# Current 1AC

### Plan

#### The United States federal government should diminish Nuclear Regulatory Commission staffing, manufacturing licensing, emergency planning zone, and safety restrictions for Small Modular Reactors to be consistent with the unique attributes of Small Modular Reactors.

### Advantage One

#### Advantage one is Natural Gas

#### Cheap and plentiful natural gas is creating an overdependence for electricity generation that will cause future price volatility and shortages – SMR development solves

Perry, Professor of Economics at UM – Flint, 12

[Mark J. Perry, “Natural gas and nuclear power need to share the lead in power generation for the future,” September 26th 2012, www.aei.org/article/energy-and-the-environment/conventional-energy/natural-gas-and-nuclear-power-need-to-share-the-lead-in-power-generation-for-the-future/]

Recent advances in drilling technologies have unleashed a boom in domestic natural gas production. The United States may have more than 100 years' worth of gas reserves, and perhaps much more, including large untapped resources in Michigan. Policy makers are increasingly looking to natural gas as the locomotive of economic growth. A striking example is the increasing use of gas in electricity production. For the last several years, natural gas has accounted for more than 80% of new electric generating capacity in the United States. It now provides 32% of total electricity generation, up from 25% just two years ago, and its share could reach 50% by 2030. Natural gas, of course, has many virtues as a fuel. Its carbon content is less than half that of coal and it emits no mercury or other toxic particulates. But natural gas is needed for much more than electricity generation. In addition to residential and commercial heating, gas accounts for the bulk of the fuel used by the petrochemical industry. Manufacturing relies on the availability of cheap gas, and its use in transportation is increasing. Additionally, gas producers are gearing up to export some of the gas to markets in Europe and Asia, where gas costs up to five times more than it does in the United States. A dozen or more U.S. companies have applied for licenses to export liquefied natural gas from terminals, mainly on the Gulf of Mexico. Because of its multiple uses and rising popularity, the demand for natural gas is starting to increase, and its price could rise significantly. That is a real possibility, and would be consistent with its long history of price volatility. If we hope to maintain the security of our energy supply, we will need to expand the use of other energy sources, including nuclear power, which is also environmentally attractive and affordable. Although the capital cost of building a nuclear plant is high, the average price of nuclear-generated electricity is lower than power produced from natural gas. In 2011, the production cost of nuclear power was 2.19 cents per kilowatt-hour, compared to 4.51 cents for natural gas and 3.23 cents for coal. Today about 20% of America’s electricity comes from nuclear power. But demand for electricity is growing steadily and that trend will continue in the future. Without building new nuclear plants, pressure will build to use even more natural gas for electricity generation, making less available for manufacturing and transportation. As an important part of America’s energy future, building a new generation of nuclear plants using advanced technologies should be considered by policy makers. To be sure, increasing the use of nuclear power certainly has its challenges. Electricity companies must cooperate to facilitate the investments that are essential for new construction. Several other key ingredients are needed: recognition that the potential for long-term profits exists due to nuclear power’s lower fuel costs; a shift in the mindset to allow for the application of innovative technologies such as small modular reactors that can be built in a factory for a fraction of the cost of large power plants; and an awareness that nuclear power can produce a huge amount of clean energy for economic growth in the United States and worldwide. Because they are both critically important economic drivers, natural gas and nuclear power need to share the lead in power generation for the future. Both are cleaner and more secure than the fuels they have replaced, and fostering their use is in our national and economic interest.

#### Long term price stability is impossible without NRC regulatory reform to promote fuel diversity

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[Jack Spencer, Research Fellow in Nuclear Energy in the Thomas A. Roe Institute for Economic Policy Studies, “More to the Story on Nuclear Power and Cheap Natural Gas,” March 16th 2012, <http://blog.heritage.org/2012/03/16/more-to-the-story-on-nuclear-power-and-cheap-natural-gas/>]

Two major financial news publications, the Economist and The Wall Street Journal, published major articles in the past week arguing that the American nuclear renaissance has ended before it ever really began. While the articles differ slightly in their presentation, the basic common thread is that new nuclear power cannot compete with cheap natural gas. The problem with this basic narrative is twofold. First, it does not fully recognize how quickly markets change. Secondly, it ignores the potential benefits that would result from better policy. If markets were static, then challenging such notions would be nearly impossible. Certain things are facts. Natural gas is very inexpensive. Building a nuclear plant is expensive and seemingly getting more expensive. But that is not the end of the story. Natural gas is cheap. No question. But it has been cheap before. Indeed, it was very cheap at about the same time the nuclear industry was last declared dead. And that’s not the only parallel. The world was responding to a recent nuclear accident at Three Mile Island (TMI), and nuclear plant construction costs were on the rise. This caused a shift toward natural gas. As demand grew, so did its price. In 1980, natural gas cost $4.39 per 1,000 cubic feet. By 2008, it had risen to $8.43 (inflation adjusted). Producers began to seek alternatives by the early 2000s. Back to nuclear. As natural gas use was growing through the mid-2000s, the nuclear industry was refining its product. It continued to bring plants on line that had been permitted prior to the TMI accident and worked to hone its safety procedures and operational efficiency. The numbers show the progress. In 1979, American had 72 plants on line. Today there are 104. Back then, America’s reactors operated at an average capacity factor of less than 60 percent. That means that the average plant spent 40 percent of that year not producing electricity. Today, reactors routinely exceed 90 percent capacity factors. This has resulted in low-cost, reliable electricity. And because the cost of fuel makes up a small percentage of actual costs, nuclear power prices do not vary over the lifetime of the plant. Best of all, these benefits are buoyed by increasing safety. This progress positioned nuclear power to mount a comeback by the late 2000s. Indeed, 18 utilities submitted applications to the Nuclear Regulatory Commission to build nearly 30 new reactors. Now, once again, with cost estimates rising for nuclear power, natural gas prices dropping, and renewed public anxiety fueled by a major accident, some like the Economist and The Wall Street Journal are questioning whether nuclear power has a future. Part of the answer can be found in the Journal’s article. It points to three concerns regarding over-reliance on natural gas: Diversity of fuel source. As one of the executives interviewed clearly states, even if one fuel source is cheap, there is great value in fuel diversity. An over-reliance on a single fuel will likely result in higher costs. Long-term prices are unpredictable. Few expected the precipitous drop in natural gas prices that has occurred since 2008. Likewise, no one is predicting any near-term price spikes. However, if history is any guide, we should expect a rise over time. The lower prices go, the less incentive there will be to find additional reserves. The Wall Street Journal reports that this is already happening. And demand will surely increase as more natural gas is used for home heating and electricity production, and industrial applications and export opportunities emerge. Fuel supply. There is also growing concern that existing pipeline capacity will not be adequate to support growing demand. The rest of the answer lies with the nuclear industry and the federal government and how they interact. As the industry underwent significant safety and operational reform after TMI, the time is now for another significant reform effort geared toward relating to the federal government. These reforms should include: Regulatory reform. America’s nuclear regulator, the Nuclear Regulatory Commission, does an outstanding job at regulating public health and safety for existing plants in a slow/no-growth market that is built around a single technology. It is not built to regulate a technologically diverse, growing nuclear industry. Waste management. While the private sector efficiently manages front-end (fuel-related) activities and plant operations, the government remains in control of America’s dysfunctional regime for waste management. Under the current system, there is little connection between used-fuel management programs, economics, and the needs of the nuclear industry. Any successful plan must grow out of the private sector, be driven by sound economics, and provide access to the funds that have been set aside for nuclear waste management activities. Though there are no guarantees, nuclear power—despite much adversity—has proved to be much more than a survivor. The rightpolicy reformstodaywill open up markets tomore abundant, moreaffordable**,** and even safernuclear energy**.**

#### The plan allows for SMR investment as a hedge against price spikes

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[Robert Rosner, William E. Wrather, Distinguished Service Professor, Departments of Astronomy and Astrophysics, and Physics at The University of Chicago, Director, Energy Policy Institute, Harris School of Public Policy, Stephen Goldberg, Professor of Law Emeritus at Northwestern Law, “Small Modular Reactors – Key to Future Nuclear Power Generation in the U.S.,” Energy Policy Institute at The University of Chicago, November 2011]

In both the 2004 Chicago Study and the current work, the future behavior of natural gas prices is the dominant factor when assessing the relative competitiveness of nuclear energy for base load power.12 In the absence of carbon pricing and increasingly stringent air and water quality and waste management regulation, natural gas-fired generation is cheaper than all other sources of generation at the moment. While the current outlook calls for domestic natural gas supplies to be robust and prices to remain relatively stable, natural gas markets remain subject to volatility. Two perturbations could occur that might cause natural gas prices to spike – pricing natural gas to its oil equivalent due to an emerging export market for natural gas and shortfalls in the realization of expected supply additions from shale gas. The study team plans to address these issues in greater detail in a future paper. Note that the natural gas market has experienced at least four price spikes in the last 10 years.13 In recent work of Dr. Rothwell (Stanford University), the uncertainty of future natural gas prices was captured in the range of estimates of the levelized cost of electricity.14 Dr. Rothwell found that there are opportunities for nuclear energy competitiveness – when decision makers require high confidence that their investments are competitive relative to other supply options. The study team further understands that this is priced into the weighted-average cost of capital (WACC). In Dr. Rothwell’s work, a variable risk premium was used for comparing GW-scale plants with natural gas-fired plants.15 The goal was to relate the risk premium to “size risk.” The conceptual basis for this approach is described further in Appendix F. Figure 1 provides a simplified illustration of risk by comparing the size of a nuclear investment with other conventional base load investments; for comparison, the average annual revenue of investor-owned nuclear utilities is shown. This analysis, which puts significant weight on the size of the investment to measure WACC, is consistent with Moody’s Investor Service opinion that “we view nuclear generation plans as a ‘bet the farm’ endeavor for most companies, due to the size of the investment and length of time needed to build a nuclear power facility.”16 As indicated in Figure 1, on average, investor-owned U.S. utilities, representing 70% of nuclear generation, have about $13 billion in average annual revenue. A twin-unit GW-scale nuclear investment of $11 billion would represent about 90% of their annual revenues – suggesting that a larger size project presents a risk premium due to size alone that cannot be ignored and may well be substantial. However, more work needs to be done to understand the sensitivity of the risk premium in this area. For SMR plants, the study team has performed an initial set of calculations for a variety of WACC outcomes. The team found that the risk premium associated with project size has significant potential to be mitigated 18 because lower upfront investments potentially shorten the pre-completion period and, therefore, lower pre-completion risk; all of these factors would result in a lower risk premium and, in turn, a lower WACC. If lower WACC is achieved, the opportunity to compete with natural gas-fired generation in both regulated and unregulated territories would be larger than for GW-scale plants, thus further enhancing the future competitiveness of SMRs. Also, Moody’s estimates that (i) financial strength metrics for both regulated and unregulated utilities (such as cash-to-debt flow ratios) and (ii) cash flow predictability for unregulated utilities are significant factors in its rating methodology (see Table 1). In the opinion of the authors, the temporal nature of cash flow predictability is an important indicator when assessing the debt quality for nuclear power plants. According to a recent study issued by the Texas Institute, the historical record of commercial nuclear power plant construction by U.S. investor-owned utilities showed an almost 70% probability that the utility would experience a rating downgrade of uncertain magnitude.19,20 It should be noted that this study was based upon the corporate finance structures that were in place in the 1980s and 1990s. These structures are not representative of today’s financing vehicles that are based on limited recourse arrangements. The study team developed a conceptual model to examine the impacts of size risk on WACC (described in Appendix F). The study team compared the WACC for conventional investments versus large nuclear investments, based on the size risk, implicit to the financial strength, as measured by Moody’s. The model indicates that investments in large nuclear projects (approximately $6-7 billion) exhibit significantly higher WACC as compared with conventional energy investments (approximately $2-3 billion).21 According to a Congressional Budget Office (CBO) report, Moody’s recently reported that it was considering taking a more negative view of bond issuers who were seeking to finance the construction of new nuclear plants. A primary concern cited by Moody’s was whether the proposed plants were economically viable, especially given uncertainties about the effects of energy efficiency programs and national clean electricity standards on the demand for new nuclear generating capacity, the availability of capital in such projects, and the effect of such investment on the sponsoring utilities’ balance sheets.22 Furthermore, CBO discussed the market risk associated with GW-scale plants: Market risk is the component of risk that investors cannot protect themselves against by diversifying their portfolios. Investors require compensation for market risk because investments exposed to such risk are more likely to have low returns when the economy as a whole is weak and resources are more highly valued…In the case of nuclear construction guarantees provided to investor-owned utilities or merchant power providers, for example, plant construction may be more likely to be slowed or canceled when the demand for electricity is depressed by a weak economy. 23,24 SMRs could potentially mitigate such a risk in several ways. First, SMRs have lower precompletion risk due to shorter construction schedules (24-36 months as compared with 48 months). Second, because of their smaller size, SMRs have lower market risk because there is significantly less power than needs to be sold as compared with GW-level plants. Finally, the modular nature of SMRs affords the flexibility to build capacity on an as-needed basis. In the case of unsubsidized financing, particularly relevant to merchant markets, utility decision makers that have significant aversion to risk of future natural gas spikes (i.e., gas prices rising to about $7/Mcf or one standard deviation above the recent average behavior of natural gas prices) would possibly view alternatives to gas-fired generation as attractive options, particularly if the investment requirements are comparable – SMRs could potentially “fit the bill.”

