### 2AC: T – Procurement ≠ Financial Incentive

#### We meet – we provide financial incentives for investors to build SMRs, the procurement is just a guarantee

#### CI - Financial incentives induce behaviors using cash

Webb 93 – lecturer in the Faculty of Law at the University of Ottawa (Kernaghan, “Thumbs, Fingers, and Pushing on String: Legal Accountability in the Use of Federal Financial Incentives”, 31 Alta. L. Rev. 501 (1993) Hein Online)

In this paper, "financial incentives" are taken to mean disbursements 18 of public funds or contingent commitments to individuals and organizations, intended to encourage, support or induce certain behaviours in accordance with express public policy objectives. They take the form of grants, contributions, repayable contributions, loans, loan guarantees and insurance, subsidies, procurement contracts and tax expenditures.19 Needless to say, the ability of government to achieve desired behaviour may vary with the type of incentive in use: up-front disbursements of funds (such as with contributions and procurement contracts) may put government in a better position to dictate the terms upon which assistance is provided than contingent disbursements such as loan guarantees and insurance. In some cases, the incentive aspects of the funding come from the conditions attached to use of the monies.20 In others, the mere existence of a program providing financial assistance for a particular activity (eg. low interest loans for a nuclear power plant, or a pulp mill) may be taken as government approval of that activity, and in that sense, an incentive to encourage that type of activity has been created.21 Given the wide variety of incentive types, it will not be possible in a paper of this length to provide anything more than a cursory discussion of some of the main incentives used.22 And, needless to say, the comments made herein concerning accountability apply to differing degrees depending upon the type of incentive under consideration. By limiting the definition of financial incentives to initiatives where *public funds are either disbursed or contingently committed*, a large number of regulatory programs with incentive *effects* which exist, but in which no money is forthcoming,23 are excluded from direct examination in this paper. Such programs might be referred to as *indirect* incentives. Through elimination of indirect incentives from the scope of discussion, thedefinition of the incentive instrument becomes both more manageable and more particular. Nevertheless, it is possible that much of the approach taken here may be usefully applied to these types of indirect incentives as well.24 Also excluded from discussion here are social assistance programs such as welfare and *ad hoc* industry bailout initiatives because such programs are not designed primarily to *encourage* behaviours in furtherance of specific public policy objectives. In effect, these programs are assistance, but they are not incentives.

#### Our definition’s from the DoE

Waxman 98 **–** Solicitor General of the US (Seth, Brief for the United States in Opposition for the US Supreme Court case HARBERT/LUMMUS AGRIFUELS PROJECTS, ET AL., PETITIONERS v. UNITED STATES OF AMERICA, http://www.justice.gov/osg/briefs/1998/0responses/98-0697.resp.opp.pdf)

2 On November 15, 1986, Keefe was delegated “the authority, with respect to actions valued at $50 million or less, to approve, execute, enter into, modify, administer, closeout, terminate and take any other necessary and appropriate action (collectively, ‘Actions’) with respect to Financial Incentive awards.” Pet. App. 68, 111-112. Citing DOE Order No. 5700.5 (Jan. 12, 1981), the delegation defines “Financial Incentives” as the authorized financial incentive programs of DOE, “including direct loans, loan guarantees, purchase agreements, price supports, guaranteed market agreements and any others which may evolve.” The delegation proceeds to state, “[h]owever, a separate prior written approval of any such action must be given by or concurred in by Keefe to accompany the action.” The delegation also states that its exercise “shall be governed by the rules and regulations of [DOE] and policies and procedures prescribed by the Secretary or his delegate(s).” Pet. App. 111-113

#### Here’s a list of financial incentives we allow

Manage 6 (12 Manage, management portal which contains over 400 methods and theories along with more than 1500 management terms, “Incentives,” 3-9, http://www.12manage.com/description\_incentives.html)

Definition Incentives. Description.

An Incentive is any extrinsic reward factor that motivates an employee or manager or team to achieve an important business goal on top of his/her/their intrinsic motivation. It is a factor aiming to shape or direct behavior. In an optimal form, executives and employees should be remunerated well (but cost-effectively) where they deserve it, and not where they do not. Pay-offs for failure should be kept to a minimum. Furthermore, to be effective, a layered or gradual approach is better than an all-or-nothing incentive. A smart executive reward scheme is one of the pillars to ensure entrepreneurial behavior and maximizing shareholder value (Compare: Value Based Management). An incentive is unlike coercion, in that coerced work is motivated by the threat or use of violence, punishment or negative action, while an incentive is a positive stimulation. Incentives can also be used as Anti Hostile Takeover Mechanisms.

categories of incentives. Classes

 Financial Incentive. Also called, Remunerative Incentive, this category involves offering a material reward (often in the form of money) in exchange for certain results or behavior. In business, this is the most important category. The many variants include:

 Profit sharing (the traditional, oldest approach).

 Merit pay (merit wage or salary increase, often depending on the results of an appraisal).

 Scientific Management (Taylor) and Piece-Rate systems (very effective on productivity, but may lead to quality issues).

 Pay for Performance or Gain Sharing.

 Moral Incentive. Where a particular behavior is widely regarded as the right thing to do, or as particularly admirable, or where the failure to act in a certain way is condemned as indecent.

 Coercive Incentive. Where a failure to behave in a certain way or to achieve certain results can be expected to result in physical force being used.

Furthermore, incentives can be either a:

 Personal Incentive (motivating a specific individual person).

 Social Incentive (motivating any individual in certain circumstances).

#### Prefer it

#### Ground – allows a wider variety of incentive mechanisms which are key since the reduce restrictions part of the topic is the biggest– forcing the aff to spend government money is the only stable mechanism for disad links and counterplan competition.

#### Predictable – it’s the only big SMR aff, you should be prepared to debate it

#### Prefer reasonability – they can always find the most limiting interpretation to exclude any aff – kills topic education because teams will go for T instead of researching the topic

### Case

#### Grid’s vulnerable and threats are growing---insiders vote aff

Merica 12 Dan, CNN, "DoD official: Vulnerability of U.S. electrical grid is a dire concern", July 27, security.blogs.cnn.com/2012/07/27/dod-official-vulnerability-of-u-s-electrical-grid-is-a-dire-concern/

Speaking candidly at the Aspen Security Forum, one defense department official expressed great concern about the possibility of a terrorist attack on the U.S. electric grid that would cause a “long term, large scale outage.” Paul Stockton, assistant secretary for Homeland Defense and Americas’ Security Affairs at the Department of Defense, said such an attack would affect critical defense infrastructure at home and abroad – a thought that Stockton said was keeping him up at night. “The DOD depends on infrastructure in order to be able to operate abroad. And to make those operations function, we depend on the electric grid,” Stockton said. The concern, Stockton continued, was that America’s adversaries would avoid attacking “the pointy end of the spear,” meaning combat troops, and would instead look for homeland, possibly non-military, targets. “Our adversaries, state and non-state, are not stupid. They are clever and adaptive,” Stockton said. “There is a risk that they will adopt a profoundly asymmetric strategy, reach around and attack us here at home, the critical infrastructure that is not owned by the Department of Defense.” But Stockton’s concerns were not solely limited to terrorist attacks. Other concerning scenarios, said the assistant secretary, include geomagnetic disturbances, earthquakes and other natural disasters that could take down the grid. According to Stockton, a recurrence of a massive earthquake, like the New Madrid earthquake of 1812, “would cause a power outage for weeks to months across a multi-state area, rolling blackouts in the East Coast…”

#### Cyberterror coming against the grid now – we already know that they’ve been able to infiltrate the system

CNN 10-13 [Pam Benson – “Panetta: Cyber threat is pre 9/11 moment”, October 13th, 2012, http://security.blogs.cnn.com/2012/10/12/panetta-cyber-threat-is-pre-911-moment/?hpt=hp\_t3, Chetan]

The United States must beef up its cyber defenses or suffer as it did on September 11, 2001 for failing to see the warning signs ahead of that devastating terrorist attack, the Secretary of Defense told a group of business leaders in New York Thursday night. Calling it a “pre-9/11 moment,” Leon Panetta said he is particularly worried about a significant escalation of attacks. In a speech aboard a decommissioned aircraft carrier, Panetta reminded the Business Executives for National Security about recent distributed denial of service attacks that hit a number of large U.S. financial institutions with unprecedented speed, disrupting services to customers. And he pointed to a cyber virus known as Shamoon which infected the computers of major energy firms in Saudi Arabia and Qatar this past summer. More than 30-thousand computers were rendered useless by the attack on the Saudi state oil company ARAMCO. A similar incident occurred with Ras Gas of Qatar. Panetta said the attacks were probably the most devastating to ever hit the private sector. The secretary did not say who is believed responsible for those attacks, but senior defense officials who briefed reporters on the speech, said the United States knows, however they would not divulge the suspect. And he warned America's critical infrastructure - its electrical power grid, water plants and transportation systems - are threatened by foreign actors. "We know of specific instances where intruders have successfully gained access to these control systems," Panetta said. "We also know they are seeking to create advanced tools to attack those systems and cause panic, destruction and even loss of life."

