#### Plan: The United States federal government should establish a matching funds program and reduce licensing restrictions for Liquid Fluoride Thorium power production in the United States.

#### LFTRs aren’t happening now endless tautological bias prevents it.

Martin, 2012 [Richard, editorial director for Pike Research, the leading clean energy research and analysis firm, Super Fuel: Thorium, the Green Energy Source for the Future, p. 199, V. Guevara]

Boiled down, the challenges facing the thorium movement in the¶ United States are twofold, with the one growing out of the other. First,¶ the nuclear power industry as a whole is hamstrung by objections,¶ mostly based on irrational fears of radioactivity, that nuclear power¶ can never be “truly safe.” Second, those objections—along with the¶ broader inertia of an entrenched and stagnant industry—have blocked¶ technological innovation to such an extent that the idea of pursuing a¶ dramatically new system, even one as tested and proven as liquid¶ fluoride thorium reactors, is rejected out of hand. We can’t do it¶ because we’ve never done it before, and even if we could do it, the public¶ will never support it. This dual dilemma turns the discussion of LFTRs,¶ and of fourth-generation reactors in general, back on itself in a¶ pointless circle. It always comes hack to the same point, and we are¶ trapped in this moment of political paralysis, technological timidity,¶ and financial insufficiency. There must be a way out of this cul de sac.

#### Our Advantage is Warming

#### First is Science –

#### Warming is real, anthropogenic and causes extinction---the tipping point’s 500 ppm

Hansen 12 James, directs the NASA Goddard Institute for Space Studies, "Game Over for the Climate", New York Times, May 9, www.nytimes.com/2012/05/10/opinion/game-over-for-the-climate.html?\_r=2

GLOBAL warming isn’t a prediction. It is happening. That is why I was so troubled to read a recent interview with President Obama in Rolling Stone in which he said that Canada would exploit the oil in its vast tar sands reserves “regardless of what we do.”¶ If Canada proceeds, and we do nothing, it will be game over for the climate.¶ Canada’s tar sands, deposits of sand saturated with bitumen, contain twice the amount of carbon dioxide emitted by global oil use in our entire history. If we were to fully exploit this new oil source, and continue to burn our conventional oil, gas and coal supplies, concentrations of carbon dioxide in the atmosphere eventually would reach levels higher than in the Pliocene era, more than 2.5 million years ago, when sea level was at least 50 feet higher than it is now. That level of heat-trapping gases would assure that the disintegration of the ice sheets would accelerate out of control. Sea levels would rise and destroy coastal cities. Global temperatures would become intolerable. Twenty to 50 percent of the planet’s species would be driven to extinction. Civilization would be at risk.¶ That is the long-term outlook. But near-term, things will be bad enough. Over the next several decades, the Western United States and the semi-arid region from North Dakota to Texas will develop semi-permanent drought, with rain, when it does come, occurring in extreme events with heavy flooding. Economic losses would be incalculable. More and more of the Midwest would be a dust bowl. California’s Central Valley could no longer be irrigated. Food prices would rise to unprecedented levels.¶ If this sounds apocalyptic, it is. This is why we need to reduce emissions dramatically. President Obama has the power not only to deny tar sands oil additional access to Gulf Coast refining, which Canada desires in part for export markets, but also to encourage economic incentives to leave tar sands and other dirty fuels in the ground.¶ The global warming signal is now louder than the noise of random weather, as I predicted would happen by now in the journal Science in 1981. Extremely hot summers have increased noticeably. We can say with high confidence that the recent heat waves in Texas and Russia, and the one in Europe in 2003, which killed tens of thousands, were not natural events — they were caused by human-induced climate change.¶ We have known since the 1800s that carbon dioxide traps heat in the atmosphere. The right amount keeps the climate conducive to human life. But add too much, as we are doing now, and temperatures will inevitably rise too high. This is not the result of natural variability, as some argue. The earth is currently in the part of its long-term orbit cycle where temperatures would normally be cooling. But they are rising — and it’s because we are forcing them higher with fossil fuel emissions.¶ The concentration of carbon dioxide in the atmosphere has risen from 280 parts per million to 393 p.p.m. over the last 150 years. The tar sands contain enough carbon — 240 gigatons — to add 120 p.p.m. Tar shale, a close cousin of tar sands found mainly in the United States, contains at least an additional 300 gigatons of carbon. If we turn to these dirtiest of fuels, instead of finding ways to phase out our addiction to fossil fuels, there is no hope of keeping carbon concentrations below 500 p.p.m. — a level that would, as earth’s history shows, leave our children a climate system that is out of their control.

#### Prefer scientific consensus to their hack deniers

Lewandowsky and Ashley 2011 (Stephan Lewandowsky, Professor of Cognitive Studies at the University of Western Australia, and Michael Ashley, Professor of Astrophysics at the University of New South Wales, June 24, 2011, “The false, the confused and the mendacious: how the media gets it wrong on climate change,” http://goo.gl/u3nOC)

But despite these complexities, some aspects of climate science are thoroughly settled. We know that atmospheric CO2 is increasing due to humans. We know that this CO₂, while being just a small fraction of the atmosphere, has an important influence on temperature. We can calculate the effect, and predict what is going to happen to the earth’s climate during our lifetimes, all based on fundamental physics that is as certain as gravity. The consensus opinion of the world’s climate scientists is that climate change is occurring due to human CO₂ emissions. The changes are rapid and significant, and the implications for our civilisation may be dire. The chance of these statements being wrong is vanishingly small. Scepticism and denialism Some people will be understandably sceptical about that last statement. But when they read up on the science, and have their questions answered by climate scientists, they come around. These people are true sceptics, and a degree of scepticism is healthy. Other people will disagree with the scientific consensus on climate change, and will challenge the science on internet blogs and opinion pieces in the media, but no matter how many times they are shown to be wrong, they will never change their opinions. These people are deniers. The recent articles in The Conversation have put the deniers under the microscope. Some readers have asked us in the comments to address the scientific questions that the deniers bring up. This has been done. Not once. Not twice. Not ten times. Probably more like 100 or a 1000 times. Denier arguments have been dealt with by scientists, again and again and again. But like zombies, the deniers keep coming back with the same long-falsified and nonsensical arguments. The deniers have seemingly endless enthusiasm to post on blogs, write letters to editors, write opinion pieces for newspapers, and even publish books. What they rarely do is write coherent scientific papers on their theories and submit them to scientific journals. The few published papers that have been sceptical about climate change have not withstood the test of time. The phony debate on climate change So if the evidence is this strong, why is there resistance to action on climate change in Australia? At least two reasons can be cited. First, as The Conversation has revealed, there are a handful of individuals and organisations who, by avoiding peer review, have engineered a phony public debate about the science, when in fact that debate is absent from the one arena where our scientific knowledge is formed. These individuals and organisations have so far largely escaped accountability. But their free ride has come to an end, as the next few weeks on The Conversation will continue to show. The second reason, alas, involves systemic failures by the media. Systemic media failures arise from several presumptions about the way science works, which range from being utterly false to dangerously ill-informed to overtly malicious and mendacious. The false Let’s begin with what is merely false. A tacit presumption of many in the media and the public is that climate science is a brittle house of cards that can be brought down by a single new finding or the discovery of a single error. Nothing could be further from the truth. Climate science is a cumulative enterprise built upon hundreds of years of research. The heat-trapping properties of CO₂ were discovered in the middle of the 19th century, pre-dating even Sherlock Holmes and Queen Victoria.

#### Uranium mining independently ensures we hit the tipping point.

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

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

#### Feedbacks can’t solve warming

Oreskes & Conway 2010

[Naomi & Erik. (A professor of history and science studies at the University of California, San Diego, Her study “Beyond the Ivory Tower” was a milestone in the fight against global warming denial and cited by Al Gore. & Has published four previous books). Merchants of Doubt. Pg 173. //Jamie]

There were, however, natural processes that might act as a brake on warming. The panel spent some time thinking about such "negative feedbacks," but concluded they wouldn't prevent a substantial warming. "We have examined with care all known negative feedback mechanisms, such as increase in low or middle cloud amount, and have concluded that the oversimplifications and inaccuracies in the models are not likely to have vitiated the principal conclusions that there will be appreciable warming."17 The devil was not in the details. It was in the main story. CO2 was a greenhouse gas. It trapped heat. So if you increased CO2, the Earth would warm up. It wasn't quite that simple—clouds, winds, and ocean circulation did complicate matters—but those complications were "second-order effects"—things that make a difference in the second decimal place, but not the first. The report concluded, "If carbon dioxide continues to increase, the study group finds no reason to doubt that climate changes will result and no reason to believe that these changes will be negligible."18

#### We are not science, we use science – our method is the same one everyone inevitably uses on a day-to-day basis, just more rigorous

Jean **Bricmont 1**, professor of theoretical physics at the University of Louvain, “Defense of a Modest Scientific Realism”, September 23, <http://www.physics.nyu.edu/faculty/sokal/bielefeld_final.pdf>

