### Advantage One is Prolif

#### Global development of nuclear power is inevitable even under conservative estimates

WNN, 9-26

[World Nuclear News, “Nuclear growth slowing not stalling,” September 26th 2012, <http://www.world-nuclear-news.org/NP-Nuclear_growth_slowing_not_stalling-2609127.html>]

Growth rates may have slowed but world nuclear energy capacity will nevertheless continue to increase over the coming decades, according to the latest projections from the International Atomic Energy Agency (IAEA). When IAEA director general Yukiya Amano referred to the findings of the 32nd edition of the IAEA's annually updated Reference Data Series No. 1 in his address to the agency's 56th General Conference in Vienna recently, he noted that although the 2011 Fukushima Daiichi accident raised "fundamental questions" on nuclear's future, the atom will remain an important option for many countries, with developing countries continuing to show a keen interest in nuclear power. The newly released report - full title Energy, Electricity and Nuclear Power Estimates for the Period up to 2050 - contains high and low projections of energy, electricity and nuclear power trends over the coming years. Under the low scenario, installed nuclear capacity is predicted to grow from 2011's 370 GWe to reach 456 GWe by 2030, about 9% down on the increase projected in 2011. A ten-year delay in growth anticipated before the Fukushima accident is observed, with nuclear capacity taking until 2030 to reach levels that had previously been anticipated for 2020. The high scenario predicts nuclear capacity reaching 740 GWe by 2040. Projected growth is strongest in the east Asia, including China and South Korea, where regional capacity is forecast to grow from 80 GWe at the end of 2011 to 153 GWe in 2030 in the low scenario and 274 GWe in the high scenario. Growth is expected in all regions of the world under the high scenario, although total Western European nuclear capacity could decline from 115 GWe in 2011 to 70 GWe in 2030 under the low scenario. The low scenario also sees a slight decrease for nuclear capacity in North America. The figures on nuclear are based on actual statistical data collected by the IAEA, with country-by-country estimates of future nuclear capacity established by a group of experts using a 'bottom up' approach. All possible licence renewals, planned shutdowns and plausible construction projects are taken into consideration. The conservative low scenario assumes the continuation of current trends and few unexpected policy changes, although it is compatible with a potential decline in nuclear's share of Japan's electricity mix. The more optimistic high scenario assumes that current global financial and economic crises are overcome relatively soon and global policies are implemented to mitigate climate change. Both scenarios are plausible and technically feasible, the IAEA maintains. The report recognises the on-going global financial crisis, the low price of natural gas and reduced electricity demand in some regions, in addition to responses to Fukushima, as challenges that will serve to temporarily delay the deployment of some nuclear power plants. Eighteen months on from the Fukushima Daiichi nuclear accident there is still uncertainty about the full extent of the effects of individual policy responses to regional projections. Nevertheless, the report says, the "underlying fundamentals of population growth and demand for electricity in the developing world," coupled with concerns over climate change, energy security and price volatility for other fuels, "continue to point to nuclear generating capacity playing an important role in the energy mix in the longer term."

#### Mismanaged transition to nuclear power will fuel a massive wave of proliferation

Macalister, Guardian Energy Editor, ’09

[Terry Macalister, Energy Editor of The Guardian, Recipient of The Energy of Word Award, International Media Award organized by The Global Energy Prize, “New generation of nuclear power stations 'risk terrorist anarchy',” March 16th 2009, <http://www.guardian.co.uk/environment/2009/mar/16/nuclearpower-nuclear-waste>]

