## \*\*\* 1AC

### 1AC—Adv 1

**Advantage One --- The Economy**

**Absent a robust PTC extension the wind manufacturing sector will collapse. Extension ensures market stability and predictability.**

**Matthews 12** (Richard, Environmental Journalist who contributes to more than fifty sites and publications including Industry Intelligence, Eco-Business.com, Environmental News Network (ENN), Green Conduct, Solar Feeds, Global Warming is Real, The Green Economy Post and Ithica School of Business, *Why Congress Must Extend the PTC for Wind Power*, March 2012, http://globalwarmingisreal.com/2012/03/07/why-congress-must-extend-the-ptc-for-wind-power/)

The expiration of the production tax credit (PTC) at the end of this year constitutes a **major obstacle** for U.S. wind energy. If the PTC is not extended by Congress, tens of thousands of jobs will be lost and **economic development** would be stymied. As stated in a report from Ernst and Young, “Failure to extend this incentive could stop wind development **in its tracks**.”

The federal renewable electricity PTC is a per-kilowatt-hour tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year. Originally enacted in 1992, the PTC has been renewed and expanded numerous times. The federal tax credit gives wind power generators 2.2 cents for every kilowatt-hour of energy produced, but it is slated to expire at the end of 2012 unless lawmakers approve a renewal.

The PTC has fueled the proliferation of wind power installations across the U.S. Since 2005, the PTC has helped to generate 47,000 megawatts of new capacity. A total of 35 percent of the new electrical generation capacity has been developed due to the PTC over the past five years. This activity is worth $60 billion in private investment.

The best wind farms in the world already produce power **as economically** as coal, gas and nuclear generators. In terms of cost efficiency, rising fuel prices mean that wind power could achieve **parity by 2016**, but this won’t happen without the PTC.

According to the U.S. Energy Information Administration’s (EIA) Annual Energy Outlook 2012, wind is one of the dominant players behind increasing U.S. renewable energy generation. Wind power now generates 3 percent of America’s electricity. Forecasts predict that wind generation will almost double between 2010 and 2035, but the growth would slow substantially if the PTC were allowed to expire.

“If Congress chooses not to renew, there is no hope for the wind industry next year,” John Graham, a BP executive, said of the tax credit. “Without it, U.S. wind projects aren’t viable.” Failure to extend the PTC would result in the loss of an estimated 40,000 jobs in the wind industry. Members of the industry supply chain are already being affected due to the uncertainty. The current PTC **uncertainty** has begun to cause layoffs and in the absence of an extension, further job losses and even plant closings will **keep accelerating**.

Despite economic headwinds, the PTC has helped the US wind market grow stronger. In 2011 the wind market improved upon the 5 GW posted in 2010. More than 7 GW of wind capacity is expected to be installed in the US in 2012 as developers of wind energy rush to complete projects before the expiration of the PTC at the end of this year. Although the wind market will experience an acceleration of installations, especially during Q1 and Q2 of 2012, if the PTC is not extended, a **major stoppage** throughout the entire US wind industry can be anticipated in the second half of 2012.

Although bipartisan contingents in both the House and Senate are calling for action, the fight over the extension of the PTC continues on Capitol Hill. U.S. Sens. Mark Udall (D-Colo.), Jerry Moran (R-Kan.) and 10 colleagues from both parties wrote to Senate Majority Leader Harry Reid (D-Nev.) and Minority Leader Mitch McConnell (R-Ky.) urging swift action on extension of the wind energy production tax credit (PTC).

In addition to Udall and Moran, the Senate letter was signed by Sens. Michael Bennet (D-Colo.), John Boozman (R-Ark.), Tom Harkin (D-Iowa), Chuck Grassley (R-Iowa), Tim Johnson (D-S.D.), John Hoeven (R-N.D.), John Kerry (D-Mass.), Scott Brown (R-Mass.), John Thune (R-S.D.), and Jon Tester (D-Mont.).

As the Senators explain in their letter, “An extension of the wind production tax credit should provide for some **long-term stability** while setting forth a path for how the wind industry can move towards **a market-based system**. While it is clear that the wind industry currently requires tax incentives like the production tax credit to compete, Congress needs to provide the wind industry with the **stability** and **predictability** to plan for the future.”

Four U.S. Representatives from the Illinois congressional delegation signed a letter to the leadership of the House and Senate calling for “a short-term Production Tax Credit extension for wind energy at the earliest opportunity in the first quarter of 2012.”

A House bill seeking to extend the PTC has 72 co-sponsors, including 18 Republicans. The bipartisan Governors’ Wind Energy Coalition, (including 23 Republican and Democratic Governors from across the U.S.), and the Western Governors’ Association also support the extension. This legislation has received the endorsement of a broad coalition of more than 370 members, including the National Association of Manufacturers, the American Farm Bureau Federation and the Edison Electric Institute. A PTC extension even has the support of the environmentally indifferent U.S. Chamber of Commerce and staunch Republicans like Governors Terry Branstad of Iowa and Sam Brownback of Kansas.

Forbes reports that a total of 15 major companies wrote to Congressional leaders urging extension of the PTC. These companies represent some of America’s biggest brands and largest purchasers of wind energy. The list includes Starbucks, Staples, Nike, Levi Strauss & Co., Campbell Soup Co. and Yahoo!. As stated in the letter, “The PTC has enabled the wind industry to slash wind energy costs – 90 percent since 1980 – a big reason why companies like ours are buying increasing amounts of wind energy.” Wind energy is increasingly attractive because it helps companies to manage costs and reduce their emissions profile while being less reliant on the price and supply volatility of foreign oil. Unlike fossil fuels, wind can offer 20-30 year fixed prices.

Opposition comes from conservatives who oppose all federal investments in energy production including members of Congress who are affiliated with the Tea Party.

In another Forbes article, Denise Bode, CEO of the American Wind Power Association wrote that wind energy is “one of **the fastest growing** new sources of US manufacturing jobs,” she said, “the PTC has driven tremendous growth in wind’s manufacturing sector.” The U.S. now has over 400 manufacturing facilities in 43 states involved in wind turbine manufacturing. That represents a 12-fold increase in domestic manufacturing over the last six years.

According to Bode, American wind power accounts for 75,000 American jobs, and can grow to almost 100,000 jobs four years from now. According to a Bush Administration study, wind can support **500,000** American jobs in less than 20 years. But these jobs won’t materialize in the absence of the PTC.

Bode quotes economic studies, which have demonstrated that Congressional inaction on the PTC will eliminate 37,000 American jobs, close plants and forego billions of dollars in private investment.

“Wind energy is an American success story and the federal Production Tax Credit (PTC) for wind is driving this success. But we need Congress to extend the PTC and keep taxes stable and low on wind in order to keep this success story going,” Bode said.

The PTC enables wind energy to compete with the heavily subsidized fossil fuel industry. Failure to extend the PTC will cripple wind power’s **competitiveness**, which will **undermine the economy** and kill one of the **greatest job creation engine**s in the United States.

**Conventional energy will destroy the economy and the manufacturing sector.**

**Sovacool 9** (Benjamin K., Assistant Professor at the Lee Kuan Yew School of Public Policy, part of the National University of Singapore. He is also a Research Fellow in the Energy Governance Program at the Centre on Asia and Globalization. He has worked in advisory and research capacities at the U.S. National Science Foundation’s Electric Power Networks Efficiency and Security Program, Virginia Tech Consortium on Energy Restructuring, Virginia Center for Coal and Energy Research, New York State Energy Research and Development Authority, Oak Ridge National Laboratory, Semiconductor Materials and Equipment International, and U.S. Department of Energy’s Climate Change Technology Program. He is the co-editor with Marilyn A. Brown of Energy and American Society: Thirteen Myths (2007) and the author of The Dirty Energy Dilemma: What’s Blocking Clean Power in the United States (2008). He is also a frequent contributor to such journals as Electricity Journal, Energy & Environment, and Energy Policy, Going Completely Renewable: Is It Possible (Let Alone Desirable)?, The Electricity Journal, Volume 22, Issue 4, May 2009, Pages 95–111)

F. Local employment and revenue

The more capital intensive a power plant is, the less embodied labor it has. Nuclear and fossil derived electricity are the most capital-intensive, and create net reductions in regional employment as ratepayers must **reduce expenditures** on other goods and services to finance construction. Renewable energy technologies such as wind and solar, however, generate three to **10 times as many jobs** per MW of installed capacity as fossil-fuel- or nuclear-based generation.26 Renewable power sources also contribute to local economic growth and provide better jobs. The manufacturing of renewable power technologies involves a **highly skilled workforce** and a modernizing of the local **industry base**. The use of renewable energy makes local businesses less dependent on imports from other regions, frees up **capital for investments** outside the energy sector, and serves as an important financial hedge against future energy price **spikes**. In some regions of the United States, such as the Southeast, electric utilities expend $8.4 billion per year importing the coal and uranium needed to fuel conventional power plants. Investments in those power plants send money out of the economy whereas investments in renewable power keep money in the economy. About 50 cents per every dollar expended on conventional electricity leaves the local economy (and in some areas 80 to 95 percent of the cost of energy leaves local economies), whereas every dollar invested in renewable electricity can produce **$1.40** of gross economic gain.27

**Wind manufacturing is the fastest growing sector. The PTC prevents its implosion.**

**Cuttino 12** (Phyllis, Director of the Clean Energy Program at the Pew Environment Group, Previously worked on the senior staffs of Sen. Brock Adams of Washington and Sen. Dianne Feinstein of California, Served as vice president of public affairs for the United Nations Foundation (UNF) and the Better World Fund, Programs developed from Ted Turner’s $1 billion gift to U.N. causes, at UNF, she oversaw communications activities as well as a $50 million grant portfolio as senior vice president at a strategic communications consulting firm in Washington, Cuttino helped Fortune 500 companies, international and domestic nongovernmental organizations and U.N. entities to influence public policy and increase awareness of critical issues, *Congress Must Act on Clean Energy*, http://energy.nationaljournal.com/2012/08/should-wind-tax-credit-stay-or.php)

In 2011, for the first time in several years, the United States led the world by investing more than $48 billion in clean energy. The clean energy sector represents one of the **fastest-growing** industries globally, with investment increasing more than 600 percent between 2004 and 2011 (excluding research and development).