#### Only SMRs can solve

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(6/24, Safer power from smaller reactors, www.newsobserver.com/2011/06/24/1295895/safer-power-from-smaller-reactors.html)

Efforts to promote energy efficiency, encourage sustainable lifestyle changes and exploit renewable energy sources are laudable, but they will not be sufficient to meet the projected growth in demand for electricity. The United States and the world need to increase the use of nuclear power, particularly for energy security and to limit climate-changing emissions. Nothing that has happened in Japan has made nuclear power any less essential. The Fukushima nuclear power plant accident was caused by a major earthquake and tsunami of the sort that are not likely to occur here, but we can learn from the cascade of events that led to reactor meltdowns and hydrogen explosions there. The U.S. Nuclear Regulatory Commission is studying the accident, and its findings could lead to a number of changes, especially better protection against a loss of power from extreme events like hurricanes, earthquakes and floods. Lessons learned from Japan's crisis would improve nuclear safety, as other changes did following the Three Mile Island accident in 1979. Change could also come from a different direction: development of a new generation of small modular reactors similar in size to those that have successfully powered U.S. submarines and aircraft carriers for decades. No bigger than a double-wide trailer and built in a factory for a fraction of the cost of a large nuclear plant, the small modular reactor (SMR) is an environmentally friendly and cost-effective way to help meet growing demand for electricity. SMRs have the potential to replace older coal plants and to provide a hedge against volatility in natural gas prices. And while solar and wind are attractive energy sources, both produce power only intermittently and require back-up power in the event the weather is not cooperating.

#### Natural gas price volatility kills the economy – nuclear hedge key

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(Public Utilities Fortnightly, The Case Against Gas Dependence, www.misi-net.com/publications/Case\_Against\_Gas\_Dependence.pdf)

Over the past two decades, the United States has, by default, come to rely on an “In Gas We Trust” energy policy. Natural gas increasingly has been seen as the preferred fuel for all applications, nowhere more than in the electric generation sector. However, the greatly increased use of natural gas forecast for the electricity sector may not be economically or technically feasible, and it does not represent optimal or desired energy policy. Rather, a more rational energy policy would be to use coal and nuclear power as the sources of new electricity generation and to use natural gas for the applications for which it is best suited—space heating and industrial use. The nuclear power industry in the United States has established an enviable economic and safety record, and a revived nuclear power option is essential for a balanced and secure U.S. energy future. The price of coal-fired electricity has been declining for more than 20 years and is forecast by the Department of Energy’s Energy Information Administration (EIA) to continue declining for at least the next 20 years. Coal-burning electric utilities also have made impressive environmental advancements: The rate of emissions per ton of coal use has decreased nearly 70 percent during the past 30 years, and this trend continues.1 Certainly, the recent run-up in natural gas prices has easily made the case for many of the perils of using more natural gas. But as early as 2000, many experts became alarmed when natural gas consumption for electricity generation exceeded the amount used for residential or commercial purposes. By 2025, use of natural gas to generate electricity will equal that used in the industrial sector and will exceed the combined use of natural gas in both the residential and commercial sectors. Total natural gas consumption is forecast to increase 49 percent between 2000 and 2025, from 23.5 Tcf to 34.9 Tcf; however, gas consumption for electric generation will more than double, increasing from 5.2 Tcf to 10.6 Tcf. Is such a dramatic increase in the use of natural gas to generate electricity feasible without straining gas supply and infrastructure? Government and industry energy analysts have expressed doubts. Even after reducing its forecasts of natural gas use for electric generation twice in the past two years, EIA remains concerned about the adequacy of future gas supplies, cautioning that “a major consideration for energy markets through 2025 will be the availability of adequate natural gas supplies at competitive prices to meet growth in demand.”2 EIA finds that domestic gas production is increasingly dependent on unconventional and costly conventional resources, both onshore and offshore. The 2003 EIA forecast of U.S. natural gas production in 2020 is 3.4 Tcf (or 12 percent) lower than the 2002 projection because of reduced estimates of reserves, changes in the economics of production, and reduced expectations for unconventional gas.3 EIA also has reduced its forecasts of the amount of gas that the United States will consume in the future, and nearly all of this reduction is due to lowered forecasts of new electric generation that will be gas-fired. In 2002, EIA projected that nearly 90 percent of all new electric generation over the next two decades will be gas-fired, while in its 2003 forecasts it projects that 80 percent of new electric generation will be gasfired. Its 2003 forecast of total gas consumption in 2020 is 1.7 Tcf lower than the 2002 forecast, and most of this (1.1 Tcf) is from reduced consumption in the electric generation sector. EIA recently has reduced its forecasts of the use of natural gas for electricity generation. In its 2001 forecast, EIA projected that in 2020 11.6 Tcf of natural gas would be used to generate electricity; in its 2002 forecast, EIA lowered this projection to 10.5 Tcf; in its forecast published in January 2003, EIA further reduced the projected 2020 use of natural gas in the electric generation sector to 9.6 Tcf. This represents a lowering of the forecast by 17 percent in only two years. U.S. natural gas production will not keep pace with demand—even with EIA’s reduced estimates of future demand—and gas imports will increase significantly. The more than doubling of the use of natural gas to generate electricity by 2025 will be accompanied by a big increase in U.S. gas imports. In 2000, U.S. natural gas imports totaled 4.6 Tcf; by 2025 imports are forecast to total 8.3 Tcf. Thus, at a time when energy policy-makers are concerned about America’s increasing dependence on imported oil, the United States will become increasingly dependent on imported natural gas as well, and much of these gas imports will come from the same politically unstable regions that contain most of the world’s oil supplies.4 Further, U.S. gas markets may not be able to accommodate the huge anticipated increase in natural gas demand over the next two decades. As Wayne Andrews of Raymond James & Associates noted:5 U.S. gas supply is declining at an unprecedented rate, and U.S. producers will find it very difficult to reverse this negative trend; The gas industry is searching from smaller reserves and decline rates are increasing; and Imports from Canada are declining; and liquefied natural gas (LNG) is the only long-term solution. Matthew Simmons of Simmons & Co. International similarly believes that:6 Although the gas well drilling boom of 2000/2001 was unprecedented, it resulted in few new supplies, and U.S. gas production has been essentially flat since 1995; The decline in domestic gas production is not reversible through a new drilling boom; A 10 percent decline in domestic production is likely but could be far worse; and By 2004, a large number of new gas-fired electric generation plants will be on line and, if are all used in the same week, the “sucking impact on gas will be unprecedented.” Simmons concludes, “If the above points hold, new gas-fired generation beyond 2005 may not be feasible, and alternate fuels will have to be used for new electric generation plants.” Strains on Supplies The United States has only 3 percent of the world’s natural gas reserves—about 170 tcf out of a world total of 5,300 tcf. William O’Grady of A.G. Edwards states the challenge succinctly: “Here’s the problem with natural gas. There’s lots of natural gas, but there are no pipelines from Kazakhstan to Los Angeles. That makes U.S. gas consumers critically dependent on U.S. production, and U.S. production is in a long-term decline that most experts do not think will reverse. We have been poking holes in the lower-48 [states] since the 1920s. The relatively easy gas-producing areas have been picked over, and what’s left are tough and expensive fields like deep gas zones.”7 Daniel Yergin, an LNG proponent, has estimated that meeting anticipated natural gas infrastructure needs through 2010 requires an industry investment of more than $500 billion— double the investments made during the 1990s.8 “The United States is making a major bet on future gas supplies— without realizing it,” he notes.9 According to the Strategic Center for Natural Gas at the National Energy Technology Laboratory (NETL), 400,000 miles of new pipelines will be required by 2015 to meet expected near-term increases in natural gas demand.10 Such rapid growth, driven largely by the use of gas to generate electricity, will place severe strains on the industry. Along with increasing loads, the expansion of natural gas use will place new burdens on the gas storage and delivery infrastructure. In addition, building new pipelines is an expensive, lengthy undertaking that generates intense local opposition. Most (80 to 90 percent) of the 350 GW of new generating capacity required over the next two decades is expected to be gas-fired. By 2020 an additional 6 Tcf of gas will be required— about 6 Bcf per day. NETL concludes that “even with favorable market conditions for natural gas technologies, there is growing concern that demand could outstrip supply.11 Legitimate concerns exist about the adequacy of the pipeline system not only for interstate transportation, but also for regional and local distribution.”12 NETL doubts that technologies will be developed in time to produce new sources of natural gas economically. Investment in R&D by major energy producers is declining, since a competitive energy market has forced the industry to streamline operations and reduce R&D.13 Increased Price Volatility In addition to concerns about future supplies, price volatility is a major problem with using gas to generate electricity. Annual average prices of natural gas to electric utilities have been extremely volatile, and price fluctuations of 50 to 100 percent have been common. Monthly gas price variations to electric utilities have been even more extreme. In recent years, the monthly price of natural gas has varied by more than 300 percent. Natural gas prices are likely to remain extremely volatile during the next two decades. This volatility likely will worsen, given the increased demand for natural gas (especially for electricity generation) and tightening supplies. Even more seriously, this volatility will be occurring along a trend line of increasing gas prices. EIA forecasts that natural gas prices will increase as technology fails to offset resource depletion and increased demand, and prices to electricity generators are projected to reach $4.40/mcf by 2015 (2001 dollars)—equivalent to more than $6.00/mcf in nominal dollars. The Economy and Demand Destruction The energy crises of the 1970s demonstrated the harmful impact on jobs and the economy that natural gas shortages can have. The U.S. economy suffered through recessions, widespread unemployment, inflation, and record-high interest rates. In the winter of 1975-76, unemployment resulting from gas curtailments in hard-hit regions ran as high as 100,000 for periods lasting from 20 to 90 days.14 These effects were especially serious for the poor and for the nation’s minorities. 15 More recently, the winter of 2002-2003 brought higher natural gas bills to many consumers, and low-income families were especially hard hit. As Paul Cicio, director of the Industrial Energy Consumers Association, notes: “The economic welfare of our economy, the competitiveness of our industries, the affordability of natural gas for all consumers are at risk. We cannot afford another natural gas crisis. Every U.S. energy crisis in the last 30 years has been followed by an economic recession, and the 2000-2001 price spike was no exception. The energy crisis devastated industrial consumers. When natural gas prices reached $4/MMBtu, manufacturing began to reduce production and shift production to locations outside the U.S. At even higher prices, they shut down production, laying off employees, and damaging communities. We have arrived at this price threshold.”16 Moreover, two articles last year in Public Utilities Fortnightly that addressed natural gas supply, demand, and price issues seemed to confuse the solution with the problem. Robert Linden noted that high gas prices would lead to “demand destruction” in the industrial sector, which would, in part, counterbalance increasing power sector demand.17He further stated, “This price-induced demand destruction can be added to the other causes of reduced gas demand, including the closure of industrial facilities using natural gas as a feedstock.”18 Similarly, John Herbert, after noting that high natural gas prices have forced U.S. fertilizer plants to shut down, stated, “As fertilizer and other chemical plants continue to shut down, this will reduce demand for natural gas and increase overall supplies.”19 Both authors are correct in pointing out that high natural gas prices will tend to reduce industrial natural gas demand as industrial plants shut down, and that this will temper future natural gas price increases. However, the “destruction” of the nation’s industrial sector is an extremely serious problem for the United States; it is not a “solution” to the natural-gas pricing problem. We should be very concerned with the strongly negative impact high natural gas prices are having on the U.S. industrial sector and the potential implications of this for the U.S. economy. Despite all of the hype in recent years about the new economy, the information economy, the service economy, etc., manufacturing is, by far, the most critical sector of the U.S. economy, and it creates the broad foundation upon which the rest of the economy grows. Manufacturing drives the rest of the economy, provides a disproportionate share of the nation’s tax base, generates innovation, and disseminates new technology throughout the economy. The average manufacturing job creates 4.2 jobs directly and indirectly throughout the economy, whereas the average service and retail job generates about one other job, directly and indirectly. The manufacturing sector uses 40 percent of the natural gas consumed in the United States, and virtually every manufacturing industry is heavily dependent on natural gas as a fuel, feedstock, and, increasingly, as a source of electricity generation. Price spikes in the cost of natural gas and electricity in the fall of 2000 precipitated the current manufacturing recession. During the past three years, this sector has been severely affected, losing more than 2.5 million jobs.21 The current manufacturing recovery is slower than the first year of any recovery in 40 years.22Manufacturing is suffering from intense global competition and cannot pass though increased energy costs via product price increases. Reliance on low-cost natural gas has been an often-unrecognized factor in the U.S. manufacturing sector’s global competitiveness, and an ample supply of reasonably priced natural gas is critical to its competitiveness. This sector is bearing the brunt of the energy impacts of the natural gas crisis and is suffering from a triple whammy: High natural gas prices are causing industrial electricity prices to increase, the cost of natural gas as a feedstock and fuel is greatly increasing manufacturing costs, and industrial operations are the first to be cut off from natural gas supplies when winter emergencies occur. The natural gas crisis has become a matter of exporting profits and jobs to countries with cheaper natural gas. Thus, the impact of high natural gas prices is, indeed, to destroy the U.S. industrial sector. However, instead of viewing this as an effect that will serve to moderate future natural gas price increases, this must be viewed as a very serious problem resulting from high natural gas prices. To the extent natural gas demand and prices are being driven by the increasing use of gas for electric power generation, the solution should be to substitute other fuels, such as nuclear and coal in this sector, and not to accept demand destruction in the nation’s industrial sector.