The new generation of atomic power stations planned for Britain, China and many other parts of the world risks proliferation that could lead to "nuclear anarchy", a security expert warned in a report published today. Governments and multilateral organisations must come up with a strategy to deal the impact of the new nuclear age, which will produce enough plutonium to make 1m nuclear weapons by 2075, argues Frank Barnaby from the Oxford Research Group thinktank in a paper for the Institute for Public Policy Research (IPPR). "We are at a crossroads. Unless governments work together to safeguard nuclear energy supplies, the rise in unsecured nuclear technology will put us all in danger. Without this, we are hurtling towards a state of nuclear anarchy where terrorists or rogue states have the ways and means of making nuclear weapons or 'dirty bombs', the consequences of which are unimaginable," says Barnaby. Any country choosing to operate new-generation nuclear reactors in future would have relatively easy access to plutonium, which is used to make the most efficient atomic weapons, along with the nuclear physicists and engineers to design them. These countries would be latent nuclear-weapon powers "and it is to be expected that some will take the political decision to become actual nuclear weapons powers," argues Barnaby in his paper submitted to the IPPR's independent Commission on National Security chaired by former Nato boss, Lord George Robertson. The issue of nuclear proliferation security has been largely ignored until today as the nuclear power debate has concentrated on the economics, social issues and how to deal with radioactive waste. Ministers in the UK have made clear their desire to see a new generation of facilities to replace existing ones at a time when North Sea gas is running out and the country needs to reduce its reliance on fossil fuels to meet its Kyoto protocol carbon emission targets. Nuclear power plants across the life cycle produce one third of the CO2 of gas-fired ones. Barnaby says that a shortage of uranium for the kind of reactors that EDF and others are considering building in Britain could encourage them to reprocess fuel and produce more plutonium. But he is equally convinced that a nuclear renaissance will lead to fast breeder reactors which produce more nuclear fuel than they use and which could be useful to terrorists. The Atomic Energy Agency and the Organisation for Economic Co-operation and Development have already suggested that uranium resources would last less than 70 years if processed using the current generation of light water nuclear reactors. Barnaby wants the non-proliferation treaty strengthened at a "make or break" review conference next year and would also like to see countries as yet without nuclear capabilities discouraged from obtaining enriched uranium, a problem highlighted in the case of Iran. Ian Kearns, deputy commissioner of the IPPR's security commission, said it was crucial that the rush to address climate change did not worsen the international security environment. "A global nuclear renaissance, if badly managed, could bring enormous complications in terms of nuclear non-proliferation and terrorism. Policymakers need to be alert to the dangers and to construct policies that bring secure low-carbon energy and a stable nuclear weapons environment," he said.

#### New proliferators will develop offensive postures that increase the risk of conventional and nuclear conflict

Horowitz, professor of poli sci, 9 —Professor of Political Science at University of Pennsylvania (Michael Horowitz, “The Spread of Nuclear Weapons and International Conflict: Does Experience Matter?” Journal of Conflict Resolution, Volume 53 Number 2, April 2009 pg. 234-257)

This section focuses on how acquiring nuclear weapons influences both the new nuclear state and potential adversaries. In theory, systemwide perceptions of nuclear danger could allow new nuclear states to partially skip the early Cold War learning process concerning the risks of nuclear war and enter a proliferated world more cognizant of nuclear brinksmanship and bargaining than their predecessors. However, each new nuclear state has to resolve its own particular civil–military issues surrounding operational control and plan its national strategy in light of its new capabilities. Empirical research by Sagan (1993), Feaver (1992), and Blair (1993) suggests that viewing the behavior of other states does not create the necessary tacit knowledge; there is no substitute for experience when it comes to handling a nuclear arsenal, even if experience itself cannot totally prevent accidents. Sagan contends that civil–military instability in many likely new proliferators and pressures generated by the requirements to handle the responsibility of dealing with nuclear weapons will skew decision making toward more offensive strategies (Sagan 1995). The questions surrounding Pakistan’s nuclear command and control suggest there is no magic bullet when it comes to new nuclear powers’ making control and delegation decisions (Bowen and Wolvén 1999). Sagan and others focus on inexperience on the part of new nuclear states as a key behavioral driver. Inexperienced operators and the bureaucratic desire to “justify” the costs spent developing nuclear weapons, combined with organizational biases that may favor escalation to avoid decapitation—the “use it or lose it” mind-set— may cause new nuclear states to adopt riskier launch postures, such as launch on warning, or at least be perceived that way by other states (Blair 1993; Feaver 1992; Sagan 1995). 3 Acquiring nuclear weapons could alter state preferences and make states more likely to escalate disputes once they start, given their new capabilities. But their general lack of experience at leveraging their nuclear arsenal and effectively communicating nuclear threats could mean new nuclear states will be more likely to select adversaries poorly and to find themselves in disputes with resolved adversaries that will reciprocate militarized challenges. The “nuclear experience” logic also suggests that more experienced nuclear states should gain knowledge over time from nuclearized interactions that helps leaders effectively identify the situations in which their nuclear arsenals are likely to make a difference. Experienced nuclear states learn to select into cases in which their comparative advantage, nuclear weapons, is more likely to be effective, increasing the probability that an adversary will not reciprocate.