We're in danger of losing our place at the top, however. To maintain our lead amid fierce international competition and to continue to attract private capital, there must be policy **certainty**. While other nations have **national policies** to encourage the adoption of clean energy, we rely on a **patchwork of state policies** and cyclical federal tax incentives, one of the most important of which is to end in a year.

The production tax credit (PTC) is an **effective tool** to keep electricity prices low and encourage the development of proven clean energy projects. While not large--about 2.2 cents per kilowatt hour--it gives American businesses the certainty they need to continue to invest, build, and deploy. But it's set to expire at the end of 2013. Uncertainty about whether Congress will act to extend the PTC has already resulted in a sharp drop in investments in wind energy production, threatening the livelihoods of the more than 78,000 people nationwide who are in wind-supported jobs.

When Congress has allowed the PTC to expire in the past, wind installations declined by 73 to 93 percent. According to a December 2011 study by Navigant, a global consulting firm known for its expertise in energy issues, 37,000 wind-supported jobs would be lost if the PTC was not extended before 2013. Congress should enact a multiyear extension of this incentive, which provides certainty to the industry and would ensure the continued growth of renewable energy industries. Our country leads the world in clean energy venture capital investment, but without such **strong policy commitments** to clean energy as the PTC, it will be challenging to scale up new innovations. If demand for these modern technologies is not created in the United States, development of the clean energy industry will suffer.

There is no lack of political support. Karl Rove, who was a senior advisor to President George W. Bush, raised eyebrows recently when he joined with Robert Gibbs, who served as President Barack Obama's press secretary, to publicly support congressional action to extend financial incentives for development of wind energy. In endorsing the policy, Rove said, "My hope is that after the election, people say, look, let's start making some priorities, and find some things that we can agree on, and maybe one of them is the production tax credit." If political party operatives such as Rove and Gibbs, Republican and Democratic governors, and the Sierra Club can agree to extend this policy, Washington lawmakers from both sides of the aisle whould be able to do so as well.

Policy matters. Nations that have strong policy commitments to clean energy already reap the economic rewards. If the United States is to **effectively compete** in the global clean energy race, Congress should extend the PTC.

**Manufacturing is the largest determinate of economic growth.**

**Vargo 3** (Franklin, Vice President for International Economic Affairs at the National Association of Manufacturers, Had a distinguished career at the United States Department of Commerce, His many positions at the Commerce Department included serving as Deputy Assistant Secretary for Asia, Deputy Assistant Secretary for WTO Affairs and for trade agreements compliance, and Deputy Assistant Secretary for Europe, Holds the President’s Distinguished Executive Award – the highest award that can be granted to a U.S. government executive, *Hearing On China’s Exchange Rate Regime and Its Effects on the U.S. Economy*, Testimony of Franklin J. Vargo Vice President, International Economic Affairs National Association of Manufacturers On Behalf of The National Association of Manufacturers Before the Subcommittee on Domestic and International Monetary Policy, Trade, and Technology of the House Committee on Financial)

MANUFACTURING: VITAL TO AMERICA

I would like to begin my statement with a review of why manufacturing is **vital to** the U.S. economy. Since manufacturing only represents about 16 percent of the nation’s output, who cares? Isn’t the United States a post-manufacturing services economy? Who needs manufacturing? The answer in brief is that the United States economy **would collapse** without manufacturing, as would our national security and our role in the world. That is because manufacturing is really **the foundation** of our economy, both in terms of innovation and production and in terms of **supporting the rest** of the economy. For example, many individuals point out that only about 3 percent of the U.S. workforce is on the farm, but they manage to feed the nation and export to the rest of the world. But how did this agricultural productivity come to be? It is because of the tractors and combines and satellite systems and fertilizers and advanced seeds, etc. that came from the genius and productivity of the manufacturing sector.

Similarly, in services -- can you envision an airline without airplanes? Fast food outlets without griddles and freezers? Insurance companies or banks without computers? Certainly not. The manufacturing industry is truly the innovation industry, without which the rest of the economy could not prosper. Manufacturing performs over 60 percent of the nation’s research and development. Additionally, it also **underlies** the technological ability of the United States to maintain its national security and its global leadership.

Manufacturing makes a disproportionately large contribution to productivity, more than twice the rate of the overall economy, and pays wages that are about 20 percent higher than in other sectors. But its most fundamental importance lies in the fact that a healthy manufacturing sector truly underlies the entire U.S. standard of living -- because it is the principal way by which the United States pays its way in the world.

Manufacturing accounts for over 80 percent of all U.S. exports of goods. America’s farmers will export somewhat over $50 billion this year, but America’s manufacturers export almost that much every month! Even when services are included, manufacturing accounts for two-thirds of all U.S. exports of goods and services.3

If the U.S. manufacturing sector were to become seriously impaired, what combination of farm products together with architectural, travel, insurance, engineering and other services could make up for the missing two-thirds of our exports represented by manufactures? The answer is “**none**.” What would happen instead is the dollar would collapse, falling precipitously -- not to the reasonable level of 1997, but far below it -- and with this collapse would come high U.S. inflation, a wrenching economic downturn and a collapse in the U.S. standard of living and the U.S. leadership role in the world. That, most basically, is why the United States cannot become a “nation of shopkeepers.”

**The US is key to the global economy.**

**Caploe 9** (David, CEO of the American Centre for Applied Liberal Arts and Humanities in Asia, *Focus still on America to lead global recovery*, April 7, The Strait Times, lexis)

IN THE aftermath of the G-20 summit, most observers seem to have missed perhaps the most crucial statement of the entire event, made by United States President Barack Obama at his pre-conference meeting with British Prime Minister Gordon Brown: 'The world has become accustomed to the US being a voracious consumer market, the engine that drives a lot of economic growth worldwide,' he said. 'If there is going to be renewed growth, it just can't be the US as the engine.' While superficially sensible, this view is deeply problematic. To begin with, it ignores the fact that the global economy has in fact been **'America-centered**' for more than 60 years. Countries - China, Japan, Canada, Brazil, Korea, Mexico and so on - either sell to the US or they sell to countries that sell to the US. This system has generally been advantageous for all concerned. America gained certain historically unprecedented benefits, but the system also enabled participating countries - first in Western Europe and Japan, and later, many in the Third World - to achieve undreamt-of prosperity. At the same time, this **deep inter-connection** between the US and the rest of the world also explains how the collapse of a relatively small sector of the US economy - 'sub-prime' housing, logarithmically exponentialised by Wall Street's ingenious chicanery - has cascaded into the worst global economic crisis since the Great Depression. To put it simply, Mr Obama doesn't seem to understand that there is **no other engine** for the world economy - and hasn't been for the last six decades. If the US does not drive global economic growth, growth is not going to happen. Thus, US policies to deal with the current crisis are critical not just domestically, but also to the entire world. Consequently, it is a matter of global concern that the Obama administration seems to be following Japan's 'model' from the 1990s: allowing major banks to avoid declaring massive losses openly and transparently, and so perpetuating 'zombie' banks - technically alive but in reality dead. As analysts like Nobel laureates Joseph Stiglitz and Paul Krugman have pointed out, the administration's unwillingness to confront US banks is the main reason why they are continuing their increasingly inexplicable credit freeze, thus ravaging the American and global economies. Team Obama seems reluctant to acknowledge the extent to which its policies at home are failing not just there but around the world as well. Which raises the question: If the US can't or won't or doesn't want to be the global economic engine, which country will? The obvious answer is China. But that is unrealistic for three reasons. First, China's economic health is more tied to America's than practically any other country in the world. Indeed, the reason China has so many dollars to invest everywhere - whether in US Treasury bonds or in Africa - is precisely that it has structured its own economy to complement America's. The only way China can serve as the engine of the global economy is if the US starts pulling it first. Second, the US-centred system began at a time when its domestic demand far outstripped that of the rest of the world. The fundamental source of its economic power is its ability to act as the global consumer of last resort. China, however, is a poor country, with low per capita income, even though it will soon pass Japan as the world's second largest economy. There are real possibilities for growth in China's domestic demand. But given its structure as an export-oriented economy, it is doubtful if even a successful Chinese stimulus plan can pull the rest of the world along unless and until China can start selling again to the US on a massive scale. Finally, the key 'system' issue for China - or for the European Union - in thinking about becoming the engine of the world economy - is monetary: What are the implications of having your domestic currency become the global reserve currency? This is an extremely complex issue that the US has struggled with, not always successfully, from 1959 to the present. Without going into detail, it can safely be said that though having the US dollar as the world's medium of exchange has given the US some tremendous advantages, it has also created huge problems, both for America and the global economic system. The Chinese leadership is certainly familiar with this history. It will try to avoid the yuan becoming an international medium of exchange until it feels much more confident in its ability to handle the manifold currency problems that the US has grappled with for decades. Given all this, the US will remain **the engine** of global economic recovery for the **foreseeable future**, even though other countries must certainly help. This crisis began in the US - and it is going to have to be solved there too.

**Economic decline causes global wars.**

**Kemp 10** (Geoffrey, Director of Regional Strategic Programs at The Nixon Center, served in the White House under Ronald Reagan, special assistant to the president for national security affairs and senior director for Near East and South Asian affairs on the National Security Council Staff, Former Director, Middle East Arms Control Project at the Carnegie Endowment for International Peace, 2010, *The East Moves West: India, China, and Asia’s Growing Presence in the Middle East*, p. 233-4)

The second scenario, called Mayhem and Chaos, is the opposite of the first scenario; everything that can go wrong does go wrong. The world economic situation weakens rather than strengthens, and **India**, **China**, and **Japan** suffer a major reduction in their growth rates, further weakening the global economy. As a result, energy demand falls and the price of fossil fuels plummets, leading to a financial crisis for the energy-producing states, which are forced to cut back dramatically on expansion programs and social welfare. Thanbt in turn leads to **political unrest**: and nurtures different **radical groups**, including, but not limited to, Islamic extremists. The **internal stability** of some countries is challenged, and there are more “failed states.” Most serious is the collapse of the democratic government in **Pakistan** and its takeover by Muslim extremists, who then take possession of a large number of nuclear weapons. The danger of war between **India** and Pakistan increases significantly. **Iran**, always worried about an extremist Pakistan, expands and weaponizes its nuclear program. That further enhances nuclear proliferation in the Middle East, with Saudi Arabia, Turkey, and Egypt joining Israel and Iran as nuclear states. Under these circumstances, the potential for nuclear terrorism increases, and the possibility of a **nuclear terrorist attack** in either the Western world or in the oil-producing states may lead to a further devastating **collapse** of the world economic market, with a tsunami-like impact on stability. In this scenario, major disruptions can be expected, with dire consequences for two-thirds of the **planet’s population**.