#### Natural gas prices outweigh alt causes – price stability ensures growth

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(How Near-Term Energy Policy Could Make or Break Us, jaydiatribe.blogspot.com/2012/10/how-near-term-energy-policy-could-make.html)

The new horizontal drilling technology known as “fracking” has brought us a “glut” of natural gas. In so doing, it has reduced natural-gas prices by a factor of five or six from their levels just a few years ago. This “glut” and its consequent price reduction give us extraordinary opportunities as a nation. As I’ve analyzed in detail in an earlier post, they give us the chance to dump the most catastrophically damaging fuel known—coal—once and for all. We can do that by switching our non-renewable power sources to natural gas. Doing so would make us a leader, not a lagger, in fighting climate change. At the same time, it would reduce our incidence of acid rain, mercury pollution of waterways and seas, and particulate-induced asthma and other respiratory diseases that burning coal causes. But that’s just the beginning. Not only can we switch power generation from coal to natural gas. We can also switch our small vehicles and even our long-distance trucking. In that way we can make ourselves 100% energy independent in just the ten to fifteen years it would take us to convert, if we make up our minds to do so quickly. Energy independence and lower energy prices would revive our sluggish economy in three ways. First, the conversion process would create millions of non-outsourceable jobs, not only in energy extraction, but in building and maintaining gas pipelines, converting vehicles, and making and selling gas compressors for use by homes and small businesses to “gas up” in one’s own garage. Second, the price of energy still affects the price of almost everything, notwithstanding our strenuous efforts to conserve and increase efficiency. By lowering the price of the energy we use (as compared to oil and coal, for example), natural gas would allow our business and industry to become more competitive abroad. Finally, as I have described in detail in the earlier post, natural gas can provide a gateway and smooth transition to a truly sustainable energy infrastructure. Natural gas works well in tandem with wind and solar power, making a transition to renewables quicker and cheaper and, at the same time, extending the deadline for doing so by extending our natural-gas reserves. There is just one problem. Rising prices of natural gas threaten to put all of these promises beyond our reach. Just seven months ago, last March, I published my post analyzing the many benefits of natural gas as a transition fuel. At that time, the wholesale price of natural gas was about $2.60 per million BTU. That was near a several-year low that occurred in middle of this year. [See Spot Prices Graph] Now natural-gas prices are soaring. For the week of October 3, 2012, they were $3.21 per million BTU. [See right sidebar: “Overview”] That’s an increase of 23%—nearly a quarter—in just seven months. If this trend continues, all the benefits of the fracking craze that I outlined above and described in my earlier post will be lost, because they all depend on natural-gas’ price advantage. We will be left with the many (but manageable) environmental consequences of “fracking” but none of its benefits, except for a bigger supply of natural-gas for space heating at higher prices.

#### US economic collapse emboldens adversaries – ensures global warfare

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(7/10, The Real National Security Threat: America's Debt, www.brookings.edu/research/opinions/2012/07/10-economy-foreign-policy-lieberthal-ohanlon)

Lastly, American economic weakness undercuts U.S. leadership abroad. Other countries sense our weakness and wonder about our purported decline. If this perception becomes more widespread, and the case that we are in decline becomes more persuasive, countries will begin to take actions that reflect their skepticism about America's future. Allies and friends will doubt our commitment and may pursue nuclear weapons for their own security, for example; adversaries will sense opportunity and be less restrained in throwing around their weight in their own neighborhoods. The crucial Persian Gulf and Western Pacific regions will likely become less stable. Major war will become more likely. When running for president last time, Obama eloquently articulated big foreign policy visions: healing America's breach with the Muslim world, controlling global climate change, dramatically curbing global poverty through development aid, moving toward a world free of nuclear weapons. These were, and remain, worthy if elusive goals. However, for Obama or his successor, there is now a much more urgent big-picture issue: restoring U.S. economic strength. Nothing else is really possible if that fundamental prerequisite to effective foreign policy is not reestablished.

#### Affordable natural gas in the US is key to the global economy – makes up for shortfalls from Europe and China

Perry, Professor of Economics at UM – Flint, 12

[Mark J. Perry, “U.S. Emerges As A Main Engine of Global Growth,” mjperry.blogspot.com/2012/04/us-emerging-as-main-engine-of-global.html]

"The U.S. once again may be emerging as a main engine for global growth -- and at an opportune time, as Europe slides into recession and China’s economy decelerates. An improving job market, rising stock prices and easier credit are combining to lift U.S. consumer confidence and spending, with optimism measured by the Bloomberg Comfort Index near a four-year high. Personal-consumption expenditures increased by the most in seven months in February, rising 0.8 percent, the Commerce Department said last week. “We’re entering a sweet spot for the economy,” said Allen Sinai, president of Decision Economics Inc. in New York. “We’re in a self-reinforcing cycle,” where faster employment growth leads to higher household income and increased consumer spending. The U.S. is taking the lead in global growth, thanks in part to a domestic glut of natural gas, Larry Kantor, head of research at Barclays in New York, wrote in a March 22 report. Natural-gas futures on the New York Mercantile Exchange fell to 10-year lows last week, helping to blunt the impact of higher oil prices on the economy. U.S. manufacturers are benefiting, with the Institute for Supply Management’s factory index climbing to 53.4 (NAPMPMI) last month, beating the median estimate in a Bloomberg News survey, from 52.4 in February, the Tempe, Arizona-based group said yesterday. Readings greater than 50 signal growth. The recovery “has been an emerging-market -- really a Chinese-led -- story, with the U.S. having lagged the cycle,” Kantor said. “Now, however, the U.S. has reasserted its traditional role, and the current pickup in growth is clearly being led by the U.S.”

#### Global economic collapse ensures great power conflict and accesses every impact possible

Green & Schrage, IR Prof @ Georgetown, ’09

[Michael Green, Senior Advisor & Japan Chair @ The Center for Strategic and International Studies & Associate Professor @ The Walsh School of Foreign Service, Steven Schrage, CSIS Scholl Chair in International Business, Former Senior official with the U.S. Trade Representative's Office, State Department and Ways & Means Committee, “It's not just the economy,” March 26th 2009, <http://www.atimes.com/atimes/Asian_Economy/KC26Dk01.html>]

Facing the worst economic crisis since the Great Depression, analysts at the World Bank and the US Central Intelligence Agency are just beginning to contemplate the ramifications for international stability if there is not a recovery in the next year. For the most part, the focus has been on fragile states such as some in Eastern Europe.  However, the Great Depression taught us that a downward global economic spiral can even have jarring impacts on great powers. It is no mere coincidence that the last great global economic downturn was followed by the most destructive war in human history.  In the 1930s, economic desperation helped fuel autocratic regimes and protectionism in a downward economic-security death spiral that engulfed the world in conflict. This spiral was aided by the preoccupation of the United States and other leading nations with economic troubles at home and insufficient attention to working with other powers to maintain stability abroad. Today's challenges are different, yet 1933's London Economic Conference, which failed to stop the drift toward deeper depression and world war, should be a cautionary tale for leaders heading to next month's London Group of 20 (G-20) meeting. There is no question the US must urgently act to address banking issues and to restart its economy. But the lessons of the past suggest that we will also have to keep an eye on those fragile threads in the international system that could begin to unravel if the financial crisis is not reversed early in the Barack Obama administration and realize that economics and security are intertwined in most of the critical challenges we face. A disillusioned rising power? Four areas in Asia merit particular attention, although so far the current financial crisis has not changed Asia's fundamental strategic picture. China is not replacing the US as regional hegemon, since the leadership in Beijing is too nervous about the political implications of the financial crisis at home to actually play a leading role in solving it internationally. Predictions that the US will be brought to its knees because China is the leading holder of US debt often miss key points. China's currency controls and full employment/export-oriented growth strategy give Beijing few choices other than buying US Treasury bills or harming its own economy. Rather than creating new rules or institutions in international finance, or reorienting the Chinese economy to generate greater long-term consumer demand at home, Chinese leaders are desperately clinging to the status quo (though Beijing deserves credit for short-term efforts to stimulate economic growth). The greater danger with China is not an eclipsing of US leadership, but instead the kind of shift in strategic orientation that happened to Japan after the Great Depression. Japan was arguably not a revisionist power before 1932 and sought instead to converge with the global economy through open trade and adoption of the gold standard. The worldwide depression and protectionism of the 1930s devastated the newly exposed Japanese economy and contributed directly to militaristic and autarkic policies in Asia as the Japanese people reacted against what counted for globalization at the time. China today is similarly converging with the global economy, and many experts believe China needs at least 8% annual growth to sustain social stability. Realistic growth predictions for 2009 are closer to 5%. Veteran China hands were watching closely when millions of migrant workers returned to work after the Lunar New Year holiday last month to find factories closed and jobs gone. There were pockets of protests, but nationwide unrest seems unlikely this year, and Chinese leaders are working around the clock to ensure that it does not happen next year either. However, the economic slowdown has only just begun and nobody is certain how it will impact the social contract in China between the ruling communist party and the 1.3 billion Chinese who have come to see President Hu Jintao's call for "harmonious society" as inextricably linked to his promise of "peaceful development". If the Japanese example is any precedent, a sustained economic slowdown has the potential to open a dangerous path from economic nationalism to strategic revisionism in China too. Dangerous states It is noteworthy that North Korea, Myanmar and Iran have all intensified their defiance in the wake of the financial crisis, which has distracted the world's leading nations, limited their moral authority and sown potential discord. With Beijing worried about the potential impact of North Korean belligerence or instability on Chinese internal stability, and leaders in Japan and South Korea under siege in parliament because of the collapse of their stock markets, leaders in the North Korean capital of Pyongyang have grown increasingly boisterous about their country's claims to great power status as a nuclear weapons state. The junta in Myanmar has chosen this moment to arrest hundreds of political dissidents and thumb its nose at fellow members of the 10-country Association of Southeast Asian Nations. Iran continues its nuclear program while exploiting differences between the US, UK and France (or the P-3 group) and China and Russia - differences that could become more pronounced if economic friction with Beijing or Russia crowds out cooperation or if Western European governments grow nervous about sanctions as a tool of policy. It is possible that the economic downturn will make these dangerous states more pliable because of falling fuel prices (Iran) and greater need for foreign aid (North Korea and Myanmar), but that may depend on the extent that authoritarian leaders care about the well-being of their people or face internal political pressures linked to the economy. So far, there is little evidence to suggest either and much evidence to suggest these dangerous states see an opportunity to advance their asymmetrical advantages against the international system. Challenges to the democratic model; The trend in East Asia has been for developing economies to steadily embrace democracy and the rule of law in order to sustain their national success. But to thrive, new democracies also have to deliver basic economic growth. The economic crisis has hit democracies hard, with Japanese Prime Minister Aso Taro's approval collapsing to single digits in the polls and South Korea's Lee Myung-bak and Taiwan's Ma Ying Jeou doing only a little better (and the collapse in Taiwan's exports - particularly to China - is sure to undermine Ma's argument that a more accommodating stance toward Beijing will bring economic benefits to Taiwan). Thailand's new coalition government has an uncertain future after two years of post-coup drift and now economic crisis. The string of old and new democracies in East Asia has helped to anchor US relations with China and to maintain what former secretary of state Condoleezza Rice once called a "balance of power that favors freedom". A reversal of the democratic expansion of the past two decades would not only impact the global balance of power but also increase the potential number of failed states, with all the attendant risk they bring from harboring terrorists to incubating pandemic diseases and trafficking in persons. It would also undermine the demonstration effect of liberal norms we are urging China to embrace at home.

### Advantage Two

#### Advantage two is environmental leadership

#### Obama’s climate legitimacy is dead – only changes to domestic energy policy can reinvigorate leadership

Herz, Senior International Climate Attorney with the Sierra Club, 12-17

[12/17, Dithering In Doha: We Need To Re-Frame The Politics Of Climate, thinkprogress.org/climate/2012/12/17/1343391/dithering-in-doha-we-need-to-re-frame-the-politics-of-climate/?mobile=nc]

Just as disappointing as the outcome in Doha was the role of the United States in bringing it about. When President Obama first took office, there were great expectations that he would bring about a new era American climate leadership. Instead, the US negotiating posture too often has been characterized by a reluctance to expend real political capital, a hypersensitivity to Congressional extremism, and an unwillingness to lead by example. Still, there were good reasons to hope that Doha might be the place where the President would begin to fashion a more creative and ambitious negotiating strategy. After all, hadn’t President Obama just handily won reelection over an (opportunistically) denialist opponent, and in the flush of victory, affirmed his intent to address the climate crisis in his Second Administration? Didn’t superstorm Sandy just drive home the intolerable human costs of a significantly warmer planet in the starkest terms possible? With the election safely behind him and the devastation of Sandy laid out before him, was there ever a fiercer urgency than now? It was not to be. On every critical issue, the Obama team did just enough to avoid being called out for blocking progress, far less than what was needed, and nowhere near what real leadership required. For example, the US negotiators refused to discuss how the US could ramp up its actions at home, despite the fact that the actions countries have agreed to take before 2020 are not nearly enough to limit warming to 3.6°F, and the US has committed to do much less than other developed countries. The US also made sure that developed countries would not provide any clarity on how they would ramp up climate assistance to developing countries to meet their collective pledge to provide $100 billion a year by 2020. It has become fashionable to blame the UN process itself for the collective failure to craft an adequate international response to climate change. But the US performance in Doha cannot be attributed to a failure of international politics; it was plainly a failure of politics right here at home. Most of the blame, of course, lies with a Republican opposition that is contemptuous of science, heedless of risk, and beholden to the most regressive fossil fuel interests. But President bears much responsibility as well. Rather than using the power of the Presidency, his high public approval ratings and his peerless rhetorical gifts to change the political dynamics around climate change, he has simply taken the political space as he has found it. President Obama has two critical opportunities to re-frame America’s climate diplomacy in the coming months. First, he must select a new Secretary of State with a clear sense of the overriding strategic importance of climate change to America’s core interests, and the creativity and vision to lead the world towards more ambitious collective action. Second and more importantly, he must use his State of the Union Address to discuss the stakes and impacts, and explain why an appropriate response is essential for our long-term prosperity and security. He should commit in no uncertain terms that climate change will be a signature priority in his Second Administration. And he should propose a suite of policy initiatives that can swiftly reduce our emissions, and give other nations confidence that we will not shirk our responsibilities. Together, these actions would go a long way towards ensuring that our climate diplomacy is much more successful in the second Obama Administration than it was in the first.