So, how does one obtain evidence concerning the truth or falsity of scientific assertions? By the same imperfect methods that we use to obtain evidence about empirical assertions generally. Modern science, in our view, is nothing more or less than the deepest (to date) refinement of the rational attitude toward investigating any question about the world, be it atomic spectra, the etiology of smallpox, or the Bielefeld bus routes. Historians, detectives and plumbers indeed, all human beings use the same basic methods of induction, deduction and assessment of evidence as do physicists or biochemists.18 Modern science tries to carry out these operations in a more careful and systematic way, by using controls and statistical tests, insisting on replication, and so forth. Moreover, scientific measurements are often much more precise than everyday observations; they allow us to discover hitherto unknown phenomena; and scientific theories often conflict with "common sense'\*. But [he con f I id is al the level of conclusions, nol (he basic approach. As Susan Haack lucidly observes: Our standards of what constitutes good, honest, thorough inquiry and what constitutes good, strong, supportive evidence are not internal to science. In judging where science has succeeded and where it has failed, in what areas and at what times it has done better and in what worse, we are appealing to the standards by which we judge the solidity of empirical beliefs, or the rigor and thoroughness of empirical inquiry, generally.1'1 Scientists' spontaneous epistemology the one that animates their work, regardless of what they may say when philosophizing is thus a rough-and-ready realism: the goal of science is to discover (some aspects of) how things really are. More The aim of science is to give a true (or approximately true) description of reality. I'll is goal is realizable, because: 1. Scientific theories are either true or false. Their truth (or falsity) is literal, not metaphorical; it does not depend in any way on us, or on how we test those theories, or on the structure of our minds, or on the society within which we live, and so on. 2. It is possible to have evidence for the truth (or falsity) of a theory. (Tt remains possible, however, that all the evidence supports some theory T, yet T is false.)20 Tin- most powerful objections to the viability of scientific realism consist in various theses showing that theories are underdetermined by data.21 In its most common formulation, the underdetermination thesis says that, for any finite (or even infinite) set of data, there are infinitely many mutually incompatible theories that are "compatible'' with those data. This thesis, if not properly understood22, can easily lead to radical conclusions. The biologist who believes that a disease is caused by a virus presumably does so on the basis of some "evidence" or some "data'\*. Saying that a disease is caused by a virus presumably counts as a "theory'' (e.g. it involves, implicitly, many counlerfactual statements). But if there are really infinitely many distinct theories that are compatible with those "data", then we may legitimately wonder on what basis one can rationally choose between those theories. In order to clarify the situation, it is important to understand how the underdetermination thesis is established; then its meaning and its limitations become much clearer. Here are some examples of how underdeterminatiou works; one may claim that: The past did not exist: the universe was created five minutes ago along with all the documents and all our memories referring to the alleged past in their present state. Alternatively, it could have been created 100 or 1000 years ago. The stars do not exist: instead, there are spots on a distant sky that emit exactly the same signals as those we receive. All criminals ever put in jail were innocent. For each alleged criminal, explain away all testimony by a deliberate desire to harm the accused; declare that all evidence was fabricated by the police and that all confessions were obtained bv force.2'1 Of course, all these "theses'1 may have to be elaborated, but the basic idea is clear: given any set of facts, just make up a story, no matter how ad hoc, to "account" for the facts without running into contradictions.2,1 It is important to realize that this is all there is to the general (Quinean) underdetermination thesis. Moreover, this thesis, although it played an important role in the refutation of the most extreme versions of logical positivism, is not very different from the observation that radical skepticism or even solipsism cannot be refuted: all our knowledge about the world is based on some sort of inference from the observed to the unobserved, and no such inference can be justified by deductive logic alone. However, it is clear that, in practice, nobody ever takes seriously such "theories" as those mentioned above, any more than they take seriously solipsism or radical skepticism. Let us call these "crazy theories'\*2'1 (of course, it is not easy to say exactly what it means for a theory to be non-crazy). Xote that these theories require no work: they can be formulated entirely a priori. On the other hand, the difficult problem, given some set of data, is to find even one non-crazy theory that accounts for them. Consider, for example, a police enquiry about some crime: it is easy enough to invent a story that "accounts for the facts'" in an ad hoc fashion (sometimes lawyers do just that); what is hard is to discover who really committed the crime and to obtain evidence demonstrating that beyond a reasonable doubt. Reflecting on this elementary example clarifies the meaning of the underdelermination thesis. Despite the existence of innumerable "crazy theories'\* concerning any given crime, it sometimes happens in practice that there is a unique theory (i.e. a unique story about who committed the crime and how) that is plausible and compatible with the known facts; in that case, one will say that the criminal has been discovered (with a high degree of confidence, albeit not with certainty). It may also happen that no plausible theory is found, or that we are unable to decide which one among several suspects is really guilty: in these cases, the underdetermination is real.-'' One might next ask whether there exist more subtle forms of underdetermination than the one revealed by a Duhem Quine type of argument. In order to analyze this question, let us consider the example of classical electromagnetism. This is a theory that describes how particles possessing a quantifiable property called "electric charge" produce "electromagnetic fields" that "propagate in vacuum" in a certain precise fashion and then "guide" the motion of charged particles when they encounter them.2' Of course, no one ever "sees" directly an electromagnetic field or an electric charge. So, should one interpret this theory "realistically'', and if so, what should it be taken to mean? Classical electromagnetic theory is immensely well supported by precise experiments and forms the basis for a large part of modern technology. It is "confirmed'' every time one of us switches on his or her computer and finds that it works as designed.'8 Does this overwhelming empirical support imply that there are "really"' electric and magnetic fields propagating in vacuum? In support of the idea that thenare, one could argue that electromagnetic theory postulates the existence of those fields and that there is no known non-crazy theory that accounts equally well for the same data; therefore it is reasonable to believe that electric and magnetic fields really exist. But is it in fact true that there are no alternative non-crazy theories? Here is one possibility: Let us claim that there are no fields propagating "in vacuum", but that, rather, there are only "forces" acting directly between charged particles.29 Of course, in order to preserve the empirical adequacy of the theory, one lias to use exactly the same Maxwell Lorentz system of equations as before (or a mathematically equivalent system). But one may interpret the fields as a mere "calculational device" allowing us to compute more easily the net effect of the "real" forces acting between charged particles.30 Almost every physicist reading these lines will say that this is some kind of metaphysics or maybe even a play on words that this "alternative theory" is really just standard electromagnetic theory in disguise. Xow, although the precise meaning of "metaphysics" is hard to pin down 31, there is a vague sense in which, if we use exactly the same equations (or a mathematically equivalent set of equations) and make exactly the same predictions in the two theories, then they are really the same theory as far as "physics" is concerned, and the distinction between the two if any lies outside of its scope. The same kind of observation can be made about most physical theories: In classical mechanics, are there really forces acting on particles, or are the particles instead following trajectories defined by variational principles? In general relativity, is space-time really curved, or are there, rather, fields that cause particles to move as if space-time were curved?'2 Let us call this kind of underdetermination "genuine'\*, as opposed to the "crazy" underdeterminations of the usual Duhem Quine thesis. By "genuine'\*, we do not mean that these underdeterminations are necessarily worth losing sleep over, but simply that there is no rational way to choose (at least on empirical grounds alone) between the alternative theories if indeed they should be regarded as different theories.

#### Next is Framing -

#### You should err on the side of solving warming because climate change could be irreversible even if the evidence is debatable

Sunstein 2007

(– Professor of Political Science Cass R., Professor in the Department of Political Science and at the Law School of the University of Chicago, 2007, “Worst-Case Scenarios”, Harvard University Press) MattG

Most worst-case scenarios appear to have an element of irreversibility. Once a species is lost, it is lost forever. The special concern for endangered species stems from the permanence of their loss (outside of Jurassic Park). One of the most serious fears associated with genetically modified organisms is that they might lead to irreversible ecological harm. Because some greenhouse gases stay in the atmosphere for centuries, the problem of climate change may be irreversible, at least for all practical purposes. Transgenic crops can impose irreversible losses too, because they can make pests more resistant to pesticides. If we invest significant wealth in one source of energy and neglect others, we may be effectively stuck forever, or at least for a long time. One objection to capital punishment is that errors cannot be reversed. In ordinary life, our judgments about worst-case scenarios have everything to do with irreversibility. Of course an action may be hard but not impossible to undo, and so there may be a continuum of cases, with different degrees of difficulty in reversing. A marriage can be reversed, but divorce is rarely easy; having a child is very close to irreversible; moving from New York to Paris is reversible, but moving back may be difficult. People often take steps to avoid courses of action that are burdensome rather than literally impossible to reverse. In this light, we might identify an Irreversible Harm Precautionary Principle, applicable to a subset of risks.' As a rough first approximation, the principle says this: Special steps should be taken to avoid irreversible harms, through precautions that go well beyond those that would be taken if irreversibility were not a problem. The general attitude here is "act, then learn," as opposed to the tempting alternative of "wait and learn." In the case of climate change, some people believe that research should be our first line of defense. In their view, we should refuse to commit substantial resources to the problem until evidence of serious harm is unmistakably clear.' But even assuming that the evidence is not so clear, research without action allows greenhouse gas emissions to continue, which might produce risks that are irreversible, or at best difficult and expensive to reverse. For this reason, the best course of action might well be to take precautions now as a way of preserving flexibility for future generations. In the environmental context in general, this principle suggests that regulators should proceed with far more aggressive measures than would otherwise seem justified.

#### Climate change also causes huge resource wars and is a conflict multiplier

Klare 2006 (Michael Klare, professor of peace and world security studies at Hampshire College, March 10, 2006, “The Coming Resource Wars,” http://goo.gl/sPH9D)

