**1AC – Inherency**

**Contention 1 is Inherency –**

**The DOE spent 450 million dollars on SMR’s this year and Obama has taken credit- takes out any perception or funding disads**

**Energy.gov 12** (Energy.gov, “Obama Administration Announces $450 Million to Design and Commercialize U.S. Small Modular Nuclear Reactors”, <http://energy.gov/articles/obama-administration-announces-450-million-design-and-commercialize-us-small-modular>, March 22, 2012)

**Obama** Administration **Announces $450 Million to** Design and Commercialize U.S. **Small Modular Nuclear Reactors**. Today, **as** President **Obama went to Ohio State University to discuss the all-out, all-of-the-above strategy for American energy**, **the White House announced new funding to advance the development of American-made** small modular reactors (**SMRs**), **an important element of the President’s energy strategy. A total of $450 million will be made available to support** first-of-its-kind **engineering**, design certification and licensing for up to two **SMR designs over five years**, subject to congressional appropriations. Manufacturing these reactors domestically will offer the United States important export opportunities and will advance our competitive edge in the global clean energy race. Small modular reactors, which are approximately one-third the size of current nuclear plants, have compact, scalable designs that are expected to offer a host of safety, construction and economic benefits. **“The Obama Administration and the Energy Department are committed to an all-of-the-above energy strategy that develops every source of American energy, including nuclear power**, and strengthens our competitive edge in the global clean energy race,” said Energy Secretary Steven Chu. “**Through the funding for small modular nuclear reactors announced today, the Energy Department and private industry are working to position America as the leader in advanced nuclear energy technology and manufacturing.”** Through cost-share agreements with private industry, **the Department will solicit proposals for promising SMR projects that have the potential to be licensed by the Nuclear Regulatory Commission and achieve commercial operation by 2022**. These cost-share agreements will span a five-year period and, subject to congressional appropriations, will provide a total investment of approximately $900 million, with at least 50 percent provided by private industry. SMRs can be made in factories and transported to sites where they would be ready to “plug and play” upon arrival, reducing both capital costs and construction times. The smaller size also makes SMRs ideal for small electric grids and for locations that cannot support large reactors, offering utilities the flexibility to scale production as demand changes. **Today’s announcement builds on the Obama Administration’s efforts to help jumpstart America’s nuclear energy industry that include: · In 2010,** **the Department signed a conditional commitment for $8 billion in loan guarantees to support the Vogtle project, where the Southern Company and Georgia Power are building two new nuclear reactors**, helping to create new jobs and export opportunities for American workers and businesses. · **The Energy Department has also supported the Vogtle project and the development of the next generation of nuclear reactors by providing more than $200 million through a cost-share agreement to support the licensing reviews for Westinghouse’s AP1000 reactor design certification.** The Vogtle license is the first for new nuclear power plant construction in more than three decades. · **Promoting a sustainable nuclear industry in the U.S. also requires cultivating the next generation of scientists and engineers. Over the past three years, the Department has invested $170 million in research grants at more than 70 universities, supporting R&D into a full spectrum of technologies, from advanced reactor concepts to enhanced safety design.**

#### But this still falls short of a true nuclear recolution – slow moving NRC process is hampering commercialization

**Wheeler 11** (Brian Wheeler - Associate Editor of Power Engineering, February 11 “Small Modular Reactors Are "Hot” proquest. Power Engineering Volume 115 No. 2)

The distant timeframe is for numerous reasons. The plan is to build a SMR, start generating power and bring more online to form a larger nuclear plant, as needed. The SMRs are expected to be ready, as the DOE calls it, to "plug and play" when the reactor arrives on-site. Sounds simple? There are still obstacles that need to be defeated before the arrival of a commercial SMR. Licensing is the number one challenge at this point. The Nuclear Regulatory Commission established the Advanced Reactor Program in 2009 to focus on new licensing technologies. NRC is studying several pre-application reviews to identify possible technical issues, such as safety, security and emergency planning. The light water small reactors may be very similar to large designs, but they still must go through a separate licensing process. Vendors that engage the NRC early can resolve these technical issues. To address safety and security concerns, the small reactors will be built with post-9/11 safety concepts into the designs. NRC expects the first application submission by 2012. The funds for the research and development of the SMR could pose a problem as well. But the Obama administration has requested $38.9 million for the 2011 fiscal year budget for the development of SMRs. The DOE supports public and private partnerships to advance mature SMR designs and supports "research and development activities to advance the understanding and demonstration of innovative reactor technologies and concepts." Among other goals, in FY2011 the DOE plans to “solicit, select and award project(s) with industry partners for cost-sharing the U.S. NRC review of design certification document for up to two of the most promising light water SMR concept(s) for near-term licensing and deployment” and “develop recommendations, in collaboration with NRC and industry, for changes in NRC policy, regulations or guidance to license and enable SMRs for deployment in the U.S. And as the general public’s interest in energy continues to grow, so does the interest in SMRs, said Philip Moor, vice president of consulting and management firm High Bridge Associates. If approved, the funding towards the development of small reactors in the U.S. may play a part of the International Atomic Energy Agency’s estimate of between 49 to 97 SMRs built by 2030. Utilities may have more interest in SMRs once the NRC gains more expertise and the uncertainty of deploying these reactors in the U.S. can be addressed. And if the regulator approves any of the designs for licensing, the U.S. may see a stronger nuclear renaissance take place. As we have seen, some operators have scaled back or completely pulled out on plans to build new large reactors due to the cost. The ability to construct these reactors in factories could lead to lower costs and shorter construction times. Of course, the upfront capital to develop and engineer the facility is going to be needed. But after that, the reactors can be built in the controlled environment in repetition to lower cost, which could in return lead to more clean energy on the grid.

**1AC – Warming**

**Contention 2 is Harms**

**Advantage 1 is Warming**

**Warming is real and human induced – emissions reductions are key to avoid dangerous climate disruptions**

**Somerville 11** [Richard Somerville - Distinguished Professor Emeritus and Research Professor at Scripps Institution of Oceanography at the University of California, San Diego, Coordinating Lead Author in Working Group I for the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 3-8-2011, “CLIMATE SCIENCE AND EPA'S GREENHOUSE GAS REGULATIONS,” CQ Congressional Testimony, Lexis, Chetan]

**In** early **2007**, at the time of the publication of WG1 of AR4, **the** mainstream **global community of climate scientists already understood from the most recent research that the latest observations of climate change were disquieting**. In the words of a research paper published at the same time as the release of AR4 WG1, a paper for which I am a co-author, "**observational data underscore the concerns about global climate change. Previous projections**, as summarized by IPCC, **have not exaggerated but may in some respects even have underestimated the change**" (Rahmstorf et al. 2007). Now, **in 2011, more recent research and newer observations have demonstrated that climate change continues to occur, and in several aspects the magnitude and rapidity of observed changes frequently exceed the estimates of earlier projections**, including those of AR4. In addition, **the case for attributing much observed recent climate change to human activities is even stronger now** than at the time of AR4. **Several** recent examples, drawn from many **aspects of climate science**, but especially emphasizing atmospheric phenomena, **support this conclusion. These include temperature, atmospheric moisture content, precipitation, and other aspects of the hydrological cycle**. Motivated by the rapid progress in research, a recent scientific synthesis, The Copenhagen Diagnosis (Allison et al. 2009), has assessed recent climate research findings, including: -- Measurements show that the Greenland and Antarctic ice**-sheets are losing mass** and contributing to sea level rise. -- Arctic sea-ice has melted far **beyond the expectations of climate models**. -- Global **sea level rise may attain or exceed 1 meter by 2100, with a rise of up to 2 meters considered possible**. -- **In 2008, global carbon dioxide emissions from fossil fuels were about 40% higher than those in 1990**. -- At today's global emissions rates, **if these rates were to be sustained** unchanged, after only about 20 more years, **the world will no longer have a reasonable chance of limiting warming** to less than 2 degrees Celsius, or 3.6 degrees Fahrenheit, above 19th-century pre-industrial temperature levels, This is a much- discussed goal for a maximum allowable degree of climate change, and this aspirational target has now been formally adopted by the European Union and is supported by many other countries, as expressed, for example, in statements by both the G-8 and G-20 groups of nations. The Copenhagen Diagnosis also cites research supporting the position that, **in order to have a reasonable likelihood of avoiding the risk of dangerous climate disruption**, defined by this 2 degree Celsius (or 3.6 degree Fahrenheit) limit, **global emissions of greenhouse gases** such as carbon dioxide **must** peak and then start to **decline rapidly within the next five to ten years**, reaching near zero well within this century.