#### Reversing Obama’s go slow approach on new nuclear technology is necessary to establish presidential leadership on climate

Hansen, Director NASA Goddard Institute, ’11

(NASA’s Hansen Presses Obama for a Carbon Cost and Nuclear Push, dotearth.blogs.nytimes.com/2011/01/24/nasas-hansen-presses-obama-for-a-carbon-cost-and-nuclear-push/?partner=rss&emc=rss)

It would have made good sense to give energy/climate a high priority right at the start. Solving our fossil fuel addiction and altering the course of global warming can be handled with a good overall strategy, but that strategy would not be based on a compromise that has special interests defining the details.That’s why I wrote a letter to Michelle and Barack Obama [in 2008], starting it while stuck in London, where Anniek [Hansen's wife] had a heart attack. John Holdren agreed to deliver the letter, but not until after he was confirmed, so I made it a public letter. I understand that John told the media that he was not free to discuss what he communicated to the President and what reaction he received. In any case, I never heard back anything from the White House. Another reason for concern: the President’s comment on global warming in his 2009 State of the Union message, which began with something to the effect: I know some of you don’t believe in global warming… It is not a matter of belief. Galileo had to accept the reality that whether the Earth orbited the sun or vice versa was a matter of belief (if he did not want to go to an early grave), so he recanted his statements (probably with his fingers crossed). But we are not living in a time when beliefs should trump science. The President should use his ascendancy to the most powerful position on the planet to help set a new sensible course for the planet and humanity. It would have required being blunt and honest about the situation and what was needed to break our addiction and avoid the tremendous inter-generational injustice that the present path will bring to pass. The path to a clean energy future would not be painful for the public, but it requires standing up to special interests who benefit from business-as-usual. It is both a moral issue and a question of where the United States will stand in the future. Our economic standing is going to become second class this century if we do not move smartly toward a clean energy future. No where is the lame middle-of-the-road go-slow compromise approach clearer than in the case of nuclear power. The Administration has been reluctant to admit that the Carter and Clinton/Gore administrations made a huge mistake in pulling the U.S. back from development of advanced nuclear technology. That is the way to make nuclear power safer (nuclear power already has the best safety record of any major industry in the United States) and resistant to weapons proliferation. The approach to nuclear power is to take a few baby steps with current technology. People such as Bill Gates are despairing at the lack of leadership in Washington — investing his own money in development of advanced reactor designs. But even Bill Gates does not have enough money to make up for the lack of dynamic leadership in Washington. If we took advantage of our brainpower (which is rapidly aging!), we could still be the leader in developing safer clean energy for the future and producing a better future for our children, rather than going after the last drop of oil in pristine environments, off-shore, in the tar sands. It is such a purblind foolish approach. We need someone with the courage to stand up to the special interests who have hamstrung U.S. policy, including the minority of anti-nukes who have controlled the energy policy of the Democratic party. We are still waiting for an Abraham Lincoln, a leader who will stand tall. It is a moral matter. Lincoln would not have released half of the slaves…. The other thing not mentioned above is that the most fundamental problem, which I keep repeating, is this: as long as fossil fuels are the cheapest energy, somebody will keep burning them — implication, we must put a rising price on carbon. (Not cap-and-trade! A simple, honest approach — collect a fee from fossil fuel companies at first sale, distribute that money, 100 percent, to the public.) Nevertheless, the easiest thing that he could do, and perhaps the best that we can hope for, is for him to give a strong boost to nuclear power. Unfortunately, he seems to fall prey to Democratic politics on this, rather than being a responsible leader.

#### Only support for nuclear power can resolve perceptions of international law illegality constraining US foreign policy

Hickey, Law Professor at Hofstra, 07

[REVIVING THE NUCLEAR POWER OPTION IN THE UNITED STATES: USING DOMESTIC ENERGY LAW TO CURE TWO PERCEPTIONS OF INTERNATIONAL LAW ILLEGALITY, lawarchive.hofstra.edu/pdf/Academics/Journals/LawReview/lrv\_issues\_v35n02\_i03.pdf]

Two perceptions, right or wrong, of international law illegality on the part of the United States have arisen in the last few years with regard to both the use of military force in Iraq and to global warming. The first perception is that the United States invaded Iraq illegally to secure a significant source of foreign oil. The second perception is that the United States ignores the letter and spirit of the evolving international climate change regime to reduce greenhouse gas (“GHG”) emissions. Both perceptions of international law illegality directly reflect the domestic growth energy policy of the United States that is anchored by a present and future reliance almost exclusively on fossil fuels (oil, coal and natural gas), which both emit GHG and contribute to the dependence of the United States on foreign oil. Those perceptions of illegality could be fully cured by an aggressive use of existing domestic law to revive the nuclear power industry in the United States to replace its fossil fuel based electric supply. This would put the United States in compliance with the climate change regime (whether or not it ever participates in it) and would help both to greatly reduce the dependence of the United States on foreign oil as a factual matter and to eliminate the perception that it uses force to secure foreign oil sources as a policy matter. In turn, the benefits of removing perceptions of international law illegality ought to play a significant and positive role in weighing the benefits and costs of future domestic nuclear energy production. II. PERCEPTIONS OF INTERNATIONAL LAW ILLEGALITY The first perception of illegality is that the invasion of Iraq was all about securing a foreign oil supply. Three considerations fuel that perception: the absence of an international law justification for the invasion, the presence of large oil reserves in Iraq, and the growing dependence of the United States on foreign oil for most of its oil needs. There was little justification in international law for the invasion by the United States and the coalition of willing states. International law forbids “the threat or use of force by states against the territorial integrity or political independence of any state,” except in an act of legitimate individual or collective self-defense or if authorized to maintain or restore international peace and security by the U.N. Security Council.2 The invasion of Iraq was not an act of self-defense under either the U.N. Charter,3 or under customary international law. Iraq had not actually attacked anyone for twelve years prior to March 2003.4 The invasion also was not justified as an act of anticipatory self-defense because Iraq neither had the capability nor demonstrated any intention of launching an imminent armed attack against the United States or other coalition states.5 The alternative notion that the invasion was legally justified in international law to preempt an armed attack at some remote point in time in the distant future is a dangerous and discredited international law justification for the use of force and there is no record to support that Iraq had such long term intentions. The invasion also could not be justified in international law as an act of humanitarian intervention.6 Finally, the invasion of Iraq was not legally justified by resolutions of the U.N. Security Council.7 The only two Security Council resolutions that could be invoked to justify the invasion were Resolution 678,8 and Resolution 1441.9 Neither resolution authorized the invasion of Iraq in March 2003. Resolution 678 was over a dozen years old and only authorized force to oust Iraq from Kuwait in the Desert Storm war.10 If the United States thought Resolution 678 provided a legal predicate to invade Iraq in 2003, it would not have sought Resolution 1441 from the Security Council. Resolution 1441 did not authorize the use of force because it did not contain the “magic words” of authorization—“use all necessary means.” Two permanent members of the Security Council (Russia and France) said in voting for 1441 that they did not intend to authorize the use of force, and that the resolution itself clearly required the Security Council to take an additional decision if Iraq violated 1441.11 The Security Council subsequently never issued any resolution authorizing the use of force against Iraq. In the absence of international law justifications for the invasion, the perception persists in some quarters, rightly or wrongly, that the United States invaded Iraq primarily to secure long term foreign sources of oil. After all, the United States depends mostly on foreign oil for much of the country’s energy needs.12 “In 2005, total U.S. demand for petroleum was 20.8 million barrels per day, of which 12.5 million barrels per day, or 60 percent, was from net imports.”13 Domestic oil production is mature, is increasingly under environmental constraints, and is not expected to rise significantly in the future.14 Under the present growth energy policy of the United States, grounded in fossil fuel use, secure foreign sources of oil must be found. In this regard, Iraq is estimated to have up to 216 billion barrels of untapped oil reserves in the ground, the third highest reserves in the world behind Saudi Arabia and Canada.15 The second perception of international law illegality is that the United States is acting contrary to the letter and spirit of the emerging international law regime to deal with climate change, in particular, efforts to reduce GHG emissions that contribute to global warming that are found in the 1992 United Nations Framework Convention on Climate Change (“Climate Change Convention”) and later in the 1997 Kyoto Protocol to the Climate Change Convention (“Kyoto Protocol”). The United States is a party to the Climate Change Convention along with 188 other nations. The Climate Change Convention establishes an administrative mechanism for governments to cooperate in stabilizing and ultimately reducing man-made GHG emissions to stop global warming. It establishes a largely aspirational framework to address the problem of climate change by urging cooperation among nations, by calling for the gathering of data on GHG emissions, by the launching of strategies to facilitate needed financing and technologies, and by articulating principles (like equity, sustainable development, and the precautionary principle) to guide more substantive rules. An overall goal of the Climate Change Convention is to have developed nations reduce GHG emissions to their 1990 levels and to have them assist developing countries in dealing with GHG.20 While still a party to the Climate Change Convention, the United States, in 2001, withdrew from the Kyoto Protocol. The Kyoto Protocol, which entered into force in February 2005 and has 169 parties to it, imposed binding international law obligations on industrialized nations to cap GHG emissions. If the United States had not withdrawn from the Kyoto Protocol, it would have been obligated to reduce its GHG emissions seven percent below 1990 levels.23 Just the opposite happened. From 1990 through 2000, for example, total GHG emissions by the United States rose from 1647 million metric tons annually to 1885 million metric tons.24 In 2005, GHG emissions from the United States were seventeen percent higher than in 1990.25 The United States alone produces roughly one quarter of all the world’s energy-related carbon emissions.26 Forty percent of that total comes from electric power plants burning coal, oil, and natural gas.27 In addition, the United States domestically has refused to regulate GHG emissions from automobiles under the Clean Air Act.28 By any measure, this is a domestic energy policy position out of step with the international law regimes emerging to deal with climate change.III. REVIVING THE NUCLEAR POWER OPTION Nuclear power is one of the most readily available domestic energy sources that can be used to achieve energy independence. It has a fiftyyear record of safe operational experience with over one hundred power plants.29 There are an estimated 498 million tons of uranium ore reserves in the United States30 to fuel a revived nuclear power industry. In addition, Australia and Canada, two close U.S. allies, have most of the world’s uranium reserves. Unlike fossil fuel electric power, nuclear electric power does not produce any GHGs. In 2005, over 200 million barrels of oil were used directly for electric generation.31 This consumption can be replaced by nuclear generation, which would help to reduce U.S. foreign oil dependence. In addition, the heavy reliance on the automobile in the United States is a major source of both oil consumption and of GHG emissions. The movement to introduce electric and electric hybrid cars to the U.S. automobile market is an attempt to reduce oil use and GHG emissions. However, if electric batteries used in these cars are recharged with fossil fuel generated electricity, little is achieved to reduce GHG emissions because the source of those emissions is simply moved from the tailpipe to the smokestack. In a revived nuclear power industry, additional GHG emission reductions could be achieved by recharging electric car batteries with electricity produced from nuclear power plants. Despite these advantages, the growth of the nuclear power industry has been moribund since the late 1970s because of domestic concerns about cost, accidents, and waste disposal.32 As a result, the nuclear energy contribution to meet the nation’s total electric demand hovers at about twenty percent.33 If nothing changes in the calculus of the benefits and costs of nuclear power production, the contribution of nuclear energy to meet the rising energy needs of the United States will decline in the future. Existing nuclear plants are operating at top efficiency and they are near the end of their useful lives, with no new plants on the horizon.34 In turn, U.S. electric demand is expected to increase by fortythree percent over the next twenty years requiring between 1300 and 1900 new power plants. Without nuclear power plants, the primary fuel source for those plants will be fossil fuels (coal, natural gas and oil), which are the major contributors of GHG to the atmosphere from electric generation. Renewable energy sources presently contribute little more than two percent of the nation’s total electric generation, excluding hydroelectricity (i.e. wind, solar, geothermal) Even if renewable capacity was tripled, it would still constitute only a very small portion of the total electric energy needs of the country. Hydroelectric power provides between six and seven percent of the country’s electricity.38 It is fully developed in the sense that nearly all rivers and streams capable of being used for production of hydroelectricity have been exploited. It is estimated that fossil fuels, without a change in energy laws and policies, will provide eighty-six percent of the energy supply of the United States in 2030.39 There is also in place a comprehensive legal and administrative regime for revival of the nuclear power industry. For example, the 1954 Atomic Energy Act allows private ownership of nuclear power plants under licenses issued by the federal Nuclear Regulatory Commission.40 The 1957 Price-Anderson Act limits investment risks and encourages investment in nuclear power plants by limiting the overall liability of commercial nuclear plant operators.41 The 1969 National Environmental Policy Act requires environmental impact statements to be prepared.42 The 1982 Nuclear Waste Policy Act addresses disposal of nuclear wastes associated with nuclear power production.43 The 1992 Energy Policy Act simplifies nuclear plant licensing procedures and encourages research and development of advanced nuclear power facilities.44 Finally, the 2005 Energy Policy Act renews the Price-Anderson Act, provides for loan guarantees for new nuclear power reactors, and establishes nuclear power production tax credits.45 What then prevents a shift in domestic growth energy policy towards aggressive nuclear power development and away from reliance on fossil fuels? There are four areas of concern about the nuclear power industry that inhibit its revival: costs, safety, proliferation, and waste. First, nuclear power remains at present relatively expensive under current financial comparisons. The cost of new nuclear plant construction per kilowatt hour is roughly $1500 compared to half that for a new coal plant.46 However, those cost comparisons do not fully internalize the associated global warming costs associated with GHG emissions from coal fired power production. In addition, the cost benefits of reducing GHG emissions by using nuclear power plants is also not reflected in current cost calculations. The cost comparisons also do not reflect any of the benefits achieved by curing the perceptions of illegality with regard to the use of force or to global warming. Cost calculations could also be reduced on a short term basis with government subsidies for the first few plants until economies of scale kick in with a revived nuclear industry, which would further reduce the cost per kilowatt hour. Second, since the Three Mile Island accident in 1979 and the 1987 Chernobyl plant meltdown in the Ukraine, there are concerns about plant safety and harm from accidents. Since those accidents, many industry and government measures have been undertaken to improve safety margins at nuclear plants in the United States. In addition, nuclear plant technology has changed greatly and is continuing to change to produce safer plants. In any event, the old Chernobyl type technology has never been used in the United States.47 There is also a new concern about the possibility of terrorist strikes against nuclear power plants and those safety concerns must be taken into consideration.48 In weighting safety concerns, it must be appreciated that global warming from GHG emissions can potentially produce far more catastrophic harms to the planet than local significant releases of radiation from a nuclear plant accident or terrorist strike for that matter.49 Third, there are concerns about nuclear weapons proliferation weapons. However, proliferation is not a problem inside the United States. It is a problem abroad in countries like Iran and North Korea. In any event, the July 18, 2005 agreement of the United States to share advanced nuclear plant technology with India, which is not a party to the Nuclear Non-Proliferation Treaty, should remove concerns about proliferation from a revived U.S. nuclear power industry from the calculus.50 If the United States is not concerned about nuclear proliferation from its nuclear power plant technology being used to make bombs in India, then it should hardly be much of a factor in considering the revival of the U.S. nuclear power industry. Fourth, there are legitimate concerns about disposal and storage of nuclear waste. Throughout the fuel cycle, low level and high level radioactive waste is created. Of particular concern, is spent nuclear fuel from fuel rods that can no longer produce enough heat to make electricity.51 Those highly radioactive spent fuel rods require storage permanently and safely to prevent exposure to humans, animals and flora and fauna. The waste disposal problem can be significantly ameliorated if the United States would lift its ban on nuclear fuel reprocessing, which would allow spent fuel rods to be used again rather than stored.52 What is not taken into account in considering the revival of the nuclear power industry are the substantial and real benefits in removing perceptions of international law illegality that have arisen in the context of climate change and the use of force. These benefits are admittedly hard to quantify. However, they belong firmly in the revival calculations. IV. CONCLUSION From the 1950s through the 1970s there was a pro-nuclear power consensus in the United States that resulted in the birth and vigorous growth of the nuclear power industry. Rising costs, construction delays, accidents, and waste disposal concerns shattered the pro-nuclear power consensus and stopped the growth of the industry in its tracks. It may now be time to rebuild that consensus and revive the growth of the nuclear power industry in the United States. Our dependence on foreign oil has grown to an unacceptable degree and evidence of the dangers of irreversible global catastrophe from global warming is mounting, while the energy policy of the United States remains a prisoner of fossil fuels. This has resulted in widely held perceptions, right or wrong, that the United States violated international law on the use of force by invading Iraq to secure foreign oil sources and that it now is violating the letter and spirit of the emerging international law regime to deal with climate change. Those perceptions can be removed by a domestic growth energy policy resting on existing domestic energy laws that moves away from fossil fuels and expands nuclear power production. If fossil fuels continue to be the centerpiece of long term domestic energy policy, those perceptions of international law illegality will persist to the detriment of U.S. foreign policy for decades.