#### US primacy prevents global conflict – withdrawl causes a power vaccum that causes transition wars in multiple places

Brooks et al 13 [Stephen G. Brooks is Associate Professor of Government at Dartmouth College.G. John Ikenberry is the Albert G. Milbank Professor of Politics and International Affairs at Princeton University in the Department of Politics and the Woodrow Wilson School of Public and International Affairs. He is also a Global Eminence Scholar at Kyung Hee University.William C. Wohlforth is the Daniel Webster Professor in the Department of Government at Dartmouth College. “Don't Come Home, America: The Case against Retrenchment”, Winter 2013, Vol. 37, No. 3, Pages 7-51,[http://www.mitpressjournals.org/doi/abs/10.1162/ISEC\_a\_00107](http://www.mitpressjournals.org/doi/abs/10.1162/ISEC_a_00107%22%20%5Ct%20%22_blank)]

A core premise of deep engagement is that it prevents the emergence of a far more dangerous*global*security environment. For one thing, as noted above, the United States’ *overseas presence gives it the leverage to restrain partners from taking provocative action*. Perhaps more important, its core alliance commitments also deter states with aspirations to regional hegemony from contemplating expansion and make its partners more secure, reducing their incentive to adopt solutions to their security problems that threaten others and thus stoke security dilemmas. The contention that engaged U.S. power dampens the baleful effects of anarchy is consistent with influential variants of realist theory. Indeed, arguably the scariest portrayal of the war-prone world that would emerge absent the “American Pacifier” is provided in the works of John Mearsheimer, who forecasts dangerous multipolar regions replete with security competition, arms races, nuclear proliferation and associated preventive wartemptations, regional rivalries, and even runs at regional hegemony and full-scale great power war. 72 How do retrenchment advocates, the bulk of whom are realists, discount this benefit? Their arguments are complicated, but two capture most of the variation: (1) U.S. security guarantees are not necessary to prevent dangerous rivalries and conflict in Eurasia; or (2) prevention of rivalry and conflict in Eurasia is not a U.S. interest. Each response is connected to a different theory or set of theories, which makes sense given that the whole debate hinges on a complex future counterfactual (what would happen to Eurasia’s security setting if the United States truly disengaged?). Although a certain answer is impossible, each of these responses is nonetheless a weaker argument for retrenchment than advocates acknowledge. The first response flows from defensive realism as well as other international relations theories that discount the conflict-generating potential of anarchy under contemporary conditions. 73 Defensive realists maintain that the high expected costs of territorial conquest, defense dominance, and an array of policies and practices that can be used credibly to signal benign intent, mean that Eurasia’s major states could manage regional multipolarity peacefully without theAmerican pacifier. Retrenchment would be a bet on this scholarship, particularly in regions where the kinds of stabilizers that nonrealist theories point to—such as democratic governance or dense institutional linkages—are either absent or weakly present. There are three other major bodies of scholarship, however, that might give decisionmakers pause before making this bet. First is regional expertise. Needless to say, there is no consensus on the net security effects of U.S. withdrawal. Regarding each region, there are optimists and pessimists. Few experts expect a return of intense great power competition in a post-American Europe, but many doubt European governments will pay the political costs of increased EU defense cooperation and the budgetary costs of increasing military outlays. 74 The result might be a Europe that is incapable of securing itself from various threats that could be destabilizing within the region and beyond (e.g., a regional conflict akin to the 1990s Balkan wars), lacks capacity for global security missions in which U.S. leaders might want European participation, and is vulnerable to the influence of outside rising powers. What about the other parts of Eurasia where the United States has a substantial military presence? Regarding the Middle East, the balance begins to*swing toward pessimists*concerned that states currently backed by Washington— notably Israel, Egypt, and Saudi Arabia—might take actions upon U.S. retrenchment that would intensify security dilemmas. And concerning East Asia, pessimismregarding the region’s prospects without the American pacifier is pronounced. Arguably the principal concern expressed by area experts is that Japan and South Korea are likely to obtain a nuclear capacity and increase their military commitments, which could stoke a destabilizing reaction from China. It is notable that during the Cold War, both South Korea and Taiwan moved to obtain a nuclear weapons capacity and were only constrained from doing so by astill-engaged United States. 75 The second body of scholarship casting doubt on the bet on defensive realism’s sanguine portrayal is all of the research that undermines its conception of state preferences. Defensive realism’s optimism about what would happen if the United States retrenched is very much dependent on itsparticular—and highly restrictive—assumption about state preferences; once we relax this assumption, then much of its basis for optimism vanishes. Specifically, the prediction of post-American tranquility throughout Eurasia rests on the assumption that security is the only relevant state preference, with security defined narrowly in terms of protection from violent external attacks on the homeland. Under that assumption, the security problem is largely solved as soon as offense and defense are clearly distinguishable, and offense is extremely expensive relative to defense. Burgeoning research across the *social and other sciences*, however,undermines that core assumption: states have preferences not only for security but also for prestige, status, and*other aims, and they*engage in trade-offs among the various objectives. 76 In addition, they define security not just in terms of territorial protection but in view of many and varied milieu goals. It follows that even states that are relatively secure may nevertheless engage in highly competitive behavior. Empirical studies show that this is indeed sometimes the case. 77 In sum, a bet on a benign postretrenchment Eurasia is a bet that leaders of major countries will never allow these nonsecurity preferences to influence their strategic choices. To the degree that these bodies of scholarly knowledge have predictive leverage, U.S. retrenchment would result in a significant deterioration in the security environment in at least some of the world’s key regions. We have already mentioned the third, even more alarming body of scholarship. Offensive realism predicts thatthe withdrawal of the American pacifier will yield either a *competitive regional multipolarity*complete with associated*insecurity, arms racing, crisis instability, nuclear proliferation*, and the like, or bids for regional hegemony, which may be beyond the capacity of local*great*powers to contain (and which in any case would generate intensely competitive behavior, possibly including regional *great power war*).