**It’s the most likely scenario for extinction**

**Deibel 7** [Terry L. Professor of IR at National War College, 2007 “Foreign Affairs Strategy: Logic for American Statecraft”, Conclusion: American Foreign Affairs Strategy Today]

Finally, **there is one major existential threat** to American security (as well as prosperity) of a nonviolent nature, **which**, though far in the future, **demands urgent action. It is the threat of global warming to the stability of the climate upon which all earthly life depends. Scientists** worldwide have **been observing** the gathering of this threat **for three decades now, and what was once a** mere **possibility has passed through probability to near certainty**. Indeed **not one of more than 900 articles on climate change published in refereed scientific journals from 1993 to 2003 doubted that anthropogenic warming is occurring. “In legitimate scientific circles**,” writes Elizabeth Kolbert, “**it is virtually impossible to find evidence of disagreement over the fun damentals of global warming**.” Evidence from a vast international scientific monitoring effort accumulates almost weekly, as this sample of newspaper reports shows: an international panel predicts “brutal droughts, floods and violent storms across the planet over the next century”; climate change could “literally alter ocean currents, wipe away huge portions of Alpine Snowcaps and aid the spread of cholera and malaria”; “glaciers in the Antarctic and in Greenland are melting much faster than expected, and…worldwide, plants are blooming several days earlier than a decade ago”; “rising sea temperatures have been accompanied by a significant global increase in the most destructive hurricanes”; “NASA scientists have concluded from direct temperature measurements that 2005 was the hottest year on record, with 1998 a close second”;“**Earth’s warming climate is estimated to contribute to more than 150,000 deaths and 5 million illnesses each year” as disease spreads**; “widespread bleaching from Texas to Trinidad…killed broad swaths of corals” due to a 2-degree rise in sea temperatures. “**The world is slowly disintegrating**,” concluded Inuit hunter Noah Metuq, who lives 30 miles from the Arctic Circle. “They call it climate change…but we just call it breaking up.” From the founding of the first cities some 6,000 years ago until the beginning of the industrial revolution, carbon dioxide levels in the atmosphere remained relatively constant at about 280 parts per million (ppm). At present they are accelerating toward 400 ppm, and by 2050 they will reach 500 ppm, about double pre-industrial levels. **Unfortunately, atmospheric CO2 lasts about a century, so there is no way immediately to reduce levels, only to slow their increase, we are thus in for significant global warming; the only debate is how much and how serous the effects will be**. As the newspaper stories quoted above show, **we are already experiencing** the effects of 1-2 degree warming in more **violent storms, spread of disease, mass die offs of plants and animals, species extinction, and** threatened **inundation of low-lying countries** like the Pacific nation of Kiribati and the Netherlands at a warming of 5 degrees or less **the Greenland and West Antarctic ice sheets could disintegrate, leading to a sea level of rise of 20 feet** that would cover North Carolina’s outer banks, swamp the southern third of Florida, and inundate Manhattan up to the middle of Greenwich Village. **Another catastrophic effect would be the collapse of the Atlantic thermohaline circulation that keeps the winter weather in Europe far warmer than its latitude would otherwise allow**. Economist William Cline once estimated the damage to the United States alone from moderate levels of warming at 1-6 percent of GDP annually; severe warming could cost 13-26 percent of GDP. But **the most frightening scenario is runaway greenhouse warming, based on positive feedback from the buildup of water vapor in the atmosphere that is both caused by and causes hotter surface temperatures**. Past ice age transitions, associated with only 5-10 degree changes in average global temperatures, took place in just decades, even though no one was then pouring ever-increasing amounts of carbon into the atmosphere. Faced with this specter, the best one can conclude is that “humankind’s **continuing enhancement of the natural greenhouse effect is akin to playing Russian roulette with the earth’s climate and humanity’s life support system**. At worst, says physics professor Marty Hoffert of New York University, “**we’re just going to burn everything up; we’re going to heat the atmosphere to the temperature it was in the Cretaceous when there were crocodiles at the poles, and then everything will collapse**.” During the Cold War, astronomer Carl Sagan popularized a theory of nuclear winter to describe how a thermonuclear war between the Untied States and the Soviet Union would not only destroy both countries but possibly end life on this planet. **Global warming is the** post-Cold War era’s **equivalent of nuclear winter** at least as serious **and considerably better supported scientifically**. Over the long run **it puts dangers form** terrorism and traditional **military challenges to shame. It is a threat** not only to the security and prosperity to the United States, but potentially **to the continued existence of life on this planet**.

#### SMR development offsets oil and gas burned in electricity production, renewables can’t provide a stable baseload or provide localized power generation – absent nuclear transition emissions pass the tipping point

Loudermilk 11 [Micah K. Loudermilk, Contributor Micah J. Loudermilk is a Research Associate for the Energy & Environmental Security Policy program with the Institute for National Strategic Studies at National Defense University, contracted through ASE Inc, “Small Nuclear Reactors and US Energy Security: Concepts, Capabilities, and Costs”, http://www.ensec.org/index.php?option=com\_content&view=article&id=314:small-nuclear-reactors-and-us-energy-security-concepts-capabilities-and-costs&catid=116:content0411&Itemid=375, May 31, 2011, Chetan]

Lastly, and often ignored, is the ability of small reactors to bring a secure energy supply to locations detached from the grid. Small communities across Canada, Alaska, and other places have expressed immense interest in this opportunity. Additionally, the incorporation of small reactors may be put to productive use in energy-intensive operations including the chemical and plastics industries, oil refineries, and shale gas extraction. Doing so, especially in the fossil fuels industry would free up the immense amounts of oil and gas currently burned in the extraction and refining process. All told, small reactors possess numerous direct and indirect cost benefits which may alter thinking on the monetary competitiveness of the technology. Nuclear vs. Alternatives: a realistic picture When discussing the energy security contributions offered by small nuclear reactors, it is not enough to simply compare them with existing nuclear technology, but also to examine how they measure up against other electricity generation alternatives—renewable energy technologies and fossil fuels. Coal, natural gas, and oil currently account for 45%, 23% and 1% respectively of US electricity generation sources. Hydroelectric power accounts for 7%, and other renewable power sources for 4%. These ratios are critical to remember because idealistic visions of providing for US energy security are not as useful as realistic ones balancing the role played by fossil fuels, nuclear power, and renewable energy sources. Limitations of renewables Renewable energy technologies have made great strides forward during the last decade. In an increasingly carbon emissions and greenhouse gas (GHG) aware global commons, the appeal of solar, wind, and other alternative energy sources is strong, and many countries are moving to increase their renewable electricity generation. However, despite massive expansion on this front, renewable sources struggle to keep pace with increasing demand, to say nothing of decreasing the amount of energy obtained from other sources. The continual problem with solar and wind power is that, lacking efficient energy storage mechanisms, it is difficult to contribute to baseload power demands. Due to the intermittent nature of their energy production, which often does not line up with peak demand usage, electricity grids can only handle a limited amount of renewable energy sources—a situation which Germany is now encountering. Simply put, nuclear power provides virtually carbon-free baseload power generation, and renewable options are unable to replicate this, especially not on the scale required by expanding global energy demands. Small nuclear reactors, however, like renewable sources, can provide enhanced, distributed, and localized power generation. As the US moves towards embracing smart grid technologies, power production at this level becomes a critical piece of the puzzle. Especially since renewable sources, due to sprawl, are of limited utility near crowded population centers, small reactors may in fact prove instrumental to enabling the smart grid to become a reality. Pursuing a carbon-free world Realistically speaking, a world without nuclear power is not a world full of increased renewable usage, but rather, of fossil fuels instead. The 2007 Japanese Kashiwazaki-Kariwa nuclear outage is an excellent example of this, as is Germany’s post-Fukushima decision to shutter its nuclear plants, which, despite immense development of renewable options, will result in a heavier reliance on coal-based power as its reactors are retired, leading to a 4% increase in annual carbon emissions. On the global level, without nuclear power, carbon dioxide emissions from electricity generation would rise nearly 20% from nine to eleven billion tons per year. When examined in conjunction with the fact that an estimated 300,000 people per year die as a result of energy-based pollutants, the appeal of nuclear power expansion grows further. As the world copes simultaneously with burgeoning power demand and the need for clean energy, nuclear power remains the one consistently viable option on the table. With this in mind, it becomes even more imperative to make nuclear energy as safe as possible, as quickly as possible—a capacity which SMRs can fill with their high degree of safety and security. Additionally, due to their modular nature, SMRs can be quickly constructed and deployed widely.