#### Presidential leadership to address international climate concerns key to global environmental cooperation

Shepard, Natural Resources/Water Resources University Laboratory Teacher, 10

[U.S. Environmental Policy and Leadership, http://www.brighthub.com/environment/science-environmental/articles/39623.aspx?p=2]

The Bush administration’s failure to see the big picture in reference to global environmental change can clearly be seen in the resulting outcomes of his eight years as president. The withdrawal of the U.S. from the Kyoto treaty is both an important symbol of American isolationism from Europe and a direct link as to why the country (and perhaps the world as a whole) has not reduced greenhouse gas emissions and other pollutants that affect the global environment. The Kyoto agreement is not without flaws but the unwillingness to negotiate, or inaction, was not conducive to a good outcome for the global environment. "Greenhouse" Gases According to the Energy Information Administration (EIA) the United States greenhouse gas emissions went up by 1.4% in 2007. An article in the LA times states carbon dioxide emissions rose by nearly 2.0% in the U.S. in 2007 while Denmark’s went down by 8%, the U.K. and Germany 3%, and France and Australia 2%. Granted, this is only a single year, but considering the breadth of the consequences and that Bush had been in office since 2000, these numbers sum up rather well the effect of his administration on global environmental change. Bush Environmental Policies Overturned The ironic nature of the Bush administration’s response to environmental change is that the best aspect of it is reflected in policy’s that did not take effect. The administration made a habit of changing environmental regulations, many of which have been overturned by the Supreme Court. It's a tribute to our system that these efforts were not allowed to come to fruition. An example is the blocking of “changes to the rules that govern what kind of logging, mining or other activities can be allowed in national forests.” (Shogren, 2007) Carol Browner, head of the EPA in the Clinton administration and Obama energy “czarina”, is quoted as saying: "As dreadful as the Bush administration has been with respect to clean air and forests and all these environmental issues, the courts have been really our savior. And have time and time again in the last years [it has] stepped in." (Shogren, 2007) Another example of Bush environmental policy being thwarted is President Obama’s retracting of regulations inserted by Bush before he left office. One such regulation “would have opened 2 million acres of public land in Wyoming, Colorado, and Utah for oil-shale drilling.” (O'Carroll, 2009) Environment vs. Economy It appears that Bush was mired in the old ways of pitting the environment against the economy. In an April 2008 speech Bush states “The Kyoto Protocol would have required the United States to drastically reduce greenhouse gas emissions. The impact of this agreement, however, would have been to limit our economic growth…” (The White House Office of the Press Secretary, 2008) I maintain that this did not have to be, and that Obama has offered a glaring contrast to this outdated thinking. Obama campaigned on stimulating the economy in part by creating “green” jobs and fostering energy efficiency that will both save money and reduce fossil fuel use. Moving Forward There are numerous goals and programs of the new administration that were never considered by the Bush administration. These include a national Renewable Portfolio Standard, proposing a carbon cap and trade system, and already making it so states such as California can pass their own automobile fuel mileage standards that will likely be followed by other states. One of the biggest and perhaps controversial measures thus far is the April Environmental Protection Agency ruling making carbon dioxide a pollutant. A fairly novel idea being studied is to provide incentives for land owners (and money for planting in government owned forest land) to plant trees that can provide sinks for carbon. This is being carried out by a new department called the Office of Ecosystem Services and Markets. (Wilkinson, 2009) Will Obama Meet New Standards? Even with these goals and very early achievements it is unclear if the overall “political will”, no matter how different from the last eight years, is sufficient to tackle the challenges of global environmental change, particularly when the will of the presidential administration may not be enough. There are many representatives who do not share Obama’s enthusiasm for environmental issues. As pointed out previously, there have already been compromises made that have decreased funding for environmental initiatives. The American people can help by not letting the environmental agenda once again take a back seat, though only time will tell just how strong the will and influence of the Obama administration is. Opportunity for Leadership in Copenhagen The U.S. is the world superpower. I argue that the latest world economic troubles only serve to accentuate the extent to which this is true, as economies of the world are suffering due to the domino effect triggered by the collapse of the U.S. housing market. The Kyoto treaty was only a piece of paper without the U.S. on board. The other major polluting nations such as China and India will not take the problem of global environmental change seriously until America does. Copenhagen is a chance to right the ship before it is too late. Our nation is just as capable of steering the ship in the right direction as it is in the wrong direction. This means allowing Earth to take the helm, and remembering humanity adapts to her, not her to humanity. Update: Copenhagen; What happened? Dissapointment seems to be the predominant reaction from environmental organizations to the Copenhagen Climate Summit. Indeed, no binding agreement, or even a pledge to make a binding agreement in 2010 was achieved. This was not, however, the true test of the Obama administration's environmental policy. The real test is whether Obama can get a legitimate climate bill through the Senate. U.S. environmental leadership can still be the beacon it needs to be with a strong message from our lawmakers.

#### US environmental leadership key internal link to effective environmental governance

Esty & Ivanova, Director Yale Center Environmental Policy, 08

[Daniel C. Esty, Hillhouse Professor of Environmental Law and Policy at Yale University, Director of the Yale Center for Environmental Law and Policy and the Center for Business & Environment at Yale, Maria Ivanova, Assistant Professor of Government and Environmental Policy at The College of William and Mary and the Director of the Global Environmental Governance Project at the Yale Center for Environmental Law and Policy, “Reclaiming U.S. Leadership in Global Environmental Governance,” SAIS Review, Volume 28, Number 2, Summer-Fall 2008, pp. 57-75]

The Bush Administration’s “go-it-alone” strategy in security issues has mirrored a similar unilateralism in the international environmental domain. Once a leader in international environmental policy, the United States has lost much of its political influence today. What is more, U.S. withdrawal from multilateralism has left the United Nations—the imperfect but important instrument for international cooperation—“in limbo, neither strengthened nor abandoned,”1 threatening the ability of the world community to resolve fundamental global problems. Two key dynamics now mark international environmental policy. First, while it is widely recognized that U.S. engagement and cooperation is not just important, but historically seen as essential for progress, other nations today seem willing to move ahead with or without the United States. Germany, for example, announced a national greenhouse gas emissions reduction target of 40 percent by 2020 and threatened to boycott the U.S. “major emitters” initiative launched outside the Kyoto framework. That the United States could have gotten itself crosswise with so many other nations on so many issues is unprecedented. As Jonathan Lash, President of the World Resources Institute, recently observed, the extraordinary degree of anger and confrontation on environmental matters “reflects increasing alarm on climate change and the level of frustration with the U.S.”2 At the same time, many U.S. governors and mayors have launched state and local initiatives to reduce greenhouse gas emissions. Governor Arnold Schwarzenegger in California has gone so far as to open talks with the European Union on how to link his state-level initiatives with Europe’s emerging carbon market. Second, the Bush Administration’s reflexive unilateralism on international concerns—whether environmental, economic, or security—represents a break with the prevailing presumption since World War II favoring cooperation [End Page 58] and multilateralism through NATO, OECD, and other regional bodies, if not the UN. The “go-it-alone” approach is especially difficult to justify on issues that are inescapably global in scope, such as climate change. Even if the United States were able to eliminate its greenhouse gas emissions entirely, climate change would not be stopped. The build-up of atmospheric concentrations of carbon dioxide driven by rising emissions in China, India, Indonesia, and other developing countries would continue, leaving the United States exposed to the threat of global warming, increased intensity of windstorms, altered rainfall patterns, melting ice caps, and rising sea levels. These dynamics beg two questions: Can progress on any of the difficult global environmental issues be achieved without the participation and leadership of the United States? Conversely, can the United States shoulder the burden of addressing such concerns without the cooperation of the rest of the global community? In this article, we address these core questions. We argue that the next President of the United States must re-engage with other nations. Success in protecting the planet from climate change cannot be achieved by the United States acting on its own. International cooperation is essential. Similar collaborative efforts at the global scale will be required to protect the planet’s biological diversity, restore the vibrancy of the world’s fisheries, prevent the spread of persistent organic pollutants, conserve forests, and other issues that are inescapably trans-boundary in nature. We contend, moreover, that not only is U.S. participation critical, but U.S. leadership is crucial and necessary to achieve successful environmental outcomes. The U.S. environmental footprint is larger than any other country’s. The United States consumes a disproportionate share of the world’s energy and natural resources. With less than 5 percent of the world population, the United States uses 25 percent of the world’s fossil fuel resources—accounting for nearly 25 percent of the world’s annual coal burning, 26 percent of the world’s oil, and 27 percent of the world’s natural gas.3 It also accounts for 18.5 percent of the consumption of global forestry products and 13.7 percent of the world’s water usage. The United States is in a unique position. Given its economic and strategic power as well as its financial and technological prowess, U.S. leadership could influence international environmental policy and promote effective environmental governance. Conversely, the record of the past fifteen years has demonstrated that “when the United States declines to exercise leadership, the impact is significant.”4 Little progress is made without the United States. Reasserting global environmental leadership, however, will not be easy for the next U.S. president. There are considerable domestic challenges [End Page 59] as the U.S. public remains deeply ambivalent about international entanglements and international organizations—even those related to protecting the planet.