#### Plan solves meltdowns and accidents

**Wheeler 10** – Workforce Planning Manager with Entergy; Producer “This Week in Nuclear” Podcast (John, 11/21 “Small Modular Reactors May Offer Significant Safety & Security Enhancements.” http://thisweekinnuclear.com/?p=1193)

They are smaller, so the amount of radioactivity contained in each reactor is less. So much less in fact, that even if the worst case reactor accident occurs, the amount of radioactive material released would not pose a risk to the public. In nuclear lingo we say SMRs have a smaller “source term.”  This source term is so small we can design the plant and emergency systems to virtually eliminate the need for emergency actions beyond the physical site boundaries.  Then, by controlling access to the site boundary, we can eliminate the need for off-site protective actions (like sheltering or evacuations). These smaller reactors contain less nuclear fuel.  This smaller amount of fuel (with passive cooling I’ll mention in a minute) slows down the progression of reactor accidents.  This slower progression gives operators more time to take action to keep the reactor cool.  Where operators in large reactors have minutes or hours to react to events, operators of SMRs may have hours or even days. This means the chance of a reactor damaging accident is very, very remote. Even better, most SMRs are small enough that they cannot over heat and melt down. They get all the cooling they need from air circulating around the reactor. This is a big deal because if SMRs can’t melt down, then they can’t release radioactive gas that would pose a risk to the public.  Again, this means the need for external emergency actions is virtually eliminated. Also, some SMRs are not water cooled; they use gas, liquid salt, or liquid metal coolants that operate at low pressures.  This lower operating pressure means that if radioactive gases build up inside the containment building there is less pressure to push the gas out and into the air.  If there is no pressure to push radioactive gas into the environment and all of it stays inside the plant, then it poses no risk to the public. SMRs are small enough to be built underground. This means they will have a smaller physical footprint that will be easier to defend against physical attacks.  This provides additional benefits of lower construction costs because earth, concrete and steel are less costly than elaborate security systems in use today, and lower operating costs (a smaller footprint means a smaller security force).

#### Meltdowns cause extinction

Lendman 11 – Research Associate of the Centre for Research on Globalization (Stephe, 3/13. “Nuclear Meltdown in Japan” The People’s Voice <http://www.thepeoplesvoice.org/TPV3/Voices.php/2011/03/13/nuclear-meltdown-in-japan>)

Reuters said the 1995 Kobe quake caused $100 billion in damage, up to then the most costly ever natural disaster. This time, from quake and tsunami damage alone, that figure will be dwarfed. Moreover, under a worst case core meltdown, all bets are off as the entire region and beyond will be threatened with permanent contamination, making the most affected areas unsafe to live in. On March 12, Stratfor Global Intelligence issued a "Red Alert: Nuclear Meltdown at Quake-Damaged Japanese Plant," saying: Fukushima Daiichi "nuclear power plant in Okuma, Japan, appears to have caused a reactor meltdown." Stratfor downplayed its seriousness, adding that such an event "does not necessarily mean a nuclear disaster," that already may have happened - the ultimate nightmare short of nuclear winter. According to Stratfor, "(A)s long as the reactor core, which is specifically designed to contain high levels of heat, pressure and radiation, remains intact, the melted fuel can be dealt with. If the (core's) breached but the containment facility built around (it) remains intact, the melted fuel can be....entombed within specialized concrete" as at Chernobyl in 1986. In fact, that disaster killed nearly one million people worldwide from nuclear radiation exposure. In their book titled, "Chernobyl: Consequences of the Catastrophe for People and the Environment," Alexey Yablokov, Vassily Nesterenko and Alexey Nesterenko said: "For the past 23 years, it has been clear that there is a danger greater than nuclear weapons concealed within nuclear power. Emissions from this one reactor exceeded a hundred-fold the radioactive contamination of the bombs dropped on Hiroshima and Nagasaki." "No citizen of any country can be assured that he or she can be protected from radioactive contamination. One nuclear reactor can pollute half the globe.Chernobyl fallout covers the entire Northern Hemisphere." Stratfor explained that if Fukushima's floor cracked, "it is highly likely that the melting fuel will burn through (its) containment system and enter the ground. This has never happened before," at least not reported. If now occurring, "containment goes from being merely dangerous, time consuming and expensive to nearly impossible," making the quake, aftershocks, and tsunamis seem mild by comparison. Potentially, millions of lives will be jeopardized. Japanese officials said Fukushima's reactor container wasn't breached. Stratfor and others said it was, making the potential calamity far worse than reported. Japan's Nuclear and Industrial Safety Agency (NISA) said the explosion at Fukushima's Saiichi No. 1 facility could only have been caused by a core meltdown. In fact, 3 or more reactors are affected or at risk. Events are fluid and developing, but remain very serious. The possibility of an extreme catastrophe can't be discounted. Moreover, independent nuclear safety analyst John Large told Al Jazeera that by venting radioactive steam from the inner reactor to the outer dome, a reaction may have occurred, causing the explosion. "When I look at the size of the explosion," he said, "it is my opinion that there could be a very large leak (because) fuel continues to generate heat." Already, Fukushima way exceeds Three Mile Island that experienced a partial core meltdown in Unit 2. Finally it was brought under control, but coverup and denial concealed full details until much later. According to anti-nuclear activist Harvey Wasserman, Japan's quake fallout may cause nuclear disaster, saying: "This is a very serious situation. If the cooling system fails (apparently it has at two or more plants), the super-heated radioactive fuel rods will melt, and (if so) you could conceivably have an explosion," that, in fact, occurred. As a result, massive radiation releases may follow, impacting the entire region. "It could be, literally, an apocalyptic event.

DoD doesn’t face regulatory hurdles

Loudermilk and Andres 10 (Richard B. Andres is a Senior Fellow at the Institute for National Strategic Studies at National Defense University and a Professor of National Security Strategy at the National War College, Micah J. Loudermilk is a researcher at the Institute for National Strategic Studies at National Defense University, “Small Reactors and the Military's Role in Securing America's Nuclear Industry”, <http://sitrep.globalsecurity.org/articles/100823646-small-reactors-and-the-militar.htm>, April 23, 2010)

However, despite the hurdles facing private industry, the U.S. military is in a position to take a leading role in the advancement of nuclear reactor technology through the integration of small reactors on its domestic bases. While the Obama Administration has pledged $8 billion in federal loan guarantees to the construction of two new reactors in Georgia and an additional $36 billion in new guarantees to the nuclear industry, this comes on top of $18.5 billion budgeted, but unspent, dollars. Despite this aid, it is still improbable that the U.S. will see any new large reactors now or in the foreseeable future as enormous cost, licensing, construction, and regulatory hurdles must be overcome. In recent years though, attention in the nuclear energy sphere has turned in a new direction: small-scale reactors. These next-generation reactors seek to revolutionize the nuclear power industry and carry a host of benefits that both separate them from their larger cousins and provide a legitimate opportunity to successfully reinvigorate the American nuclear industry. When compared to conventional reactors, small reactors have a number of advantages. First, the reactors are both small and often scalable - meaning that sites can be configured to house one to multiple units based on power needs. Although they only exist on paper and the military has yet to embrace a size or design, the companies investing in these technologies are examining a range of possibilities. Hyperion, for example, is working on a so-called "nuclear battery" - a 25 MWe sealed and transportable unit the size of a hot tub. Similarly, Babcock & Wilcox - the company which built many of the Navy's reactors - is seeking licensing for its mPower reactor, which is scalable and produces 125 MWe of power per unit. Other designs, such as Westinghouse's International Reactor Innovative and Secure (IRIS) model, have a generating capacity of up to 335 MWe. Second, large reactors come with enormous price tags - often approaching $10 billion in projected costs. The costs associated with building new reactors are so astronomical that few companies can afford the capital outlay to finance them. Additionally, the risks classically associated with the construction of nuclear reactors serve as an additional deterrent to interested utilities. As a result, companies must be willing to accept significant financial risks since ventures could potentially sink them or result in credit downgrades - as evidenced by the fact that 40 of 48 utilities issuing debt to nuclear projects suffered downgrades following the accident at Three Mile Island. All of this adds up to an environment that is not conducive to the sponsorship of new reactor plants. On the other hand, small reactors are able to mostly circumvent the cost hurdles facing large reactors. During the construction of large reactors, utilities face "single-shaft risk" - forced to invest and tie up billions of dollars in a single plant. However, small reactors present the opportunity for utilities to buy and add reactor capacity as neede d or in a step-by-step process, as opposed to an all-or-nothing approach. Small reactors are also factory-constructed and shipped, not custom-designed projects, and can be built and installed in half the time - all of which are cost-saving measures. Additionally, despite concerns from critics over the proliferation and safety risks that a cadre of small reactors would potentially pose, the reality is considerably different. On the safety side, the new designs boast a number of features - including passive safety measures and simpler designs, thus reducing the number of systems to monitor and potential for system failure, enhancing the safety of the reactors. Small reactors can often be buried underground, are frequently fully contained and sealed (complete with a supply of fuel inside), can run longer between refueling cycles, and feature on-site waste storage - all of which serve to further insulate and secure the units. Finally, due to their small size, the reactors do not require the vast water resources needed by large reactors and in the event of an emergency, are far easier to isolate, shut off, and cool down if necessary. Notwithstanding all of these benefits, with a difficult regulation environment, anti-nuclear lobbying groups, and skeptical public opinion, the nuclear energy industry faces an uphill - and potentially unwinnable - battle in the quest for new reactors in the United States. Left to its own devices it is unlikely, at best, that private industry will succeed in bringing new reactors to the U.S. on its own. However, a route exists by which small reactors could potentially become a viable energy option: the U.S. military. Since 1948, the U.S. Navy has deployed over 500 reactors and possesses a perfect safety record in managing them. At the same time, grave concern exists over the fact that U.S. military bases are tied to and entirely dependent upon the civilian electric grid - from which they receive 99% of their power. Recently, attention has turned to the fact that the civilian grid, in addition to accidents, is vulnerable to cyber or terrorist attacks. In the event of a deliberate attack on the United States that knocks out all or part of the electric grid, the assets housed at the affected bases would be unavailable and U.S. global military operations potentially jeopardized. The presence of small-scale nuclear reactors on U.S. military bases would enable these facilities to effectively become "islands" - insulating them from the civilian grid and even potentially deterring attacks if the opponent knows that the military network would be unaffected. Unlike private industry, the military does not face the same regulatory and congressional hurdles to constructing reactors and would have an easier time in adopting them for use.