**Try or die – without nuclear power warming is inevitable**

**Lynas 9-14** [Mark Lynas – Climate Scientist for The Guardian, “Without nuclear, the battle against global warming is as good as lost”, September 14th, 2012, <http://www.guardian.co.uk/environment/2012/sep/14/nuclear-global-warming>, Chetan]

Let me be very clear. **Without nuclear, the battle against global warming is as good as lost.** Even many greens now admit this in private moments. We are already witnessing the first signs of the collapse in the biosphere this entails – with the Arctic in full-scale meltdown, more solar radiation is being captured by the dark ocean surface, and the weather systems of the entire northern hemisphere are being thrown into chaos. **With nuclear, there is a chance that global warming this century can be limited to 2C; without nuclear, I would guess we are heading for 4C or above. That will devastate ecosystems and societies worldwide on a scale which is unimaginable.**

**Small reactor designs enable nuke power to offset as much CO2 as every car in America**

**Whitman 12** [Christine Todd Whitman CASEnergy Co-Chair, Former EPA Administrator and New Jersey Governor, “Nuclear Power Garners Bipartisan Support”, August 13th, 2012, <http://energy.nationaljournal.com/2012/08/finding-the-sweet-spot-biparti.php>, Chetan]

This support is founded in the fact that **nuclear energy**, safely managed, **provides an efficient, reliable source of energy**. In fact, **nuclear power is the only baseload source of carbon-free electricity. It provides nearly two-thirds of the nation’s low-carbon electricity, and will** continue to **be an important source of energy** well into the future **given the advent of** innovative large and **small reactor designs. The use of nuclear energy prevents more than 613 million metric tons of carbon dioxide every year – as much CO2 as is emitted by every passenger car in America.**

**Specifically, the plan is able to integrate into smaller electrical markets**

**King et al 11** [Marcus King • LaVar Huntzinger • Thoi Nguyen – CNA Environment and Energy Team - Resource Analysis Division, “Feasibility of Nuclear Power on US Military Installations”, March 2011, <http://www.cna.org/sites/default/files/research/Nuclear%20Power%20on%20Military%20Installations%20D0023932%20A5.pdf>, Chetan]

**SMRs have** potential **advantages over larger plants because they provide** owners **more flexibility in financing**, **siting, sizing,** and end-use applications. SMRs can reduce an owner's initial capital outlay or investment because of the lower plant capital cost. **Modular components and factory fabrication** can reduce construction costs and schedule duration. Additional modules can be added incrementally as demand for power increases. SMRs **can provide power for applications where large plants are not needed or may not have the necessary infrastructure to support a large unit such as smaller electrical markets, isolated areas, smaller grids, or restricted water or acreage sites. Several domestic utilities have expressed** considerable **interest in SMRs as potential replacements** for aging fossil plants to increase their fraction of non-carbon-emitting generators. Approximately 80 percent of the 1174 total operating **U.S. coal plants have power outputs of less than 500 MWe**; 100 percent of coal plants that are more than 50 years old have capacities below 500 MWe [3]. **SMRs would be a viable replacement option for these plants.**

**This allows for global energy transition– ideally suited for developing countries**

**Solan et al 10 –** Assistant Professor of Public Policy & Administration and Director of the Energy Policy Institute at Boise State University (David, June. “Economic and Employment Impacts of Small Modular Nuclear Reactors.” Energy Policy Institute, Center for Advanced Energy Studies. http://epi.boisestate.edu/media/3494/economic%20and%20employment%20impacts%20of%20smrs.pdf)

**The primary obstacle for many developing countries lies in their lack of available resources to build a large scale nuclear reactor that costs billions of dollars and requires at least several years to construct**. Aside from costs, **other key factors may inhibit the production of conventional nuclear reactors or larger fossil fuel plants within these countries** (IAEA, 2007). **Electrical grids with limited capacity are susceptible to operation and stability issues when power variations in excess of 10% of the total grid capacity occur**. **In certain countries**, regardless of whether the population is concentrated in urban areas or dispersed in remote regions, **the grid is not well developed or robust** (Carelli et al., 2010). As a result, **SMRs may be an attractive alternative due to their ability to be used as both incremental and distributed generation sources**. With this potential, however, come security concerns regarding transport and emplacement of SMRs in remote areas of some developing countries.

**This is especially true for small reactors – countries are looking to follow the US’s lead in new technical standards and operations for SMRs**

**Lovering et al 12** [Jessica Lovering, Ted Nordhaus, and Michael Shellenberger are policy analyst, chairman, and president of the Breakthrough Institute, a public policy think tank and research organization. “Out of the Nuclear Closet”, September 7th, 2012, <http://www.foreignpolicy.com/articles/2012/09/07/out_of_the_nuclear_closet>, Chetan]

**To move the needle on nuclear energy** to the point that it might actually be capable of displacing fossil fuels, **we'll need new nuclear technologies that are cheaper and smaller**. Today, there are a range of nascent, smaller nuclear power plant designs, some of them modifications of the current light-water reactor technologies used on submarines, and others, like thorium fuel and fast breeder reactors, which are based on entirely different nuclear fission technologies. **Smaller, modular reactors can be built much faster and cheaper** than traditional large-scale nuclear power plants. Next-generation nuclear reactors are **designed to be incapable of melting down, produce drastically less radioactive waste, make it very difficult or impossible to produce weapons grade material, useless water, and require less maintenance.** Most of these designs still face substantial technical hurdles before they will be ready for commercial demonstration. **That means a great deal of research and innovation will be necessary** to make these next generation plants viable and capable of displacing coal and gas. **The United States could be a leader on developing these technologies, but unfortunately U.S. nuclear policy remains mostly stuck in the past**. Rather than creating new solutions, efforts to restart the U.S. nuclear industry have mostly focused on encouraging utilities to build the next generation of large, light-water reactors with loan guarantees and various other subsidies and regulatory fixes. With a few exceptions, this is largely true elsewhere around the world as well. Nuclear has enjoyed bipartisan support in Congress for more than 60 years, but the enthusiasm is running out. The Obama administration deserves credit for authorizing funding for two small modular reactors, which will be built at the Savannah River site in South Carolina. But a much more sweeping reform of U.S. nuclear energy policy is required. At present, the Nuclear Regulatory Commission has little institutional knowledge of anything other than light-water reactors andvirtually no capability to review or regulate alternative designs. **This affects nuclear innovation in other countries as well, since the NRC remains, despite its many critics, the global gold standard for thorough regulation of nuclear energy. Most other countries follow the NRC's lead when it comes to establishing new technical and operational standards for the design, construction, and operation of nuclear plants. What's needed now is a new national commitment to the development, testing, demonstration,** and early stage commercialization **of** a broad range of **new nuclear technologies** -- **from much smaller light-water reactors** to next generation ones -- in search of a few designs that can be mass produced and deployed at a significantly lower cost than current designs. **This will require** both greater public support for nuclear innovation and **an entirely different regulatory framework to review and approve new commercial designs**. In the meantime, developing countries will continue to build traditional, large nuclear powerplants. But time is of the essence. With the lion's share of future carbon emissions coming from those emerging economic powerhouses, **the need to develop smaller and cheaper designs that can scale faster is all the more important. A true nuclear renaissance can't happen overnight**. And it won't happen so long as large and expensive light-water reactors remain our only option. **But in the end, there is no credible path to mitigating climate change without a massive global expansion of nuclear energy. If you care about climate change, nothing is more important than developing the nuclear technologies we will need to get that job done**.

**1AC – DoD Advantage**

**Advantage 2 is Forward Deployment**

**DoD bases are vulnerable to grid disruptions which destroys command infrastructure**

**Robitaille 12** (George, Department of Army Civilian, United States Army War College, “Small Modular Reactors: The Army’s Secure Source of Energy?” 21-03-2012, Strategy Research Project)