#### Proliferation sparks wars that escalate to great power nuclear conflict

Below 08

[Tim D.Q., Wing Commander, RAF; MA in Defence Studies, King’s College London; “Options for US nuclear disarmament: exemplary leadership or extraordinary lunacy?,” June 2008, Thesis for School of Advanced Air and Space Studies, Air University Maxwell Air Force Base, Alabama]

Proliferation. Roger Molander, of RAND Corporation, asserts that “in the near future, a large number of countries are each going to develop a small number of nuclear weapons.”50 The Union of Concerned Scientists considers this to be the greatest long term danger confronting both US and international security today. Proliferation increases risk in a number of ways. First, the more states that hold nuclear weapons, the more likely it is that one will have an insufficiently mature or robust nuclear doctrine to manage its capability responsibly. Tom Sauer suggests that developing states that do not have democratic political systems present a particularly high risk because in dictatorial regimes, the military are frequently in control, and as Sagan has observed, the military appear to be more inclined to initiate preventative attacks against adversaries than civilians.52 Second, the more widely proliferated nuclear weapons become, the more theoretical opportunities may be presented for theft of nuclear material. Third, proliferation increases the risk of nuclear intervention by an established nuclear power, including the five NWSs. Stephen Younger envisages several scenarios in which currently established nuclear powers might “feel a need” to intervene with nuclear weapons in present regional conflicts, especially if WMD are being employed or threatened. Moreover, since proliferation is frequently associated with reaction to nuclear development either within a bordering nation or regional counterpart, further proliferation is in turn likely to generate a quasi-exponential expansion of similar regional scenarios.53 Ambassador Lehman envisages a scenario in which proliferation may induce a chain reaction of related regional arms races that could result in unintended and unexpected consequences far removed from the objectives of the proliferating nations, and in the United States’ specific case, a risk that the nation could get sucked into a conventional regional conflict which is subsequently escalated into nuclear warfare by its allies or their opponents.

#### Specifically – The Middle East in is developing new plants

Williams, Utilities Management Consultant, 8-17

[Glenn Williams, Management Consultant for Regulated Utilities and Energy Service Organization, 30 years of expereinece in startup and operation of large-scale power projects including coal plants, natural gas facilities and half of the nation’s nuclear power facilities, Masters in Technology Management from the University of Maryland, “The Nuclear Renaissance Has Arrived,” August 17th 2012, http://realmoney.thestreet.com/articles/08/17/2012/nuclear-renaissance-has-arrived]