#### US environmental leadership prevents extinction – Biodiversity loss, ocean acidification, and soil erosion

Khosla, President of the International Union for Conservation of Nature, 09

(A new President for the United States: We have a dream, www.iucn.org/news\_homepage/news\_by\_date/2009\_news/january\_2009/?2595/new-President-for-the-United-States-We-have-a-dream)

A rejuvenated America, with a renewed purpose, commitment and energy to make its contribution once again towards a better world could well be the turning point that can reverse the current decline in the state of the global economy, the health of its life support systems and the morale of people everywhere. This extraordinary change in regime brings with it the promise of a deep change in attitudes and aspirations of Americans, a change that will lead, hopefully, to new directions in their nation’s policies and action. In particular, we can hope that from being a very reluctant partner in global discussions, especially on issues relating to environment and sustainable development, the United States will become an active leader in international efforts to address the Millennial threats now confronting civilization and even the survival of the human species. For the conservation of biodiversity, so essential to maintaining life on Earth, this promise of change has come not a moment too soon. It would be a mistake to put all of our hopes on the shoulder of one young man, however capable he might be. The environmental challenges the world is facing cannot be addressed by one country, let alone by one man. At the same time, an inspired US President guided by competent people, who does not shy away from exercising the true responsibilities and leadership his country is capable of, could do a lot to spur the international community into action. To paraphrase one of his illustrious predecessors, “the world asks for action and action now.” What was true in President Roosevelt’s America 77 years ago is even more appropriate today. From IUCN’s perspective, the first signals are encouraging. The US has seriously begun to discuss constructive engagement in climate change debates. With Copenhagen a mere 11 months away, this commitment is long overdue and certainly very welcome. Many governments still worry that if they set tough standards to control carbon emissions, their industry and agriculture will become uncompetitive, a fear that leads to a foot-dragging “you go first” attitude that is blocking progress. A positive intervention by the United States could provide the vital catalyst that moves the basis of the present negotiations beyond the narrowly defined national interests that lie at the heart of the current impasse. The logjam in international negotiations on climate change should not be difficult to break if the US were to lead the industrialized countries to agree that much of their wealth has been acquired at the expense of the environment (in this case greenhouse gases emitted over the past two hundred years) and that with the some of the benefits that this wealth has brought, comes the obligation to deal with the problems that have resulted as side-effects. With equitable entitlement to the common resources of the planet, an agreement that is fair and acceptable to all nations should be easy enough to achieve. Caps on emissions and sharing of energy efficient technologies are simply in the interest of everyone, rich or poor. And both rich and poor must now be ready to adopt less destructive technologies – based on renewables, efficiency and sustainability – both as a goal with intrinsic merit and also as an example to others But climate is not the only critical global environmental issue that this new administration will have to deal with. Conservation of biodiversity, a crucial prerequisite for the wellbeing of all humanity, no less America, needs as much attention, and just as urgently. The United States’ self-interest in conserving living natural resources strongly converges with the global common good in every sphere: in the oceans, by arresting the precipitate decline of fish stocks and the alarming rise of acidification; on land, by regenerating the health of our soils, forests and rivers; and in the atmosphere by reducing the massive emission of pollutants from our wasteful industries, construction, agriculture and transport systems. Historically, American consumers have acquired highly inefficient habits in the way they use natural resources – energy, materials, water. And these consumers produce enough wastes, particularly greenhouse gases, to overwhelm nature’s capacity to absorb them. US corporations have invented remarkable products that have been the source of material wellbeing for hundreds of millions around the world, but have used production systems whose unintended fallout threatens the very viability of life on our planet. These consumption patterns and production methods must change, but that does not mean going back to the Stone Age. An average citizen of Switzerland, whose per capita GDP is higher than USA’s emits one third as much CO2 as an American. And in other societies and cultures, a full and happy life can be had for one third of what the Swiss consume. Doing more with less is possible – usually by doing it differently -- and now it has become essential, an issue of planetary survival.

#### Global ecosystems are on the brink of collapse – we are reaching the “tipping point” of environmental degradation

Knight, ’10

[Matthew, Cites the GBO and CBD: The GBO-3 is a landmark study in what is the U.N.'s International Year of Biodiversity and will play a key role in guiding the negotiations between world governments at the U.N. Biodiversity Summit in Nagoya, Japan in October 2010. The CBD -- an international treaty designed to sustain diversity of life on Earth -- was set up at the Earth Summit in Rio de Janeiro in 1992, May 10, “U.N. report: Eco-systems at 'tipping point'”, http://edition.cnn.com/2010/WORLD/americas/05/10/biodiversity.loss.report/index.html?eref=igoogle\_cnn]

The world's eco-systems are at risk of "rapid degradation and collapse" according to a new United Nations report. The third Global Biodiversity Outlook (GBO-3) published by the Convention on Biological Diversity (CBD) warns that unless "swift, radical and creative action" is taken "massive further loss is increasingly likely." Ahmed Djoghlaf, executive secretary of the CBD said in a statement: "The news is not good. We continue to lose biodiversity at a rate never before seen in history." The U.N. warns several eco-systems including the Amazon rainforest, freshwater lakes and rivers and coral reefs are approaching a "tipping point" which, if reached, may see them never recover. The report says that no government has completely met biodiversity targets that were first set out in 2002 -- the year of the first GBO report. Executive Director of the U.N. Environmental Program Achim Steiner said there were key economic reasons why governments had failed in this task. "Many economies remain blind to the huge value of the diversity of animals, plants and other life-forms and their role in healthy and functioning eco-systems," Steiner said in a statement. Although many countries are beginning to factor in "natural capital," Steiner said that this needs "rapid and sustained scaling-up." Despite increases in the size of protected land and coastal areas, biodiversity trends reported in the GBO-3 are almost entirely negative. Vertebrate species fell by nearly one third between 1970 and 2006, natural habitats are in decline, genetic diversity of crops is falling and sixty breeds of livestock have become extinct since 2000. Nick Nuttall, a U.N. Environmental Program spokesman, said the cost of eco-systems degradation is huge. "In terms of land-use change, it's thought that the annual financial loss of services eco-systems provide -- water, storing carbon and soil stabilization -- is about &euro50 billion ($64 billion) a year," Nuttall told CNN. "If this continues we may well see by 2050 a cumulative loss of what you might call land-based natural capital of around &euro95 trillion ($121 trillion)," he said.

#### Outweighs any other impact

Chen, 2K

[Jim, Prof of law U of Minnesota, Now Dean of Law School at Louisville “Globalization and Its Losers”, 9 Minn. J. Global Trade 157’ HeinOnline]

**The** **spread of Homo sapiens around the earth have brought about mass extinctions and related ecological changes on a scale not seen since the Cretaceous** period. **In its** evolutionary **impact**, comprehensive **human colonization** of the planet easily **out- classes an ice age, or even twenty.' The previous geological event of comparable magnitude ushered out the dinosaurs; the one before that, the mass extinction that closed out the Permian period**, nearly ended the terrestrial tenure of what we arro- gantly call "higher" life forms.2 **In the last 600 million years** of geological history, **only five previous extinction spasms have taken place.3** **We are living - or perhaps more accurately, dying - through the sixth**.4 **"[Half the world's species will be extinct or on the verge of extinction" by the end of the twenty-first century.5 In environmental terms, globalization merely continues what humanity has been doing since the glaciers last re- treated:** subdue every niche within its reach. he spectacle of mass extinction gives rhetorical ammuni- tion to all opponents of globalization - not just environmental- ists, but also those who resist free trade as a threat to labor standards, cultural independence, religious values, declining languages, agricultural self-sufficiency, and the like. Just as the global expansion of a single "Terminator" primate species has sparked the Holocene epoch's ecological holocaust, the emer- gence of a global society threatens a host of human institutions. **Where a geological clock once marked the entrance and exit of species, an accelerated human stopwatch now tracks the rise and fall of regimes, religions, languages, and civilizations**. **Time and chance happen to them al**l.7 **The extinction metaphor describe**s not **only a natural world in ecological cataclysm, but also a human society buffeted by changes of unprecedented scope and seemingly relentless acceleration**. In this dual sense**, globalization is nothing short of the end of the world**.8 So apocalyptic an assertion deserves nothing less than the most grandiose of intellectual frameworks. I will examine globalization through a Darwinian lens, in the hope that an application of natural evolution as "universal acid" will "eat[ ] through just about every traditional concept, and leave[ ] in its wake a revolutionized world-view, with most of the old landmarks still recognizable, but transformed in fundamental ways."9 **In economic,** cultural, and environmental **realms, globalization unleashes the same Darwinian dynamics of adaptation, natural selection, and extinction.** But **the natural world and human society do differ fundamentally. For natural species, extinction truly is forever. The ecosystems they inhabit will not recover in any time frame that humans can meaningfully contemplate. Human institutions,** by contrast, **are much more readily preserved and revived. To the extent that globalized society must choose, it should systematically favor the environment over jobs and even culture**. One final observation bears notice. Received wisdom in American intellectual circles distrusts almost any extension of evolutionary metaphors and analogies outside the strictly bio- economic case for free trade lies beyond reasonable dispute, "so- cial issues" affecting employment and income, community and culture, and health and environment supply the primary - per- haps even exclusive - fault lines for legal debate.16 **[…] Conscious decisions to allow the extinction of a species or the destruction of an entire ecosystem epitomize the "irreversible and irretrievable commitments of resources"** that NEPA is designed to retard.312 The original Endangered Species Act gave such decisions no quarter whatsoever;313 since 1979, such decisions have rested in the hands of a solemnly convened "God Squad."314 **In its permanence and gravity, natural extinction provides the baseline by which all other types of extinction should be judged. The Endangered Species Act explicitly acknowledges the "esthetic, ecological, educational, historical, recreational, and scientific value" of endangered species and the biodiversity they represent.**315 Allied bodies of international law confirm this view:316 **global biological diversity is part of the commonly owned heritage of all humanity and deserves full legal protection.**317 **Rather remarkably, these broad assertions understate the value of biodiversity and the urgency of its protection.** A Sand County Almanac, the eloquent bible of the modern environmental movement, contains only two demonstrable bio- logical errors. It opens with one and closes with another. We can forgive Aldo Leopold's decision to close with that elegant but erroneous epigram, "ontogeny repeats phylogeny."318 What concerns us is his opening gambit: "There are some who can live without wild things, and some who cannot."319 Not quite. **None of us can live without wild things. Insects are so essential to life as we know it that if they "and other land-dwelling anthropods ... were to disappear, humanity probably could not last more than a few months."**320 **"Most of the amphibians, reptiles, birds, and mammals," along with "the bulk of the flowering plants and ... the physical structure of most forests and other terrestrial habitats" would disappear in turn.**321 **"The land would return to" something resembling its Cambrian condition, "covered by mats of recumbent wind-pollinated vegetation, sprinkled with clumps of small trees and bushes here and there, largely devoid of animal life.**"322 **From this perspective, the mere thought of valuing biodiversity is absurd, much as any attempt to quantify all of earth's planetary amenities as some trillions of dollars per year is absurd.** But the frustration inherent in enforcing the Convention on International Trade in Endangered Species (CITES) has shown that conservation cannot work without appeasing Homo economicus, the profit-seeking ape. Efforts to ban the international ivory trade through CITES have failed to stem the slaughter of African elephants.323 The preservation of biodiversity must therefore begin with a cold, calculating inventory of its benefits. Fortunately, **defending biodiversity preservation in humanity's self-interest is an easy task. As yet unexploited species might give a hungry world a larger larder than the storehouse of twenty plant species that provide nine-tenths of humanity's current food supply.**324 "**Waiting in the wings are tens of thousands of unused plant species, many demonstrably superior to those in favor."**325 **As genetic warehouses, many plants enhance the productivity of crops already in use. In the United States alone, the latest phylogeny" means that the life history of any individual organism replays the entire evolutionary history of that organism's species.** genes of wild plants have accounted for much of "the explosive growth in farm production since the 1930s."326 The contribution is worth $1 billion each year.327 **Nature's pharmacy demonstrates even more dramatic gains than nature's farm**.328 **Aspirin and penicillin, our star analgesic and antibiotic, had humble origins in the meadowsweet plant and in cheese mold.**329 **Leeches, vampire bats, and pit vipers all contribute anticoagulant drugs that reduce blood pressure, pre- vent heart attacks, and facilitate skin transplants**.330 Merck & Co., the multinational pharmaceutical company, is helping Costa Rica assay its rich biota.33' A single commercially viable product derived "from, say, any one species among... 12,000 plants and 300,000 insects ... could handsomely repay Merck's entire investment" of $1 million in 1991 dollars.332 **Wild animals, plants, and microorganisms also provide ecological services.**333 **The Supreme Court has lauded the pesticidal talents of migratory birds**.334 **Numerous organisms process the air we breathe, the water we drink, the ground we stroll.**335 **Other species serve as sentries. Just as canaries warned coal miners of lethal gases, the decline or disappearance of indicator species provides advance warning against deeper environmental threats**.336 **Species conservation yields the greatest environmental amenity of all: ecosystem protection. Saving discrete species indirectly protects the ecosystems in which they live.**337 **Some larger animals may not carry great utilitarian value in themselves, but the human urge to protect these charismatic "flagship species" helps protect their ecosystems**.338 **Indeed, to save any species, we must protect their ecosystems.**339 **Defenders of biodiversity can measure the "tangible economic value" of the pleasure derived from "visiting, photographing, painting, and just looking at wildlife."**340 In the United States alone, wildlife observation and feeding in 1991 generated $18.1 billion in consumer spending, $3 billion in tax revenues, and 766,000 jobs.341 Ecotourism gives tropical countries, home to most of the world's species, a valuable alternative to subsistence agriculture. Costa Rican rainforests preserved for ecotourism "have become many times more profitable per hectare than land cleared for pastures and fields," while the endangered gorilla has turned ecotourism into "the third most important source of income in Rwanda."342 In a globalized economy where commodities can be cultivated almost anywhere, environmentally sensitive locales can maximize their wealth by exploiting the "boutique" uses of their natural bounty. The value of endangered species and the biodiversity they embody is "literally . . . incalculable."343 What, if anything, should the law do to preserve it? There are those that invoke the story of Noah's Ark as a moral basis for biodiversity preservation.344 Others regard the entire Judeo-Christian tradition, especially the biblical stories of Creation and the Flood, as the root of the West's deplorable environmental record.345 To avoid getting bogged down in an environmental exegesis of Judeo- Christian "myth and legend," we should let Charles Darwin and evolutionary biology determine the imperatives of our moment in natural "history."346 **The loss of biological diversity is quite arguably the gravest problem facing humanity. If we cast the question as the contemporary phenomenon that "our descendants [will] most regret," the "loss of genetic and species diversity by the destruction of natural habitats" is worse than even "energy depletion, economic collapse, limited nuclear war, or conquest by a totalitarian government.**"347 Natural evolution may in due course renew the earth with a diversity of species approximating that of a world unspoiled by Homo sapiens - in ten million years, perhaps a hundred million.