**We have strong statistical support.**

**Royal 10** (Jedidiah, Director of Cooperative Threat Reduction at the U.S. Department of Defense, M.Phil. Candidate at the University of New South Wales, 2010, *Economic Integration, Economic Signalling and the Problem of Economic Crises*, Economics of War and Peace: Economic, Legal and Political Perspectives, Edited by Ben Goldsmith and Jurgen Brauer, Published by Emerald Group Publishing, ISBN 0857240048, p. 213-215)

Less intuitive is how periods of economic decline may increase the likelihood of external conflict. Political science literature has contributed a moderate degree of attention to the impact of economic decline and the security and defence behaviour of interdependent states. Research in this vein has been considered at systemic, dyadic and national levels. Several notable contributions follow.

First, on the systemic level, Pollins (2008) advances Modelski and Thompson's (1996) work on leadership cycle theory, finding that rhythms in the global economy are associated with the rise and fall of a pre-eminent power and the often **bloody transition** from one pre-eminent leader to the next. As such, exogenous shocks such as economic crises could usher in a **redistribution** of relative power (see also Gilpin. 1981) that leads to **uncertainty** about power balances, increasing the risk of **miscalculation** (Feaver, 1995). Alternatively, even a relatively certain redistribution of power could lead to a permissive environment for conflict as a rising power may seek to challenge a declining power (Werner. 1999). Separately, Pollins (1996) also shows that global economic cycles combined with parallel leadership cycles impact the likelihood of conflict among major, medium and small powers, although he suggests that the causes and connections between global economic conditions and security conditions remain unknown.

Second, on a dyadic level, Copeland's (1996, 2000) theory of trade expectations suggests that 'future expectation of trade' is a significant variable in understanding economic conditions and security behaviour of states. He argues that interdependent states are likely to gain pacific benefits from trade so long as they have an optimistic view of future trade relations. However, if the expectations of future trade decline, particularly for difficult [end page 213] to replace items such as energy resources, the likelihood for conflict increases, as states will be inclined to use force to gain access to those resources. Crises could potentially be the trigger for decreased trade expectations either on its own or because it triggers protectionist moves by interdependent states.4

Third, others have considered the link between economic decline and external armed conflict at a national level. Blomberg and Hess (2002) find a strong correlation between internal conflict and external conflict, particularly during periods of economic downturn. They write,

The linkages between internal and external conflict and prosperity are strong and mutually reinforcing. Economic conflict tends to spawn internal conflict, which in turn returns the favour. Moreover, the presence of a recession tends to amplify the extent to which international and external conflicts **self-reinforce** each other. (Blomberg & Hess, 2002. p. 89)

Economic decline has also been linked with an increase in the likelihood of terrorism (Blomberg, Hess, & Weerapana, 2004), which has the capacity to spill across borders and lead to external tensions.

Furthermore, crises generally reduce the popularity of a sitting government. “Diversionary theory" suggests that, when facing unpopularity arising from economic decline, sitting governments have increased incentives to **fabricate external military conflicts** to create a **'rally around the flag**' effect. Wang (1996), DeRouen (1995). and Blomberg, Hess, and Thacker (2006) find supporting evidence showing that economic decline and use of force are at least indirectly correlated. Gelpi (1997), Miller (1999), and Kisangani and Pickering (2009) suggest that the tendency towards diversionary tactics are greater for democratic states than autocratic states, due to the fact that democratic leaders are generally more susceptible to being removed from office due to lack of domestic support. DeRouen (2000) has provided evidence showing that periods of weak economic performance in the United States, and thus weak Presidential popularity, are **statistically linked** to an increase in the use of force.

In summary, recent economic scholarship positively correlates economic integration with an increase in the frequency of economic crises, whereas political science scholarship links economic decline with external conflict at systemic, dyadic and national levels.5 This implied connection between integration, crises and armed conflict has not featured prominently in the economic-security debate and deserves more attention.

### 1AC—Adv 2

**Advantage Two --- The Environment**

**Warming is happening now due to anthropogenic causes and still reversible if we act now.**

**Nuccitelli 11** (Dana, Environmental Scientist at a Private Environmental Consulting Firm in the Sacramento – California, Bachelor's Degree in Astrophysics from the University of California at Berkeley, Master's Degree in Physics from the University of California at Davis, Active contributor to Skeptical Science, The Big Picture, Updated 2011, Originally Posted 2010, http://www.skepticalscience.com/big-picture.html)

Oftentimes we get bogged down discussing one of the many pieces of evidence behind man-made global warming, and in the process we can't see the forest from the trees. It's important to every so often take a step back and see how all of those trees comprise the forest as a whole. Skeptical Science provides an invaluable resource for examining each individual piece of climate evidence, so let's make use of these individual pieces to see how they form the big picture.

The Earth is Warming

We know **the planet is warming** from surface temperature stations and satellites measuring the temperature of the Earth's surface and lower atmosphere. We also have various tools, which have measured the warming of the Earth's oceans. Satellites have measured an energy imbalance at the top of the Earth's atmosphere. Glaciers, sea ice, and ice sheets are all receding. Sea levels are rising. Spring is arriving sooner each year. There's simply no doubt - the planet is warming (Figure 1).

Global Warming Continues

And yes, the warming is continuing. The 2000s were hotter than the 1990s, which were hotter than the 1980s, which were hotter than the 1970s. 2010 tied for the hottest year on record. The 12-month running average global temperature broke the record three times in 2010, according to NASA Goddard Institute for Space Studies (GISS) data. Sea levels are still rising, ice is still receding, spring is still coming earlier, there's still a planetary energy imbalance, etc. etc.

Contrary to what some would like us to believe, the planet has not magically stopped warming. Those who argue otherwise are confusing short-term noise with long-term global warming (Figure 2).

Foster and Rahmstorf (2011) showed that when we filter out the short-term effects of the sun, volcanoes, and El Niño cycles, the underlying man-made global warming trend becomes even more clear (Figure 3).

For as much as atmospheric temperatures are rising, the amount of energy being absorbed by the planet is even more striking when one looks into the deep oceans and the change in the global heat content (Figure 4).

Humans are Increasing Atmospheric Greenhouse Gases

The amount of greenhouse gases in the atmosphere - particularly carbon dioxide (CO2) - has been rising steadily over the past 150 years. There are a number of lines of evidence, which clearly demonstrate that this increase is due to human activities, primarily **burning fossil fuels**.

The most direct of evidence involves simple accounting. Humans are currently emitting approximately 30 billion tons of CO2 per year, and the amount in the atmosphere is increasing by about 15 billion tons per year. Our emissions have to go somewhere - half goes into the atmosphere, while the other half is absorbed by the oceans (which is causing another major problem - ocean acidification).

We also know the atmospheric increase is from burning fossil fuels because of the isotopic signature of the carbon in the atmosphere. Carbon comes in three different isotopes, and plants have a preference for the lighter isotopes. So if the fraction of lighter carbon isotopes in the atmosphere is increasing, we know the increase is due to burning plants and fossil fuels, and that is what scientists observe.

The fact that humans are responsible for the increase in atmospheric CO2 is settled science. The evidence is clear-cut.

Human Greenhouse Gases are Causing Global Warming

There is overwhelming evidence that humans are the dominant cause of the recent global warming, mainly due to our greenhouse gas emissions. Based on fundamental physics and math, we can quantify the amount of warming human activity is causing, and verify that we're responsible for essentially all of the global warming over the past 3 decades. The aforementioned Foster and Rahmstorf (2011) found a 0.16°C per decade warming trend since 1979 after filtering out the short-term noise.

In fact we expect human greenhouse gas emissions to cause more warming than we've thus far seen, due to the thermal inertia of the oceans (the time it takes to heat them). Human aerosol emissions are also offsetting a significant amount of the warming by causing global dimming. Huber and Knutti (2011) found that human greenhouse gas emissions have caused 66% more global warming than has been observed since the 1950s, because the cooling effect of human aerosol emissions have offset about 44% of that warming. They found that overall, human effects are responsible for approximately 100% of the observed global warming over the past 60 years (Figure 5).

There are also numerous 'fingerprints' which we would expect to see from an increased greenhouse effect (i.e. more warming at night, at higher latitudes, upper atmosphere cooling) that we have indeed observed (Figure 6).

Climate **models have projected** the ensuing global warming to a high level of accuracy, verifying that we have a good understanding of the fundamental physics behind climate change.

Sometimes people ask "what would it take to falsify the man-made global warming theory?". Well, basically it would require that our fundamental understanding of physics be wrong, because that's what the theory is based on. This fundamental physics has been scrutinized through scientific experiments for decades to centuries.

The Warming will Continue

We also know that if we continue to emit large amounts of greenhouse gases, the planet will continue to warm. We know that the climate sensitivity to a doubling of atmospheric CO2 from the pre-industrial level of 280 parts per million by volume (ppmv) to 560 ppmv (we're currently at 390 ppmv) will cause 2–4.5°C of warming. And we're headed for 560 ppmv in the mid-to-late 21st century if we continue business-as-usual emissions.

The precise sensitivity of the climate to increasing CO2 is still fairly uncertain: 2–4.5°C is a fairly wide range of likely values. However, even if we're lucky and the climate sensitivity is just 2°C for doubled atmospheric CO2, if we continue on our current emissions path, we will commit ourselves to that amount of warming (2°C above pre-industrial levels) within the next 75 years.

The Net Result will be Bad

There will be some positive results of this continued warming. For example, an open Northwest Passage, enhanced growth for some plants and improved agriculture at high latitudes (though this will require use of more fertilizers), etc. However, the negatives will almost certainly outweigh the positives, by a long shot. We're talking decreased biodiversity, water shortages, increasing heat waves (both in frequency and intensity), decreased crop yields due to these impacts, damage to infrastructure, displacement of millions of people, etc.