### 2AC – DoD DA

#### Link non unique – Obama already spent

#### Not intrinsic – a logical policymaker can choose to fund both DoD warfighting capabliities and SMRs

#### Our Aff is a link turn to the DA – even if the DoD can fund warfighting capabilities, they need a stable Grid to maintain forward operating bases

#### Their evidence says DoD needs ewnables – Andres

#### They’re even easier to hack

Charles Barton 11, founder of the Nuclear Green Revolution blog, MA in philosophy, “Future storm damage to the grid may carry unacceptable costs”, April 30, <http://nucleargreen.blogspot.com/2011_04_01_archive.html>

Amory Lovins has long argued that the traditional grid is vulnerable to this sort of damage. Lovins proposed a paradigm shift from centralized to distributed generation and from fossil fuels and nuclear power to renewable based micro-generation. Critics have pointed to flaws in Lovins model. Renewable generation systems are unreliable and their output varies from locality to locality, as well as from day to day, and hour to hour. In order to bring greater stability and predictability to the grid, electrical engineers have proposed expanding the electrical transmission system with thousands of new miles of transmission cables to be added to bring electricity from high wind and high sunshine areas, to consumers. This would lead, if anything, to greater grid vulnerability to storm damage in a high renewable penetration situation. Thus Lovins renewables/distributed generation model breaks down in the face of renewables limitations. Renewables penetration, will increase the distance between electrical generation facilities and customer homes and businesses, increasing the grid vulnerable to large scale damage, rather than enhancing reliability. Unfortunately Lovins failed to note that the distributed generation model actually worked much better with small nuclear power plants than with renewable generated electricity. Small nuclear plants could be located much closer to customer's homes, decreasing the probability of storm damage to transmission lines. At the very worst, small NPPs would stop the slide toward increased grid expansion. Small reactors have been proposed as electrical sources for isolated communities that are too remote for grid hookups. If the cost of small reactors can be lowered sufficiently it might be possible for many and perhaps even most communities to unhook from the grid while maintaining a reliable electrical supply. It is likely that electrical power will play an even more central role in a post-carbon energy era. Increased electrical dependency requires increased electrical reliability, and grid vulnerabilities limit electrical reliability. Storm damage can disrupt electrical service for days and even weeks. In a future, electricity dependent economy, grid damage can actually impede storm recovery efforts, making large scale grid damage semi-self perpetuating. Such grid unreliability becomes a threat to public health and safety. Thus grid reliability will be a more pressing future issue, than it has been. It is clear that renewable energy sources will worsen grid reliability, Some renewable advocates have suggested that the so called "smart grid" will prevent grid outages. Yet the grid will never be smart enough to repair its own damaged power lines. In addition the "smart grid" will be venerable to hackers, and would be a handy target to statures. A smart grid would be an easy target for a Stuxnet type virus attack. Not only does the "smart grid" not solve the problem posed by grid vulnerability to storm damage, but efficiency, another energy approach thought to be a panacea for electrical supply problems would be equally useless. Thus, decentralized electrical generation through the use of small nuclear power plants offers real potential for increasing electrical reliability, but successful use of renewable electrical generation approaches may worsen rather than improved grid reliability.

#### DOD increased counter-terror funding- thumps the disad

Purlain 8/10 (Ted Purlain, BioPrep Watch, “DOD to increase funding of nerve agent medical countermeasure program”, <http://www.bioprepwatch.com/weapons_of_bioterrorism/dod-to-increase-funding-of-nerve-agent-medical-countermeasure-program/324924/>, August 10, 2012, LEQ)

Pharmathene, Inc., recently announced that the U.S. Department of Defense plans to exercise an option to accelerate funding for its nerve agent medical countermeasure program. Pharmathene said the option is contingent on the countermeasure rBChE achieving key milestones in its development. “We believe this is a timely decision given the recent headlines about the potential threat of chemical weapons. PharmAthene is proud to be working in collaboration with the DoD to address this threat and provide innovative new solutions for our partners,” Eric I. Richman, the president and CEO of Pharmathene, said. “We have enjoyed a productive collaboration with the DoD for many years, beginning with our first generation nerve agent countermeasure, Protexia which completed a Phase I clinical study. We are pleased to be continuing our partnership to advance a next generation platform to deliver a flexible and efficient manufacturing approach, and a cost-effective solution to our government client in support of this important national security initiative.” RBChE, a recombinant form of human butyrycholinesterase, is a protein that is naturally occurring and found in minute quantities of human blood. It acts as a bioscavenger that can absorb toxins before they cause irreversible nerve damage. Pharmathene’s non-clinical animal studies have shown that rBChE can provide protection against nerve agent poisoning when administered before exposure and may increase survival rates when administered post-exposure.

#### No link- the plan doesn’t require the DOD spend money until the SMR’s are operational- whatever is on the “chopping block” will have already passed by then- or something else would have triggered it-

#### Fuel costs spill-over and destroy the DOD budget

Freed 12 Josh, Vice President for Clean Energy, Third Way, “Improving capability, protecting 'budget”, May 21, <http://energy.nationaljournal.com/2012/05/powering-our-military-whats-th.php>

As Third Way explains in a digest being released this week by our National Security Program, the Pentagon’s efforts to reduce energy demand and find alternative energy sources could keep rising fuel costs from encroaching on the budgets of other important defense programs. And the payoff could be massive. The Air Force has already been able to implement behavioral and technology changes that will reduce its fuel costs by $500 million over the next five years. The Army has invested in better energy distribution systems at several bases in Afghanistan, which will save roughly $100 million each year. And, using less than 10% of its energy improvement funds, the Department has begun testing advanced biofuels for ships and planes. This relatively small investment could eventually provide the services with a cost-effective alternative to the increasingly expensive and volatile oil markets. These actions are critical to the Pentagon’s ability to focus on its defense priorities. As Secretary Panetta recently pointed out, he’s facing a $3 billion budget shortfall caused by “higher-than-expected fuel costs.” The Department’s energy costs could rise even further if action isn’t taken. DOD expects to spend $16 billion on fuel next year. The Energy Information Administration predicts the price of oil will rise 23% by 2016, without a major disruption in oil supplies, like the natural disasters, wars, and political upheaval the oil producing states have seen during the last dozen years. Meanwhile, the Pentagon’s planned budget, which will remain flat for the foreseeable future, will require significant adjustment to the Department’s pay-any-price mindset, even if sequestration does not go into effect. Unless energy costs are curbed, they could begin to eat into other budget priorities for DOD. In addition, the Pentagon’s own Defense Science Board acknowledges that using energy more efficiently makes our forces more flexible and resilient in military operations, and can provide them with greater endurance during missions. Also, by reducing energy demand in the field, DOD can minimize the number of fuel convoys that must travel through active combat zones, reducing the chances of attack to avoiding casualties and destruction of material. At our domestic bases, DOD is employing energy conservation, on-site clean energy generation, and smart grid technology to prevent disruptions to vital activities in case the civilian grid is damaged by an attack or natural disaster. The bottom line is, developing methods and technologies to reduce our Armed Forces’ use of fossil fuels and increase the availability of alternative energy makes our military stronger. That’s why the Pentagon has decided to invest in these efforts.