### Solvency

#### NRC regulations are an absolute barrier to SMR commercialization – providing an easier path to licensing ensures widespread adoption

Spencer & Loris, Nuclear Research Fellow @ Thomas Roe Institute, ’11

[Jack Spencer, Research Fellow in Nuclear Energy in the Thomas A. Roe Institute for Economic Policy Studies, Nicolas D. Loris is a Research Associate in the Roe Institute at The Heritage Foundation, “A Big Future for Small Nuclear Reactors?,” February 2nd 2011, http://www.heritage.org/research/reports/2011/02/a-big-future-for-small-nuclear-reactors]

If SMRs Are So Great, Where Is the Construction? While some designs are closer to market introduction than others, the fact is that America’s regulatory and policy environment is not sufficient to support a robust expansion of existing nuclear technologies, much less new ones. New reactor designs are difficult to license efficiently, and the lack of a sustainable nuclear waste management policy causes significant risk to private investment. Many politicians are attempting to mitigate these market challenges by offering subsidies, such as loan guarantees. While this approach still enjoys broad support in Congress and industry, the reality is that it has not worked. Despite a lavish suite of subsidies offered in the Energy Policy Act of 2005, including loan guarantees, insurance against government delays, and production tax credits, no new reactors have been permitted, much less constructed. These subsidies are in addition to existing technology development cost-sharing programs that have been in place for years and defer significant research and development costs from industry to the taxpayer. The problem with this approach is that it ignores the larger systemic problems that create the unstable marketplace to begin with. These systemic problems generally fall into three categories: Licensing. The Nuclear Regulatory Commission (NRC) is ill prepared to build the regulatory framework for new reactor technologies, and no reactor can be offered commercially without an NRC license. In a September 2009 interview, former NRC chairman Dale E. Klein said that small nuclear reactors pose a dilemma for the NRC because the commission is uneasy with new and unproven technologies and feels more comfortable with large light water reactors, which have been in operation for years and has a long safety record.[11] The result is that enthusiasm for building non-light-water SMRs is generally squashed at the NRC as potential customers realize that there is little chance that the NRC will permit the project within a timeframe that would promote near-term investment. So, regardless of which attributes an SMR might bring to the market, the regulatory risk is such that real progress on commercialization is difficult to attain. This then leaves large light water reactors, and to a lesser extent, small ones, as the least risky option, which pushes potential customers toward that technology, which then undermines long-term progress, competition, and innovation. Nuclear Waste Management. The lack of a sustainable nuclear waste management solution is perhaps the greatest obstacle to a broad expansion of U.S. nuclear power. The federal government has failed to meet its obligations under the 1982 Nuclear Waste Policy Act, as amended, to begin collecting nuclear waste for disposal in Yucca Mountain. The Obama Administration’s attempts to shutter the existing program to put waste in Yucca Mountain without having a backup plan has worsened the situation. This outcome was predictable because the current program is based on the flawed premise that the federal government is the appropriate entity to manage nuclear waste. Under the current system, waste producers are able to largely ignore waste management because the federal government is responsible. The key to a sustainable waste management policy is to directly connect financial responsibility for waste management to waste production. This will increase demand for more waste-efficient reactor technologies and drive innovation on waste-management technologies, such as reprocessing. Because SMRs consume fuel and produce waste differently than LWRs, they could contribute greatly to an economically efficient and sustainable nuclear waste management strategy. Government Intervention. Too many policymakers believe that Washington is equipped to guide the nuclear industry to success. So, instead of creating a stable regulatory environment where the market value of different nuclear technologies can determine their success and evolution, they choose to create programs to help industry succeed. Two recent Senate bills from the 111th Congress, the Nuclear Energy Research Initiative Improvement Act (S. 2052) and the Nuclear Power 2021 Act (S. 2812), are cases in point. Government intervention distorts the normal market processes that, if allowed to work, would yield the most efficient, cost-effective, and appropriate nuclear technologies. Instead, the federal government picks winners and losers through programs where bureaucrats and well-connected lobbyists decide which technologies are permitted, and provides capital subsidies that allow investors to ignore the systemic problems that drive risk and costs artificially high. This approach is especially detrimental to SMRs because subsidies to LWRs distort the relative benefit of other reactor designs by artificially lowering the cost and risk of a more mature technology that already dominates the marketplace. How to Fix a Broken System At the Global Nuclear Renaissance Summit on July 24, 2008, then-NRC chairman Dale Klein said that a nuclear renaissance with regard to small reactors will take “decades to unfold.”[12] If Members of Congress and government agencies do not reform their current approach to nuclear energy, this will most certainly be the case. However, a new, market-based approach could lead to a different outcome. Instead of relying on the policies of the past, Congress, the Department of Energy, and the NRC should pursue a new, 21st-century model for small and alternative reactor technologies by doing the following: Reject additional loan guarantees. Loan guarantee proponents argue that high up-front costs of new large reactors make them unaffordable without loan guarantees. Presumably, then, a smaller, less expensive modular option would be very attractive to private investors even without government intervention. But loan guarantees undermine this advantage by subsidizing the capital costs and risk associated with large reactors. A small reactor industry without loan guarantees would also provide competition and downward price pressure on large light water reactors. At a minimum, Congress should limit guarantees to no more than two plants of any reactor design and limit to two-thirds the amount of any expanded loan guarantee program that can support a single technology. Such eligibility limits will prevent support from going only to a single basic technology, such as large light water reactors.[13] Avoid subsidies. Subsidies do not work if the objective is a diverse and economically sustainable nuclear industry. Despite continued attempts to subsidize the nuclear industry into success, the evidence demonstrates that such efforts invariably fail. The nuclear industry’s success stories are rooted in the free market. Two examples include the efficiency and low costs of today’s existing plants, and the emergence of a private uranium enrichment industry. Government intervention is the problem, as illustrated by the government’s inability to meet its nuclear waste disposal obligations. Build expertise at the Nuclear Regulatory Commission. The NRC is built to regulate large light water reactors. It simply does not have the regulatory capability and resources to efficiently regulate other technologies, and building that expertise takes time. Helping the NRC to develop that expertise now would help bring new technologies into the marketplace more smoothly. Congress should direct and resource the NRC to develop additional broad expertise for liquid metal-cooled, fast reactors and high-temperature, gas-cooled reactors. With its existing expertise in light water technology, this additional expertise would position the NRC to effectively regulate an emerging SMR industry. Establish a new licensing pathway. The current licensing pathway relies on reactor customers to drive the regulatory process. But absent an efficient and predictable regulatory pathway, few customers will pursue these reactor technologies. The problem is that the legal, regulatory, and policy apparatus is built to support large light water reactors, effectively discriminating against other technologies. Establishing an alternative licensing pathway that takes the unique attributes of small reactors into consideration could help build the necessary regulatory support on which commercialization ultimately depends.[14] Resolve staffing, security, construction criteria, and fee-structure issues by December 31, 2011. The similarity of U.S. reactors has meant that the NRC could establish a common fee structure and many general regulatory guidelines for areas, such as staffing levels, security requirements, and construction criteria. But these regulations are inappropriate for many SMR designs that often have smaller staff requirements, unique control room specifications, diverse security requirements, and that employ off-site construction techniques. Subjecting SMRs to regulations built for large light water reactors would add cost and result in less effective regulation. The NRC has acknowledged the need for this to be resolved and has committed to doing so, including developing the budget requirements to achieve it. It has not committed to a specific timeline.[15] Congress should demand that these issues be resolved by the end of 2011. Reform waste management. The federal government’s inability to fulfill its legal obligations under the 1982 Nuclear Waste Policy Act has often been cited as a significant obstacle to building additional nuclear power plants. Given nuclear power’s potential to help solve many of the nation’s energy problems, now is the time to break the impasse over managing the nation’s used nuclear fuel. The current system is driven by government programs and politics. There is little connection between used-fuel management programs, economics, and the needs of the nuclear industry. Any successful plan must grow out of the private sector, be driven by sound economics, and provide access to the funds that have been set aside for nuclear waste management.[16] Such an approach would propel the development of SMRs by placing market value on their potential waste management attributes. Transitioning to a New Era of Nuclear Power It is an exciting time for the nuclear industry in the United States and around the world, but that excitement could quickly dwindle if Congress and the White House do not usher in a new path forward for nuclear energy. New technologies have the potential to revolutionize how people produce and consume energy, but if the same bureaucratic approach is taken, it will create the same problems of dependency and stagnation that led to the demise of the commercial nuclear industry decades ago. Congress and the Administration have the opportunity to create a robust, competitive market for nuclear power and should implement the necessary reforms to make this happen.

#### Staffing, Security, and Safety regulations are the primary obstacles

Marston, CTO Electric Power Research Institute, ’12

[Dr. Theodore U. Marston, Former Chief Technology Officer of the Electric Power Research Institute, PhD Mechanical Engineering from the University of Michigan, Fellow of the American Society of Mechanical Engineers, “Status of Small Modular Light Water Reactors in the US,” The Nuclear Decarbonization Option: Profiles of Selected Advanced Reactor Technologies, March 2012]

l Staffing – Current control room staffing requirements are based on large reactors with fully analog control room technology. The control rooms and I&C systems for the smLWRs should be fully digital, possibly with a separate analog system to provide redundancy and diversity in the shutdown of the smLWRs. The inherent safety of the new smLWR designs in conjunction with the fully digital control systems with a high degree of automation should permit the safe operation of the smLWRs without the tradition one control team for each reactor, used in the existing plants. Alternative staffing requirements are under discussion. l Security – Security requirements for US LWRs have increased substantially since the terrorist events of 11 Sept 2001. The requirements are based on new threats and the ability for existing reactors to respond to those threats. The smLWR designs include security in the design and have taken major steps to reduce the security needs. For example, the entire nuclear steam supply system (NSSS), spent fuel pool and containment for all designs are located below grade. The access to control and radioactive material areas is significantly reduced over the existing plants. State of the art security and intrusion detection systems are part of the design. Therefore, it is believed that adequate security of a smLWR can be maintained with simplified security requirements. Proposed simplifications are under development for smLWRs. l Emergency planning – size of emergency planning zones – The emergency planning and the zone of evacuation for US plants is based on the existing fleet. The smLWRs are significantly different in terms of source term in the case of a core melt event. The smLWR core damage frequencies are orders of magnitude lower than what is required in the NRC regulations. 10 The containments are located below grade and the long term cooling needs of a beyond design basis core damage event are much less. For these reasons, the industry believes the current emergency planning zones and notification requirements can be greatly simplified and still protect the health and safety of the public. Proposed simplifications of emergency planning for the smLWRs are currently under development. Such simplification is required to locate a smLWR near regions of high populations, such as those surrounding the existing coal plants that will likely be shut down. This simplification will be a major challenge in light of the 2011 Fukushima accident in Japan. Regulatory challenges could make smLWRs noncompetitive. If the licensing of smLWRs become protracted affairs, the attractiveness of such small plants will vanish. The best hope for smLWRs to be competitive lies in the assumption that they can be licensed, built and commissioned quickly.