If you thought the U.S. would see a nuclear renaissance, you need to think again. No new licenses can be granted until the federal government resolves policy, technical and regulatory issues associated with the disposal of spent nuclear fuel. Meanwhile, on the other side of the world, Middle Eastern countries are doing what America cannot; they are building a fleet of new nuclear power plants. And those foreign plants are turning out to be incredibly good investments. In the U.S., regulators are allowing only three new power stations to be constructed. Unlike nuclear plants in other nations, these three plants may not be great investments. Over the last several weeks, all three projects warned their construction schedules will be delayed and their costs will increase. One is already beginning to question the urgency for their new plant. Southern Company's (SO) Plant Vogtle project just announced a possible cost and schedule change. According to the most recent Securities and Exchange Commission (SEC) Form 10-Q, Southern is "evaluating whether maintaining the currently scheduled commercial operation dates remains in the best interest of their customers." It may not matter if it's in the customers' best interests. The company's 10-Q also revealed that Southern received an official violation notice from the Nuclear Regulatory Commission (NRC). It appears to have a compliance problem based on how it constructed the plant's nuclear island, which is a critical path item. This violation could take weeks to resolve as the utility works its way through a burdensome regulatory process. SCANA (SCG) also announced a possible cost increase and schedule delay for its V.C. Summer project. According to page 10 of its 10-Q, SCANA is filing a petition with state regulators to "revise substantial completion dates for the New Units." SCANA's petition also includes new costs to, "resolve claims for costs related to regulatory delays, design modifications of the shield building, certain prefabricated structural modules for the New Units and unanticipated rock conditions at the site." Tennessee Valley Authority TVA recently discovered its Watts Bar project would not be completed in 2013. Last April, TVA advised stakeholders that their schedule was delayed an additional two years. But construction schedules may be the least of TVA's concerns. Watts Bar 2 lacks an operating license from the NRC. It appears Watts bar cannot enter into commercial operations will be delayed further until the federal government resolves spent fuel issues, allowing the NRC to grant licenses. So it seems that all three nuclear projects are caught in regulatory purgatory. Until policy, regulatory and financial issues are resolved, these projects are effectively on hold. There is no assurance that any new nuclear plant will be operating soon. Meanwhile, Middle Eastern countries are proceeding to build fleets of new nuclear power plants. According to Nuclear Energy Insider, Saudi Arabia, United Arab Emirates (UAE), Jordan, Egypt, Turkey and South Africa are pushing forward with more than $500 billion worth of new nuclear construction projects. It all started in 2009, when Korea Electric Power Corporation secured a tender for four nuclear units in the United Arab Emirates. Last month, UAE started construction on a 1,400-megawatt unit. UAE also announced plans for an additional 12 units. Saudi Arabia is planning the regions' largest nuclear project, called King Abdullah City of Atomic and Renewable Energy. Nuclear Energy Insider reports this complex will cost over $250 billion. UAE, Saudi Arabia and other oil producing nations are highly motivated to build nuclear power plants. For them, nuclear power is an incredibly worthwhile investment because a single megawatt-hour from a nuclear power plant costs approximately $21.00 to produce. To manufacture that megawatt-hour requires approximately 10 million British thermal units (MMBtu) of fuel. Combining fuel and other production costs, a nuclear power plant can produce energy for approximately $2.00 per MMBtu. In contrast, a barrel of crude oil contains approximately 5.8 MMBtu. With Brent trading at $116 per barrel, crude oil is worth approximately $20.00 per MMBtu. With almost a 10-to-1 difference, it's in their economic interest to consume cheap nuclear power and export pricy crude oil. For oil producing nations, nuclear power plants pay for themselves several times over. Nuclear power also works for some oil consuming nations, such as Jordan and China. Instead of consuming $20 of oil-based energy, they use nuclear power to produce $2 energy. The savings to the local economy can be enormous. But substituting nuclear power for oil only works in special circumstances. In the U.S., the substitution is difficult because electricity and oil are independent and non-correlated commodities. Accordingly, investing in nuclear power to supplant oil cannot reward US utilities with financial returns. Yes, the nuclear renaissance arrived. Unfortunately, it's over there and not here.

#### Middle East civilian nuclear power programs will be turned into military nuclear weapons programs

Russell, National Security Prof @ NDU, August ’12

[Richard L. Russell, Professor of National Security Affairs at the National Defense University’s Near East and South Asia Center for Strategic Studies, Special Advisor to the U.S. Central Command, the U.S. Special Operations Command, and the Joint Special Operations University, Former Adjunct Professor of Security Studies at Georgetown, Former Political-Military Analyst for the Central Intelligence Agency, “CHAPTER 6: THE MIDDLE EAST’S NUCLEAR FUTURE,” The Next Arms Race, August 2012]