In recent years, **the** U.S Department of Defense (**DoD**) **has identified a security issue at our installations related to the dependence on the civilian electrical grid**. 1 **The DoD depends on a steady source of electricity at military facilities to perform the functions that secure our nation**. **The flow of electricity into military facilities is controlled by a public grid system that is susceptible to being compromised because of the age of the infrastructure, damage from natural disasters and the potential for cyber-attacks.** Although most major functions at military installations employ diesel powered generators as temporary backup, **the public grid may not be available to provide electricity when it is needed the most. The U**nited **S**tates **electrical infrastructure system is prone to failures and susceptible to terrorist attacks**. 2 It is critical that the source of electricity for our installations is reliable and secure. In order to ensure that our military facilities possess a secure source of electricity, either the public system of electric generation and distribution is upgraded to increase its reliability as well as reducing its susceptibility to cyber attack or another source of electricity should be pursued. **Although** significant **investments are being made to upgrade the electric grid, the current investment levels are not keeping up with the aging system.** Small modular reactors (SMRs) are nuclear reactors that are about an order of magnitude smaller than traditional commercial reactor used in the United States. SMRs are capable of generating electricity and at the same time, they are not a significant contributor to global warming because of green house gas emissions. **The DoD needs to look at** small modular nuclear reactors (**SMRs**) to determine if they can provide a safe and secure source of electricity. Electrical Grid Susceptibility to Disruptions According to a recent report by the Defense Science Board, **the DoD gets ninety nine percent of their electrical requirements from the civilian electric grid.** 3 **The electric grid**, as it is currently configured and envisioned to operate for the foreseeable future, **may not be reliable enough to ensure an uninterrupted flow of electricity for our critical military facilities given the influences of the aging infrastructure, its susceptibility to severe weather events, and the potential for cyber attacks**. The DoD dependency on the grid is reflected in the $4.01 Billion spent on facilities energy in fiscal year 2010, the latest year which data was available. 4 The electricity used by military installations amounts to $3.76 billion. 5 As stated earlier, **the DoD relies on the commercial grid to provide a secure source of energy to support the operations that ensure the security of our nation and it may not be available when we need it**. **The system could be taken down for extended periods of time by failure of aging components, acts of nature, or intentionally by cyber attacks.** Aging Infrastructure. **The** U.S electric power **grid is made up of independently owned power plants and transmission lines.** **The political and environmental resistance to building new electric generating power plants combined with the rise in consumption and aging infrastructure increases the potential for grid failure in the future.** **There are components in the** U.S. electric **grid that are over one hundred years old and** some of the **recent outages** such as the 2006 New York blackout **can be directly attributed to this out of date, aging infrastructure.** 6 Many of the **components of this system are** at or **exceeding their operational life and the** general **trend of the utility companies is to not replace** power lines and other **equipment until they fail**. 7 The government led deregulation of the electric utility industry that started in the mid 1970s has contributed to a three decade long deterioration of the electric grid and an increased state of instability. **Although significant investments are being made to upgrade the electric grid, the many years of prior neglect will require a considerable amount of time and funding to bring the aging infrastructure up to date**. Furthermore, the **current investment levels to upgrade the grid are not keeping up with the aging system.** 8 In addition, **upgrades to the digital infrastructure which were done to increase the systems efficiency and reliability, have actually made the system more susceptible to cyber attacks**. 9 **Because of** the **aging infrastructure and the impacts related to weather, the extent, as well as frequency of failures is expected to increase in the future.** Adverse Weather. **According to a 2008 grid reliability report** by the Edison Electric Institute, **sixty seven per cent of all power outages are related to weather.** Specifically, **lightning contributed six percent, while adverse weather provided thirty one percent and vegetation thirty percent** (which was predominantly attributed to wind blowing vegetation into contact with utility lines) of the power outages. 10 In 1998 a falling tree limb damaged a transformer near the Bonneville Dam in Oregon, causing a cascade of related black-outs across eight western states. 11 In August of 2003 the lights went out in the biggest blackout in North America, plunging over fifty million people into darkness over eight states and two Canadian provinces. Most areas did not have power restored four or five days. In addition, drinking water had to be distributed by the National Guard when water pumping stations and/or purification processes failed. The estimated economic losses associated with this incident were about five billion dollars. Furthermore, this incident also affected the operations of twenty two nuclear plants in the United States and Canada. 12 In 2008, Hurricane Ike caused approximately seven and a half million customers to lose power in the United States from Texas to New York. 13 **The electric grid suffered numerous power outages every year throughout the U**nited **S**tates **and the number of outages is expected to increase as the infrastructure ages** without sufficient upgrades **and weather-related impacts continue to become more frequent.** Cyber Attacks. **The civilian grid is made up of three unique electric networks which cover the East, West and Texas** with approximately one hundred eighty seven thousand miles of power lines. **There are several weaknesses in the electrical distribution infrastructure** system **that could compromise the flow of electricity to military facilities. The flow of energy in the network lines as well as the main distribution hubs has become totally dependent on computers and internet-based communications**. Although the **digital infrastructure** makes the grid more efficient, it also **makes it more susceptible to cyber attacks.** **Admiral** Mr. Dennis C. **Blair** (ret.), **the former Director of National Intelligence, testified** before Congress **that “the growing connectivity between information systems, the Internet, and other infrastructures creates opportunities for attackers to disrupt telecommunications, electrical power, energy pipelines, refineries, financial networks, and other critical infrastructures.** 14 ” The Intelligence Community assesses that **a number of nations already have the technical capability to conduct such attacks**. 15 In the 2009 report, Annual Threat Assessment of the Intelligence Community for the Senate Armed Services Committee, **Adm. Blair stated that “Threats to cyberspace pose one of the most serious** economic and national **security challenges of the 21st Century for the U**nited **S**tates and our allies.”16 In addition, **the report highlights a growing array of state and non-state actors that are targeting** the **U.S. critical infrastructure for** the purpose of **creating chaos that will** subsequently **produce detrimental effects on citizens, commerce, and government operations**. These **actors have the ability to compromise, steal, change, or completely destroy information** through their detrimental activities on the internet. 17 In January 2008, US Central Intelligence Agency senior analyst Tom Donahue told a gathering of three hundred international security managers from electric, water, oil & gas, and other critical industry, that **data was available from multiple regions outside the U**nited **S**tates, **which documents cyber intrusions into utilities**. In at least one case (outside the U.S.), the disruption caused a power outage affecting multiple cities. Mr. Donahue did not specify who executedthese attacks or why, but did state that all the intrusions were conducted via the Internet. 18 During the past twenty years, advances in computer technologies have permeated and advanced all aspects of our lives. Although the **digital infrastructure** is **being** increasingly **merged with the power grid** to make it more efficient and reliable, it also **makes it more vulnerable to cyber attack. In** October **2006, a foreign hacker invaded the Harrisburg**, PA., **water filtration system and planted malware**. 19 **In** June **2008**, **the Hatch nuclear power plant in Georgia shut down for two days after an engineer loaded a software update** for a business network **that** also **rebooted the plant's power control system. In** April **2009**, The Wall Street Journal reported that **cyber spies** had **infiltrated the U.S. electric grid and left behind software that could be used to disrupt the system.** **The hackers came from China, Russia and other nations and were on a “fishing expedition” to map out the system**. 20 According to the secretary of Homeland Security, Janet Napolitano at an event on 28 October 2011, **cyber–attacks have come close to compromising the country’s critical infrastructure on multiple occasions**. 21 Furthermore, during FY11, the United States Computer Emergency Readiness Team took action on more than one hundred thousand incident reports by releasing more than five thousand actionable cyber security alerts and information products. 22 The interdependence of modern infrastructures and digital based systems makes any cyber attacks on the U.S. electric grid potentially significant. The December 2008 report by the Commission on Cyber Security for the forty fourth Presidency states the challenge plainly: “America’s failure to protect cyberspace is one of the most urgent national security problems facing the new administration”. 23 The susceptibility of the grid to being compromised has resulted in a significant amount of resources being allocated to ensuring the systems security. **Although a substantial amount of resources are dedicated to protecting the nation’s infrastructure, it may not be enough to ensure the continuous flow of electricity to our critical military facilities.** **SMRs** as they are currently envisioned **may be able to provide a secure and independent alternative source of electricity in the event that the public grid is compromised**. **SMRs** may **also provide** **additional DoD benefit by supporting** the recent **government initiatives related to energy consumption and by circumventing** the adverse ramifications associated with **building coal or natural gas fired power plants** on the environment.

**Developing military SMR is necessary to create self-sufficient bases. No other alternative fills in. Failure to resolve energy vulnerabilities collapses global military deployments and escalates to nuclear war**

**Andres and Breetz 11** [Richard Andres, Professor of National Security Strategy at the National War College and a Senior Fellow and Energy and Environmental Security and Policy Chair in the Center for Strategic Research, Institute for National Strategic Studies, at the National Defense University, and Hanna Breetz, doctoral candidate in the Department of Political Science at The Massachusetts Institute of Technology, Small Nuclear Reactors for Military Installations: Capabilities, Costs, and Technological Implications, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf](http://www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf)]