It's official: the era of resource wars is upon us. In a major London address, British Defense Secretary John Reid warned that global climate change and dwindling natural resources are combining to increase the likelihood of violent conflict over land, water and energy. Climate change, he indicated, "will make scarce resources, clean water, viable agricultural land even scarcer" -- and this will "make the emergence of violent conflict more rather than less likely." Although not unprecedented, Reid's prediction of an upsurge in resource conflict is significant both because of his senior rank and the vehemence of his remarks. "The blunt truth is that the lack of water and agricultural land is a significant contributory factor to the tragic conflict we see unfolding in Darfur," he declared. "We should see this as a warning sign." Resource conflicts of this type are most likely to arise in the developing world, Reid indicated, but the more advanced and affluent countries are not likely to be spared the damaging and destabilizing effects of global climate change. With sea levels rising, water and energy becoming increasingly scarce and prime agricultural lands turning into deserts, internecine warfare over access to vital resources will become a global phenomenon. Reid's speech, delivered at the prestigious Chatham House in London (Britain's equivalent of the Council on Foreign Relations), is but the most recent expression of a growing trend in strategic circles to view environmental and resource effects -- rather than political orientation and ideology -- as the most potent source of armed conflict in the decades to come. With the world population rising, global consumption rates soaring, energy supplies rapidly disappearing and climate change eradicating valuable farmland, the stage is being set for persistent and worldwide struggles over vital resources. Religious and political strife will not disappear in this scenario, but rather will be channeled into contests over valuable sources of water, food and energy. Prior to Reid's address, the most significant expression of this outlook was a report prepared for the U.S. Department of Defense by a California-based consulting firm in October 2003. Entitled "An Abrupt Climate Change Scenario and Its Implications for United States National Security," the report warned that global climate change is more likely to result in sudden, cataclysmic environmental events than a gradual (and therefore manageable) rise in average temperatures. Such events could include a substantial increase in global sea levels, intense storms and hurricanes and continent-wide "dust bowl" effects. This would trigger pitched battles between the survivors of these effects for access to food, water, habitable land and energy supplies. "Violence and disruption stemming from the stresses created by abrupt changes in the climate pose a different type of threat to national security than we are accustomed to today," the 2003 report noted. "Military confrontation may be triggered by a desperate need for natural resources such as energy, food and water rather than by conflicts over ideology, religion or national honor." Until now, this mode of analysis has failed to command the attention of top American and British policymakers. For the most part, they insist that ideological and religious differences -- notably, the clash between values of tolerance and democracy on one hand and extremist forms of Islam on the other -- remain the main drivers of international conflict. But Reid's speech at Chatham House suggests that a major shift in strategic thinking may be under way. Environmental perils may soon dominate the world security agenda. This shift is due in part to the growing weight of evidence pointing to a significant human role in altering the planet's basic climate systems. Recent studies showing the rapid shrinkage of the polar ice caps, the accelerated melting of North American glaciers, the increased frequency of severe hurricanes and a number of other such effects all suggest that dramatic and potentially harmful changes to the global climate have begun to occur. More importantly, they conclude that human behavior -- most importantly, the burning of fossil fuels in factories, power plants, and motor vehicles -- is the most likely cause of these changes. This assessment may not have yet penetrated the White House and other bastions of head-in-the-sand thinking, but it is clearly gaining ground among scientists and thoughtful analysts around the world. For the most part, public discussion of global climate change has tended to describe its effects as an environmental problem -- as a threat to safe water, arable soil, temperate forests, certain species and so on. And, of course, climate change is a potent threat to the environment; in fact, the greatest threat imaginable. But viewing climate change as an environmental problem fails to do justice to the magnitude of the peril it poses. As Reid's speech and the 2003 Pentagon study make clear, the greatest danger posed by global climate change is not the degradation of ecosystems per se, but rather the disintegration of entire human societies, producing wholesale starvation, mass migrations and recurring conflict over resources. "As famine, disease, and weather-related disasters strike due to abrupt climate change," the Pentagon report notes, "many countries' needs will exceed their carrying capacity" -- that is, their ability to provide the minimum requirements for human survival. This "will create a sense of desperation, which is likely to lead to offensive aggression" against countries with a greater stock of vital resources. "Imagine eastern European countries, struggling to feed their populations with a falling supply of food, water, and energy, eyeing Russia, whose population is already in decline, for access to its grain, minerals, and energy supply." Similar scenarios will be replicated all across the planet, as those without the means to survival invade or migrate to those with greater abundance -- producing endless struggles between resource "haves" and "have-nots." It is this prospect, more than anything, that worries John Reid. In particular, he expressed concern over the inadequate capacity of poor and unstable countries to cope with the effects of climate change, and the resulting risk of state collapse, civil war and mass migration. "More than 300 million people in Africa currently lack access to safe water," he observed, and "climate change will worsen this dire situation" -- provoking more wars like Darfur. And even if these social disasters will occur primarily in the developing world, the wealthier countries will also be caught up in them, whether by participating in peacekeeping and humanitarian aid operations, by fending off unwanted migrants or by fighting for access to overseas supplies of food, oil, and minerals. When reading of these nightmarish scenarios, it is easy to conjure up images of desperate, starving people killing one another with knives, staves and clubs -- as was certainly often the case in the past, and could easily prove to be so again. But these scenarios also envision the use of more deadly weapons. "In this world of warring states," the 2003 Pentagon report predicted, "nuclear arms proliferation is inevitable." As oil and natural gas disappears, more and more countries will rely on nuclear power to meet their energy needs -- and this "will accelerate nuclear proliferation as countries develop enrichment and reprocessing capabilities to ensure their national security." Although speculative, these reports make one thing clear: when thinking about the calamitous effects of global climate change, we must emphasize its social and political consequences as much as its purely environmental effects. Drought, flooding and storms can kill us, and surely will -- but so will wars among the survivors of these catastrophes over what remains of food, water and shelter. As Reid's comments indicate, no society, however affluent, will escape involvement in these forms of conflict.

#### Warming impacts will be fast and sudden

Mukerjee, former editor at Scientific American, 2012

(Madhusree, Scientific American, "Apocalypse Soon:Has Civilization Passed the Environmental Point of No Return?", May 23, [http://www.scientificamerican.com/article.cfm?id=apocalypse-soon-has-civilization-passed-the-environmental-point-of-no-return](http://www.scientificamerican.com/article.cfm?id=apocalypse-soon-has-civilization-passed-the-environmental-point-of-no-return" \t "_blank), accessed 7-31-12, MR )

**Instead, the latest global data are tracking one of the most alarming scenarios, in which these variables increase steadily to reach a peak and then suddenly drop in a process called collapse.**In fact, "I see collapse happening already**,"** he says. "**Food per capita is going down, energy is becoming more scarce, groundwater is being depleted." Most worrisome, Randers notes, greenhouse gases are being emitted twice as fast as oceans and forests can absorb them**. Whereas in 1972 humans were using 85 percent of the regenerative capacity of the biosphere to support economic activities such as growing food, producing goods and assimilating pollutants, the figure is now at 150 percent—and growing. Randers's ideas most closely resemble a World3 scenario in which **energy efficiency and renewable energy stave off the worst effects of climate change until after 2050.** For the coming few decades, Randers predicts, life on Earth will carry on more or less as before. **Wealthy economies will continue to grow, albeit more slowly as investment will need to be diverted to deal with resource constraints and environmentlemal probs**, which thereby will leave less capital for creating goods for consumption. Food production will improve: increased carbon dioxide in the atmosphere will cause plants to grow faster, and warming will open up new areas such as Siberia to cultivation. Population will increase, albeit slowly, to a maximum of about eight billion near 2040. Eventually, however, floods and desertification will start reducing farmland and therefore the availability of grain. **Despite humanity's efforts to ameliorate climate change, Randers predicts that its effects will become devastating sometime after mid-century, when global warming will reinforce itself by, for instance, igniting fires that turn forests into net emitters rather than absorbers of carbon.** **"Very likely, we will have war long before we get there,"** Randers adds grimly. **He expects that mass migration from lands rendered unlivable will lead to localized armed conflicts.**

#### Climate Change is Bad –

#### Scenario 1 is the Ocean –

#### Warming leads to sea level rise—flooding will be inevitable without intervention

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As mentioned in chapter 1, increasing temperatures contribute to sea level rise both through thermal expansion of the water, causing it to take up more volume, and through the addition of mass to the oceans when land-based ice either melts or calves into the ocean. Both thermal expansion and land ice decay have been at play through much of the twentieth and into the twenty-first century, with ocean temperature increases83 and glacial retreats (next paragraph). The combined result during the twentieth century was a sea level rise of about 1.7 millimeters (0.17 centi­**meters)** per year on average, for a 100-year total of 17 centimeters.84 The rise has not been uniform spatially or over time, but it has been enough to have caused problems for many low-lying coastal communities, as the rising sea has submerged some areas and in other areas has caused increased coastal erosion, flooding, and intrusion of salt water into underground and aboveground freshwater reservoirs and fields.85 In the case of two uninhabited islands in Kiribati, an island nation in the central Pacific Ocean, sea level rise has totally eliminated the islands, as they disappeared into the ocean in 1999. Relatedly, the 100 inhabitants of Tegua, an island in the island nation of Vanuatu in the South Pacific, were forced to abandon their island in December 2005.86 Other locations have not yet been eliminated but are being flooded repeated­ly because of the rising seas, one such location being Saint Mark's Square in Venice. At the beginning of the twentieth century, the square flooded fewer than 10 times a year, by 1990 it flooded about 40 times a year, and in 1996 it flooded almost 100 times, and some predictions are that, without further protections, it will be flooding every day of the year by the end of the twenty-first century.87

#### Sea level rise will threaten millions that live in coastal regions

Bernstein**,** PhD Chemical Engineering @ Purdue and President of the CMC,2007

(Lenny, IPCC Fourth Assessment Report, http://www.ipcc.ch/ipccreports/ar4-syr.htm, More Authors on Draft Team)

Coasts are projected to be exposed to increasing risks, including coastal erosion, due to climate change and sea level rise. The effect will be exacerbated by increasing human-induced pressures on coastal areas (very high confidence). {WGII 6.3, 6.4, SPM} \_ By the 2080s, many millions more people than today are projected to experience floods every year due to sea level rise. The numbers affected will be largest in the densely populated and low-lying megadeltas of Asia and Africa while small islands are especially vulnerable (very high confidence). {WGII 6.4, 6.5, Table 6.11, SPM}

#### Forces mass migrations which threaten global insecurity

Jarvis et al 2011. Lionel Jarvis, surgeon rear admiral (Ministry of Defence), Hugh Montgomery, professor (UCL Institute for Public Health and Performance), Neil Moresetti, rear admiral (Ministry of Defence), Ian Gilmore, professor (Royal Liverpool Hospital). [Climate Change, Conflict & Ill Health Linked, Pose ‘Grave Threat’](http://planetsave.com/2011/04/21/climate-change-conflict-amp-ill-health-linked-pose-grave-threat/). 21 April 2011. <http://planetsave.com/2011/04/21/climate-change-conflict-amp-ill-health-linked-pose-grave-threat/>

“Climate change poses an immediate and grave threat, driving ill health and increasing the risk of conflict, such that each feeds on the other.” asserts a new report in the British Medical Journal by a group of UK defense, medical and public health officials.\* The somewhat unusual collaborative report draws upon several previous studies’ findings (in the U.S. and UK) to make its case. In particular, a recent report by the International Institute for Strategic Studies (IISS) is quoted at length, citing “the effects of climate change will present a threat to collective security and global order in the first half of the 21st century. This will limit access to food, safe water, power, sanitation, and health services and drive mass migration and competition for remaining resources.” The report also notes that — as a result of increasing conflicts around the world — starvation, diarrhea and various infectious diseases (such as cholera) will grow more common, as will neonatal and adult mortality. Using statistics from a 2004 Lancet paper (Salama et al), the report notes that in 7 out of 10 countries with the highest infant mortality rates (of children under 5 yo), 5 of these countries were engaged in military conflict or had just emerged from conflict. The report further summarizes data analyses conducted by US and UK military and intelligence communities, to wit: “Climate change may already be changing weather and precipitation patterns” and will “continue to drive extreme weather events and changes in water resources (through flood, drought, and rising sea levels), and it will adversely affect global food and energy production.” Median age by country. A youth bulge is evident for Africa, and to a lesser extent for South and Southeast Asia and Central America. A "youth bulge" of young "cohort" males in a population pyramid - with a lack of regular, peaceful employment opportunities -- is seen as a risk pool for violence. Stressing the three synergistic factors of poverty, environmental degradation, and the weakening of already fragile governments, the report offers additional conclusions from a 2010 Quadrennial Defense Review prepared by the Pentagon for Congress: “Climate change will contribute to food and water scarcity, will increase the spread of disease, and may spur or exacerbate mass migration.” These conditions may increase the probability of instability and risks to national security in the form of failed states. Echoing these findings, the United Kingdom’s Ministry of Defense states that “climate change will amplify existing social, political and resource stresses” and will “shift the tipping point at which conflict ignites.” UK’s foreign secretary, William Hague, recently described climate change as “perhaps the 21st century’s biggest foreign policy challenge.” Noting that increasing urbanization of human populations, the report warns that the infrastructures of large urban centers (over 10 million) will become greatly strained and susceptible to increasing demands on resources, leading to resource shortages. “Damage to this fragile infrastructure by severe weather systems or rising sea levels will disrupt public health, and shortages of water, sanitation, heating, and food will combine to increase disease and ill health.”