The great danger is that the United States is “cutting off its nose to spite its face” with nuclear weapons proliferation in the Middle East. Washington has shown an eagerness to support nuclear power infrastructure in the Gulf based largely on commercial interests. It is actively marketing nuclear plants and assistance to the UAE and Kuwait. The United States no doubt wants American industry to win regional commercial competition against French and other foreign firms that are aggressively marketing their nuclear wares in the region. The American, French, and European commercial perspectives on nuclear power in the Middle East, however, neglects the stubborn key determinants of nuclear developments discussed in this chapter. Middle Eastern states will be under heavy pressure in the future to convert ostensibly civilian nuclear power programs into clandestine military nuclear weapons programs, given the key determinants at play in the region. The Western community is putting itself at risk by essentially replaying the French mistake of supplying Israel and Iraq with ostensibly civilian nuclear power reactors that in the last century were clandestinely harnessed for military nuclear weapons programs. Even if Western nuclear technology is not directly harnessed for military nuclear weapons programs, the expertise and technology could be easily diverted to the military. The United States, France, and other Western countries, for example, made that mistake in supplying South Africa with civilian nuclear technology and assistance. Although that assistance did not directly build South Africa’s nuclear weapons before the 1990 abandonment, the assistance substantially increased the technical competence of Pretoria’s nuclear engineers, technicians, and scientists, who made up South Africa’s nuclear weapons intellectual capital.29 Some observers might argue that Arab states would not dare risk jeopardizing their bilateral security relationships with the United States by embarking on clandestine nuclear weapons programs. But these programs could be very small and difficult to detect. The South African case is illustrative of how medium-sized powers like the Arab states could nurture nuclear weapons programs that could go undetected. The South African bomb program in the 1980s employed only 100 people, of whom about 40 were directly involved in the weapons program and only 20 built South Africa’s small nuclear arsenal. By the time the program was cancelled in 1990, the work force still had only about 300 people.30 International safeguards under the auspices of the IAEA would be little more than speed bumps for determined Middle Eastern proliferators to overcome. North Korea has set a model of behavior in which nation-states could ostensibly comply with IAEA safeguards for years until their nuclear capabilities have sufficiently matured to allow them to go it alone without international community assistance, after they had withdrawn from the NPT. Or, if they were the least bit cunning, they could play along with IAEA inspections and hide military nuclear weapons programs for as long as possible, much as Iraq had done prior to the 1991 war. IAEA safeguards would hamper, but not stop, determined Arab efforts to shift or divert civilian nuclear power infrastructure toward military nuclear weapons programs. Arab states, for example, might acquire large uranium holdings from the international market and then give formal notice and withdraw from the treaty and its inspection requirements. Uranium stocks could then be run through reactors and reprocessed for weapons-grade plutonium, perhaps by parallel and clandestine plutonium-reprocessing facilities purchased from China or other states. Uranium stocks too could be run through clandestine centrifuges—perhaps acquired from Pakistan, much like North Korea appears to have done—and refined to weapons grade. The Arab Gulf states are relying on international technical assistance from France, the United States, China, and Russia, to name just a few, to get their nuclear power infrastructure foundations laid and then up and running. In the meantime, the Arab Gulf states are training a cadre of domestic talent, which over a generation could be ready to fill foreign shoes and assume the reigns of the nuclear power infrastructure, especially if these states withdrew from IAEA safeguards and the NPT and shifted their civilian programs to wartime-like military nuclear weapons programs. Emirati officials, for example, readily admit today that they are developing domestic talent to run and maintain nuclear reactors by creating nuclear science and engineering degree programs at Khalifa University, the country’s largest technical school.31 One cannot help but suspect that UAE officials look to how far Iran has progressed with its nuclear program, and are determined to keep pace—even though the Emirates got a late start.

#### Middle East proliferation ensures nuclear exchange

Edelman & Krepinevich, Former Undersecretary for Defense, ‘11

[Eric Edelman, Fellow at the Center for Strategic and Budgetary Assessments, Former Undersecretary for Defense, Andrew Krepinevich, President of the Center for Strategic and Budgetary Assessment, Evan Montgomery, Research Fellow at the Center for Strategic and Budgetary Assessments, “The dangers of a nuclear Iran,” http://www.csbaonline.org/wp-content/uploads/2010/12/2010.12.27-The-Dangers-of-a-Nuclear-Iran.pdf]