#### Plan saves money

Causbie and Hart 12 Lieutenant Colonel Steven Hart, Cadet Hanson Causbie, West Point, New York, United States Military Academy, May 13, “Deployable Nukes: The Future Of Nuclear Power In The Deployed Environment”, PDF Online

Ten years of operating in the deployed environment have brought to light a number of challenges faced by the United States Army. Over the course of the past decade we have developed our counterinsurgency and stability strategy operations, refined the training of our troops in a variety of fields, and fielded new equipment to help us fight and win in our current operations. Overall, we have adapted to our new environment well and created a fighting force more capable, lethal, and agile than perhaps ever before. Unfortunately, the advancement of our technology and strategy has not extended to that of infrastructure development, particularly power production. Power production and the fuel necessary for the process are a vital element of stability operations and the sustainment of troops in the deployed environment. The equipment needed to support power production, usually diesel generators, are costly and require constant time and attention to keep them operational. These generators are also heavy polluters, releasing carbon dioxide as well as other byproducts from burning diesel fuel. Additionally, thousands of gallons of fuel are required to power these generators. This fuel is often difficult to transport as well as dangerous especially in the regions where U.S. troops currently operate. A new source of power production is necessary to replace the military’s currently dirty and costly system and provide our service members with the clean, reliable, and safe power they need to fight and win our nation’s wars. Luckily, this power source has already existed for a number of years. Since its introduction in the 1960s nuclear power has continued to grow and advance at an exponential rate. The nuclear power of today is far beyond where it was even ten years ago. Clean, safe, and easy to maintain, nuclear power facilities also provide a substantial amount of power with a relatively small amount of waste compared to that of coal, natural gas, and diesel generators. With new and self- contained units now on the market nuclear power is able to be provided to almost any region in the world at a reasonable cost and with few safety risks. This new nuclear technology is also an excellent fit for deployed environment because of its self-contained operation, low fuel intake, high power output, and clean operation. This paper will assess the feasibility and practicality of small nuclear power plants for use by the United States Army in the deployed environment as an alternative to other methods of power production. Through the data presented it can be seen that the deployment of small nuclear power facilities could save the Army millions of dollars annually while substantially cutting fuel requirements. Additionally, the Army would cut its environmental waste production and leave its allied partners with a sustainable energy source which could be used for up to a decade. This paper is broken into four sections. First, the paper will present some statistics on the current power production methods in the deployed environment and data regarding fuel consumption. Next the paper will examine available nuclear technology and the benefits as well associated risks with this equipment in addition to the costs of this equipment. Third, the two methods of power production will be compared with the advantages and disadvantages of both discussed in detail. Finally, the study will close with conclusions on both power sources as well as the future of power production in the deployed environment. CURRENT POWER REQUIREMENTS AND PRODUCTION The current operational environment has completely changed the power requirements for deployed troops. In World War II, for example, a soldier consumed an average of one gallon of fuel a day. In Iraq and Afghanistan the average soldier now consumes twenty gallons of fuel daily.1 Such an increase has resulted in the Marine Corps tripling its use of energy in the deployed environment in the past ten years.2 The training, deployment, and support of military forces in the field now consume 75% of the energy used by the Department of Defense.3 In Afghanistan approximately 30% of operational fuel is used to supply power to forward deployed bases.4 70% of the logistics operations in Afghanistan and Iraq are devoted to fuel and water, a staggering amount of time and effort for only two of the thousands of resources the military must supply to its service members.5 In 2008 the Department of Defense was supplying 68 million gallons of fuel to OIF and OEF per month, or roughly 2 million gallons of fuel daily.6 In 2010, the Department of Defense spent $15 billion on fuel.7 The consumption of fuel for power is only one element of the power production process. For fuel to be consumed it must first be transported to the site requiring power. This is oftentimes one of the most dangerous jobs in the deployed environment. In Afghanistan 80% of convoys are dedicated to the transport of fuel.8 These convoys are extremely deadly, responsible for an average of one soldier killed or injured for every 24 convoys.9 Convoys have become such a danger that Marine Corps Major General Richard Zilmer sent the Pentagon a “Priority 1” request for renewable energy in order to bring awareness of the issue to higher. In 2011, the Pentagon published its first ever energy plan to address the burgeoning need for power on the battlefield. In the report the Pentagon spoke extensively about reducing the military’s energy footprint through the use of non-oil energy sources.10 The report concluded that reduction in oil usage must be reduced not only to shrink the logistical footprint of deployed troops but also because of the possible “disruption of oil supplies” in the near future.11 Size and Demands Base camps vary in size and the scope of the number of troops they must support. From platoon- sized Combat Outposts (COP) to a Forward Operating Base (FOB) of 25,000 soldiers and contractors COPs and FOBs have differing power demands depending on their mission and the equipment and troops they support. According to ATP 3-37.10, the Army’s guide to building base camps, base camps are built in four sizes. The smallest base camps are built for 50 to 299 people and are no larger than 150 by 250 meters.12 The largest base camps are for a population of 6,000 or greater with the dimensions determined by the individual planners.13 This study will focus on the latter category to include base camps of the “megabase” variety supporting up to 30,000 soldiers and contractors. This size of base camp would be the easiest to institute changes in the power infrastructure because of the massive amount of required and would also be the easiest to emplace nuclear power production facilities. The type and scope of power production also depends on the size of the base camp. At the smallest COPs there may be no source of power expect for batteries for radios and other equipment. Conversely, at Balad Air Base in Iraq the Air Force powered the base with a “generator farm” containing a number of 40 foot MILVANs holding 12 cylinder diesel generators.14 At Camp Leatherneck in Afghanistan the five megawatts of power is supplied by 196 generators consuming 15,431 gallons of fuel daily.15 On smaller FOBs and COPs power is obviously produced on a much more austere scale than the megabases of Balad and Leatherneck. Many of the generators used on larger base camps are Mobile Electric Power (MEP) units.16 One of the most common of the MEP units is the 750 KW MEP 012A Prime Power Units. These generators are powered by Cummins turbocharged twelve cylinder engines and weigh 25,000 pounds. On average these units consume 55 gallons of diesel fuel per hour.17 Many of these 012A generators are gradually being replaced by Deployable Power Generator and Distribution Systems (DPGDS) which are 25% lighter and 15% more fuel efficient than their 012A predecessors.18 82% of the generators in the deployed environment are Tactical Quiet Generators (TQG).19 These generators are available in six major models and range in size from medium suitcases to full-size tractor trailers.20 Power output for these generators ranges from as little as 3 kW to as much as 100 kW.21 These generators are usually used during early stages of a campaign or at smaller FOBs and COPs where transportation of larger generators is difficult or impossible. Varying estimates exist for the amount of power required for a large FOB and the assets which reside at the base. FOBs which support aviation assets require far more fuel than those supporting solely ground assets. One senior military official estimated that the average Army brigade (3,500 to 4,000 soldiers) requires 10,000 gallons of fuel daily or 2.5-2.8 gallons of fuel per soldier per day.22 Fuel costs range from $6.35 per gallon to as much as $45.00 per gallon for FOBs and COPs located on the “tactical edge,” or locations far from combat infrastructure and deep in enemy territory. These prices include transport and fees for the fuel required by contractors.23 Some of this fuel, however, is necessary for vehicles which are not powered by generators. Therefore, power requirements per soldier often give a more accurate picture of fuel requirements for FOBs. ATP 3.37.10 calls for anywhere from 1.5 to 3.5 KW required for each individual on a FOB.24 Approximated Power Costs A series of calculations are necessary for an accurate idea of the power and fuel requirements and the respective cost for a FOB of 25,000 soldiers and contractors. Using an average of 2 KW required per individual a FOB of 25,000 requires 50,000 KW or 500 MW of power. Assuming that the FOB is powered by the new DPGDS, consuming 47 gallons of fuel per hour at 750 KW, the base would require a minimum of 67 generators burning 3,149 gallons of fuel per hour. At a standardized price of $10.00 a gallon the cost per hour of generation is $31,490 or $755,760 per day. These calculations have been greatly simplified with a number of additional factors which must be taken into consideration. First, a number of power generation sources may be employed at a megabase described in this experiment. The construction of a more permanent power plant may decrease costs while the use of older, less efficient generator may increase fuel consumption and thus costs. Similarly, the fluctuation of fuel costs also changes the overall costs as does the fluctuation of contractor costs and contracts. Finally, this estimate does not include estimates on maintenance as well as the cost for additional generators. Many of the generators used on FOBs run at no more than 30% capacity because of maintenance issues. FOBs are also required to have more generators in case of maintenance issues or a sudden surge in power requirements.25 NUCLEAR POWER PRODUCTION AND REQUIREMENTS As can be seen in the preceding section power production through the use of generators can often be inefficient, expensive, and plagued with maintenance issues. This section will discuss the available nuclear technology for the deployed environment as well as the costs associated with this technology. Available Technology A number of nuclear reactor designs are available at varying costs and power outputs. Many of these designs are currently only available on paper while others have entered the initial stages of production. All of the designs, however, share common features which make them appropriate to the deployed environment. The first feature is their size. Reactors range in size from as small as a residential hot tub to as large as a van. This compactness allows these units to achieve specific fabrication and performance goals not found in large light water reactors. 