Arguments to the contrary are superficial

One thing I've found in reading skeptic criticisms of climate science is that they're consistently superficial. For example, the criticisms of James Hansen's 1988 global warming projections never go beyond "he was wrong," when in reality it's important to evaluate what caused the discrepancy between his projections and actual climate changes, and what we can learn from this. And those who argue that "it's the Sun" fail to comprehend that we understand the major mechanisms by which the Sun influences the global climate, and that they cannot explain the current global warming trend. And those who argue "it's just a natural cycle" can never seem to identify exactly which natural cycle can explain the current warming, nor can they explain how our understanding of the fundamental climate physics is wrong.

There are legitimate unresolved questions

Much ado is made out of the expression "the science is settled." The science is settled in terms of knowing that the planet is warming rapidly, and that humans are the dominant cause.

There are certainly unresolved issues. As noted above, there's a big difference between a 2°C and a 4.5°C warming for a doubling of atmospheric CO2, and it's an important question to resolve, because we need to know how fast the planet will warm in order to know how fast we need to reduce our greenhouse gas emissions. There are significant uncertainties in some feedbacks which play into this question. For example, will clouds act as a net positive feedback (by trapping more heat, causing more warming) or negative feedback (by reflecting more sunlight, causing a cooling effect) as the planet continues to warm? And exactly how much global warming is being offset by human aerosol emissions?

These are the sorts of questions we should be debating, and the issues that most climate scientists are investigating. Unfortunately there is a there is a very vocal contingent of people determined to continue arguing the resolved questions for which the science has already been settled. And when climate scientists are forced to respond to the constant propagation of misinformation on these settled issues, it just detracts from our investigation of the legitimate, unresolved, important questions.

Smart Risk Management Means Taking Action

People are usually very conservative when it comes to risk management. Some of us buy fire insurance for our homes when the risk of a house fire is less than 1%, for example. When it comes to important objects like cars and homes, we would rather be **safe than sorry**.

But there is arguably no more important object than the global climate. We rely on the climate for our basic requirements, like having enough accessible food and water. Prudent risk management in this case is clear. The scientific evidence discussed above shows indisputably that there is a risk that we are headed towards very harmful climate change. There are uncertainties as to how harmful the consequences will be, but uncertainty is not a valid reason for inaction. There's very high uncertainty whether I'll ever be in a car accident, but it would be foolish of me not to prepare for that possibility by purchasing auto insurance. Moreover, **uncertainty cuts both ways**, and it's just as likely that the consequences will be worse than we expect as it is that the consequences won't be very bad.

We Can Solve the Problem

The good news is that we have the tools we need to mitigate the risk posed by climate change. A number of plans have been put forth to achieve the necessary greenhouse gas emissions cuts (i.e. here and here and here). We already have all the technology we need.

Opponents often argue that mitigating global warming will hurt the economy, but the opposite is true. Those who argue that reducing emissions will be too expensive ignore the costs of climate change - economic studies have consistently shown that mitigation is several times less costly than trying to adapt to climate change (Figure 7).

The Big Picture

The big picture is that we know the planet is warming, humans are causing it, there is a substantial risk to continuing on our current path, but we don't know exactly how large the risk is. However, uncertainty regarding the magnitude of the risk is not an excuse to ignore it. We also know that if we continue on a business-as-usual path, the risk of catastrophic consequences is very high. In fact, the larger the uncertainty, the greater the potential for the exceptionally high-risk scenario to become reality. We need to continue to decrease the uncertainty, but it's also critical to acknowledge what we know and what questions have been resolved, and that taking no action is not an option. The good news is that we know how to solve the problem, and that doing so will minimize the impact not only on the climate, but also on the economy.

The bottom line is that from every perspective - scientific, risk management, economic, etc. - there is no reason not to immediately take serious action to mitigate climate change, and failing to do so would be exceptionally foolish.

**Warming causes extinction.**

**Brandenberg 99** (John & Monica Paxson, Visiting Prof. Researcher @ Florida Space Institute, Physicist Ph.D., Science Writer, Dead Mars Dying Earth, Pg 232-233)

The ozone hole expands, driven by a monstrous synergy with global warming that puts more catalytic **ice crystals** into the stratosphere, but this affects the far north and south and not the major nations’ heartlands. The **seas rise**, the **tropics roast** but the media networks no longer cover it. The **Amazon** rainforest becomes the Amazon desert. **Oxygen levels** fall, but profits rise for those who can provide it in bottles. An equatorial high-pressure zone forms, forcing **drought** in central Africa and Brazil, the **Nile dries up** and the monsoons fail. Then inevitably, at some unlucky point in time, a major unexpected event occurs—a major volcanic eruption, a sudden and dramatic shift in ocean circulation or a large asteroid impact (those who think freakish accidents do not occur have paid little attention to life or Mars), or a **nuclear war** that starts between **Pakistan** and **India** and escalates to involve **China** and **Russia** . . . Suddenly the gradual climb in global temperatures goes on a mad excursion as the oceans warm and release large amounts of dissolved carbon dioxide from their lower depths into the atmosphere. Oxygen levels go down precipitously as oxygen replaces lost oceanic carbon dioxide. Asthma cases double and then double again. Now a third of the world fears breathing. As the oceans dump carbon dioxide, the greenhouse effect increases, which further warms the oceans, causing them to dump even more carbon. Because of the heat, **plants die** and burn in **enormous fires**, which release more carbon dioxide, and the **oceans evaporate**, adding more water vapor to the greenhouse. Soon, we are in what is termed a runaway greenhouse effect, as happened to Venus eons ago. The last two surviving scientists inevitably argue, one telling the other, “See! I told you the missing sink was in the ocean!” Earth, as we know it, dies. After this Venusian excursion in temperatures, the **oxygen disappears** into the soil, the **oceans evaporate** and are lost and the dead Earth loses its ozone layer completely. Earth is too far from the Sun for it to be the second Venus for long. Its atmosphere is slowly lost—as is its water—because of ultraviolet bombardment breaking up all the molecules apart from carbon dioxide. As the atmosphere becomes thin, the Earth becomes colder. For a short while temperatures are nearly normal, but the **ultraviolet** sears any life that tries to make a comeback. The carbon dioxide thins out to form a thin veneer with a few wispy clouds and dust devils. Earth becomes the second Mars—red, desolate, with perhaps a few hardy microbes surviving.

**Air pollution causes extinction.**

**Driesen 3** (David, Associate Professor at Syracuse University College of Law, J.D. Yale Law School, Stumbling Toward Sustainability, 1989,Fall/Spring, 10 Buff. Envt'l. L.J. 25)

Air pollution can **make life unsustainable** by harming the ecosystem upon which **all life depends** and harming the health of both future and present generations.

The Rio Declaration articulates six key principles that are relevant to air pollution. These principles can also be understood as goals, because they describe a state of affairs that is worth achieving. Agenda 21, in turn, states a program of action for realizing those goals. Between them, they aid understanding of sustainable development's meaning for air quality. The first principle is that "human beings . . . are entitled to a healthy and productive life in harmony with nature", because they are "at the center of concerns for sustainable development." While the Rio Declaration refers to human health, its reference to life "in harmony with nature" also reflects a concern about the natural environment.

Since air pollution damages both human health and the environment, air quality implicates both of these concerns. Lead, carbon monoxide, particulate, tropospheric ozone, sulfur dioxide, and nitrogen oxides have historically threatened urban air quality in the United States. This review will focus upon tropospheric ozone, particulate, and carbon monoxide, because these pollutants present the most widespread of the remaining urban air problems, and did so at the time of the earth summit. 6 Tropospheric ozone refers to ozone fairly near to the ground, as opposed to stratospheric ozone high in the atmosphere. The stratospheric ozone layer protects human health and the environment from ultraviolet radiation, and its depletion causes problems. By contrast, tropospheric ozone damages human health and the environment. 8 In the United States, the pollutants causing "urban" air quality problems also affect human health and the environment well beyond urban boundaries. Yet, the health problems these pollutants present remain most acute in urban and suburban areas.

Ozone, carbon monoxide, and particulate cause very serious public health problems

that have been well recognized for a long time. Ozone forms in the atmosphere from a reaction between volatile organic compounds, nitrogen oxides, and sunlight. Volatile organic compounds include a large number of hazardous air pollutants. Nitrogen oxides, as discussed below, also play a role in acidifying ecosystems. Ozone damages lung tissue. It plays a role in triggering asthma attacks, sending thousands to the hospital every summer. It effects young children and people engaged in heavy exercise especially severely. Particulate pollution, or soot, consists of combinations of a wide variety of pollutants. Nitrogen oxide and sulfur dioxide contribute to formation of fine particulate, which is associated with the most serious health problems. 13 Studies link particulate to tens of thousands of annual premature deaths in the United States. Like ozone it contributes to respiratory illness, but it also seems to play a [\*29] role in triggering heart attacks among the elderly. The data suggest that fine particulate, which EPA did not regulate explicitly until recently, plays a major role in these problems. 16 Health researchers have associated carbon monoxide with various types of neurological symptoms, such as visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks. The same pollution problems causing current urban health problems also contribute to long lasting ecological problems. Ozone harms crops and trees. These harms affect ecosystems and future generations. Similarly, particulate precursors, including nitrogen oxide and sulfur dioxide, contribute to acid rain, which is not easily reversible. To address these problems, Agenda 21 recommends the adoption of national programs to reduce health risks from air pollution, including urban air pollution. These programs are to include development of "appropriate pollution control technology . . . for the introduction of environmentally sound production processes." It calls for this development "on the basis of risk assessment and epidemiological research." It also recommends development of "air pollution control capacities in large cities emphasizing enforcement programs using monitoring networks as appropriate." A second principle, the precautionary principle, provides support for the first. As stated in the Rio Declaration, the precautionary principle means that "lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" when "there are threats of serious or **irreversible damage**." Thus, lack of **complete certainty** about the adverse environmental and human health effects of air pollutants does not, by itself, provide a reason for tolerating them. Put differently, governments need to address air pollution on a precautionary basis to ensure that human’s can life a healthy and productive life. 8

**Evaluate these impacts through the lens of precaution**.

**Pittock 10** (Barrie, Led the Climate Impact Group in CSIRO until his retirement in 1999. He contributed to or was the lead author of all four major reports of the Intergovernmental Panel on Climate Change. He was awarded a Public Service Medal in 1999 and is CSIRO Honorary Fellow, Climate Change: The Science, Impacts, and Solutions, 2010, pg. 326)

It is absolutely crucial that options for reducing greenhouse gas emissions be pursued with a real sense of urgency. **Every extra tonne** of carbon dioxide placed into the atmosphere increases the very real risk of dangerous climate change, and nobody will escape the direct or indirect consequences. We are in danger of inadvertently **tripping the 'on' switch** to disaster, with an inevitably long delay before it can be turned off again. What is done now that enhances climate change cannot be easily undone, so we should err on the side of caution. But it is not all doom and gloom: we can save the day. As we have seen earlier in this book, the technology already exists to rapidly reduce emissions via large investments in energy efficiency (which saves money) and renewable base-load power (which will rapidly come down in price as it is scaled up). Supplemented later this century by large-scale carbon capture and sequestration and (if necessary) by safe nuclear power, the peak in greenhouse gas concentrations can be minimized and then brought down. We need to reduce carbon emissions, and **we need to do it fast**. Although we are facing an emergency, with an appropriate allocation of ingenuity and resources, together we can do it. We owe that, at least, to our children.