#### Environmental migration causes terrorism and failed states

Smith, associate professor of national security affairs at the United States Naval War College, 2007 [Paul, Climate Change, Mass Migration and the Military Response, 8/29/07, ScienceDirect] Victor

Another consideration related to climate change is the problem of weak or failed states, which are at high risk of being destabilized by climate change. Mass population movements (both internal and international) may be one mechanism through which this failure is triggered. Large and acute population movements may exacerbate internal social and ethnic tensions, or pose an enormous economic challenge that exceeds the host state's ability to manage. Thus, climate change-induced environmental migration may cause states that are already experiencing social and economic instability to reach a “tipping point” leading to instability or state failure. A National Intelligence Council report assessing key security trends through the year 2020 asserted that “weak governments, lagging economies, religious extremism, and youth bulges will align to create a perfect storm for internal conflict in certain regions.”55¶ In addition, as climate change contributes to state weakness or failure—a more likely scenario for poor, developing countries plagued with preexisting social and economic problems—it could lead to additional security challenges for the world community. For example, the 2005 U.S. National Defense Strategy states that “the absence of effective governance in many parts of the world creates sanctuaries for terrorists, criminals, and insurgents.”56 Such an environment may invite outside military intervention, although probably at a stage where military forces would be less welcome and less able to restore order or mitigate the underlying causes of state failure.¶ Bangladesh serves as a good example of a state struggling with potential terrorist threats, while at the same time being positioned directly in the crosshairs of likely future climate change events.57 U.S. officials have described Bangladesh, the seventh most populous country in the world, as “a voice of moderation among developing countries, in the Islamic world and in South Asia.”58 Bangladesh has been praised by the United States also for achieving “some impressive victories against extremists” as a result of the recent arrests of the leaders of a militant Islamist group known as Jamaat ul Mujahideen Bangladesh (JMB).59

#### Extinction

Yonah Alexander, professor and director of the Inter-University for Terrorism Studies, 8/28/03 (Washington Times)

Last week's brutal suicide bombings in Baghdad and Jerusalem have once again illustrated dramatically that the international community failed, thus far at least, to understand the magnitude and implications of the terrorist **threats to the very survival of civilization itself**. Even the United States and Israel have for decades tended to regard terrorism as a mere tactical nuisance or irritant rather than a critical strategic challenge to their national security concerns. It is not surprising, therefore, that on September 11, 2001, Americans were stunned by the unprecedented tragedy of 19 al Qaeda terrorists striking a devastating blow at the center of the nation's commercial and military powers. Likewise, Israel and its citizens, despite the collapse of the Oslo Agreements of 1993 and numerous acts of terrorism triggered by the second intifada that began almost three years ago, are still "shocked" by each suicide attack at a time of intensive diplomatic efforts to revive the moribund peace process through the now revoked cease-fire arrangements [hudna]. Why are the United States and Israel, as well as scores of other countries affected by the universal nightmare of modern terrorism surprised by new terrorist "surprises"? There are many reasons, including misunderstanding of the manifold specific factors that contribute to terrorism's expansion, such as lack of a universal definition of terrorism, the religionization of politics, double standards of morality, weak punishment of terrorists, and the exploitation of the media by terrorist propaganda and psychological warfare. Unlike their historical counterparts, contemporary terrorists have introduced a new scale of violence in terms of conventional and unconventional threats and impact. The internationalization and brutalization of current and future terrorism make it clear we have entered an Age of Super Terrorism [e.g. biological, chemical, radiological, nuclear and cyber] with its serious implications concerning national, regional and global security concerns.

#### Oceanic heating independently makes Hurricanes worse

TheGuardian2011**.** The Guardian citing various studies. Are hurricanes getting worse because of global warming?, <http://www.guardian.co.uk/environment/2011/mar/04/hurricanes-global-warming>

There's tremendous variation in hurricane activity over time and from place to place. Various studies published since 2005 indicate that the number and/or strength of hurricanes have increased in various regions, especially since the 1970s. However, it's likely that some hurricanes at sea went unnoticed in the days before satellites and hurricane-hunter aircraft, and that complicates the assessment. There's no doubt, though, that hurricane activity has stepped up since the mid-1990s in the North Atlantic, where ocean temperatures have risen through long-term warming and an apparent multidecadal cycle in Atlantic currents. The tropics are part of a global trend toward ocean warming that goes hand in hand with atmospheric warming, and warm oceans provide the energy to drive hurricanes. As for the future, computer models tend to point towards fewer hurricanes overall (for reasons that aren't yet firmed up) but a general strengthening of winds and rainfall in the hurricanes that do form.

#### More intense storms collapse infrastructure and kill the economy

Nicholas Stern—Head of the British Government Economic Service—2007

(Former Head Economist for the World Bank, I.G. Patel Chair at the London School of Economics and Political Science, “The Economics of Climate Change: The Stern Review”, The report of a team commissioned by the British Government to study the economics of climate change led by Siobhan Peters, Head of G8 and International Climate Change Policy Unit, Cambridge University Press, p. 78-79)

Damage to infrastructure from storms will increase substantially from only small increases in event intensity. Changes in soil conditions (from droughts or permafrost melting) will influence the stability of buildings. By increasing the amount of energy available to fuel storms (Chapter 1), climate change is likely to increase the intensity of storms. Infrastructure damage costs will **increase substantially** from even small increases in sea temperatures because: (1) peak wind speeds of tropical storms are a **strongly exponential function** of temperature, increasing by about 15 - 20% for a 3°C increase in tropical sea surface temperatures;68 and (2) damage costs typically scale as the **cube** of wind-speed or more (Figure 3.10).69 Storms and associated flooding are already the **most costly** natural disaster today, making up almost 90% of the total losses from natural catastrophes in 2005 ($184 billion from windstorms alone, particularly hurricanes and typhoons).70 A large proportion of the financial losses fall in the developed world, because of the high value and large amount of infrastructure at risk (more details in Chapter 5). High latitude regions are already experiencing the effects of warming on previously frozen soil. Thawing weakens soil conditions and causes subsidence of buildings and infrastructure. Climate change is likely to lead to significant damage to buildings and roads in settlements in Canada and parts of Russia currently built on permafrost.71 The Quinghai-Tibet Railway, planned to run over 500 Km of permafrost, is designed with a complex and costly insulation and cooling system to prevent thawing of the permafrost layer (more details in Chapter 20). However, most of the existing infrastructure is not so well designed to cope with permafrost thawing and land instability.

#### This causes a rally around the flag effect and ends in miscalculation and war ending in extinction

Royal ‘10 director of Cooperative Threat Reduction at the U.S. Department of Defense (Jedediah, Economics of War and Peace: Economic, Legal, and Political Perspectives, pg 213-215)

Less intuitive is how periods of economic decline may increase the likelihood of external conflict. Political science literature has contributed a moderate degree of attention to the impact of economic decline and the security and defence behaviour of interdependent stales. Research in this vein has been considered at systemic, dyadic and national levels. Several notable contributions follow. First, on the systemic level. Pollins (20081 advances Modclski and Thompson's (1996) work on leadership cycle theory, finding that rhythms in the global economy are associated with the rise and fall of a pre-eminent power and the often bloody transition from one pre-eminent leader to the next. As such, exogenous shocks such as economic crises could usher in a redistribution of relative power (see also Gilpin. 19SJ) that leads to uncertainty about power balances, increasing the risk of miscalculation (Fcaron. 1995). Alternatively, even a relatively certain redistribution of power could lead to a permissive environment for conflict as a rising power may seek to challenge a declining power (Werner. 1999). Separately. Pollins (1996) also shows that global economic cycles combined with parallel leadership cycles impact the likelihood of conflict among major, medium and small powers, although he suggests that the causes and connections between global economic conditions and security conditions remain unknown. Second, on a dyadic level. Copeland's (1996. 2000) theory of trade expectations suggests that 'future expectation of trade' is a significant variable in understanding economic conditions and security behaviour of states. He argues that interdependent states are likely to gain pacific benefits from trade so long as they have an optimistic view of future trade relations. However, if the expectations of future trade decline, particularly for difficult to replace items such as energy resources, the likelihood for conflict increases, as states will be inclined to use force to gain access to those resources. Crises could potentially be the trigger for decreased trade expectations either on its own or because it triggers protectionist moves by interdependent states.4 Third, others have considered the link between economic decline and external armed conflict at a national level. Mom berg and Hess (2002) find a strong correlation between internal conflict and external conflict, particularly during periods of economic downturn. They write. The linkage, between internal and external conflict and prosperity are strong and mutually reinforcing. Economic conflict lends to spawn internal conflict, which in turn returns the favour. Moreover, the presence of a recession tends to amplify the extent to which international and external conflicts self-reinforce each other (Hlomhen? & Hess. 2(102. p. X9> Economic decline has also been linked with an increase in the likelihood of terrorism (Blombcrg. Hess. & Wee ra pan a, 2004). which has the capacity to spill across borders and lead to external tensions. Furthermore, crises generally reduce the popularity of a sitting government. "Diversionary theory" suggests that, when facing unpopularity arising from economic decline, sitting governments have increased incentives to fabricate external military conflicts to create a 'rally around the flag' effect. Wang (1996), DcRoucn (1995), and Blombcrg. Hess, and Thacker (2006) find supporting evidence showing that economic decline and use of force arc at least indirecti) correlated. Gelpi (1997). Miller (1999). and Kisangani and Pickering (2009) suggest that Ihe tendency towards diversionary tactics arc greater for democratic states than autocratic states, due to the fact that democratic leaders are generally more susceptible to being removed from office due to lack of domestic support. DeRouen (2000) has provided evidence showing that periods of weak economic performance in the United States, and thus weak Presidential popularity, are statistically linked lo an increase in the use of force. In summary, rcccni economic scholarship positively correlates economic integration with an increase in the frequency of economic crises, whereas political science scholarship links economic decline with external conflict al systemic, dyadic and national levels.' This implied connection between integration, crises and armed conflict has not featured prominently in the economic-security debate and deserves more attention.

