial reporting experience, JUNE 23, 2009]

I was offline most of yesterday attending a high-intensity series of presentations hosted by Esquire magazine in the magnificent suite of rooms at the top of the new Hearst tower. GE’s Eric Loewen was there, talking about nuclear power, and specifically what he calls a PRISM reactor — a fourth-generation nuclear power station which runs on the nuclear waste generated by all the previous generations of nuclear power stations.¶ PRISM is GE’s name for an integral fast reactor, or IFR, and it’s a pretty great technology. The amount of fuel which already exists for such reactors would be enough to power the world for millennia — no new mining needed. Fast reactors also solve at a stroke the problem of what to do with the vast amounts of nuclear waste which are being stockpiled unhappily around the world. They’re super-safe: if they fail they just stop working, they don’t melt down. And they can even literally replace coal power stations:¶ One nice thing about the S-PRISM is that they’re modular units and of relatively low output (one power block of two will provide 760 MW). They could be emplaced in excavations at existing coal plants and utilize the same turbines, condensers (towers or others), and grid infrastructure as the coal plants currently use, and the proper number of reactor vessels could be used to match the capabilities of those facilities. Essentially all you’d be replacing is the burner (and you’d have to build a new control room, of course, or drastically modify the current one). Thus you avoid most of the stranded costs. If stranded costs can thus be kept to a minimum, both here and, more importantly, in China, we’ll be able to talk realistically not just about stopping to build new coal plants but replacing the existing ones, even the newest ones.¶ And best of all they’re eminently affordable: Loewen showed that they could be profitable selling energy at just 5 cents per KwH — which means that you don’t need to price carbon emissions at all to make these power stations economically attractive. With pricing on carbon emissions, of course, they become even economically compelling. So what’s the problem? They’re untested, and the regulators in the US will take many years and many billions of dollars before they will approve such a project. And legislation is needed, too — including legislation allowing the use of nuclear waste as a fuel. But mainly all that’s needed is political will. It’s unclear the degree to which Steven Chu, the US energy secretary, supports this technology. But if he puts the weight of the Obama administration into supporting this technology and trying to make it a reality, then a lot of private capital will start flowing into the area. And it might be much, much easier to achieve ambitious carbon-emission reduction targets than many people currently think.

#### c. International cooperation and modeling

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

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

#### IFR’s are really safe

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

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