**Wind power trades off with dirty fuels --- it prevents climate change and particle pollution.**

**Sovacool 11** (Benjamin K., Assistant Professor at the Lee Kuan Yew School of Public Policy, part of the National University of Singapore. He is also a Research Fellow in the Energy Governance Program at the Centre on Asia and Globalization. He has worked in advisory and research capacities at the U.S. National Science Foundation’s Electric Power Networks Efficiency and Security Program, Virginia Tech Consortium on Energy Restructuring, Virginia Center for Coal and Energy Research, New York State Energy Research and Development Authority, Oak Ridge National Laboratory, Semiconductor Materials and Equipment International, and U.S. Department of Energy’s Climate Change Technology Program. He is the co-editor with Marilyn A. Brown of Energy and American Society: Thirteen Myths (2007) and the author of The Dirty Energy Dilemma: What’s Blocking Clean Power in the United States (2008). He is also a frequent contributor to such journals as Electricity Journal, Energy & Environment, and Energy Policy, The Hidden Factors That Make Wind Energy Cheaper than Natural Gas in the United States, The Electricity Journal, Volume 24, Issue 9, November 2011, Pages 84–95)

I. Introduction

With the Fukushima nuclear accident in Japan still lingering in the public memory, the environmental costs of coal-fired power continuing to mount, and the expense of oil-fired electricity generation maintaining cost-prohibitive levels, the true contest for new electricity facilities in the United States appears to be between wind energy and natural gas.

Total installed capacity for wind energy throughout the country exceeded 40,000 MW at the end of 2010, an increase of 15 percent over the year before, and state renewable portfolio standards continue to drive strong investment. Wind power contributed 42 percent of electric generating capacity additions in 2009, and according to the most recent data available from the U.S. Department of Energy, at the end of 2010 there were 258 GW of planned wind power capacity – more than six times current installed wind power capacity – within the transmission interconnection queues administered by independent system operators, regional transmission organizations, and electric utilities. These additions constituted more than 50 percent of all planned generating capacity, more than twice as much as the next largest source, natural gas.1 Researchers at Lawrence Berkeley National Laboratory also surveyed the actual production costs from 128 separate wind projects in the United States totaling 8,303 MW in 2007 and found they tended to produce electricity for less than 5 cents per kWh, making them more attractive than natural gas in many markets.2

The U.S. Energy Information Administration (EIA) reports, however, that natural gas use is on the rise, with electric utility consumption outweighing industrial demand for the first time ever in 2007.3 The agency states that the levelized cost of electricity in 2010 for natural-gas-fired power plants, excluding externalities, was competitive with onshore and offshore wind turbines.4 Natural gas is widely viewed as the “cleanest fossil fuel,” the United States has plentiful conventional reserves, and it can be stored in underground formations.5 Moreover, natural gas can be transported relatively easily through existing pipelines and requires no new transmission infrastructure to reach commercial markets.

Furthermore, improvements in technology have recently enabled the cheap production of unconventional forms of natural gas, with a blossoming “shale gas boom” underway in Texas and the Midwest.6 The term “shale gas” refers to natural gas extracted from gas shales, porous rocks that hold gas in pockets. Shale gas is most commonly captured by hydraulic fracturing, or fracking, a process which shatters rocks by injecting water, sand, and chemicals to release the gas.7 The EIA estimates that “technically recoverable” shale gas reserves could meet domestic natural gas consumption in the United States for more than 30 years,8 conclusions backed by independent studies.9 A few years ago experts were warning that the United States could become a net natural gas importer; with shale gas, the country in 2009 became the largest gas producer in the world.10 The Worldwatch Institute, an environmental nongovernmental organization, even concluded that “the rapid development of shale gas resources in the past few years has already dramatically affected U.S. energy markets—lowering energy prices and carbon dioxide emissions.”11

With uncertainty around natural gas and power prices as the economy recovers, wind's long-term price stability is even more valued.

Such close competition between wind and natural gas has led to some contradictory and confusing statements from energy experts. Taking just two examples, Elizabeth Salerno, director of industry data and analysis for the American Wind Energy Association, commented earlier this year that “wind's costs have dropped over the past two years, with power purchase agreements being signed in the range of 5 to 6 cents per kilowatt-hour recently. With uncertainty around natural gas and power prices as the economy recovers, wind's long-term price stability is even more valued. We expect that utilities will move to lock in more wind contracts, given the cost-competitive nature of wind in today's market.”12 Conversely, Sherle Schwenninger, director of economic growth programs at the New America Foundation, stated the opposite this summer when he said that “it makes no economic sense … to subsidize the installation of imported wind turbines when natural-gas-fired generators can produce an equivalent amount of energy for one-third to one-half the cost.”13

Which side is right? In an attempt to contribute to the debate, this study looks at a broader set of costs and benefits associated with natural gas and wind energy including human health, wildlife, and climate change implications. We compare two sources of energy at two locations: natural-gas-fired peaking plants run by Pacific Gas & Electric (PG&E) in California with the wind energy from 580 MW Altamont Pass, and combined cycle natural-gas-fired power plants operated by Idaho Power with the 12 MW Sawtooth wind farm.

As discussed below, we find that negative externalities, associated with air-pollution-related health effects and climate change, add about 2–12 cents per kWh for natural-gas-fired generation, depending on the location of the wind farms and other factors. These readily quantifiable negative externalities, while not a full accounting of all possible externalities, suggest that the cost of natural-gas-fired electricity exceeds that of wind power.

II. Human Health and Air Pollution

A significant benefit of wind power compared to natural gas is the almost complete elimination of fossil-fuel-related emissions. Natural gas combustion directly emits fine particulate matter less than 2.5 microns in diameter (PM2.5) as well as noxious gases such as **sulfur dioxide** (SO2), **nitrogen oxides** (NOx), **volatile organic carbons** (VOCs), and **ammonia** (NH3) that contribute to secondary PM2.5 and ozone formation. Both PM2.5 and ozone have serious health consequences. PM2.5 is more harmful and it is easier to model, so the present analysis focuses on PM2.5, and simply notes that our estimate of the air-pollution-related health impacts of natural gas is an underestimate to the extent that it does not include ozone.

To estimate the PM2.5-related health benefits of wind power, we relied on the Co-Benefits Risk Assessment Tool (COBRA), which is a screening instrument developed by Abt Associates for the U.S. Environmental Protection Agency to support assessments of the human health and economic benefits of air pollution reductions.14 COBRA essentially has four components.

First, it has a detailed, county-level emission inventory that EPA developed for its analysis of the Clean Air Interstate Rule.15 The inventory includes direct emissions of PM2.5, as well as precursors associated with the formation of PM2.5 in the atmosphere: NOx, SO2, VOC, and NH3.

Second, COBRA has a relatively simple, reduced-form air quality model, to estimate the impact of a change in natural gas combustion emissions on ambient PM2.5. The change in PM2.5 can then be used to estimate health impacts.

Third, COBRA has a suite of mortality and morbidity health impact functions that the EPA has used in recent regulatory benefit assessments.16 The health effects estimated include premature mortality, hospital admissions, emergency room visits, acute bronchitis, respiratory symptoms, asthma exacerbation, work loss days, and minor restricted activity days.

Finally, COBRA has valuation functions, which place a dollar value per estimated case of an adverse health effect. COBRA multiplies the number of adverse health effects with the appropriate dollar value per case to estimate the overall economic cost of adverse health impacts.

Using COBRA, we first estimated the reduction in air pollutant emissions due to wind power from the Sawtooth and Altamont wind farms compared to natural gas. This involved estimating the megawatt-hours (MWh) of power generated at both facilities, and then multiplying the estimated MWh by the estimated avoided emissions per MWh. Then, an adjustment was made to account for a small loss in efficiency due to the intermittent nature of wind power.17

To estimate the MWh of power production for the period 1987 to 2006 for Altamont, we relied on historical calculations provided by Altamont Winds Incorporated, which operates about 20 percent of the generating capacity at Altamont Pass. We presume that its operating experience is generally representative of the other companies operating turbines in Altamont Pass, as most of these companies rely on the same type of turbines. For the forecasted production period of 2012–2031, we estimate that there will be 580 MW of capacity, running at an average capacity factor of 38 percent. This translates into 1,931 GWh of electricity production annually. For the forecasted production period of 2012–2031 for Sawtooth, we assume that there will be 22.4 MW of capacity, running at a somewhat lower average capacity factor of 33 percent, due to differences in the local environment. This translates into 65 GWh of electricity production annually.

To estimate the emissions per MWh, we used facility-level SO2 and NOx emissions data from the EPA Clean Air Markets Division18, and PM2.5 emissions data from the California Air Resources Board19 and the Idaho Department of Environmental Quality.20Table 1 summarizes the estimated emissions reduction; further details can be found in two reports by McCubbin and Sovacool.21

We include in our analysis estimated emissions of PM2.5, SO2, and NOx associated with the combustion of natural gas, and we do not attempt to estimate the impact of emissions associated with the production and distribution of natural gas. Combustion-related emissions of NH3 and VOC, which have some effect on ambient PM2.5, are relatively minor, so we do not include them. In addition, while upstream emissions, particularly of NOx, are perhaps nontrivial,22 we do not include them, as it would require developing emission factors and estimating where the emissions occur, steps which are beyond the scope of the present analysis. As a result, our estimate of the impact on ambient PM2.5 will tend to be conservative.