26 Second is the self- containment of these units. Most of the current designs are simply installed in the required location and then left alone with the only maintenance required at the time of removal or refuel.27 Finally, these mini reactors are significantly safer than the prior generations of nuclear technology. Current reactors, known as Generation IV reactors, have fewer moving parts and fewer systems, thus decreasing the points of failure and thus danger of the units.28 Illustration 1 (see below) outlines a few of available nuclear power units available on today’s market. All of these units are self-contained and differ in the length of their service as well as their power output. Name Manufacturer Generating Capacity Fueling Cycle Transportable Gen4 Module (formerly Hyperion Power Module) Gen4 Energy (formerly Hyperion Power Generation) 25 (MW), scalable 8-10 years, returned to factory for refueling and waste removal Ship, rail, or truck NuScale NuScale 45 MW, scalable 2 years, on-site refueling and spent fuel cooling Ship, rail, or truck mPower The Babcock and Wilcox Company 125 MW, scalable 4.5 years, on-site refueling and waste storage Ship or rail Illustration 1: Nuclear Power Reactor Designs29 All of the units above are manufactured and then transported in their entirety to their on-site locations.30 Some of the larger units may require to be sent in components because of their size. Even though the units are self-contained they do require additional infrastructure to distribute power including but not limited to cooling towers and condensers, a steam turbine, and additional support services. Associated Costs Even though all of the above products are capable of operating in the deployed environment the Gen4 Module will be used as the example unit for a number of reasons. First, the Gen4 Module is the smallest and most transportable unit, thus making it an easier unit to integrate into FOBs and begin the transition to nuclear power. Second, the Gen4 Module is the closest to development with delivery of the first units by June of 2013.31 Finally, the Gen4 Module has some important technological advances over its counterparts which make it even more appropriate for the deployed environment. These characteristics will be discussed in detail below. The Gen4 Module is 1.5 meters wide by 2.5 meters high and is a completely self-contained unit with each reactor stocked with ten years of uranium.32 The entire unit, including fuel, weighs approximately 20 tons and requires movement by a heavy haul truck.33 The unit fits into many standard shipping containers as well, making air or water travel fairly straightforward.34 After ten years, or when the uranium has reached 15% uranium enrichment, the reactor module is replaced with a new module within the plant and the old module is shipped back to the manufacturing facility for disposal. The plant can continually produce 25 MW of power for entire ten year life of the reactor core. 35 Each unit is scheduled to cost between $25 million and $30 million dollars.36 Construction on-site will be limited to the reactor vault, water support systems, and connection of the plant to the current power infrastructure.37 Illustration 2 offers a glimpse of the dimensions and design of the unit. Illustration 2: Gen4 Energy Module38 As opposed to other light water reactor designs, the primary cooling system of the Gen4 module is not water. Instead, the reactor is cooled using a lead and bismuth composite, known as LBE. This alloy is non-reactive to air and water and has an exit temperature of 500C, thus making it much safer than water because of its higher boiling point. This makes the reactor much less susceptible to overheating.39 Additionally, such a reactor requires far less water than a traditional reactor with the only water being that in the secondary cooling loop which is self-contained within the power plant.40 Therefore, instead of the need to draw water from an exterior water source the Gen4 Module can operate on approximately 10,000 gallons of water per hour.41 This would require approximately 20,000 gallons of water to be in the system at all times.42 Assuming each unit to cost $30 million, a FOB of 25,000 personnel would require a minimum of twenty of these units to meet power demands for a total of $600 million for ten years of power production. Therefore, the total cost per day comes to approximately $164,384.00. It is important to note that this cost does not include the cost of vault construction, transport of the unit to site, or construction of the cooling system and necessary water required for the cooling of the reactor. The final construction of the power plant to support the Gen4 Module can be seen in Illustration 3. Much of this material, however, is readily available and easily transported to the deployed environments. For example, steam generators capable of supporting 25 MW of power are readily available in the commercial market and are sized to be transported with relative ease.43 After some additional research a reasonable estimate for the added cost of support structures, training, and water requirements necessary for the reactor an additional $8 million plus $3 million dollars annually would be a likely figure for each power plant. This would put the total cost of operation at $372,603.00, still less than half of the costs associated with the current power infrastructure. Even with these rough estimates using approximated numbers the benefits of nuclear technology in the deployed environment are substantial. COMPARISON After calculating the cost per day for each type of technology it can be seen that nuclear power provided by the Gen4 module costs approximately $372,603.00 per day compared to the $755,760.00 for diesel generators. Therefore, nuclear power appears to be over 50% less than the current power infrastructure in our deployed environment. Nonetheless, a number of other factors must be taken into consideration when considering the costs and considerations of nuclear power compared to diesel generators. As stated above, estimated numbers were used for predicting the costs in addition to the cost of the reactor itself. Therefore, fluctuation in costs of transport, training of personnel, water, and additional material necessary for power plant construction may drastically alter the affordability of such power plants. 25 MW steam turbines, for example, may cost as much as $2 million and vary by manufacturer and design. The need for extra training is another added cost of nuclear power. Even though Gen4 Energy includes operator training, licensing support, and technical support with the installation of their units contractors must be hired or Army personnel must be retrained in order to install the modules as well as to address any maintenance or safety issues with the plants.45 It is quite possible, however, that training for Amy personnel could be provided by other branches. The Navy, for example could provide the training or even the personnel for the sustainment of nuclear facilities. The Army may also require additional security and safety measures because of the dangers of nuclear power even though the units are buried underground and thus safe from threats of terrorism or theft. Even though the reactors discussed are buried underground and are relatively isolated from terrorist threats more research and analysis needs to be done by both the Army as well as the manufacturer to address security concerns. These challenges do not exist with the current power infrastructure. Personnel are already trained to maintain generators with minimum security and safety requirements. Generators also do not require special transport as they are not considered as volatile and dangerous as their nuclear counterparts. Additionally, the stigma associated with nuclear power does not exist with diesel power production. Education of the military population regarding the safety of nuclear power as well as our coalition partners is essential to successful use of this technology. While a host nation may not have an issue with diesel generators they may have concerns with the installation of a nuclear power facility on their own soil. CONCLUSIONS AND RECOMMENDATIONS Even with the additional costs and limitations nuclear power provided by small reactors is still a viable option for the future of Army operations in the deployed environment. However, this technology may only work in certain areas suitable for this new technology. First, the technology is more cost-effective in larger FOBs because of cheaper transportation costs as well as the current high security state of these facilities. Large FOBs may also have greater access to the good and services necessary for the construction and maintenance of these facilities. Finally, larger FOBs allow for the refinement of this technology before such units are deployed closer to the tactical edge.