#### Our solvency is reverse causal – a strong SMR nuclear renaissance will follow reduction of NRC regulations

Wheeler, Power Engineering Editor, ’11

[Brian Wheeler, Associate Editor, Power Engineering, “Small Modular Reactors are ‘Hot’,” February 1st 2011, http://www.power-eng.com/articles/print/volume-115/issue-2/departments/nuclear-reactions/small-modular-reactors-are-hot.html]

One of the “hottest” topics being discussed in the U.S. nuclear industry is the viability of deploying small modular reactors (SMR), those under 300 MW, into the nuclear fleet to help address environmental concerns while keeping up with the demand for power. The U.S. electricity demand is projected to increase by 28 percent by 2035. And annual CO2 emissions are projected to increase by 275 million metric tons, according to the Department of Energy. The DOE has a goal to decrease 28 percent of greenhouse gas emissions by 2020 and it expects that the goal can be met with the help of small modular reactors. The concept is to install the small modular reactors to areas and applications underserved by large plants, or sites that may not be able to support a large unit. “But it is not a competition between large and small reactors,” said Paul Genoa, director of policy development at trade group the Nuclear Energy Institute. But the idea of the SMR is not new in the U.S. The U.S. Navy has been using small reactors on vessels for over 50 years. Using this design in the energy industry, though, is new. Currently, the U.S. does not currently have any SMRs producing commercial power, but vendors such as Babcock and Wilcox are moving forward towards design certification. Although, the NRC expects the first deployment of an SMR in the U.S. may not come until the 2018 to 2020 timeframe. 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.

#### Funding for SMR commercialization exists now – reducing NRC barriers ensures fast development

Cunningham, Policy Analyst for Energy and Climate at the American Security Project, October, ’12

[Small Modular Reactors: A Possible Path Forward for Nuclear Power. americansecurityproject.org/ASP%20Reports/Ref%200087%20-%20Small%20Modular%20Reactors.pdf]

Finally, the rapid increase in demand for electricity around the world over the next several decades presents the U.S. with a huge opportunity to create jobs through exporting nuclear technology. Demand for nuclear power is expected to increase by 70% over the next 20 years, and America is well-positioned to capture much of that new business. The Nuclear Industry Has Stalled A variety of factors have conspired in the last several decades to halt the advance of nuclear power. Many plants experienced construction delays and cost overruns in the 1970s and 1980s, forcing utilities to shift to alternatives. Concerns over safety have made siting extremely difficult. Public outcry over several infamous incidents – Three Mile Island, Chernobyl, and Fukushima – has forced societies around the globe to reconsider nuclear power. 3 Even when nuclear power makes financial sense for both ratepayers and utilities, the long-term payback for assets that have lifetimes of up to 60 years make investors nervous, driving up the cost of finance. Despite these challenges, in recent years many believed a nuclear “renaissance” was afoot. Rising energy demand and concerns over climate change led to plans for new power plants. However, the renaissance came to an abrupt standstill due to the financial crisis and low natural gas prices, at least in the United States. A few projects are under construction, but the industry remains stalled. The major problems that keep utilities from investing in new nuclear power plants can be addressed if the industry shifts towards Small Modular Reactors. There are many advantages of SMRs over conventional large reactors and they will be discussed below.There are several features of SMRs that provide greater flexibility relative to conventional large reactors. First, SMRs can be added incrementally to load centers as demand increases. If electricity demand is increasing at a slow rate, a large nuclear reactor might greatly exceed the required load capacity, making it difficult to justify to ratepayers. Adding small reactors incrementally may better match supply with demand. Second, once a reactor is constructed, additional reactors at the same site will be easier and cheaper to build. Once an initial reactor is approved, the regulatory process for obtaining permits for subsequent reactors would be less onerous.8 Third, utilities can site SMRs on the same sites as other power plants. The rapidly aging fleet of coal plants will result in a wave of retirements in the coming years, and coal plants can be swapped with SMRs to take advantage of the existing sites and connections to the grid.9 Fourth, SMRs can be used for a variety of energy applications that conventional large reactors cannot, such as desalination, industrial processes, hydrogen production, oil shale recovery, and district heating.10 Such versatility allows for SMRs to meet energy needs for more than just large baseload power. Fifth, multiple small reactors can also improve operating time, as a single site can have three or four SMRs, allowing one to go off-line for refueling while the other reactors stay online.11 This allows power to be continuously generated, whereas in a conventional nuclear reactor, the entire plant must go offline to refuel. Finally, SMRs can be built to be “grid-independent.”12 For military bases that want to avoid the vulnerability to the commercial electric power grid, SMRs can provide an off-grid solution. Also, in remote areas where it would not be cost-effective to build a larger nuclear power plant, or in places where the transmission grid is not well-developed (i.e. developing countries), SMRs can provide a source of baseload power. Reduced Safety and Weapons Proliferation Concerns SMRs can offer improved safety and security over conventional large reactors because of specific design features inherent to small reactors. First, one danger from nuclear power plants is the radiation from the reactor core. SMRs offer a reduction in danger from radiation because a smaller reactor core produces less radiation.13 Second, due to their small size, SMRs are better able to incorporate passive safety features – those that do not require human or electronic actions to function properly.14 These include cooling systems that use gravity instead of relying on access to power, natural convection systems, and passive heat removal.15 For example, in the event something goes wrong, Westinghouse’s SMR is designed to keep the reactor cool for several days without the need for operators or power.16 While the latest reactor designs are incorporating passive safety features, including for large reactors, passive safety features are inherently easier with small designs due to a smaller reactor core. Third, SMRs can benefit from a simplification of design, using less components, resulting in a more compact reactor.17 SMR designs can eliminate the need for coolant pipes, which are considered the most significant safety challenge during the development of nuclear power plants An integral design, in which the primary reactor core, the steam generator, and the pressurizer are incorporated into a single common pressure vessel, is only possible in a small design.19 In comparison, large reactors have components outside the containment vessel, increasing the chance of an accident. Fourth, unlike large reactors, SMRs can be installed underground, reducing the vulnerability to a terrorist attack or natural disaster.20 A design from Gen4, a nuclear reactor vendor, seals off the reactor underground. This allows for it to never be opened once it is installed, enhancing proliferation resistance.21 It would also operate for 10 years before refueling would be needed, compared to conventional large reactors that require refueling every 18-24 months.22 Lower Upfront Costs The greatest challenge facing the nuclear power industry is the upfront costs of new reactors. Although large reactors should be able to take advantage of economies of scale, there are economic advantages to small designs. Large reactors require substantial upfront investment, with long permitting and construction times before a return on investment can be realized. These upfront costs make investing in a large nuclear power plant highly risky even if the final cost per kilowatt-hour is profitable. A large nuclear power plant can cost between $6 and $9 billion, often exceeding the financing capabilities of most financial institutions, utilities, or even small countries.23 Conversely, small modular reactors at commercial scale could produce a 100 MW plant for $250 million.24 Due to lower upfront costs and shorter lead times, SMRs would present lower financial risks, allowing for significantly lower costs of financing. The shorter lead times for SMRs allow for more certainty for investors, and the ability to change with market conditions. The smaller project size of each additional reactor also reduces the risks of cost-overruns. This translates not only to lower absolute costs, but also lower upfront capital costs, making it easier for projects to attract financing, at better rates. Shorter construction times also provide a quicker revenue stream. SMRs can be built in roughly one-half to one-third of the time required for conventional plants. Even comparing multiple small reactors to the equivalent installed capacity of one large reactor, SMRs allow incremental capacity to come online while the large reactor is still under construction. SMRs create revenue generation immediately after each small unit is completed, and the owner can retire debt before the next increment is constructed. Similarly, the SMR units can be under parallel construction (multiple reactors under construction simultaneously), allowing the full SMR project to be completed before the large nuclear reactor, a significant cost advantage for SMRs over large reactors.30 Another major drawback for conventional large reactors is the lack of standardization. This leads to long, expensive, and uncertain time periods for licensing and siting. SMRs can overcome this hurdle with standardized designs, standardized components, and enhanced safety from reduced reactor size, all of which are not easy to accomplish with large reactors.31 Small Modular Reactors, as their name suggests, can be “modularized”. SMRs can be constructed in factories and actually shipped to site. Factory construction allows for greater quality control, predictability and scheduling. In contrast, large reactors are designed and built uniquely for each project, which can lead to delays and inflated costs. 32 Major Challenges for SMRs There are, however, several obstacles that are slowing the development of SMRs. Institutional Obstacles The most difficult challenge currently facing SMRs is the institutional barriers. Currently, the Nuclear Regulatory Commission has not certified a single SMR design. Despite the variety of SMR designs from several nuclear vendors, the NRC has lacked sufficient human and technical capacity to license small modular reactors in the past.33 Even as policymakers have expressed greater interest in SMRs in recent years, the licensing process for a new design takes several years at a cost of hundreds of millions of dollars.34 Also, many regulations create a difficult environment for small reactors and favor large reactors. For example, the NRC requires 10 mile emergency planning zones around nuclear power plants, making it difficult to site a small reactor near urban centers where it could be used for energy applications other than centralized electricity generation.35 SMRs will need to overcome this long history of institutional bias towards large reactors. As the most prominent licensing body for the nuclear industry worldwide, the NRC to a certain degree, shapes the global future for nuclear power. If the NRC does not lead on small modular reactors, it may be an uphill battle for the SMR industry. No Performance History The nuclear industry has maintained a high performance standard with its fleet of large light water reactors, and SMRs would need to demonstrate the same high performance. However, as with any new technology, SMRs have no track record to prove their performance. The industry lacks a credible demonstration project that would inform future projects and inspire confidence.36 SMRS need to demonstrate advantages over conventional plants, including advantages in cost, safety and flexibility. Looking forward, this creates a “chicken and egg” problem. In order to bring costs down, nuclear vendors will need a high-tech manufacturing facility to mass produce small reactors. However, in order to justify the construction of such a facility, the industry estimates it will need to book dozens of orders upfront. It cannot book these orders without proof of cost, safety and performance. Industry leaders are hesitant to be the “first-mover” in an uncertain market, and governments are reluctant to provide incentives or invest in unproven products. Safety Concerns While there are real safety benefits of SMRs, critics site new safety concerns with SMRs that are not associated with conventional nuclear plants. The owner of small modular reactors would need to manage, inspect, and maintain more reactors for the same amount of power output as a single large reactor.37 The industry needs to prove that the inherent safety benefits of SMRs over large reactors outweigh the downsides. Nuclear Waste Disposal of spent nuclear fuel has confounded the nuclear industry for decades and the problem of waste disposal will still need to be dealt with for SMRs. While large reactors suffer from the same problem, expanding the use of SMRs would mean waste from more reactor sites would need to be coordinated.38 The quantity of waste may not change, but a given amount of waste is easier to manage from one site, rather than multiple. The problem of disposing nuclear waste is a serious one, and the lack of a solution despite 30 years of debate is troubling. In January 2010, President Obama setup a Blue Ribbon Commission (BRC) to study the problem and to recommend actions to finally address the nuclear waste problem. The BRC recommended the establishment of a consent-based approach to siting a waste facility, the development of interim storage facilities, the creation of a separate government entity tasked only with addressing nuclear waste, as well as several other recommendations.39 The recommendations will be difficult to pass through Congress, but until resolved, the nuclear waste problem will bedevil the entire nuclear industry, including SMRs. Low Natural Gas Prices Another problem that is not unique to SMRs, but plagues the nuclear industry as a whole, is the current low prices of natural gas. Due to major advances in hydraulic fracturing and horizontal drilling, the U.S. is awash in natural gas. Prices have plummeted, and the Energy Information Administration (EIA) estimates that prices will rise very slowly over the next two decades. For example, in their 2012 Annual Energy Outlook, the EIA predicts that natural gas prices will not rise back above $6 per million Btu until around 2030.40 SMRs may need natural gas prices to reach $7 or $8 per million Btu to be competitive.41 This makes any new nuclear power plant, including an SMR, uneconomical compared to natural gas. Unless natural gas prices rise more quickly than expected, or Congress implements a price on carbon, nuclear power may struggle to compete. Progress in Rolling Out SMRs In recent years, the government has tried to provide incentives to kick-start the moribund nuclear industry. As part of the Energy Policy Act of 2005, loan guarantees and risk insurance were extended to new nuclear power plants.42 However, although loan guarantees have provided enough support to help four new reactors move forward, these have proven to be the exception. Looking foward, it will be exceedingly difficult to build additional large nuclear power plants. Policymakers have become increasingly interested in making SMRs a reality as an alternative to large plants. In January 2012, the Department of Energy announced a new initiative to support SMR development. DOE plans on spending $452 million over the next five years (subject to congressional appropriations) to help nuclear vendors through the design and licensing process. The program will provide 50% of the cost in the form of a grant while the industry would need to pay for the other half. DOE stated that it is looking for designs that can be licensed and up and running by 2022. Several companies have applied for the funding. More Needs To Be Done Several of the issues discussed above – difficult in licensing, unproven projects, and a “first-mover” problem – present a role for the government. The NRC can work with nuclear vendors through the licensing process to reduce the time required for licenses to be issued. Reducing the time and cost for design licensing will accelerate the development of SMRs.