Small Reactors and Energy Security **The DOD interest in small reactors derives** largely **from** problems with base and logistics vulnerability. Over the last few years, the Services have begun to reexamine virtually every aspect of how they generate and use energy with an eye toward cutting costs, decreasing carbon emissions, and reducing energy-related vulnerabilities. These actions have resulted in programs that have significantly reduced DOD energy consumption and greenhouse gas emissions at domestic bases. Despite strong efforts, however, two critical security issues have thus far proven resistant to existing solutions: bases’ vulnerability to civilian power outages, and the need to transport large quantities of fuel via convoys through hostile territory to forward locations. Each of these is explored below. Grid Vulnerability. **DOD is unable to provide its bases with electricity when the civilian** electrical **grid is offline** for an extended period of time. Currently, domestic **military installations receive 99 percent of their electricity from the civilian** power **grid. As explained in a recent study from the Defense Science Board: DOD’s** key **problem** with electricity **is that critical missions**, such as national strategic awareness and national command authorities, **are** almost **entirely dependent on the national** transmission **grid** . . . [**which] is fragile, vulnerable, near its capacity limit, and outside of DOD control. In most cases, neither the grid nor on-base backup power provides sufficient reliability to ensure continuity of critical national priority functions** and oversight of strategic missions **in the face of a long term** (several months) **outage**.7 **The grid’s fragility was demonstrated during the 2003** Northeast **blackout** in which 50 million people in the United States and Canada lost power, some for up to a week, when one Ohio utility failed to properly trim trees**. The blackout created** cascading disruptions in sewage systems, gas station pumping, cellular communications, border check systems, and so forth, and demonstrated the interdependence of modern infrastructural systems.8 More recently, awareness has been growing that the grid is also vulnerable to purposive attacks. **A report sponsored by the** Department of Homeland Security **suggests that a coordinated cyberattack** on the grid **could result in a third of the country losing power for** a period of weeks or months.9 Cyberattacks on critical infrastructure are not well understood. It is not clear, for instance, whether existing terrorist groups might be able to develop the capability to conduct this type of attack. It is likely, however, that some **nation-states** either **have** or are working on developing **the ability to take down the U.S. grid. In the event of a war** with one of these states, **it is possible**, if not likely, **that** parts of **the civilian grid would cease to function, taking with them military bases** located in affected regions. **Government and private organizations are currently working to secure the grid** against attacks; however, **it is not clear that they will be successful. Most** military **bases** currently **have backup power that allows them to function for** a period of **hours** or, at most, a few days on their own. **If power were not restored** after this amount of time, **the results could be disastrous**. First, **military assets taken offline** by the crisis **would not be available to help** with disaster relief. Second, **during an extended blackout, global military operations could be seriously compromised; this disruption would be** particularly **serious if the blackout was induced during major combat operations**. During the Cold War, this type of event was far less likely because the United States and Soviet Union shared the common understanding that **blinding an opponent with a grid blackout could escalate to nuclear war**. America’s current opponents, however, may not share this fear or be deterred by this possibility. In 2008, the Defense Science Board stressed that **DOD should mitigate** the electrical grid’s **vulnerabilities by turning military installations into “islands” of energy self-sufficiency**.10 **The department has made efforts** to do so **by promoting efficiency programs** that lower power consumption on bases **and** by **constructing renewable power** generation **facilities** on selected bases. **Unfortunately, these programs will** not come close **to reaching the goal of islanding the vast majority of bases.** **Even with massive investment in** efficiency and **renewable, most bases would not be able to function for more than a few days** after the civilian grid went offline. Unlike other alternative sources of energy, **small reactors have the potential to solve DOD’s vulnerability to grid outages. Most bases have** relatively **light power demands when compared to** civilian towns or **cities. Small reactors could easily support bases’ power demands** separate from the civilian grid during crises. In some cases, the reactors could be designed to produce enough power not only to supply the base, but also to provide critical services in surrounding towns during long-term outages. Strategically, **islanding bases** with small reactors **has another benefit. One of the main reasons an enemy might be willing to risk reprisals** by taking down the U.S. grid **during** a period of **military hostilities would be to affect ongoing military operations. Without the lifeline of intelligence, communication, and logistics provided by U.S. domestic bases, American military operations would be compromised** in almost any conceivable contingency. **Making bases** more **resilient** to civilian power outages **would reduce the incentive for an opponent to attack the grid**. An opponent might still attempt to take down the grid for the sake of disrupting civilian systems, but **the powerful incentive to do so in order to win a**n ongoing battle or **war would be** greatly reduced. Operational Vulnerability. Operational energy use represents a second serious vulnerability for the U.S. military. In recent years, the military has become significantly more effective by making greater use of technology in the field. The price of this improvement has been a vast increase in energy use. Over the last 10 years, for instance, the Marine Corps has more than tripled its operational use of energy. **Energy and water now make up** 70 percent **of the logistics burden for troops** operating in forward locations in the wars in Afghanistan and Iraq. **This burden represents a severe vulnerability** and is costing lives. In 2006, troop losses from logistics convoys became so serious that Marine Corps Major General Richard Zilmer sent the Pentagon a “Priority 1” request for renewable energy backup.11 This unprecedented request put fuel convoy issues on the national security agenda, triggering several high-level studies and leading to the establishment of the Power Surety Task Force, which fast-tracked energy innovations such as mobile power stations and super-insulating spray foam. Currently, the Marine Corps is considering a goal of producing all nonvehicle energy used at forward bases organically and substantially increasing the fuel efficiency of vehicles used in forward areas. Nevertheless, **attempts to solve the** current **energy use problem with** efficiency measures and **renewable sources are unlikely to fully address this vulnerability. Wind, solar, and hydro generation** along with tailored cuts of energy use in the field **can reduce the** number of convoys needed to supply troops, **but these measures will quickly reach limits and have** their own **challenges, such as visibility, open exposure, and intermittency**. Deploying vehicles with greater fuel efficiency will further reduce convoy vulnerability but will not solve the problem. **A strong consensus has been building** within planning circles **that small reactors have the potential to significantly reduce liquid fuel use and**, consequently, **the need for convoys to supply power** at forward locations. **Just over 30 percent of operational fuel used in Afghanistan** today **goes to generating electricity. Small reactors could easily generate all electricity needed to run large forward operating bases**. This innovation would, for instance, allow the Marine Corps to meet its goal of self-sufficient bases. **Mobile reactors** also **have the potential to make the Corps** significantly **lighter and more mobile** by reducing its logistics tail. Another way that **small reactors could** potentially be used in the field is to **power hydrogen electrolysis units to generate hydrogen for vehicles**.12 **At forward locations, ground vehicles** currently **use around 22 percent imported fuel. Many** ground transport **vehicles can be converted to run on hydrogen, considerably reducing the need for fuel convoys. If the wars in Iraq and Afghanistan are indicative of future operations, and fuel convoys remain a target for enemy action, using small reactors** at forward locations **has the potential to save** hundreds or thousands of U.S. **lives**.

**US military forward deployment is key to peace- deters wars and prevents them from escalating**

**Flournoy and Davidson 12** [Michele Flournoy- Co-Founder of the Center for a New American Security and former U.S. Undersecretary of Defense for Policy; Professor at George Mason University and Janine Davidson former U.S. Deputy Assistant Secretary of Defense for Plans A Plea for Smart, Forward U.S. Military Engagement, The Diplomat, 7/10/12, <http://thediplomat.com/flashpoints-blog/2012/07/10/a-plea-for-smart-forward-u-s-military-engagement/>]

The recent global economic downturn has generated doubts about American resilience and our ability to lead in the world. Far from being a nation in decline, however, the United States’ global standing remains unmatched and the imperative for it to lead in today’s tumultuous environment is clear. Those who assume that in order to recover economically the United States must close its overseas bases and bring its military forces home misunderstand the role the U.S. military plays in promoting global prosperity. The United States has benefited enormously from a highly interdependent and globalized economy – one that has relied on the security and stability underwritten by our armed forces and our alliances for over 70 years. In this context, we simply cannot divorce “American” interests from “global” interests or otherwise opt out of the system economically or militarily. As the U.S. military downsizes following a decade of operations in Afghanistan and Iraq, we face a strategic inflection point with respect to how we restructure and re-posture our forces abroad. The United States has an opportunity and a responsibility to shape the global environment through its leadership, global reach, and ability to catalyze positive multilateral activity that enables and encourages others to share the burden of global stability and security. This means being present in key regions of the world where threats are likely to emerge and focusing our military activities on prevention and preparedness. Our military posture should thus be tailored in a strategic way that reflects the imperatives of regional threats and respects the interests of partners and allies. In places such as the Korean peninsula, the Straits of Hormuz, or Malacca, a clear, visible U.S. posture is required; in other regions a less visible, over-the-horizon presence may be more appropriate. In some places, part-time use of shared facilities and flexible access agreements may constitute the extent of U.S. military presence. In all of these regions, the United States can and should continue to build and lead powerful partnerships and alliances founded on shared norms such as freedom of navigation, peaceful resolution of disputes, respect for the rule of law, human rights, and civilian control over the military. Key to our global rebalancing is President Barack Obama’s renewed focus on the Asia-Pacific. Militarily, this means the United States will sustain a robust presence with our long-term allies while enhancing our military activities with other partners across the region. Our posture from Hawaii to the Indian Ocean will be more geographically distributed, operationally resilient, and politically sustainable. Our bases in South Korea and Japan will remain the cornerstone of our presence in Northeast Asia, where we will enhance our cooperative planning and military exercises. We will leverage the geo-strategic value of our U.S. territory by moving a few thousand marines to Guam, and we will forward deploy new littoral combat ships in Singapore. Up to 2500 marines will be scheduled to rotate in and out of Darwin Australia for bilateral training exercises and we will ramp up our utilization of other Australian ports and airfields as part of a wider re-commitment to this key ally. Such moves, along with increased military cooperation with the Philippines, Thailand, and Vietnam demonstrate the U.S. commitment to sustaining our leadership while assisting others in meeting the most pressing challenges, from terrorism and piracy, to freedom of navigation or humanitarian disasters. This re-commitment to Asia should not be interpreted as our abandoning our leadership role elsewhere in the world. In the greater Middle East and Central Asia, our military activities will continue to support multilateral solutions to shared security threats. Following our operations in Afghanistan and Iraq, we will transition to a lighter, but scalable footprint focused on countering terrorism, deterring the destabilizing behavior of Iran, ensuring the free flow of commerce, and checking the proliferation of weapons of mass destruction (WMD). Instead of maintaining permanent installations, U.S. air and naval forces will likely rotate in and out of countries such as Bahrain, Qatar, Saudi Arabia, the United Arab Emirates, and, potentially, Afghanistan and Iraq. In the wake of the Arab Spring, our military-to-military engagements with the region’s rising democracies can help promote the development of civilian-led security forces, respectful of human rights and the rule of law. Our military posture in Europe reflects the fact that NATO, through American leadership, remains the indispensible global military alliance. We have fought hard and learned valuable lessons together over the past 10 years, from the major wars in Iraq and Afghanistan, to our multilateral operations in Libya, to operations against pirates in the Red Sea. Our U.S. military posture in Europe will leverage these lessons to ensure that the alliance remains capable of responding to emerging threats in and outside of the European theater. We will retain two modernized brigade combat teams along with seven other enabling army brigades and air forces optimized for global reach and partnership. We will build a robust missile defense architecture sustained by forward-based Aegis cruisers and maintain a network of bases and agreements that ensure our ability to train regularly with allies and respond to crises. This emphasis on partnership and multilateral activities is also reflected in our posture across Africa and South America. In regions where few U.S. forces are permanently stationed, the United States’ day-to-day military posture should remain tailored toward the needs of our partners, focused on high-priority activities such as countering violent extremism, halting illicit trafficking and support to law enforcement. A focus on building partner capacity will enhance their abilities to meet local and transnational challenges before they become larger crises. **A robust, forward engaged U.S. military is the right strategic investment** at this critical inflection point. As we emerge from a decade of war and reduce the overall size of our military, we cannot afford to have our remaining forces inefficiently garrisoned at home training only themselves. Not only does forward engagement allow our forces to train the way they will most likely fight--abroad and with allies--but it is also a more efficient way to ensure they are postured to respond should deterrence fail. As Secretary of Defense Leon Panetta asserted, “We do not have to choose between national security and fiscal security.” Continued U.S. leadership in the world, underpinned by smart forward military engagement, is imperative to our domestic economic prosperity and to shaping the future security environment.