#### Plan solves colonization

O’Neil 11[Ian, PhD from University of Wales, founder and editor of Astroengine, space producer for Discovery News “'Suitcase' Nuclear Reactors to Power Mars Colonies,” August 30th, <http://news.discovery.com/space/mars-colonies-powered-by-mini-nuclear-reactors-110830.html>]

Nuclear power is an emotive subject -- particularly in the wake of the Fukushima power plant disaster after Japan's March earthquake and tsunami -- but in space, it may be an essential component of spreading mankind beyond terrestrial shores. On Monday, at the 242nd National Meeting and Exposition of the American Chemical Society (ACS) in Denver, Colo., the future face of space nuclear power was described. You can forget the huge reactor buildings, cooling towers and hundreds of workers; the first nuclear reactors to be landed on alien worlds to support human settlement will be tiny. Think less "building sized" and more "suitcase sized." "People would never recognize the fission power system as a nuclear power reactor," said James E. Werner, lead of the Department of Energy's (DOE) Idaho National Laboratory. "The reactor itself may be about 1 feet wide by 2 feet high, about the size of a carry-on suitcase. There are no cooling towers. A fission power system is a compact, reliable, safe system that may be critical to the establishment of outposts or habitats on other planets. Fission power technology can be applied on Earth's Moon, on Mars, or wherever NASA sees the need for continuous power." The joint NASA/DOE project is aiming to build a demonstration unit next year. Obviously, this will be welcome news to Mars colonization advocates; to have a dependable power source on the Martian surface will be of paramount importance. The habitats will need to have a constant power supply simply to keep the occupants alive. This will be "climate control" on an unprecedented level. Water extraction, reclamation and recycling; food cultivation and storage; oxygen production and carbon dioxide scrubbing; lighting; hardware, tools and electronics; waste management -- these are a few of the basic systems that will need to be powered from the moment humans set foot on the Red Planet, 24 hours 39 minutes a day (or "sol" -- a Martian day), 669 sols a year. Fission reactors can provide that. However, nuclear fission reactors have had a very limited part to play in space exploration up until now. Russia has launched over 30 fission reactors, whereas the US has launched only one. All have been used to power satellites. Radioisotope thermoelectric generators (RTGs), on the other hand, have played a very important role in the exploration of the solar system since 1961. These are not fission reactors, which split uranium atoms to produce heat that can then be converted into electricity. RTGs depend on small pellets of the radioisotope plutonium-238 to produce a steady heat as they decay. NASA's Pluto New Horizons and Cassini Solstice missions are equipped with RTGs (not solar arrays) for all their power needs. The Mars Science Laboratory (MSL), to be launched in November 2011, is powered by RTGs for Mars roving day or night. RTGs are great, but to power a Mars base, fission reactors would be desirable because they deliver more energy. And although solar arrays will undoubtedly have a role to play, fission reactors will be the premier energy source for the immediate future. "The biggest difference between solar and nuclear reactors is that nuclear reactors can produce power in any environment," said Werner. "Fission power technology doesn't rely on sunlight, making it able to produce large, steady amounts of power at night or in harsh environments like those found on the Moon or Mars. A fission power system on the Moon could generate 40 kilowatts or more of electric power, approximately the same amount of energy needed to power eight houses on Earth." "The main point is that nuclear power has the ability to provide a power-rich environment to the astronauts or science packages anywhere in our solar system and that this technology is mature, affordable and safe to use." Of course, to make these "mini-nuclear reactors" a viable option for the first moon and Mars settlements, they'll need to be compact, lightweight and safe. Werner contends that once the technology is validated, we'll have one of the most versatile and affordable power resources to support manned exploration of the solar system.

#### Colonization solves extinction

Schulze-Makuch and Davies 10 (Dirk Schulze-Makuch, Ph.D., School of Earth and Environmental Sciences, Washington State University and Paul Davies, Ph.D., Beyond Center, Arizona State University, “To Boldly Go: A One-Way Human Mission to Mars”, <http://journalofcosmology.com/Mars108.html>)

There are several reasons that motivate the establishment of a permanent Mars colony. We are a vulnerable species living in a part of the galaxy where cosmic events such as major asteroid and comet impacts and supernova explosions pose a significant threat to life on Earth, especially to human life. There are also more immediate threats to our culture, if not our survival as a species. These include global pandemics, nuclear or biological warfare, runaway global warming, sudden ecological collapse and supervolcanoes (Rees 2004). Thus, the colonization of other worlds is a must if the human species is to survive for the long term. The first potential colonization targets would be asteroids, the Moon and Mars. The Moon is the closest object and does provide some shelter (e.g., lava tube caves), but in all other respects falls short compared to the variety of resources available on Mars. The latter is true for asteroids as well. Mars is by far the most promising for sustained colonization and development, because it is similar in many respects to Earth and, crucially, possesses a moderate surface gravity, an atmosphere, abundant water and carbon dioxide, together with a range of essential minerals. Mars is our second closest planetary neighbor (after Venus) and a trip to Mars at the most favorable launch option takes about six months with current chemical rocket technology.

### 2AC - Human Cap DA

#### Their D'Agostino, 10 says supercomputers exist now to map and interpret diseases that solves the impact – they’ll still be there post plan, no link WHO still exist

#### No reason plan trades off with these workers specifically, they work in different departments, people in disease departments are not the same as nuclear sciensts.

firms in **the private sector**

**may offer more desirable work so they wouldn’t trade off with the plan**

#### SMRs solve water scarcity – turns disease

Palley 11[Reese Palley, The London School of Economics, 2011, The Answer: Why Only Inherently Safe, Mini Nuclear Power Plans Can Save Our World, p. 168-71]

The third world has long been rent in recent droughts, by the search for water. In subsistence economies, on marginal land, water is not a convenience but a matter of life and death. As a result small **wars have been fought, rivers diverted, and wells poisoned in what could be a warning of what is to come as industrialized nations begin to face failing water supplies.** Quite aside from the demand for potable water is the dependence of enormous swaths of industry and agriculture on oceans of water used for processing, enabling, and cleaning a thousand processes and products. It is interesting to note that fresh water used in both industry and agriculture is reduced to a nonrenewable resource as agriculture adds salt and industry adds a chemical brew unsuitable for consumption. More than one billion people in the world already lack access to clean water, and things are getting worse. Over the next two decades, the average supply of water per person will drop by a third, **condemning millions** of people **to** waterborne **diseases** and an avoidable premature death.81 So **the stage is set for water access wars between** the **first and the third worlds**, between **neighbors** downstream of supply, between **big industry** and big agriculture, between **nations**, between **population** centers, and ultimately between you and the people who live next door for an already inadequate world water supply that is not being renewed. **As populations inevitably increase, conflicts will intensify**.82 It is only by virtue of the historical accident of the availability of nuclear energy that humankind now has the ability to remove the salt and other pollutants to supply all our water needs. The problem is that **desalination is an intensely local process**. Some localities have available sufficient water from renewable sources to take care of their own needs, but not enough to share with their neighbors, and it **is here that the scale of nuclear energy production must be defined locally.** Large scale 1,000 MWe plants can be used to desalinate water as well as for generating electricity However we cannot build them fast enough to address the problem, and, if built they would face the extremely expensive problem of distributing the water they produce. Better, much better, would be to use small desalinization plants sited locally. Beyond desalination for human use is the need to green some of the increasing desertification of vast areas such as the Sahara. Placing twenty 100 MWe plants a hundred miles apart along the Saharan coast would green the coastal area from the Atlantic Ocean to the Red Sea, a task accomplished more cheaply and quickly than through the use of gigawatt plants.83 This could proceed on multiple tracks wherever deserts are available to be reclaimed. Leonard Orenstein, a researcher in the field of desert reclamation, speculates: If most of the Sahara and Australian outback were planted with fast-growing trees like eucalyptus, the forests could draw down about 8 billion tons of carbon a year—nearly as much as people emit from burning fossil fuels today. As the forests matured, they could continue taking up this much carbon for decades.84 **The use of small, easily transported**, easily **sited**, and walk away **safe nuclear reactors dedicated to desalination is the only answer** to the disproportionate distribution of water resources that have distorted human habitation patterns for millennia. Where there existed natural water, such as from rivers, great cities arose and civilizations flourished. Other localities lay barren through the ages. We now have the power, by means of SMRs profiled to local conditions, not only to attend to existing water shortages but also to smooth out disproportionate water distribution and create green habitation where historically it has never existed. **The endless wars that have been fought**, first over solid bullion gold and then over oily black gold, **can now engulf us in the desperate reach for liquid blue gold. We need never fight these wars again as we now have the nuclear power to fulfill the** biblical **ability to “strike any local rock and have water gush forth**.”