Given an emissions reduction associated with using power generated at the Altamont and Sawtooth wind farms, as opposed to natural gas facilities, COBRA uses it reduced form air quality model to estimate the change in ambient PM2.5 levels in the continental U.S. In turn, COBRA can then use the change in ambient PM2.5 to estimate the impact on premature mortality and a variety of morbidity endpoints.

To estimate premature deaths, COBRA relies on epidemiological evidence from Pope et al.23, which is quite conservative in comparison to the results from the expert elicitation conducted for EPA.24 We also use a more recent study by Laden et al.25, which found a much larger impact of PM2.5 on mortality, one toward the upper end of the range of results from the expert elicitation.26 To estimate premature mortality in this analysis, the Pope et al. result is used in the low-impact scenario and Laden et al. is used in the high-impact scenario.

In addition to premature mortality, a variety of morbidity endpoints, including non-fatal heart attacks, hospital admissions, and asthma attacks, are estimated as well. Table 2 presents the estimated number of PM2.5-related cases of adverse health impacts. Finally, to estimate the economic benefit of the estimated change in health incidence, the number of adverse cases of a specific type of effect (e.g., mortality) is multiplied by its associated unit value and then adjusted for the estimated change in income over time and when the deaths are estimated to occur. Table 3 presents the estimated external cost per kWh of using natural gas in place of wind energy.

III. Impoverished Avian Wildlife

Unlike wind energy, the lifecycle of natural gas also involves deleterious impacts on **wildlife**. The production and extraction of natural gas, which is itself toxic, involves bringing large quantities of rock fragments, called “cuttings,” to the surface, and these cuttings are coated with drilling fluids, called “drilling muds,” which operators use to lubricate drill bits and stabilize pressure within oil and gas wells. The quantity of toxic cuttings and mud released for each facility is gargantuan, ranging between 60,000 and 300,000 gallons per day. In addition to cuttings and drilling muds, vast quantities of water contaminated with suspended and dissolved solids are also brought to the surface, creating what geologists refer to as “produced water.” The average offshore oil and gas platform in the United States releases about 400,000 gallons of produced water back into the ocean or sea every day.27 Produced water contains **lead**, **zinc**, **mercury**, **benzene**, and **toluene**, making it highly toxic and requiring operators to often treat it with chemicals, increasing its **salinity** and making it fatal to many types of **plants**, before releasing it into the environment

The U.S. Geological Survey (USGS) estimated that there are more than 2 million oil and natural gas wells in the continental United States. But the most intense areas of oil and gas production are off the shores of the Gulf of Mexico and along the northern coast of Alaska. Offshore natural gas exploration and production in the Gulf of Mexico exposes aquatic and marine wildlife to chronic, low-level releases of many toxic chemicals through the discharge and seafloor accumulation of drilling muds and cuttings, as well as the continual release of hydrocarbons around production platforms.28 Drilling operations there generate massive amounts of polluted water (an average of 180,000 gallons per well every year), releasing toxic metals including mercury, lead, and cadmium into the local environment.29 The Natural Resources Defense Council also noted that the onshore infrastructure required to sustain oil and natural gas processing in the United States has destroyed more coastal **wetlands** and **salt marsh** than can be found in the total area stretching from New Jersey through Maine, and that estimate was made before the Deepwater Horizon disaster.30

In addition, the fracking of shale gas produces liquid wastes that can contaminate surface and drinking water.31 The Worldwatch Institute reports that:

The environmental risks associated with the development of shale gas are similar to those associated with conventional onshore gas, including gas migration and groundwater contamination due to faulty well construction, blowouts, and above-ground leaks and spill of waste water and chemicals used during drilling and hydraulic fracturing.32

Another study cautioned that “residents living near shale gas drilling complain of headaches, diarrhea, nosebleeds, dizziness, blackouts, muscle spasms, and other problems,”33 implying that shale gas production, too, has negative impacts on the local environment.

In their review of impacts of power generation on wildlife, EBF34 noted that toxic air emissions have been associated with mortality, injury, and behavioral changes in wildlife. Olsgard et al.35 report that the immune system in kestrels was adversely affected by benzene and toluene exposure, which are common pollutants associated with natural gas extraction. Brown et al.36 report that ambient particulate matter has harmed **birds** in a variety of environments, with “significant pathology after only a short duration of exposure,” giving examples of kiwis foraging within loose dust and sand, birds living in or near desert like conditions, birds exposed to volcanic ash, and poultry exposed to aerosols in crowded production houses. Canaries were used for many years in mines to test for carbon monoxide, as they are exquisitely sensitive to certain pollutants.

To generate a preliminary estimate of the impact of ambient PM2.5 on birds, we use the relatively conservative study by Pope et al.37 as our high impact scenario estimate, and in the low-impact scenario we assume half of the estimated coefficient from the Pope et al. study. At Altamont we estimate 1,200–8,400 avoided bird deaths in 1987–2006 and 1,300–10,500 in 2012–2031, while at Sawtooth we estimate 50–350 avoided bird deaths in 2012–2031.

IV. Climate Change

Natural gas power plants contribute to climate change by emitting significant amounts of **methane** during the production process. Natural gas, when not separated from oil deposits, is often burned off at the well site, flared (combusted into carbon dioxide and water vapor), or vented directly into the atmosphere. Five percent of world natural gas production—or 150 billion cubic meters of natural gas, more than 2 billion tons of carbon dioxide equivalent (CO2-e)—is lost to flaring and venting each year, making the gas industry responsible for roughly 10 percent of annual global methane emissions.38

Methane is also a greenhouse gas 21 to **23 times more potent** than carbon dioxide on a 100-year timeframe, and its half-life is only 12 years, meaning its instantaneous impact is much larger on the climate system. Methane is already the second-largest contributor to anthropogenic greenhouse gas emissions after carbon dioxide, accounting for 16 percent of the total on a CO2-e basis.39 Researchers at the International Association of Oil and Gas Producers and the Society of Petroleum Engineers have calculated that the global average emission ratio for gas production is about 130 to 140 tons of CO2-e for every thousand tons of production—more than any other electricity fuel besides oil and coal.40

New evidence has surfaced that the lifecycle of gas is more carbon-intensive than previously thought. This refers to not just the gas produced or used in Idaho and California, but its entire lifecycle.41 Natural gas must be extracted from wells and processing plants before it enters the transmission system in the United States which includes storage systems like aquifers and salt caverns.

Previous estimates of the carbon footprint of gas did not account for losses within this system. Taking into account new information regarding methane leaks from loose pipe fittings and methane vented from gas wells, the U.S. Environmental Protection Agency doubled its previous estimate of the carbon footprint of natural gas. When included, these losses make gas as little as 25 percent cleaner than coal from a carbon standpoint.42

In addition, the EIA notes that natural gas storage operators must “boil off” significant quantities of natural gas every day to maintain adequate pressure—meaning that approximately 0.25 to 0.50 percent of their inventory is lost every day due to vaporization.43 One report from the Lawrence Berkeley National Laboratory noted that leaks in natural gas storage facilities can occur due to improper well design, construction, maintenance, and operation.44 The report cautioned that leakage from natural gas storage structures can be especially hazardous when they cause natural gas to migrate into drinking water aquifers or escape to the surface, creating a “significant safety risk.”

Natural gas storage facilities, in addition to significantly adding to the cost of natural gas infrastructure, are also inefficient and susceptible to serious accidents that can release methane and pollute the air and water of local communities. In January 2001, hundreds of explosions rocked the Yaggy field—a natural gas salt formation storage site in Hutchinson, Kan.—when natural gas escaped from one of the storage wells and erupted into a seven-mile wall of fire (burning an estimated 143 million cubic feet of natural gas). Cleanup for the disaster necessitated the construction of 57 new venting wells extending a distance of more than nine miles.45

Overpressurization (needed to enlarge gas bubbles and obtain higher delivery rates) is another main cause of leakage, as many underground natural gas storage projects tend to be operated at pressures exceeding their original designs. Such leaks can become excessively costly: the Gulf South Pipeline Company's Magnolia facility, a $234 million salt-cavern storage system, opened in 2003 only to permanently close a few months later after a well collapsed.46

Pipelines are prone to catastrophic failure, which can release methane into the atmosphere as well. Faulty joints connecting pipeline components, malfunctioning valves, operator error, and corrosion induce frequent leaks and ruptures. Looking back from 1907 to 2007, natural gas pipelines are the type of energy infrastructure most frequent to fail, accounting for 33 percent of all major energy accidents worldwide.47 The U.S. Department of Transportation has noted that gas pipelines fail so often that they expect 2,241 major accidents and an additional 16,000 spills every 10 years.48

Greater reliance on shale gas would also significantly increase the carbon footprint of natural gas power plants. Nature cautions that 0.6 to 3.2 percent of the methane in shale gas can escape directly, and that on a 20-year timeframe methane is 70 times more powerful at heating the atmosphere.49 Other studies have noted that 3.6 to 7.9 percent of methane from shale gas production escapes to the atmosphere through venting and leaks, which make methane emissions from shale gas between 30 percent more and as much as twice as great compared to conventional natural gas.50

Although the natural gas industry has fiercely contested their findings,51 these studies have noted that fugitive methane emissions escape during the completion of wells, especially the drilling stage of new reserves. Venting and equipment leaks of methane are common, too, with the typical well having 55 to 150 different connections to equipment including heaters, meters, dehydrators, and compressors, as well as vapor recovery systems that can all fail and induce leakage. Processing, where hydrocarbons and impurities such as sulfur are removed, is energy and carbon intensive, and shale gas needs more extensively processed to make it ready for existing pipelines.

Lastly, greater reliance on liquefied natural gas (LNG) imports with greater travel times and distances will also raise the carbon footprint of natural gas. LNG has three significant parts of its lifecycle that make it more carbon-intensive, and less efficient, than ordinary gas:

•The liquefaction phase is needed to cool and pressurize natural gas into LNG for transport, usually via ocean tanker;

•The LNG tankers themselves operate on oil and diesel and travel long distances;

•Regasification must occur when those tankers reach their destinations and offload the LNG so it can enter the US transmission system.