**Multiple scenarios for war**

**Kagan 7** (Robert, Senior Associate – Carnegie Endowment for International Peace, “End of Dreams, Return of History: International Rivalry and American Leadership”, Policy Review, August/September, <http://www.hoover.org/publications/policyreview/8552512.html#n10>)

The jostling for status and influence among these ambitious nations and would-be nations is a second defining feature of the new post-Cold War international system. Nationalism in all its forms is back, if it ever went away, and so is international competition for power, influence, honor, and status. **American predominance prevents these rivalries from intensifying** —  its regional as well as its global predominance**. Were the U**nited **S**tates **to diminish its influence** in the regions where it is currently the strongest power, **the other nations would settle disputes** as great and lesser powers have done in the past: sometimes through diplomacy and accommodation but often **through** confrontation and **wars** of varying scope, intensity, and destructiveness. One novel aspect of such a multipolar world is that **most** of these powers would **possess nuclear weapons. That could make wars** between them less likely, or it could simply make them more **catastrophic. It is** easy but also **dangerous to underestimate the role the U**nited **S**tates **plays in providing** a measure of **stability in the world** even as it also disrupts stability. For instance, the United States is the dominant naval power everywhere, such that other nations cannot compete with it even in their home waters. They either happily or grudgingly allow the United States Navy to be the guarantor of international waterways and trade routes, of international access to markets and raw materials such as oil. Even when the United States engages in a war, it is able to play its role as guardian of the waterways. In a more genuinely multipolar world, however, it would not. Nations would compete for naval dominance at least in their own regions and possibly beyond. Conflict between nations would involve struggles on the oceans as well as on land. Armed embargos, of the kind used in World War i and other major conflicts, would disrupt trade flows in a way that is now impossible. Such order as exists in the world rests not only on the goodwill of peoples but also on American power. Such order as exists in the world rests not merely on the goodwill of peoples but on a foundation provided by American power. Even the European Union, that great geopolitical miracle, owes its founding to American power, for without it the European nations after World War II would never have felt secure enough to reintegrate Germany. Most Europeans recoil at the thought, but even today **Europe ’s stability depends on the** guarantee, however distant and one hopes unnecessary, that the **U**nited **S**tates could step in **to check any dangerous development** on the continent. In **a** genuinely **multipolar world**, that **would not be possible without renewing the danger of world war**. People who believe greater equality among nations would be preferable to the present American predominance often succumb to a basic logical fallacy. They believe the order the world enjoys today exists independently of American power. They imagine that in a world where American power was diminished, the aspects of international order that they like would remain in place. But that ’s not the way it works. International order does not rest on ideas and institutions. It is shaped by configurations of power. The international order we know today reflects the distribution of power in the world since World War ii, and especially since the end of the Cold War. A different configuration of power, a multipolar world in which the poles were Russia, China, the United States, India, and Europe, would produce its own kind of order, with different rules and norms reflecting the interests of the powerful states that would have a hand in shaping it. Would that international order be an improvement? Perhaps for Beijing and Moscow it would. But it is doubtful that it would suit the tastes of enlightenment liberals in the United States and Europe. The current order, of course, is not only far from perfect but also offers no guarantee against major conflict among the world ’s great powers. Even under the umbrella of unipolarity, regional conflicts involving the large powers may erupt. **War could erupt between China and Taiwan** and draw in both the United States and Japan. War could erupt between **Russia and Georgia**, forcing the United States and its European allies to decide whether to intervene or suffer the consequences of a Russian victory. Conflict between **India and Pakistan** remains possible, as does conflict between Iran and Israel **or** other **Middle Eastern states. These**, too, **could draw in** other **great powers, including the U**nited **S**tates. Such conflicts may be unavoidable no matter what policies the United States pursues. But they are more likely to erupt **if the U**nited **S**tates **weakens** or withdraws from **its positions** of regional dominance. This is especially true in East Asia, where most nations agree that a reliable American power has a stabilizing and pacific effect on the region. That is certainly the view of most of China ’s neighbors. But even China, which seeks gradually to supplant the United States as the dominant power in the region, faces the dilemma that an **American withdrawal could unleash a**n ambitious, independent, **nationalist Japan**. Conflicts are more likely to erupt if the United States withdraws from its positions of regional dominance. **In Europe**, too, the **departure** of the United States from the scene — even if it remained the world’s most powerful nation — **could be destabilizing. It could tempt Russia to a**n even more overbearing and potentially **forceful approach** to unruly nations on its periphery. Although some realist theorists seem to imagine that the disappearance of the Soviet Union put an end to the possibility of confrontation between Russia and the West, and therefore  to the need for a permanent American role in Europe, history suggests that conflicts in Europe involving Russia are possible even without Soviet communism. If the United States withdrew from Europe — if it adopted what some call a strategy of “offshore balancing” — **this could** in time **increase the likelihood of conflict involving Russia and its** near **neighbors, which could** in turn **draw the United States back in** under unfavorable

**SMR’s “island” bases by providing constant reliable power – allow military bases to be robust against interruptions and attacks**

**King 11** [Marcus King, Ph.D., Center for Naval Analyses Project Director and Research Analyst for the Environment and Energy TeamLaVar Huntzinger, Thoi Nguyen, March 2011, Feasibility of Nuclear Power on U.S.Military Installations, www.cna.org/sites/default/files/research/Nuclear Power on Military Installations D0023932 A5.pdf]

**Having a reliable source of electricity is critically important for many DoD installations**. Fort Meade, Maryland, which hosts the National Security Agency’s power intensive computers, is an example of where **electricity is mission critical. Installations need to be more robust against interruptions caused by natural forces or intentional attack**. Most **installations currently rely on the commercial electricity grid and backup generators**. **Reliance on generators presents** some **limitations**. **A building dedicated generator only provides electricity to a specific building when there is a power outage**. Typically, **diesel standby generators have an availability of 85 percent when operated for more than 24 hours** [38]. Most **DoD installations keep less than a 5-day supply of fuel**. **Small nuclear power plants could contribute to electrical energy surety and survivability. Having nuclear power plants networked with the grid and other backup generating systems** 5 **could give DoD installations higher power availability during extended utility power outages and more days of utility-independent operation**. Existing large commercial **nuclear power plants have an availability of over 90 percent**. **When a small nuclear power plant is networked with existing backup generating systems and the grid, overall availability values could be as high as 99.6 percent** [39]. Since proposed small reactors have long refueling intervals (from 4 to 30 years), **if power from the commercial grid became unavailable, a small reactor could provide years of electrical power independent of the commercial grid** [4]. Power assurance to DoD installations also involves three infrastructure aspects of electricity delivery: electrical power transmission, electricity distribution, and electricity control (of distribution and transmission). Electric power transmission is the bulk transfer of electrical energy from generating plants to substations located near population centers. Electricity distribution networks carry electricity from the substations to consumers. Electricity control is the management of switches and connections to control the flow of electricity through transmission and distribution networks. Typically, transmission lines transfer electricity at high voltages over long distances to minimize loss; electricity distribution systems carry medium voltages. **For electrical power transmission, very little additional infrastructure is required to incorporate small nuclear power plants because they would be located on or near the DoD installation being serviced**. However, redundancy in transmission lines would make the overall network more robust. **Electricity control capabilities**, such as self-healing 6 and optimization of assets to increase operational efficiency, could improve overall power availability; however, they **are not necessary for the integration of small nuclear power plants**. Key components for improving electricity control include advanced electricity meters and electricity meter data management. **These tools are needed in order to establish islanding**, a condition in which a portion of the utility system, which contains both load and generation, is isolated from the remainder of the utility system and continues to operate. **Since the power generation capacities of small nuclear power plants are larger than required for most DoD bases, islanding could extend to adjacent communities** if sufficient technical upgrades were performed to systems outside of the installation. **This contributes to DoD missions** because civilians and service members working on the installation often live with their families in adjacent communities. **The power would ensure that critical services such as emergency response, waste water treatment, and hospitals could be maintained**.