#### Climate change causes war over Arctic resources

Macalister 10. Terry, writer for the Guardian citing Natio commander, Admiral James G Stavridis. Climate change could lead to Arctic conflict, warns senior Nato commander. 10 October 2010. <http://www.guardian.co.uk/environment/2010/oct/11/nato-conflict-arctic-resources>

One of [Nato](http://www.guardian.co.uk/world/nato)'s most senior commanders has warned that global warming and a race for resources could lead to conflict in the [Arctic](http://www.guardian.co.uk/world/arctic). The comments, by Admiral James G Stavridis, supreme allied commander for Europe, come as Nato countries convene on Wednesday for [groundbreaking talks on environmental security in the Arctic Ocean](http://www.nrf.is/images/stories/news_pdf/nato-arw_draft_agenda_environmental_security_in_the_arctic_ocean_15sep10.pdf). The discussions, in the format of a "workshop", with joint Russian leadership, are an attempt to create dialogue with Moscow aimed at averting a second cold war. "For now, the disputes in the north have been dealt with peacefully, but [climate change](http://www.guardian.co.uk/environment/climate-change) could alter the equilibrium over the coming years in the race of temptation for exploitation of more readily accessible natural resources," said Stavridis. The US naval admiral believes military forces have an important role to play in the area – but mainly for specialist assistance around commercial and other interests. "The cascading interests and broad implications stemming from the effects of climate change should cause today's global leaders to take stock, and unify their efforts to ensure the Arctic remains a zone of co-operation – rather than proceed down the icy slope towards a zone of competition, or worse a zone of conflict," he added. Stavridis made his views known in a foreword to a Whitehall paper, entitled [Environmental security in the Arctic Ocean: promoting co-operation and preventing conflict](http://www.rusi.org/publications/whitehall/ref:I4CA4506CA6EBA/), written by Prof [Paul Berkman](http://www.spri.cam.ac.uk/people/berkman/), head of the Arctic Ocean geopolitics programme at the University of Cambridge. The discussions, which take place at the Scott Polar Institute where Berkman is based, have been given impetus by the speed of change around the north pole where the ice cap is melting and [oil](http://www.guardian.co.uk/environment/oil) and other minerals are becoming available for extraction. In recent weeks, [Cairn Energy has announced the first oil and gas discoveries off Greenland](http://www.guardian.co.uk/business/2010/sep/21/cairn-energy-oil-find-greenland) and a wave of new mining licences are about to be awarded there. There are similar moves to produce [gas](http://www.guardian.co.uk/environment/gas) in the far north of Russia and Norway, all in the shadow of [BP's Gulf of Mexico's oil spill](http://www.guardian.co.uk/environment/bp-oil-spill). Vladimir Putin, the Russian prime minister, spoke about our "common responsibility" [at the international forum on the Arctic in Moscow two weeks ago](http://www.guardian.co.uk/world/2010/sep/23/putin-arctic-claims-international-law). He is aware the melting ice offers access to reserves of oil and minerals, as well as new shipping lanes, but that the Arctic is [an "area for co-operation and dialogue](http://www.guardian.co.uk/world/2010/sep/23/putin-arctic-claims-international-law)". Berkman, a key figure in organising the workshop, with funding from the Nato science for peace and security programme, said the challenge is to balance national and common interests in the Arctic Ocean in the interests of all humankind. "Strategic long-range ballistic missiles or other such military assets for national security purposes in the Arctic Ocean are no less dangerous today than they were during the cold war. In effect, the cold war never ended in the Arctic Ocean." One of the first speakers at the workshop will be Prof Alexander Vylegzhanin, who is codirecting the workshop from the Russian Academy of Sciences. He will be followed by former US ambassador Kenneth Yalowitz; European Parliament vice-president, Diana Wallis; and Canadian high commissioner, James Wright. There will also be contributions from senior British, Danish, Finnish, Icelandic and Norwegian delegates with participants from 16 nations. Building on the interdisciplinary discussions with academics, government administrators, politicians, and industry representatives, Berkman said the workshop should be a major first step towards building a dialogue that both considers strategies to promote co-operation as well as prevent conflict in the Arctic Ocean. As Stavridis noted: "Melting of the polar ice cap is a global concern because it has the potential to alter the geopolitical balance in the Arctic heretofore frozen in time."

#### **Escalates to nuclear war**

Staples, 8/10/2009 (Steven - Rideau Institute, Steps toward an arctic nuclear weapon free zone, p. 5-6)

The fact is, the Arctic is becoming an zone of **increased military competition**. Russian President Medvedev has announced the creation of a special military force to defend Arctic claims. Russian General Vladimir Shamanov declared that Russian troops would step up training for Arctic combat, and that Russia’s submarine fleet would **increase its “operational radius**.” This week, two Russian attack submarines were spotted off the U.S. east coast for the first time in 15 years. In January, on the eve of Obama’s inauguration, President Bush issued a National Security Presidential Directive on Arctic Regional Policy. As Michael Hamel-Greene has pointed out, it affirmed as a priority to preserve U.S. military vessel and aircraft mobility and transit throughout the Arctic, including the Northwest Passage, and foresaw greater capabilities to protect U.S. borders in the Arctic. The Bush administration’s disastrous eight years in office, particularly its decision to withdraw from the ABM treaty and deploy missile defence interceptors and a radar in Eastern Europe, has greatly contributed to the instability we are seeing today. The Arctic has figured in this renewed interest in Cold War weapons systems, particularly the upgrading of the Thule Ballistic Missile Early Warning System radar for ballistic missile defence. The Canadian government, as well, has put forward new military capabilities to protect Canadian sovereignty claims in the Arctic, including proposed ice-capable ships, a northern military training base and a deep water port. Denmark last week released an all-party defence position paper that suggests the country should create a dedicated Arctic military contingent that draws on army, navy and air force assets with ship-based helicopters able to drop troops anywhere. Danish fighter planes could be patrolling Greenlandic airspace. Last year, Norway chose to buy 48 Lockheed F-35 fighter jets, partly because of their suitability for Arctic patrols. In March, that country held a major Arctic military practice involving 7,000 soldiers from 13 countries in which a fictional country called Northland seized offshore oil rigs. The manoeuvres prompted a protest from Russia – which objected again in June after Sweden held its largest northern military exercise since the end of the Second World War. About 12,000 troops, 50 aircraft and several warships were involved. Jayantha Dhanapala, President of Pugwash and former UN Under-Secretary for Disarmament Affairs, summarizes the situation bluntly. He warns us that “From those in the international peace and security sector, deep concerns are being expressed over the fact that two nuclear weapon states – the United States and the Russian Federation, which together own **95 per cent of the nuclear weapons** in the world – **converge on the Arctic and have competing claims**. These claims, together with those of other allied NATO countries – Canada, Denmark, Iceland, and Norway – could, if unresolved, lead to **conflict escalating into the** threat or **use of nuclear weapons**.”

#### Now, we don’t have to win the timeframe question – Even 1 degree of warming warms the oceans and causes catastrophic methane burps

Atcheson 4 – a geologist, has held a variety of policy positions in several federal government agencies. (John, “Ticking Time Bomb,” <http://www.commondreams.org/views04/1215-24.htm>)

The Arctic Council's recent report on the effects of global warming in the far north paints a grim picture: global floods, extinction of polar bears and other marine mammals, collapsed fisheries. But it ignored a ticking time bomb buried in the Arctic tundra. There are enormous quantities of naturally occurring greenhouse gasses trapped in ice-like structures in the cold northern muds and at the bottom of the seas. These ices, called clathrates, contain 3,000 times as much methane as is in the atmosphere. Methane is more than 20 times as strong a greenhouse gas as carbon dioxide. Now here's the scary part. A temperature increase of merely a few degrees would cause these gases to volatilize and "burp" into the atmosphere, which would further raise temperatures, which would release yet more methane, heating the Earth and seas further, and so on. There's 400 gigatons of methane locked in the frozen arctic tundra - enough to start this chain reaction - and the kind of warming the Arctic Council predicts is sufficient to melt the clathrates and release these greenhouse gases into the atmosphere. Once triggered, this cycle could result in runaway global warming the likes of which even the most pessimistic doomsayers aren't talking about. An apocalyptic fantasy concocted by hysterical environmentalists? Unfortunately, no. Strong geologic evidence suggests something similar has happened at least twice before. The most recent of these catastrophes occurred about 55 million years ago in what geologists call the Paleocene-Eocene Thermal Maximum (PETM), when methane burps caused rapid warming and massive die-offs, disrupting the climate for more than 100,000 years. The granddaddy of these catastrophes occurred 251 million years ago, at the end of the Permian period, when a series of methane burps came close to wiping out all life on Earth. More than 94 percent of the marine species present in the fossil record disappeared suddenly as oxygen levels plummeted and life teetered on the verge of extinction. Over the ensuing 500,000 years, a few species struggled to gain a foothold in the hostile environment. It took 20 million to 30 million years for even rudimentary coral reefs to re-establish themselves and for forests to regrow. In some areas, it took more than 100 million years for ecosystems to reach their former healthy diversity. Geologist Michael J. Benton lays out the scientific evidence for this epochal tragedy in a recent book, *When Life Nearly Died: The Greatest Mass Extinction of All Time*. As with the PETM, greenhouse gases, mostly carbon dioxide from increased volcanic activity, warmed the earth and seas enough to release massive amounts of methane from these sensitive clathrates, setting off a runaway greenhouse effect. The cause of all this havoc? In both cases, a temperature increase of about 10.8 degrees Fahrenheit, about the upper range for the average global increase today's models predict can be expected from burning fossil fuels by 2100. But these models could be the tail wagging the dog since they don't add in the effect of burps from warming gas hydrates. Worse, as the Arctic Council found, the highest temperature increases from human greenhouse gas emissions will occur in the arctic regions - an area rich in these unstable clathrates. If we trigger this runaway release of methane, there's no turning back. No do-overs. Once it starts, it's likely to play out all the way. Humans appear to be capable of emitting carbon dioxide in quantities comparable to the volcanic activity that started these chain reactions. According to the U.S. Geological Survey, burning fossil fuels releases more than 150 times the amount of carbon dioxide emitted by volcanoes - the equivalent of nearly 17,000 additional volcanoes the size of Hawaii's Kilauea. And that is the time bomb the Arctic Council ignored. How likely is it that humans will cause methane burps by burning fossil fuels? No one knows. But it is somewhere between possible and likely at this point, and it becomes more likely with each passing year that we fail to act. So forget rising sea levels, melting ice caps, more intense storms, more floods, destruction of habitats and the extinction of polar bears. Forget warnings that global warming might turn some of the world's major agricultural areas into deserts and increase the range of tropical diseases, even though this is the stuff we're pretty sure will happen. Instead, let's just get with the Bush administration's policy of pre-emption. We can't afford to have the first sign of a failed energy policy be the mass extinction of life on Earth.