#### Solves Nuclear War from water wars

Weiner 90 (Jonathan, Pulitzer Prize winning author, “The Next One Hundred Years”, p. 270)

If we do not destroy ourselves with the A-bomb and the H-bomb, then we may destroy ourselves with the C-bomb, the Change Bomb. And in a world as interlinked as ours, one explosion may lead to the other. Already in the Middle East, from North Africa to the Persian Gulf and from the Nile to the Euphrates, tensions over dwindling water supplies and rising populations are reaching what many experts describe as a flashpoint. A climate shift in that single battle-scarred nexus might trigger international tensions that will unleash some of the 60,000 nuclear warheads the world has stockpiled since Trinity.

#### We don’t trade off with supercomputing disease personal – their ev says trades off with OTHER INFRASTRUCTURE

#### Building new plants is vital to expanding the nuclear workforce

Howard, 7 – Vice President Office of the President Nuclear Energy Institute (Angie, 2/5. “Achieving Excellence in Human Performance: Nuclear Energy Training and Education.” <http://www.nei.org/newsandevents/speechesandtestimony/2007/americannuclearsocietyextended>)

And, finally, Number Four—New Plant Pressures on Current Workforce. Yes, new plant activities are putting additional pressure on scarce utility human resources in areas like operations training, licensing and engineering, not to mention the project management and construction skills that will be needed. But, utility announcements of plans to build new plants and the resulting media coverage are raising the interest level of young people in careers in our industry. This new plant activity has also resulted in new job creation at the Nuclear Regulatory Commission. And vendors are aggressively hiring in nuclear-related disciplines. What young people are hearing is that, right now, 14 companies or consortia have publicly announced plans to apply for licenses for up to 33 new nuclear reactors. The first applications for a license to construct and operate a new nuclear plant will be submitted to the Nuclear Regulatory Commission later this year.

#### No extinction – diseases favor limited lethality and medicine will check

Posner 4 (Richard, Judge – US Court of Appeals, Catastrophe: Risk and Response, p. 22-24)

Yet the fact that Homo sapiens has managed to survive every disease to assail it in the 200,000 years or so of its existence is a source of genuine comfort, at least if the focus is on extinction events. There have been enormously destructive plagues, such as the Black Death, smallpox, and now AIDS, but none has come close to destroying the entire human race. There is a biological reason. Natural selection favors germs of limited lethality; they are fitter in an evolutionary sense because their genes are more likely to be spread if the germs do not kill their hosts too quickly. The AIDS virus is an example of a lethal virus, wholly natural, that by lying dormant yet infectious in its host for years maximizes its spread. Yet there is no danger that AIDS will destroy the entire human race. The likelihood of a natural pandemic that would cause the extinction of the human race is probably even less today than in the past (except in prehistoric times, when people lived in small, scattered bands, which would have limited the spread of disease), despite wider human contacts that make it more difficult to localize an infectious disease. The reason is improvements in medical science. But the comfort is a small one. Pandemics can still impose enormous losses and resist prevention and cure: the lesson of the AIDS pandemic. And there is always a lust time.

#### -- Burn out stops disease

Lederberg 99 (Joshua, Professor of Genetics – Stanford University School of Medicine, Epidemic The World of Infectious Disease, p. 13)

The toll of the fourteenth-century plague, the "Black Death," was closer to one third. If the bugs' potential to develop adaptations that could kill us off were the whole story, we would not be here. However, with very rare exceptions, our microbial adversaries have a shared interest in our survival. Almost any pathogen comes to a dead end when we die; it first has to communicate itself to another host in order to survive. So historically, the really severe host- pathogen interactions have resulted in a wipeout of both host and pathogen. We humans are still here because, so far, the pathogens that have attacked us have willy-nilly had an interest in our survival. This is a very delicate balance, and it is easily disturbed, often in the wake of large-scale ecological upsets.

#### US-lead development of nuclear power solves poverty – clean, affordable energy is key

**Robinson and Orient 4** - Professor of Chemistry and Founder of Oregon Institute of Science and Medicine AND \*\* executive director of the Association of American Physicians and Surgeons (Arthur and Jane, 6/14. The New American, “Science, Politics and Death.” <http://www.thenewamerican.com/node/358>)

Easily usable energy is the currency of human progress. Without it, stagnation, regression and untold human deaths will result. The lamentations of the popular press notwithstanding, there is no shortage of energy. Scientists define everything that man can perceive in the natural world as forms of "energy," including all physical objects. These forms of energy differ, however, in how easily mankind can make use of them by means of current technology. Nuclear power plants convert mass into electrical energy. This converted "nuclear energy" is, by far, the safest, cleanest and least expensive energy source available with current technology. Its use improves the standard of living, increases the quality and length of human life, and maximizes technological progress. The United States was once the world leader in the production of useful energy. Had that American leadership continued, our country and our world would be very different. Technological miracles that are only dreams today would have already taken place. Moreover, very large portions of the world's poor and underdeveloped people would have been able to lift themselves from poverty - provided they had a laboratory of liberty in which to do so - and to escape the horrible conditions in which they lead lives of desperation, constantly at the edge of death. Many people strongly desire to help humanity. They spend their lives in efforts to increase the quantity and quality of human life. Most other people, even though they do not work actively toward these goals, share the same values. They passively support things that improve human life. Those who understand energy production and its link to technological progress and who have positive humanitarian values support nuclear power. They are also in favor of hydrocarbon power derived from coal, oil and natural gas, and of hydroelectric power. Their interest in solar power, biofuel power, wind power and other alternatives is less because those methods cannot yet generate large quantities of inexpensive useful energy.

#### Ongoing poverty outweighs nuclear war and genocide—only our impact evidence is comparative

Spina 00 (Stephanie Urso, Ph.D. candidate in social/personality psychology at the Graduate School of the City University of New York, Smoke and Mirrors: The Hidden Context of Violence in Schools and Society, p. 201)

This sad fact is not limited to the United States. Globally, 18 million deaths a year are caused by structural violence, compared to 100,000 deaths per year from armed conflict. That is, **approximately every five years, as many people die because of relative poverty as would be killed in a nuclear war that caused 232 million deaths**, and **every single year, two to three times as many people die from poverty throughout the world as were killed by the Nazi genocide of the Jews over a six-year period**. This is, in effect, **the equivalent of an ongoing, unending, in fact accelerating, thermonuclear war or genocide**, perpetuated on the weak and the poor every year of every decade, throughout the world. (See James Gilligan, Violence: Reflections on a National Epidemic, New York: Vintage Books, 1997, 196).