Though for much of the last decade 75 percent of LNG imported to the United States came from nearby Trinidad and Tobago, the coming decade will see more LNG from Russia, the Middle East, and Southeast Asia.52 These longer transport times equate to higher affiliated emissions. John Hritcko, the vice president for Strategy and Development for Shell U.S. Gas & Power Company, recently estimated that by 2025, the United States is expected to import the equivalent of today's global LNG trade just to satisfy its own domestic demand.53 Greenpeace recently concluded that the energy-intensive fuel cycle for LNG exacts an energy penalty of 18 to 22 percent—contributing an additional 11 to 18 percent in CO2 emissions, compared to the same amount of non-liquefied natural gas.54

Thankfully, natural gas greenhouse gas emissions are at least partially offset by cleaner forms of electricity generation such as wind power. For our comparison in this study, avoided GHG emissions are calculated as the difference between emissions from natural-gas-fired power and wind energy across resource extraction, fuel transportation, facility construction, power generation, transmission and delivery, and decommissioning. For natural-gas-fired power, the stage with the most GHG emissions is power generation. Other stages, particularly resource extraction and fuel transportation, also contribute GHGs.

The emissions associated with wind power are quite low and are associated with such activities as building the wind energy farm, maintenance, and eventual decommissioning. Lifecycle analyses by Weisser55 and Hondo56 both report cumulative CO2-e emissions across all lifecycle stages of wind power ranging between 10 and 30 g-CO2-e per kWh. In contrast, they report that cumulative lifecycle emissions from natural-gas-powered electricity can exceed 500 g-CO2-e per kWh.

To estimate CO2 emissions, we used facility-level data on CO2 emissions and megawatts generated from the EPA's Clean Air Markets Division.57 For the period 2012–2031 for both wind farms, there will likely be decreases in CO2 emissions due to improved natural gas technology and strong regulatory pressures, so it is assumed that emissions would be somewhat lower relative to 2006. We assume a loss of 1.4 percent of CH4 in the low-impact scenario, and a loss of 5.0 percent is assumed in the high-impact scenario.

Taking into account a GWP of 33, this translates into 219 lbs CO2-e/MWh in the low-impact scenario and 513 lbs CO2-e/MWh in the high-impact scenario. In addition, calculating upstream emissions associated with the production and distribution of natural gas, Meier et al.58 estimate 3.4 metric tons of CO2-e emissions per GHh, or about 7 lbs CO2-e/MWh, are emitted during plant construction, maintenance, and decommissioning. Finally, to account for wind power's lifecycle emissions, an estimated 20 g-CO2-e per kWh (44 lbs/MWh), based on work by Weisser59 and Hondo60, is subtracted across all years.

To value CO2-e emissions, we use estimates of the damage per ton of CO2, developed by the U.S. federal government in 2010 for use in cost-benefit analysis of federal regulations.61 As noted by Kopp and Mignone62, the estimates rely upon the results from three integrated assessment models examining five socio-economic scenarios and three fixed discount rates (5 percent, 3 percent, and 2.5 percent). The estimated benefits of these avoided emissions from Altamont and Sawtooth wind power generation are presented in Table 4.

In addition to valuing the CO2-e emissions, we used the work of Sovacool63 to develop a preliminary estimate of the climate change impact on bird extinctions in the United States. Assuming that natural gas has one-third (lower bound) to one-half (upper bound) of the impact of Sovacool's estimate of 4.98 deaths per GWh for “fossil fuels,” which is a mixture of coal-, oil- and natural gas-fired electricity production, we estimate that wind power from Altamont avoids 32,000–49,000 avian deaths due to reduced emissions in 1987–2006 and 62,000–93,000 in 2012–2031. At Sawtooth, we estimate 2,100–3,200 avoided bird deaths due to reduced emissions in 2012–2031.

V. Conclusion

Perhaps surprisingly, both wind farms examined have immense environmental and economic benefits that may exceed the capital costs of the wind farms themselves, externalities summarized in Table 5. The turbines at Altamont Pass have a replacement cost of about $900 million,64 and avoid anywhere from $300 million to $3.6 billion in human health and climate related externalities. Similarly, the turbines at Sawtooth have a replacement cost of about $35 million, and avoid $20 million to $110 million of human health and climate-related externalities. Translating these negative externalities into a cost per kWh of electricity, we find that the price of natural gas rises from about 9.6 cents per kWh to 11.7–20.5 cents per kWh, with a best estimate of about 15 cents per kWh. This is more than the estimated cost associated with onshore wind power of about 10.95 cents per kWh.65

Three sobering conclusions arise for readers of this Journal and those concerned about American energy policy.

First, externalities matter, perhaps much more than we commonly wish to acknowledge. Looking at only three in this study – human health, avian deaths, and climate change – dramatically changes the game in how we view both wind energy and natural gas. Society still pays for the debilitating externalities from natural gas even though they are not reflected in our electricity or energy bills. A significantly greater number of human deaths, hospital admissions, insurance damages, degraded cities, and blighted ecosystems come from greater reliance on natural-gas-fired generation. The difference between price and cost is a reminder that, sooner or later, someone will pay (although this “someone” is often in the future and not the person imposing the cost).

Second, there is good reason to suppose that the calculations presented in this study are **conservative**, and **underestimate** both the damage from natural gas and the benefits from wind energy.

Power plants in California operate under more stringent environmental regulations than most facilities around the world, meaning the benefits of wind energy are likely greater in other regions. The estimated impact on ambient PM2.5 is quite low, as we did not include upstream emissions associated with the production and distribution of natural gas; moreover, we assumed that premature mortality occurs with a conservative 20-year lag, when work by Schwartz et al. suggests that most deaths occur within the first two or three years.66 Finally, we haven’t systematically explored negative externalities associated with natural gas for vertebrate wildlife and fish, nor have we included the adverse effects caused by ozone to human health, crops, and forests.

Third, the fact that most people believe natural gas is cheaper than wind energy, and therefore a more desirable option for the U.S. electricity sector, shows just how far we need to go at educating policymakers and altering attitudes. Simply put, the misalignment of natural gas's cost with its true price means we all continue to make suboptimal and inefficient decisions about new power plants. The negative externalities associated with the lifecycle of natural gas have become normalized and accepted so that utility executives and consumers have learned to tolerate them. Making them visible again, as we have tried to do with our study, is an important first step toward devising ways that actually start saving lives, money, and wildlife.

**The most recent rigorous studies point to the necessity and sufficiency of wind power.**

**Goggin 12** (Michael, Manager of Transmission Policy at the American Wind Energy Association, Previously consulted for two environmental advocacy groups and a consulting firm supporting the U.S. Department of Energy’s renewable energy programs, Holds an undergraduate degree with honors from Harvard University, Fact check: Coverage of Argonne wind and emissions study flawed, June 2006, http://www.awea.org/blog/index.cfm? customel\_dataPageID\_1699=16631)

Other analyses using more **accurate assumptions** and more **reliable sources** have found that wind’s emissions savings are as large or larger than expected. A recent analysis using **real-world data** derived from EPA emission monitors found that in an **absolute worst case**, wind energy achieves 98.3% of the expected carbon dioxide emissions savings, and 103.3% of the expected nitrogen oxide emissions savings. An ongoing phase of that analysis, due to be completed within the next several months, is likely to show that wind’s net emissions savings are **even larger** than expected. This result occurs because wind energy tends to disproportionately displace dirtier and less flexible coal generation instead of more flexible natural gas generation, so any slight decrease in power plant efficiency is more than offset by this additional emissions savings. This result was also found in the Argonne analysis, which noted that “…increasing wind generation leads to a shift in dispatch from coal toward natural gas,” though those emissions savings were masked by the larger impact of the incorrect assumption that wind energy would displace nuclear generation. - Real-world data confirms that states that have added significant amounts of wind energy, such as Illinois, have seen fossil fuel use and emissions decline by as much as or more than expected. Department of Energy data for Colorado show that as wind energy jumped from providing 2.5% of the state’s electricity in 2007 to 6.1% of the state’s electricity in 2008, carbon dioxide emissions fell by 4.4%, nitrogen oxide and sulfur dioxide emissions fell by 6%, coal use fell by 3% (571,000 tons), and electric-sector natural gas use fell by 14%. DOE data for Texas show that as wind and other renewables’ share of Texas’s electric mix increased from 1.3% in 2005 to 4.4% in 2008, an increase in share of 3.1 percentage points. During that period, electric sector carbon dioxide emissions declined by 3.3%, even though electricity use actually increased by 2% during that time. Because of wind energy, the state of Texas was able to turn what would have been a carbon emissions increase into a decrease of 8,690,000 metric tons per year, equal to the emissions savings of taking around 1.5 million cars off the road. Similarly, thanks to the growth of wind energy in the state, Illinois saw a 0.5% decrease in CO2 emissions from 2006 to 2009, even though electricity use actually increased by 0.75% over that time period. In Minnesota, as wind energy grew from providing less than 4% of the state’s electricity in 2006 to almost 10% in 2009, electric sector carbon dioxide emissions fell by more than 10%, or 4 million metric tons per year.

As further evidence, four of the seven major independent grid operators in the U.S. have studied the emissions impact of adding wind energy to their power grids, and **all four** have found that adding wind energy drastically reduces emissions of carbon dioxide and other harmful pollutants. While the emissions savings depend somewhat on the existing share of coal-fired versus gas-fired generation in the region, as one would expect, it is **impossible to dispute** the findings of these four independent grid operators that adding wind energy to their grids has significantly reduced emissions. The results of these studies are summarized below.

Finally, analysis of readily available DOE data puts to rest the idea that wind energy has a significant negative impact on the efficiency of fossil-fired power plants. The Department of Energy collects detailed data on the amount of fossil fuels consumed at power plants, as well as the amount of electricity produced by those power plants. By comparing how the efficiency of power plants has changed in states that have added significant amounts of wind energy against how it has changed in states that have not, one can test the hypothesis that wind energy is having a negative impact on the efficiency of fossil-fired power plants. The data clearly shows that there is no such relationship, and in fact states that use more wind energy have seen greater improvements in the **efficiency** of their fossil-fired power plants than states that use less wind energy. Specifically, coal plants in the 20 states that obtain the most electricity from wind saw their efficiency decline by only 1.00% between 2005 and 2010, versus 2.65% in the 30 other states. Increases in the efficiency at natural gas power plants were virtually identical in the top 20 wind states and the other states, at 1.89% and 2.03% improvements respectively. The conclusion that adding wind energy actually increases fossil plant efficiency makes intuitive sense, because as explained above, adding wind energy to the grid displaces the output of the most expensive, and therefore least efficient, fossil-fired power plants first.