#### Comparatively worse than the release of the entire global nuclear stockpile

Ryskin 3 (Gregory, Department of Chemical Engineering, Northwestern University, Illinois, “Methane-driven oceanic eruptions and mass extinctions” Geology 31(9): 741-744,)

Upon release of a significant portion of the dissolved methane, the ocean settles down, and the entire sequence of events (i.e., development of anoxia, accumulation of dissolved methane, the metastable state, eruption) begins anew. No external cause is required to bring about a methane-driven eruption—its mechanism is self-contained, and implies that eruptions are likely to occur repeatedly at the same location. Because methane is isotopically light, its fast release must result in a negative carbon isotope excursion in the geological record. Knowing the magnitude of the excursion, one can estimate the amount of methane that could have produced it. Such calculations (prompted by the methane-hydrate-dissociation model, but equally applicable here) have been performed for several global events in the geological record; the results range from 1018 to 1019 g of released methane (e.g., Katz et al., 1999; Kennedy et al., 2001; de Wit et al., 2002). These are very large amounts: the total carbon content of today’s terrestrial biomass is 1018 g. Nevertheless, relatively small regions of the deep ocean could contain such amounts of dissolved methane; e.g., the Black Sea alone (volume ;0.4 3 1023 of the ocean total; maximum depth only 2.2 km) could hold, at saturation, ;0.5 3 1018 g. A similar region of the deep ocean could contain much more (the amount grows quadratically with depth3). Released in a geological instant (weeks, perhaps), 1018 to 1019 g of methane could destroy the terrestrial life almost entirely. Combustion and explosion of 1019 g of methane would liberate energy equivalent to 108 Mt of TNT; 10,000 times greater than the world’s stockpile of nuclear weapons, implicated in the nuclear winter scenario **(**Turco et al., 1991).

#### Scenario 2 is the Reefs

#### Warming causes reef bleaching

Blockstein and Wiegman 10. David E. Blockstein is a Senior Scientist with the National Council for Science and the Environmen, PhD in Ecology from the University of Minnesota. Leo Wiegman, Mayor at Croton-on-Hudson. “The Climate Solutions Consensus: What we Know and What To Do About It” Island Press, 2010.

Marine Ecosystems and Biodiversity. Increased coral bleaching, in which coral dies and only its calcium skeleton remains, is already underway. This bleaching is caused by a convergence of disruptions from elevated temperatures in coastal water, changes in salinity, an increase in the acidity of the water, and a decline in plankton. [High confidence] Coral reefs are zones of high biodiversity and rich habitat for many fish species historically important in human diets. Reef bleaching is happening even faster and more extensively than the IPCC predicted just 2 years ago. This elevates the extinction rate for species dependant on coral.

#### Extinction

InterPressService2006

(http://www.climateark.org/shared/reader/welcome.aspx?linkid=55070&keybold=coral%20reef%20dying%20Pacific)

Vast swaths of coral reefs in the Caribbean sea and South Pacific Ocean are dying, while the recently-discovered cold-water corals in northern waters will not survive the century -- all due to climate change.  The loss of reefs will have a catastrophic impact on all marine life.  One-third of the coral at official monitoring sites in the area of Puerto Rico and the U.S. Virgin Islands have recently perished in what scientists call an "unprecedented" die-off.  Extremely high sea temperatures in the summer and fall of 2005 that spawned a record hurricane season have also caused extensive coral bleaching extending from the Florida Keys to Tobago and Barbados in the south and Panama and Costa Rica, according to the U.S. National Oceanic and Atmospheric Administration's Coral Reef Watch.  High sea temperatures are also killing parts of Australia's 2,000-kilometre-long Great Barrier Reef, the world's largest living reef formation. As summer ends in the Southern Hemisphere, researchers are now investigating the extent of the coral bleaching. Up to 98 percent of the coral in one area has been affected, reported the Australian Institute of Marine Science last week.  "The Great Barrier Reef has been living on this planet for 18 million years and we've undermined its existence within our lifetimes," says Brian Huse, executive director of the Coral Reef Alliance, a U.S.-based NGO dedicated to protecting the health of coral reefs.  "Twenty percent of Earth's reefs have been lost and 50 percent face moderate to severe threats," Huse told IPS.  The economic value of reefs globally is estimated at 375 billion dollars, he says.  Coral reefs are uncommon, found in less than one percent of the world's oceans. However, they are considered the tropical rainforests of the oceans because they provide home and habitat to 25 to 33 percent of all marine life. **The World Conservation Union (IUCN) considers coral reefs one of the life-support systems essential for human survival.** Reefs are made up of tiny animals called polyps, which create cup-like limestone skeletons around themselves using calcium from seawater. Reefs form as generation after generation of coral polyps live, build and die, creating habitat for themselves and many other plants and animals.  Coral gets its beautiful colors from algae that cover the polyps. The algae produce oxygen and sugars for the coral polyps to eat while the polyps produce carbon dioxide and nitrogen, which enhances algae growth. If coral polyps are stressed by too-warm sea temperatures or pollution, they lose their algae coating and turn white.  Bleached corals can recover if the stress is temporary -- lasting weeks instead of months. In 2002, extensive bleaching of the Great Barrier Reef led to a five percent permanent mortality rate. Reefs in the Indian Ocean and other parts of the Pacific have been hit even harder by warm ocean temperatures over the past few years.  Reefs face a number of other threats from trawling, blast fishing (the use of dynamite to catch fish), pollution, unsustainable tourism and disease, says Huse. Climate change is the most daunting threat of all, in large part because few people realise the impacts their carbon dioxide emissions are having on the oceans, he says.  Every day, the average person on the planet burns enough fossil fuel to emit 24 pounds of carbon dioxide (CO2) to the atmosphere, out of which about nine pounds is then taken up by the ocean. As this CO2 combines with seawater, it forms an acid in a process known as ocean acidification.  There is no debate about the fact that the oceans are becoming more and more acidic due to climate change, says Scott Doney, senior scientist at the Woods Hole Oceanographic Institution in the U.S.  "What isn't known is how marine life will react," Doney said in an interview.  Coral reefs in tropical areas appear to withstand current and future acidification, but new research shows that the recently discovered cold-water corals are highly sensitive, he says.  Cold-water corals are found at depths of 2,000 to 3,000 metres in the North Atlantic and Southern Ocean and to a lesser extent in the North Pacific. Only discovered about 20 years ago, these corals appear to be quite extensive and full of unusual marine life but their full extent has not been documented. And although nearly all of the known reef sites have been damaged by bottom trawl fishing, ocean acidification may be their worst threat.  Like warm-water corals, polyps in cold-water corals take calcium from sea water to make their limestone skeletons. However, there is much less calcium (actually aragonite, a form of calcium carbonate) available at depth and more acidic sea water dramatically reduces what is available. Corals thus form weaker, thinner skeletons or are unable to form them at all.  The calcium levels have already declined in many parts of the world's oceans and by 2100, 70 percent will no longer be able to support cold corals, says John Guinotte, marine scientist at the Marine Conservation Biology Institute in Washington State.  "Corals have no experience with these conditions and are unlikely to adapt in time," Guinotte told IPS.  While Guinotte only looked at impacts on corals, Doney has learned that many other important marine species like types of phytoplankton and small snails that make shells are similarly affected.  "Before 2100, these species won't be able to form the shells they need to live," he said.  Such highly abundant species are an important part of the marine food chain and impacts on the ocean ecology could be devastating.  "There could be a big hit but we don't what it will be yet," said Guinotte. "What we do know is that by the year 2050, the oceans will be very different than they are now."

#### Loss of coral reefs would destroy global food security

Skoloff 2010

[Brian. “Coral Reef Extinction Could Cripple Nations' Economies.” Huffington Post. <http://www.huffingtonpost.com/2010/03/26/coral-reef-extinction-cou_n_514742.html> //Jamie]

If reefs were to disappear, commonly consumed species of grouper and snapper could become just memories. Oysters, clams and other creatures that are vital to many people's diets would also suffer. And experts say commercial fisheries would fail miserably at meeting demand for seafood. "Fish will become a luxury good," said Cassandra deYoung of the U.N. Food and Agriculture Organization. "You already have a billion people who are facing hunger, and this is just going to aggravate the situation," she added. "We will not be able to maintain food security around the world."