During the Cold War, the United States and the Soviet Union only needed to concern themselves with an attack from the other. Multi-polar systems are generally considered to be less stable than bipolar systems because coalitions can shift quickly, upsetting the balance of power and creating incentives for an attack. More important, emerging nuclear powers in the Middle East might not take the costly steps necessary to preserve regional stability and avoid a nuclear exchange. For nuclear-armed states, the bedrock of deterrence is the knowledge that each side has a secure second-strike capability, so that no state can launch an attack with the expectation that it can wipe out its opponents' forces and avoid a devastating retaliation. However, emerging nuclear powers might not invest in expensive but survivable capabilities such as hardened missile silos or submarine-based nuclear forces. Given this likely vulnerability, the close proximity of states in the Middle East, and the very short flight times of ballistic missiles in the region, any new nuclear powers might be compelled to "launch on warning" of an attack or even, during a crisis, to use their nuclear forces preemptively. Their governments might also delegate launch authority to lower-level commanders, heightening the possibility of miscalculation and escalation. Moreover, if early warning systems were not integrated into robust command-and-control systems, the risk of an unauthorized or accidental launch would increase further still. And without sophisticated early warning systems, a nuclear attack might be unattributable or attributed incorrectly. That is, assuming that the leadership of a targeted state survived a first strike, it might not be able to accurately determine which nation was responsible. And this uncertainty, when combined with the pressure to respond quickly, would create a significant risk that it would retaliate against the wrong party, potentially triggering a regional nuclear war. Most existing nuclear powers have taken steps to protect their nuclear weapons from unauthorized use: from closely screening key personnel to developing technical safety measures, such as permissive action links, which require special codes before the weapons can be armed. Yet there is no guarantee that emerging nuclear powers would be willing or able to implement these measures, creating a significant risk that their governments might lose control over the weapons or nuclear material and that nonstate actors could gain access to these items. Some states might seek to mitigate threats to their nuclear arsenals; for instance, they might hide their weapons. In that case, however, a single intelligence compromise could leave their weapons vulnerable to attack or theft.

#### Most likely scenario for global escalation – Middle East instability draws in major powers

Russell, National Security Professor Naval Postgraduate School, ’09

[James Russell, Associate Professor of National Security at the Naval Postgraduate School, “Strategic Stability Reconsidered: Prospects for Escalation and Nuclear War in the Middle East,” Security Studies Center Proliferation Papers, http://www.analyst-network.com/articles/141/StrategicStabilityReconsideredProspectsforEscalationandNuclearWarintheMiddleEast.pdf]

Strategic stability in the region is thus undermined by various factors: (1) asymmetric interests in the bargaining framework that can introduce unpredictable behavior from actors; (2) the presence of non-state actors that introduce unpredictability into relationships between the antagonists; (3) incompatible assumptions about the structure of the deterrent relationship that makes the bargaining framework strategically unstable; (4) perceptions by Israel and the United States that its window of opportunity for military action is closing, which could prompt a preventive attack; (5) the prospect that Iran’s response to pre-emptive attacks could involve unconventional weapons, which could prompt escalation by Israel and/or the United States; (6) the lack of a communications framework to build trust and cooperation among framework participants. These systemic weaknesses in the coercive bargaining framework all suggest that escalation by any the parties could happen either on purpose or as a result of miscalculation or the pressures of wartime circumstance. Given these factors, it is disturbingly easy to imagine scenarios under which a conflict could quickly escalate in which the regional antagonists would consider the use of chemical, biological, or nuclear weapons. It would be a mistake to believe the nuclear taboo can somehow magically keep nuclear weapons from being used in the context of an unstable strategic framework. Systemic asymmetries between actors in fact suggest a certain increase in the probability of war – a war in which escalation could happen quickly and from a variety of participants. Once such a war starts, events would likely develop a momentum all their own and decision-making would consequently be shaped in unpredictable ways. The international community must take this possibility seriously, and muster every tool at its disposal to prevent such an outcome, which would be an unprecedented disaster for the peoples of the region, with substantial risk for the entire world.