**1AC – Plan**

**Thus the plan: The United States federal government should procure small modular reactors for its military installations in the United States.**

**1AC – Solvency**

#### DoD acting as a “first-mover” for SMRs expedites the NRC licensing process and instigates wide spread adoption

Loudermilk 11 [Micah K. Loudermilk, Contributor Micah J. Loudermilk is a Research Associate for the Energy & Environmental Security Policy program with the Institute for National Strategic Studies at National Defense University, contracted through ASE Inc, “Small Nuclear Reactors and US Energy Security: Concepts, Capabilities, and Costs”, http://www.ensec.org/index.php?option=com\_content&view=article&id=314:small-nuclear-reactors-and-us-energy-security-concepts-capabilities-and-costs&catid=116:content0411&Itemid=375, May 31, 2011, Chetan]

Concerns over reactor safety and security are alleviated by the security already present on installations and the military’s long history of successfully operating nuclear reactors without incident. Unlike reactors on-board ships, small reactors housed on domestic bases would undoubtedly be subject to Nuclear Regulatory Commission (NRC) regulation and certification, however, with strong military backing, adoption of the reactors may prove significantly easier than would otherwise be possible. Additionally, as the reactors become integrated on military facilities, general fears over the use and expansion of nuclear power will ease, creating inroads for widespread adoption of the technology at the private utility level. Finally, and perhaps most importantly, action by DOD as a “first mover” on small reactor technology will preserve America’s badly struggling and nearly extinct nuclear energy industry. The US possesses a wealth of knowledge and technological expertise on SMRs and has an opportunity to take a leading role in its adoption worldwide. With the domestic nuclear industry largely dormant for three decades, the US is at risk of losing its position as the global leader in the international nuclear energy market. If the current trend continues, the US will reach a point in the future where it is forced to import nuclear technologies from other countries—a point echoed by Secretary Chu in his push for nuclear power expansion. Action by the military to install reactors on domestic bases will guarantee the short-term survival of the US nuclear industry and will work to solidify long-term support for nuclear energy. Conclusions In the end, small modular reactors present a viable path forward for both the expansion of nuclear power in the US and also for enhanced US energy security. Offering highly safe, secure, and proliferation-resistant designs, SMRs have the potential to bring carbon-free baseload distributed power across the United States. Small reactors measure up with, and even exceed, large nuclear reactors on questions of safety and possibly on the financial (cost) front as well. SMRs carry many of the benefits of both large-scale nuclear energy generation and renewable energy technologies. At the same time, they can reduce US dependence on fossil fuels for electricity production—moving the US ahead on carbon dioxide and GHG reduction goals and setting a global example. While domestic hurdles within the nuclear regulatory environment domestically have proven nearly impossible to overcome since Three Mile Island, military adoption of small reactors on its bases would provide energy security for the nation’s military forces and may create the inroads necessary to advance the technology broadly and eventually lead to their wide-scale adoption.

**DoD acquisition of SMR’s ensures rapid military adoption and commercialization**

**Andres and Breetz 11** [Richard Andres, Professor of National Security Strategy at the National War College and a Senior Fellow and Energy and Environmental Security and Policy Chair in the Center for Strategic Research, Institute for National Strategic Studies, at the National Defense University, and Hanna Breetz, doctoral candidate in the Department of Political Science at The Massachusetts Institute of Technology, Small Nuclear Reactors for Military Installations: Capabilities, Costs, and Technological Implications, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf](http://www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf)]

Thus far, this paper has reviewed two of DOD’s most pressing energy vulnerabilities—grid insecurity and fuel convoys—and explored how they could be addressed by small reactors. We acknowledge that there are many uncertainties and risks associated with these reactors. On the other hand, **failing to pursue these technologies raises its own set of risks for DOD,** which we review in this section: first, **small reactors may fail to be commercialized in the U**nited **S**tates; second, **the designs that get locked in by the private market may not be optimal for DOD’s needs**; and third, **expertise on small reactors may become concentrated in foreign countries**. **By taking an early “first mover” role in the small reactor market, DOD could mitigate these risks and secure the long-term availability and appropriateness of these technologies for U.S. military applications.** The “Valley of Death Given the promise that small reactors hold for military installations and mobility, **DOD has a compelling interest in ensuring that they make the leap from paper to production**. However, **if DOD does not provide an initial** demonstration and **market, there is a chance that the U.S. small reactor industry may never get off the ground**. **The leap from the laboratory to the marketplace is so difficult to bridge that it is widely referred to as the “Valley of Death.”** **Many promising technologies are never commercialized due to a variety of market failures**— **including technical and financial uncertainties**, information asymmetries, **capital market imperfections, transaction costs**, and environmental and security externalities— **that impede financing and early adoption and can lock innovative technologies out of the marketplace**. 28 In such cases, **the Government can help a worthy technology to bridge the Valley of Death by accepting the first mover costs and demonstrating the technology’s scientific and economic viability**.29 [FOOTNOTE 29: **There are** numerous **actions that the Federal Government could take**, such as conducting or funding research and development, stimulating private investment, demonstrating technology, mandating adoption, and guaranteeing markets. **Military procurement** is thus only one option, but it has often **played a decisive role in technology development and is likely to be the catalyst for the U.S. small reactor industry.** See Vernon W. Ruttan, Is War Necessary for Economic Growth? (New York: Oxford University Press, 2006); Kira R. Fabrizio and David C. Mowery, “The Federal Role in Financing Major Inventions: Information Technology during the Postwar Period,” in Financing Innovation in the United States, 1870 to the Present, ed. Naomi R. Lamoreaux and Kenneth L. Sokoloff (Cambridge, MA: The MIT Press, 2007), 283–316.] Historically, **nuclear power has been “the most clear-cut example . . . of an important general-purpose technology that in the absence of military** and defense related **procurement would not have been developed at all.”**30 **Government involvement is likely to be crucial for innovative, next-generation nuclear technology** as well. Despite the widespread revival of interest in nuclear energy, Daniel Ingersoll has argued that radically innovative **designs face an uphill battle, as “the high capital cost of nuclear plants and the painful lessons learned during the first nuclear era have created a prevailing fear of first-of-a-kind designs**.”31 In addition, **M**assachusetts **I**nstitute of **T**echnology reports on the Future of Nuclear Power **called for the Government to provide modest “first mover” assistance to the private sector due to several barriers that have hindered the nuclear renaissance**, such as securing high up-front costs of site-banking, gaining NRC certification for new technologies, and demonstrating technical viability.32 It is possible, of course, that small reactors will achieve commercialization without DOD assistance. As discussed above, they have garnered increasing attention in the energy community. Several analysts have even argued that small reactors could play a key role in the second nuclear era, given that they may be the only reactors within the means of many U.S. utilities and developing countries.33 However, **given the tremendous regulatory hurdles and technical and financial uncertainties, it appears far from certain that the U.S. small reactor industry will take off. If DOD wants to ensure that small reactors are available in the future, then it should pursue a leadership role now.** Technological Lock-in. **A second risk is that if small reactors do reach the market without DOD assistance, the designs that succeed may not be optimal for DOD’s applications**. **Due to a variety of positive feedback and increasing returns to adoption** (including demonstration effects, technological interdependence, network and learning effects, and economies of scale), **the designs that are initially developed can become “locked in.”**34 **Competing designs**—even if they are superior in some respects or better for certain market segments— **can face barriers to entry that lock them out of the market. If DOD wants to ensure that its preferred designs are not locked out, then it should take a first mover role on small reactors.** It is far too early to gauge whether the private market and DOD have aligned interests in reactor designs. On one hand, Matthew Bunn and Martin Malin argue that what the world needs is cheaper, safer, more secure, and more proliferation-resistant nuclear reactors; presumably, many of the same broad qualities would be favored by DOD.35 **There are many varied market niches that could be filled by small reactors, because there are many different applications** and settings in which they can be used, and it is quite possible that some of those niches will be compatible with DOD’s interests.36 On the other hand, **DOD may have specific needs** (transportability, for instance) **that would not be a high priority for any other market segment.** Moreover, while DOD has unique technical and organizational capabilities that could enable it to pursue more radically innovative reactor lines, DOE has indicated that it will focus its initial small reactor deployment efforts on LWR designs.37 **If DOD wants to ensure that its preferred reactors are developed and available in the future, it should take a leadership role now. Taking a first mover role does not** necessarily **mean that DOD would be “picking a winner” among small reactors**, as **the market will probably pursue multiple types of small reactors. Nevertheless, DOD leadership would likely have a profound effect on the industry’s timeline and trajectory.** Domestic Nuclear Expertise. From the perspective of larger national security issues, **if DOD does not catalyze the small reactor industry, there is a risk that expertise in small reactors could become dominated by foreign companies**. A 2008 Defense Intelligence Agency report warned that the United States will become totally dependent on foreign governments for future commercial nuclear power unless the military acts as the prime mover to reinvigorate this critical energy technology with small, distributed power reactors.38 **Several of the most prominent small reactor concepts rely on technologies perfected at Federally funded laboratories and research programs**, including the Hyperion Power Module (Los Alamos National Laboratory), NuScale (DOE-sponsored research at Oregon State University), IRIS (initiated as a DOE-sponsored project), Small and Transportable Reactor (Lawrence Livermore National Laboratory), and Small, Sealed, Transportable, Autonomous Reactor (developed by a team including the Argonne, Lawrence Livermore, and Los Alamos National Laboratories). **However, there are scores of competing designs under development from over a dozen countries. If DOD does not act early to support the U.S. small reactor industry, there is a chance that the industry could be dominated by foreign companies**. Along with other negative consequences, **the decline of the U.S. nuclear industry decreases the NRC’s influence on the technology that supplies the world’s rapidly expanding demand for nuclear energy. Unless U.S. companies begin to retake global market share, in coming decades France, China, South Korea, and Russia will dictate standards on nuclear reactor reliability, performance, and proliferation resistance**.