#### These Price spikes will kill billions

Tampa Tribune ‘96

(“Grain shortage growing problem” January 20, l/n)

There are more people in this world than ever, but less grain to feed them. That's kindled fears of a world food crisis, a problem Florida may help prevent. Poor weather, drought, political unrest and economic shifts have decreased planting, pushing world grain reserves to record lows. Meanwhile, the world's population grew by 100 million, to 5.75 billion in 1995 - a record increase. Now, miners in West Central Florida are digging out phosphate more quickly, so it can be used to make fertilizer. Analysts are warning about the increasing possibility of flood or drought in the world's food-producing regions. That can push food prices much higher, both here and abroad, and even cause famine in the poorest countries. U.S. food prices may rise more than 4 percent this year, ahead of the rate of inflation. "Conditions today indicate that there is at least some vulnerability in the food supply," said Sara Schwartz, an agricultural economist with the U.S. Department of Agriculture. Corn and soybean production plunged last year in the United States, she said. Wet weather slowed grain planting in the United States and Canada. Elsewhere, drought and civil conflict in sub-Saharan Africa cut production to 20 percent below normal. The European Union has less than one quarter of the grain reserves it held in 1993. The amount of corn expected to be available in the United States by summer - when corn is harvested - was trimmed by crop forecasters this week to 507 million bushels, the lowest in 20 years. On a global scale, food supplies - measured by stockpiles of grain - are not abundant. In 1995, world production failed to meet demand for the third consecutive year, said Per Pinstrup-Andersen, director of the International Food Policy Research Institute in Washington, D.C. As a result, grain stockpiles fell from an average of 17 percent of annual consumption in 1994-1995 to 13 percent at the end of the 1995-1996 season, he said. That's troubling, Pinstrup-Andersen noted, since 13 percent is well below the 17 percent the United Nations considers essential to provide a margin of safety in world food security. During the food crisis of the early 1970s, world grain stocks were at 15 percent. "Even if they are merely blips, higher international prices can hurt poor countries that import a significant portion of their food," he said. "Rising prices can also quickly put food out of reach of the 1.1 billion people in the developing world who live on a dollar a day or less."

#### Coral reefs are the keystone to biodiversity

Walsh 2008

[Bryan. (I'm a senior writer for TIME magazine, covering energy and the environment—and also, occasionally, scary diseases.) “Coral reefs face extinction.” <http://www.time.com/time/magazine/article/0,9171,1826263,00.html> July 11, 2008. //Jamie]

You don't have to be a marine biologist to understand the importance of corals — just ask any diver. The tiny underwater creatures are the architects of the beautiful, electric-colored coral reefs that lie in shallow tropical waters around the world. Divers swarm to them not merely for their intrinsic beauty, but because the reefs play host to a wealth of biodiversity unlike anywhere else in the underwater world. Coral reefs are home to more than 25% of total marine species. Take out the corals, and there are no reefs — remove the reefs, and entire ecosystems collapse.

#### Accelerated biodiversity loss causes extinction.

Leemans 2010

[Rik. (Wageningen University: Full professor in Environmental Systems Analysis, Interim professor in Earth System Science.) Chapter 4: Ecosystems. Climate Change Science and Policy. Edited by Stephen H. Schneider. Pg 63 //Jamie]

The observed impacts already show that eco-systems will be altered everywhere. Many places will experience future local and regional extinctions; habitats, especially in the polar regions, will disappear. Probably the most vulnerable areas will be those regions with many endemic species, such as mediterranean regions (including the South African Fynbos) and mountainous areas. Forests will also potentially be affected when droughts reduce their resilience and increase fire frequencies. These changes entail grave consequences for the effectiveness of mitigation strategies because they probably release carbon into the atmosphere. This chapter shows that the magnitude and rate of climate change pose a major threat. Human-induced climate change will cause rates of change to species, ecosystems, and biodiversity that are historically unprecedented. This will exceed the ability of many plant and animal species to migrate or adapt and will lead to irreversible impacts. Although some species and ecosystems will profit, most will be adversely affected by climate change, which will accelerate the decline of biodiversity. This phenomenon has been observed in the past when biodiversity declined during periods with rapid climate change, such as the Younger Dryas of 12,000 years ago. The threats of climate change pose large challenges for conservation, especially since effective efforts to protect habitats and create ecological networks require international co-operation and concerted action. Developing successful conservation strategies must include support for developing countries. Only a global climate policy in conjunction with a conservation plan will reduce the threat of a major extinction event.

#### Even a small loss of reefs causes extinction

US Department of State 2000 ( “Coral Reefs: Fertile Gardens of the Sea,” online)

According to the Worldwatch Institute publication, "State of the World 2000," reefs include only 0.3 percent of the ocean area, but "one out of every four ocean species thus far identified is a reef-dweller, including at least 65 percent of marine fish species." Historically, coral reefs have been important to fishermen; increasingly, they stimulate local economies by drawing tourism. They protect coastlines from erosion, and over the eons have helped create brilliant beaches as their calcium carbonate leached on to the shore. According to the U.S. Fish and Wildlife Service, "Reef systems are storehouses of immense biological wealth" that provide "sources of food, pharmaceuticals, jobs, and revenues. Reef habitats provide humans with services worth about $375 billion [thousand million] each year, despite the fact that they cover less than one percent of the earth's surface." The U.S. State Department estimates that "reefs provide one-quarter of the fish catch in developing countries and employment for millions of fishers." Corals are also sensitive indicators of the health of the aquatic environment. They flourish in a fairly narrow range of temperatures, salinity, and water purity. The die-off of corals going on in many oceans does not bode well for the health of the oceans themselves; and healthy oceans are essential if life on the planet is to be sustained in its current form. Attempts to restore coral reefs and manage their biological richness better include efforts being carried out to inventory and protect the structures themselves. Watershed management, including protection and conservation of wetlands with their mud flats, mangrove forests, and sea grasses, can help the estuarine system, including corals, to remain clean and healthy. Coral reefs have come to the attention of the public only recently, perhaps because fewer people visit a coral reef than a forest or prairie. Governments and private-sector organizations have taken note of the deterioration of the world's reefs, and are trying to find solutions. In 1994, the U. S. government helped found the International Coral Reef Initiative, a partnership designed to address threats to coral reefs. In 1996, the U.S. Coral Reef Initiative was launched to support these efforts and aid them domestically. And in 1998, the president issued an executive order directing U.S. government agencies to protect coral reefs. This executive order also established the United States Coral Reef Task Force, co-chaired by the Secretary of the Interior and the Secretary of Commerce, including other federal departments. Its duties include the promotion of reef mapping, scientific research, restoration, and collaboration with other nations. As it begins to operate, the task force has focused in on illegal trade in corals and associated sea life as one important cause of reef destruction. Even aquaculture of species such as shrimp can harm reef environments, in part by undermining Biodiversity to produce large amounts of a single species. Efforts are under way in the U.S. Congress to support the task force and improve mapping and conservation of reef systems under U.S. jurisdiction. One way to help restore reef environments is simply to protect them from undue exploitation. Writing in Issues in Science and Technology, marine biologist Tundi Agardy observed, "Scientific studies on the effect of notake reserves in East Africa, Australia, Jamaica, the Lesser Antilles, New Zealand, the Philippines, and elsewhere all suggest that small, strictly protected no-take areas result in increased fish production." In addition: "Preliminary evidence from a 1997 fishing ban in 23 small coral reef reserves by the Florida Keys Marine Sanctuary, indicates that several important species, including spiny lobsters and groupers, are already beginning to rebound." Australia's Great Barrier Reef Marine Park is often cited as one example of enlightened coral reef management. Nations as diverse as Guinea Bissau, Spain, and Croatia have established marine and watershed reserves. In many instances, national governments initiate the conservation measures; in others, local communities initiate conservation efforts, with the assistance of the government. Like all ecosystems, reefs have sections and areas more crucial to Biodiversity than others. Determining which these are can be an important part of conservation. "Zoned" networks of vital areas of reef can be easier to protect than an entire system. When the most biologically vital parts of the reef are put off-limits, other areas can be made available for commercial use and tourism. The Florida Keys National Marine Sanctuary management plan, for example, establishes protective zones, as well as recreational and commercial zones -- and sets aside areas for scientific research. University of Maryland zoologist Marjorie L. Reaka-Kudla has estimated the number of species living on coral reefs at 950,000, of which about 10 percent have been studied and described. Mankind is just beginning to perceive the value of coral reefs, with their known supplies of food and as-yet-unexplored biota that could lead to the development of new medicines. The U.S. State Department estimates "half the potential pharmaceuticals being explored are from the oceans, many from coral reef ecosystems." In Reef Research, Dr. Patrick Colin, a marine "bioprospector," clearly described the hopes that had led him to spend the 1990s collecting marine samples in the Pacific for the U.S. National Cancer Institute (NCI). "Over the past 20 some years the NCI has been screening terrestrial plants and marine organisms worldwide for bioactivity against cancer and AIDS, and has come up with a number of hot prospects, a number of which are in clinical trials. We try to collect from all environments possible, from shoreline areas with mangroves, beaches or rocks to deep offshore reef environments. We do not collect any hard (stony) corals, threatened, endangered or locally protected species. We are mostly interested in soft-bodied sessile invertebrates which rely on their chemistry, rather than stinging cells, spines, jaws or teeth for their survival." Clearly, conservation of coral, and oceans in general, is linked to human survival and will continue to be an urgent issue in the 21st century.

#### These Extinctions cause a chain reaction of co-dependent species that results in total human extinction.

Whitty**,** Environmental Correspondent,2007

(Julia, April 25, “Gone: Mass Extinction and the Hazards of Earth's Vanishing Biodiversity”, http://www.motherjones.com/news/feature/2007/05/gone.html)

Nowhere is this better proven than in a 12-year study conducted in the Chihuahuan Desert by James H. Brown and Edward Heske of the University of New Mexico. When a kangaroo rat guild composed of three closely related species was removed, shrublands quickly converted to grasslands, which supported fewer annual plants, which in turn supported fewer birds. Even humble players mediate stability. So when you and I hear of this year's extinction of the Yangtze River dolphin, and think, how sad, we're not calculating the deepest cost: that extinctions lead to co-extinctions because most every living thing on Earth supports a few symbionts and hitchhikers, while keystone species influence and support a myriad of plants and animals. Army ants, for example, are known to support 100 known species, from beetles to birds. A European study finds steep declines in honeybee diversity in the last 25 years but also significant attendant declines in plants that depend on bees for pollination—a job estimated to be worth $92 billion worldwide. Meanwhile, beekeepers in 24 American states report that up to 70 percent of their colonies have recently died off, threatening $14 billion in U.S. agriculture. And bees are only a small part of the pollinator crisis. One of the most alarming developments is the rapid decline not just of species but of higher taxa, such as the class Amphibia, the 300-million-year-old group of frogs, salamanders, newts, and toads hardy enough to have preceded and then outlived most dinosaurs. Biologists first noticed die-offs two decades ago, and since have watched as seemingly robust amphibian species vanished in as little as six months. The causes cover the spectrum of human environmental assaults, including rising ultraviolet radiation from a thinning ozone layer, increases in pollutants and pesticides, habitat loss from agriculture and urbanization, invasions of exotic species, the wildlife trade, light pollution, and fungal diseases. Sometimes stressors merge to form an unwholesome synergy; an African frog brought to the West in the 1950s for use in human pregnancy tests likely introduced a fungus deadly to native frogs. Meanwhile, a recent analysis in Nature estimates that in the last 20 years at least 70 species of South American frogs have gone extinct as a result of climate change. In a 2004 analysis published in Science, author Lian Pin Koh and colleagues predict that an initially modest co-extinction rate will climb alarmingly as host extinctions rise in the near future. Graphed out, the forecast mirrors the rising curve of an infectious disease, with the human species acting all the parts: the pathogen, the vector, the Typhoid Mary who refuses culpability, and, ultimately, one of up to 100 million victims.