#### An SMR lead revival of the industry restores US nuclear leadership which controls proliferation risks

Loudermilk, Senior Energy Associate @ NDU, ’11

[Micah J. Loudermilk, Senior Associate for the Energy & Environmental Security Policy program with The Institute for National Strategic Studies at National Defense University, “Small Nuclear Reactors and US Energy Security: Concepts, Capabilities, and Costs,” Journal of Energy Security, May 2011, <http://www.ensec.org/index.php?option=com_content&view=article&id=314:small-nuclear-reactors-and-us-energy-security-concepts-capabilities-and-costs&catid=116:content0411&Itemid=375>]

Combating proliferation with US leadership: Reactor safety itself notwithstanding, many argue that the scattering of small reactors around the world would invariably lead to increased proliferation problems as nuclear technology and know-how disseminates around the world. Lost in the argument is the fact that this stance assumes that US decisions on advancing nuclear technology color the world as a whole. In reality, regardless of the US commitment to or abandonment of nuclear energy technology, many countries (notably China) are blazing ahead with research and construction, with 55 plants currently under construction around the world—though Fukushima may cause a temporary lull. Since Three Mile Island, the US share of the global nuclear energy trade has declined precipitously as talent and technology begin to concentrate in countries more committed to nuclear power. On the small reactor front, more than 20 countries are examining the technology and the IAEA estimates that 40-100 small reactors will be in operation by 2030. Without US leadership, new nations seek to acquire nuclear technology turn to countries other than the US who may not share a deep commitment to reactor safety and nonproliferation objectives. Strong US leadership globally on nonproliferation requires a vibrant American nuclear industry. This will enable the US to set and enforce standards on nuclear agreements, spent fuel reprocessing, and developing reactor technologies. As to the small reactors themselves, the designs achieve a degree of proliferation-resistance unmatched by large reactors. Small enough to be fully buried underground in independent silos, the concrete surrounding the reactor vessels can be layered much thicker than the traditional domes that protect conventional reactors without collapsing. Coupled with these two levels of superior physical protection is the traditional security associated with reactors today. Most small reactors also are factory-sealed with a supply of fuel inside. Instead of refueling reactors onsite, SMRs are returned to the factory, intact, for removal of spent fuel and refueling. By closing off the fuel cycle, proliferation risks associated with the nuclear fuel running the reactors are mitigated and concerns over the widespread distribution of nuclear fuel allayed.

#### SMR’s are key to negotiation pressure for nonproliferation - they are more desirable than other nuclear systems

Sanders, Associate Director Savannah National Lab, ’12

[Tom Sanders, Associate Laboratory Director for Clean Energy Initiatives at the Savannah River National Laboratory, Department of Energy, Former President of the American Nuclear Society, “Tom Sanders: Great expectations for small modular reactors,” Nuclear News, July 2012, pg. 48-49]

That’s a good question. One of the things that concerned me most in the nonproliferation area was the fact that the United States had lost a lot of its ability to export nuclear goods and services under U.S. export licenses. That’s important to nonproliferation, because it’s through negotiations with other countries’ export controls of nuclear technology that a lot of our goals regarding proliferation risk management are met. By that I mean that if you’re not exporting anything you’re not negotiating anything, and you’re not really establishing a standard for safety, security, and proliferation risk management around the world. Then we evaluated how to regain some of that capability, and small modular reactors became obvious for two reasons. One is that you could probably speed up the construction and licensing process by factory manufacturing and turn them out much more quickly than large reactors. And the other is that for emerging nations, most developing countries could not absorb large nuclear systems, and smaller systems would be more acceptable to them and more affordable. They may cost a little more per megawatt, but the capital costs–the upfront costs–would be significantly less. In addition, the economy of scale you possible get with a large plant doesn’t make any sense if you can’t afford it.

### Advantage Two 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, 9-26

[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

Spencer, Nuclear Research Fellow @ Thomas Roe Institute, 12

[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**.**

#### Only SMRs can solve

McNelis, Director at the Institute for the Environment at UNC-Chapel Hill, 11

(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

Bezdek, Founder and President of Management Information Services, 04

(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

Dratler, Professor of Intellectual Property at The University of Akron School of Law, 10-8

(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

Lieberthal & O'Hanlon, Director of the China center and Director of research at Brookings, 12

(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.

### Plan

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

### 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.