**SMR’s are an energy game changer - but DOD purchasing agreements are key to just-start the industry and determining optimal configurations – licensing is not a problem**

**Madia 12** (William Madia, Stanford Energy Journal, Dr. Madia serves as Chairman of the Board of Overseers and Vice President for the SLAC National Accelerator Laboratory at Stanford University. Previously, he was the Laboratory Director at the Oak Ridge National Laboratory from 2000-2004 and the Pacific Northwest National Laboratory from 1994-1999., “SMALL MODULAR REACTORS: A POTENTIAL GAME-CHANGING TECHNOLOGY”, <http://energyclub.stanford.edu/index.php/Journal/Small_Modular_Reactors_by_William_Madia>, Spring 2012)

**The drivers that caused the industry to build bigger and bigger NPPs are being offset today by various considerations that make this new breed of SMRs viable**. **Factory manufacturing is one of these considerations**. Most **SMRs are small enough to allow them to be factory built and shipped by rail or barge to the power plant sites**. **Numerous industry “rules of thumb” for factory manufacturing show dramatic savings as compared to “on-site” outdoor building methods**. Significant schedule advantages are also available because weather delay considerations are reduced. Of course, from a total cost perspective, some of these savings will be offset by the capital costs associated with building multiple modules to get the same total power output. Based on analyses I have seen, overnight costs in the range of $5000 to $8000 per installed kilowatt are achievable**. If these analyses are correct, it means that the economies of scale arguments that drove current designs to GW scales could be countered by the simplicity and factory-build possibilities of SMRs.** **No one has yet obtained a design certification from the** Nuclear Regulatory Commission (**NRC**) for an SMR, so we must consider licensing to be one of the largest unknowns facing these new designs. **Nevertheless, since the most developed of the SMRs are mostly based on proven and licensed components and are configured at power levels that are passively safe**, **we should not expect many new significant licensing issues to be raised for this class of reactor.** Still, the NRC will need to address issues uniquely associated with SMRs, such as the number of reactor modules any one reactor operator can safely operate and the size of the emergency planning zone for SMRs. **To determine if SMRs hold the potential for changing the game in carbon-free power generation,** **it is imperative that we test the design, engineering, licensing, and economic assumptions with some sort of public-private development and demonstration program**. **Instead of having government simply invest in research and development to “buy down” the risks** associated with SMRs, I propose a more novel approach. **Since the federal government is a major power consumer, it should commit to being the “first mover” of SMRs**. **This means purchasing the first few hundred MWs of SMR generation capacity and dedicating it to federal use**. The advantages of this approach are straightforward. **The government would both reduce licensing and economic risks to the point where utilities might invest in subsequent units**, thus **jumpstarting the SMR industry**. **It would then** **also be the recipient of additional carbon-free energy generation capacity**. This seems like a very sensible role for government to play without getting into the heavy politics of nuclear waste, corporate welfare, or carbon taxes. **If we want to deploy power generation technologies that can realize near-term impact on carbon emissions safely**, reliably, economically, at scale, and at total costs that are manageable on the balance sheets of most utilities, **we must consider SMRs as a key component of our national energy strategy.**

**Federal action is crucial to encourage private investing by controlling risk factors that cause regulatory delays**

**Gale et al 9** (Kelley Michael, Finance Department Chair – Latham & Watkins, “Financing the Nuclear Renaissance: The Benefits and Potential Pitfalls of Federal & State Government Subsidies and the Future of Nuclear Power in California,” Energy Law Journal, Vol. 30, p. 497-552, <http://www.felj.org/docs/elj302/19gale-crowell-and-peace.pdf>)

In a similar fashion, **regulatory risk insurance and loan guarantees provided by the federal government should encourage private financing of domestic nuclear power projects because the government providing the guarantees also controls many of the risk factors which could give rise to regulatory delays in commencing commercial operation of a new nuclear project. Further, in the nuclear power industry, the federal government is reviewing development applications and reactor designs, and is equipped with a team of experts in nuclear technologies, so that if the federal government has skin in the game, so to speak, private lenders may take additional comfort that the government has performed a certain level of due diligence on a particular project and determined that there are no major flaws from its vantage point.** Section II.D.3 below discusses the risks covered by federally provided regulatory risk insurance and the ways in which it can be adapted to best encourage private sector financing for nuclear energy.

**SMRs can be built in 2-3 years with half the cost of large reactors**

**Bosselman 9** [Professor Kent Bosselman – Chicago Kent: Illinois Institute of Technology, “The Future of Small and Medium Sized Nuclear Reactors 2009 and Beyond”, 2009, <http://www.kentlaw.edu/faculty/fbosselman/classes/energyF09/Coursedocs/Small%20Reactor%20Presentation.pdf>, Chetan]

SMR vs. Large: Cost of Construction/Operation SMRs: Private companies are estimating that **new units built on site will cost between $23 to $30 million dollars. Add** the extra costs and you approach $50 million per unit **2-3 years to construct SMRs: Large Reactors**: To build a large reactor in the U.S. today several costs are involved: Construction costs Operating cost Waste disposal cost Decommissioning costs When combined, large reactors **end up costing between $6 to $10 billion dollars 7-10 years to construct**

#### Natural gas doesn’t block nuclear investment – price spike is coming now and SMRs are a hedging strategy

Lamonica 12—Tech Review Writer  20 years of experience covering technology and business (8/9/12, Martin, A Glut of Natural Gas Leaves Nuclear Power Stalled, [www.technologyreview.com/news/428737/a-glut-of-natural-gas-leaves-nuclear-power/](http://www.technologyreview.com/news/428737/a-glut-of-natural-gas-leaves-nuclear-power/))

The nuclear renaissance is in danger of petering out before it has even begun, but not for the reasons most people once thought. Forget safety concerns, or the problem of where to store nuclear waste—the issue is simply cheap, abundant natural gas. General Electric CEO Jeffrey Immelt caused a stir last month when he told the Financial Times that it's "hard to justify nuclear" in light of low natural gas prices. Since GE sells all manner of power generation equipment, including components for nuclear plants, Immelt's comments hold a lot of weight. Cheap natural gas has become the fuel of choice with electric utilities, making building expensive new nuclear plants an increasingly tough sell. The United States is awash in natural gas largely thanks to horizontal drilling and hydraulic fracturing, or "fracking" technology, which allows drillers to extract gas from shale deposits once considered too difficult to reach. In 2008, gas prices were approaching $13 per million BTUs; prices have now dropped to around $3. When gas prices were climbing, there were about 30 nuclear plant projects in various stages of planning in the United States. Now the Nuclear Energy Institute estimates that, at most, five plants will be built by 2020, and those will only be built thanks to favorable financing terms and the ability to pay for construction from consumers' current utility bills. Two reactors now under construction in Georgia, for example, moved ahead with the aid of an $8.33 billion loan guarantee from the U.S. Department of Energy. What happens after those planned projects is hard to predict. "The question is whether we'll see any new nuclear," says Revis James, the director of generation research and development at the Electric Power Research Institute. "The prospects are not good." Outside the United States, it's a different story. Unconventional sources of natural gas also threaten the expansion of nuclear, although the potential impact is less clear-cut. Around the world, there are 70 plants now under construction, but shale gas also looms as a key factor in planning for the future. Prices for natural gas are already higher in Asia and Europe, and shale gas resources are not as fully developed as they are the United States. Some countries are also blocking the development of new natural gas resources. France, for instance, which has a strong commitment to nuclear, has banned fracking in shale gas exploration because of concerns over the environmental impact. Fast-growing China, meanwhile, needs all the energy sources available and is building nuclear power plants as fast as possible. Even in United States, of course, super cheap natural gas will not last forever. With supply exceeding demand, some drillers are said to be losing money on natural gas, which could push prices back up. Prices will also be pushed upward by utilities, as they come to rely on more natural gas for power generation, says James. Ali Azad, the chief business development officer at energy company Babcock & Wilcox, thinks the answer is making nuclear power smaller, cheaper, and faster. His is one of a handful of companies developing small modular reactors that can be built in three years, rather than 10 or more, for a fraction of the cost of gigawatt-size reactors. Although this technology is not yet commercially proven, the company has a customer in the Tennessee Valley Authority, which expects to have its first unit online in 2021 (see "A Preassembled Nuclear Reactor"). "When we arrive, we will have a level cost of energy on the grid, which competes favorably with a brand-new combined-cycle natural gas plants when gas prices are between $6 to $8," said Azad. He sees strong demand in power-hungry China and places such as Saudia Arabia, where power is needed for desalination. Even if natural gas remains cheaper, utilities don't want to find themselves with an overreliance on gas, which has been volatile on price in the past, so nuclear power will still contribute to the energy mix. "[Utilities] still continue [with nuclear] but with a lower level of enthusiasm—it's a hedging strategy," says Hans-Holger Rogner from the Planning and Economics Studies section of the International Atomic Energy Agency. "They don't want to pull all their eggs in one basket because of the new kid on the block called shale gas."