#### We Solve –

#### Jumpstarting development of LFTR reactors averts runway warming – reliance on uranium is counterproductive and doesn’t achieve sufficient levels of reduction

**Hansen, 08** [heads the NASA Goddard Institute for Space Studies in New York City, a part of the Goddard Space Flight Center in Greenbelt, Maryland. He has held this position since 1981Letter to Obama, <http://www.columbia.edu/~jeh1/mailings/2008/20081121_Obama.pdf>]

The Liquid-Fluoride Thorium Reactor (LFTR) is a thorium reactor concept that uses a chemically-stable fluoride salt for the medium in which nuclear reactions take place. This fuel form yields flexibility of operation and eliminates the need to fabricate fuel elements. 7 This feature solves most concerns that have prevented thorium from being used in solidfueled reactors. The fluid fuel in LFTR is also easy to process and to separate useful fission products, both stable and radioactive. LFTR also has the potential to destroy existing nuclear waste, albeit with less efficiency than in a fast reactor such as IFR. Both IFR and LFTR operate at low pressure and high temperatures, unlike today’s LWR’s. Operation at low pressures alleviates much of the accident risk with LWR. Higher temperatures enable more of the reactor heat to be converted to electricity (40% in IFR, 50% in LFTR vs 35% in LWR). Both IFR and LFTR have the potential to be air-cooled and to use waste heat for desalinating water. Both IFR and LFTR are 100-300 times more fuel efficient than LWRs. In addition to solving the nuclear waste problem, they can operate for several centuries using only uranium and thorium that has already been mined. Thus they eliminate the criticism that mining for nuclear fuel will use fossil fuels and add to the greenhouse effect. The Obama campaign, properly in my opinion, opposed the Yucca Mountain nuclear repository. Indeed, there is a far more effective way to use the $25 billion collected from utilities over the past 40 years to deal with waste disposal. This fund should be used to develop fast reactors that consume nuclear waste, and thorium reactors to prevent the creation of new long-lived nuclear waste. By law the federal government must take responsibility for existing spent nuclear fuel, so inaction is not an option. Accelerated development of fast and thorium reactors will allow the US to fulfill its obligations to dispose of the nuclear waste, and open up a source of carbon-free energy that can last centuries, even millennia. It is commonly assumed that 4th generation nuclear power will not be ready before 2030. That is a safe assumption under ‘business-as-usual”. However, given high priority it is likely that it could be available sooner. It is specious to argue that R&D on 4th generation nuclear power does not deserve support because energy efficiency and renewable energies may be able to satisfy all United States electrical energy needs. Who stands ready to ensure that energy needs of China and India will be entirely met by efficiency and renewables? China and India have strong incentives to achieve pollution-free skies as well as avert dangerous climate change. The United States, even if efficiency and renewables can satisfy its energy needs (considered unlikely be many energy experts), needs to deal with its large piles of nuclear waste, which have lifetime exceeding 10,000 years. Development of the first large 4th generation nuclear plants may proceed most rapidly if carried out in China or India (or South Korea, which has a significant R&D program), with the full technical cooperation of the United States and/or Europe. Such cooperation would make it much easier to achieve agreements for reducing greenhouse gases. Implications. We have already overshot the safe level of greenhouse gases. Things are beginning to crumble – Arctic ice is melting, methane is bubbling from permafrost, mountain glaciers are disappearing. We must move onto a different course within the next few years to avoid committing the planet to accelerating climate changes out ofour control.The time has passed for ‘goals’, half-measures, greenwashing, and compromises with special interests.

#### Even if they win a solvency deficit establishing a formal precedent through thorium will jumpstart a “green” economy

Johnson 6 (Brian, BS Nuclear Engineering from Oregon State U, later received a Ph.D. in Nuclear Science and Engineering from M.I.T., "Thorium for Use in Plutonium Disposition,Proliferation-Resistant Fuels for DevelopingCountries, and Future Reactor Designs," [www.wise-intern.org/journal/2006/Johnson-ANS.pdf], jam)

As it stands, the joint plutonium disposition plans of the United State and Russia have stalled. This is because MOX, the technology chosen to undertake disposition, has taken more time and money than expected. In addition to this, Russia refuses to bear any of the cost of plutonium disposition through the use of MOX. This has opened the door to other options including thorium based fuels. A program in Russia examining thorium-based fuels has made a lot of progress and promises to be an excellent way to dispose of plutonium. The United States cannot directly benefit from this research and should start a program equal in size to the Russian program so that if thorium-based fuels turn out to be a better option for disposition there will be less delay in implementation. The United States outlines a desire in the Global Nuclear Energy Partnership (GNEP) to establish reactors in developing nations to provide potable water, heat for industrial processes, and electricity to growing populations. There are currently no designs that have all of the characteristics desired for reactors to be deployed in developing countries. Thorium-based, proliferation-resistant fuels can provide an evolutionary step until better technologies are developed. The design of this fuel shares a lot of the same technology as thorium-based fuel for plutonium disposition. Because of this, the same program could cover both research objectives with marginal added cost. Molten salt reactors meet all of the goals of next generation fuel cycles. However, the United States is not currently funding research into the technology. Recent research done in France has shown that some of the issues that prohibited development can be resolved. The United States is the only country with operating experience with molten salt reactors. Considering these facts, it makes sense for the United States to fund some research into this promising technology. Thorium could be used to reach several goals in the United States. The technology is not ready for implementation. The United States should fund research into thorium to reach these goals. In doing so, the United States could become a leader in thorium-based technology.

#### This would trigger key reductions in carbon emissions—that’s essential to slow and reverse anthropogenic climate change

Hargraves and Moir ’11 Robert Hargraves, teaches energy policy at the Institute for Lifelong Education at Dartmouth, PhD in physics from Brown, and Ralph Moir, Sc.D. in nuclear engineering from MIT, published 10 papers on molten-salt reactors during his career at Lawrence Livermore National Laboratory, “Liquid Fuel Nuclear Reactors,” Physics & Society, January 2011, http://www.aps.org/units/fps/newsletters/201101/hargraves.cfm

Burning coal for power is the largest source of atmospheric CO2, which drives global warming. We seek alternatives such as burying CO2 or substituting wind, solar, and nuclear power. A source of energy cheaper than coal would dissuade nations from burning coal while affording them a ready supply of electric power. Can a LFTR produce energy cheaper than is currently achievable by burning coal? Our target cost for energy cheaper than from coal is $0.03/kWh at a capital cost of $2/watt of generating capacity. Coal costs $40 per ton, contributing $0.02/kWh to electrical energy costs. Thorium is plentiful and inexpensive; one ton worth $300,000 can power a 1,000 megawatt LFTR for a year. Fuel costs for thorium would be only $0.00004/kWh. The 2009 update of MIT’s Future of Nuclear Power shows that the capital cost of new coal plants is $2.30/watt, compared to LWRs at $4/watt. The median of five cost studies of large molten salt reactors from 1962 to 2002 is $1.98/watt, in 2009 dollars. Costs for scaled-down 100 MW reactors can be similarly low for a number of reasons, six of which we summarize briefly: Pressure. The LFTR operates at atmospheric pressure, obviating the need for a large containment dome. At atmospheric pressure there is no danger of an explosion. Safety. Rather than creating safety with multiple defense-in-depth systems, LFTR’s intrinsic safety keeps such costs low. A molten salt reactor cannot melt down because the normal operating state of the core is already molten. The salts are solid at room temperature, so if a reactor vessel, pump, or pipe ruptured they would spill out and solidify. If the temperature rises, stability is intrinsic due to salt expansion. In an emergency an actively cooled solid plug of salt in a drain pipe melts and the fuel flows to a critically safe dump tank. The Oak Ridge MSRE researchers turned the reactor off this way on weekends. Heat. The high heat capacity of molten salt exceeds that of the water in PWRs or liquid sodium in fast reactors, allowing compact geometries and heat transfer loops utilizing high-nickel metals. Energy conversion efficiency. High temperatures enable 45% efficient thermal/electrical power conversion using a closed-cycle turbine, compared to 33% typical of existing power plants using traditional Rankine steam cycles. Cooling requirements are nearly halved, reducing costs and making air-cooled LFTRs practical where water is scarce. Mass production. Commercialization of technology lowers costs as the number of units produced increases due to improvements in labor efficiency, materials, manufacturing technology, and quality. Doubling the number of units produced reduces cost by a percentage termed the learning ratio, which is often about 20%. In The Economic Future of Nuclear Power, University of Chicago economists estimate it at 10% for nuclear power reactors. Reactors of 100 MW size could be factory-produced daily in the way that Boeing Aircraft produces one airplane per day. At a learning ratio of 10%, costs drop 65% in three years. Ongoing research. New structural materials include silicon-impregnated carbon fiber with chemical vapor infiltrated carbon surfaces. Such compact thin-plate heat exchangers promise reduced size and cost. Operating at 950°C can increase thermal/electrical conversion efficiency beyond 50% and also improve water dissociation to create hydrogen for manufacture of synthetic fuels such that can substitute for gasoline or diesel oil, another use for LFTR technology. In summary, LFTR capital cost targets of $2/watt are supported by simple fluid fuel handling, high thermal capacity heat exchange fluids, smaller components, low pressure core, high temperature power conversion, simple intrinsic safety, factory production, the learning curve, and technologies already under development. A $2/watt capital cost contributes $0.02/kWh to the power cost. With plentiful thorium fuel, LFTRs may indeed generate electricity at less than $0.03/kWh, underselling power generated by burning coal. Producing one LFTR of 100 MW size per day could phase out all coal burning power plants worldwide in 38 years, ending 10 billion tons per year of CO2 emissions from coal plants.