**Wind power is capable of meeting all domestic energy needs.**

**Sovacool 9** (Benjamin K., Assistant Professor at the Lee Kuan Yew School of Public Policy, part of the National University of Singapore. He is also a Research Fellow in the Energy Governance Program at the Centre on Asia and Globalization. He has worked in advisory and research capacities at the U.S. National Science Foundation’s Electric Power Networks Efficiency and Security Program, Virginia Tech Consortium on Energy Restructuring, Virginia Center for Coal and Energy Research, New York State Energy Research and Development Authority, Oak Ridge National Laboratory, Semiconductor Materials and Equipment International, and U.S. Department of Energy’s Climate Change Technology Program. He is the co-editor with Marilyn A. Brown of Energy and American Society: Thirteen Myths (2007) and the author of The Dirty Energy Dilemma: What’s Blocking Clean Power in the United States (2008). He is also a frequent contributor to such journals as Electricity Journal, Energy & Environment, and Energy Policy, Going Completely Renewable: Is It Possible (Let Alone Desirable)?, The Electricity Journal, Volume 22, Issue 4, May 2009, Pages 95–111)

B. United States

The electricity sector in the United States is a curious mix of partially restructured and deregulated markets along with a collection of states that still adhere to the classic form of monopoly regulation. In 2007, total installed capacity was slightly more than 1,000 GW composed of about 16,000 power plants sending their power through 351,000 miles of high-voltage transmission lines and 21,688 substations. These power plants generated 4,157 million MWh of electricity, with roughly two-thirds coming from fossil-fueled units, 20 percent coming from nuclear units, and the remainder (about 10 percent) coming from renewable resources (including hydroelectric facilities).

Fortuitously, the United States has an enormous cache of renewable energy resources that it has only begun to utilize. While a bit dated, a **comprehensive study** undertaken by the U.S. Department of Energy calculated that 93.2 percent of all domestically available energy was in the form of just wind, geothermal, solar, and biomass resources. The amount of renewable resources found within the country, in other words, amounted to a total resource base the equivalent of 657,000 billion barrels of oil, more than 46,800 times the annual rate of national energy consumption at that point in time.32 Perhaps an even more amazing feature of this estimate is that it was **validated by** researchers at the U.S. Geologic Survey, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Sandia National Laboratory, National Renewable Energy Laboratory, Colorado School of Mines, and Pennsylvania State University.

Compiling data from a collection of peer-reviewed reports, the United States has 3,730,721 MW of renewable energy potential presuming the utilization of existing, commercially available technologies (Table 5). Two things pop out when looking at Table 5. First, the table shows that renewable resources have the capability to provide 3.7 times the total amount of installed electricity capacity operating in 2008. Second, the country has so far harnessed only a whopping 2.9 percent of this potential generation.

As Table 5 implies, the United States possesses an **exceptional abundance** of onshore wind resources. The fuel potential for wind energy, particularly in areas with frequent and strong winds, remains largely untapped. The Midwest and the Great Plains have been called the “Saudi Arabia of wind” and theoretically hold enough technical potential to fulfill the **entire country's energy needs**. The energy potential for offshore wind is even larger, as offshore wind turbines can harness stronger, more consistent winds than those that course through mountain passes or across open plains. An abundance of available roofs, parking lots, highway walls, and buildings are available for integrated solar PV systems and the West has immense solar thermal and geothermal potential. The Midwest has very large reserves of biomass fuel in the form of crop residues and energy crops, and every state has hydroelectric capacity that could still be developed after excluding national battlefields, parks, parkways, monuments, preserves, wildlife refuges, management areas, and wilderness reserves.

### 1AC—Plan

**Plan --- The United States federal government should permanently extend the production tax credit for wind energy in the United States.**

### 1AC—Solvency

**Contention Three – Solvency**

**Only the PTC can provide investor predictability.**

**Dewey 11** (Erin, Graduated Editor in Chief of the Boston College Law Review, Sundown and You Better Take Care: Why Sunset Provisions Harm the Renewable Energy Industry and Violate Tax Principles, May, Boston College Law Review, 52 B.C. L. Rev 1105)

B. Sunsetting the Production Tax Credit

Despite disagreement among scholars regarding the value of sunset dates generally, those in the renewable **energy industry** agree that sun setting of the PTC has impacted the industry and that a permanent PTC would result in more **long-term investment** in renewable energy. n164 Despite the success of the PTC, the credit has not become a permanent feature of the Internal Revenue Code and has been subject to the current sunset trend in Congress. n165 When the PTC was originally adopted in 1992, the taxpayer could only receive the credit if the qualifying facility was placed in service after December 31, 1993 and before July 1, 1999. n166 The latter date was the sunset date, at which point Congress would decide whether to renew the PTC. n167 Taxpayers that placed a facility in service prior to the sunset date would enjoy the full ten-year credit period. n168

As such, Congress initially gave investors a six-and-a-half-year window to begin to develop and construct projects to claim the credit before [\*1126] the PTC expired on July 1, 1999. n169 Five months after the credit expired, Congress extended it for two more years; the credit then expired for a second time on January 1, 2002. n170 Two months later, in March 2002, Congress renewed the PTC for qualifying facilities placed in service before 2004. n171 Again, in January 2004, the PTC expired for a third time, and Congress renewed it in October 2004 until the end of 2005. n172 At this point, the Energy Policy Act of 2005 renewed the PTC for facilities placed in service before 2008. n173 Congress then extended it for an additional year in December of 2008. n174 Finally, the American Recovery and Reinvestment Tax Act extended the PTC once again until the end of 2012 for wind energy. n175

Therefore, beyond the initial six-and-a-half-year period, the PTC has been extended only for one to three years at a time and only with frequent expirations. n176 It was effective for two years, and then two more years, and then one year, and then two years again, and then three years. n177 On three separate occasions, in 1999, 2001, and 2003, Congress let the PTC expire. n178 Political disagreements have contributed [\*1127] to this staggered expiration and extension schedule. n179 Clearly, even though the PTC has been consistently renewed since 2005, uncertainty over its continuation still exists because each renewal in Congress has introduced political posturing and debate. n180

The American Wind Energy Association states that the "on-again, off-again" production tax credit causes uncertainty, which discourages long-term investment in wind power manufacturing and development. n181 This impact is evidenced in Table 1, below.

Notably, Table 1 demonstrates that newly installed wind capacity **dropped precipitously** in the years in which the PTC expired. n183 This drop is particularly evident in 2002 and 2004, where the newly installed capacity dropped by over 1200 megawatts each year. n184 This trend suggests that the **PTC is essential** to the wind industry. n185 Conversely, continuity [\*1128] in the availability of the PTC promoted steady growth from 2005 to 2009, albeit at an inconsistent growth rate. n186 Furthermore, one study indicates that expiration could result in **$19 billion** of lost investment and 116,000 lost jobs. n187 If the PTC expired in 2009, this study projected that only 500 megawatts of wind energy would have been produced, compared with 6500 megawatts with the PTC in place; another study projected that the lack of the PTC would result in **fifty percent less** added wind capacity by 2025. n188

Even though the PTC has spurred investment in renewable energy, it appears that the credit has been unable to reach its full potential. n189 It is possible that the drops in added capacity represent mere timing shifts, such that no change in added capacity results. n190 Nonetheless, staggered renewals have caused investors to rush to complete projects before the PTC expiration, leading to a "boom-and-bust" investment cycle, particularly since 1999, whereby the PTC was renewed only on a 1-3 year basis and was repeatedly allowed to expire. n191 As a result of this, wind production has occurred in "tight and frenzied windows of development," leading to a number of negative outcomes for the U.S. wind industry. n192

Industry experts suggest that this "boom-and-bust" cycle leads to decreased renewable energy development. n193 First, it **increases the cost** of renewable projects. n194 A "herd effect" results when all developers strive to finish renewable projects at the same time: the resulting concurrent added demand increases the cost of materials and construction services. n195 Second, this **increased cost** in manufactured components may result in greater **reliance on foreign manufacturing** and may decrease foreign investment in U.S. manufacturing facilities of renewable [\*1129] components. n196 Third, the rush to complete a project may lead to smaller projects because to meet the "placed in service" date and be eligible for the credit, developers settle for **smaller projects** that can be finished on time. n197 Currently, development has been slowing because **lenders will not loan** money if the project is not comfortably scheduled to be in service within the year the PTC sunsets. n198

Furthermore, the renewable projects suffer from the enhanced risk of sunsetting tax credits during the riskiest phase of the project. n199 Typically the first financial phase of a project is the development and permitting phase, which requires equity funding. n200 Second, the construction phase occurs upon full permitting and relies on both debt and equity. n201 Lastly, the least risky phase is operation which requires only a construction loan refinanced with long-term, low rates. n202 The first financial stage requires commitments of **high risk equity**, including tax equity investors; uncertainty over whether the PTC will be available makes **investors unwilling** to commit to the project. n203 As a result, it is unlikely that projects would receive sufficient financing at the construction or operating stages. n204

C. The Sun Rises on the Low-Income Housing Credit

This Section discusses the LIHTC, a tax credit to promote investment in low-income housing that is a useful tool for comparison to the PTC because: (1) unlike the PTC, it has become a permanent feature of the tax code and escaped the recent sunset trend in Congress, and [\*1130] (2) it incentives private investment in low-income housing, a socially beneficial but relatively unprofitable industry, like renewable energy. n205 Congress created the LIHTC in 1986, and it has since become the primary federal program to incentivize the production of affordable housing. n206 Like the PTC and renewable energy, the program has resulted in private investment in poor communities and promoted a public-private partnership in the development of low-income housing. n207 The LIHTC amounts to a certain percentage of the "qualified basis of each qualified low-income building." n208

The LIHTC was subject to a few sunset provisions during the nascent stages of the program, but it eventually became permanent. n209 Originally, it was slated to expire in 1989. n210 Subsequently, Congress extended the LIHTC program for a year at a time in 1989, 1990, and 1991. n211 Finally, in 1993, the tax provision became a permanent part of the tax code through the Omnibus Budget Reconciliation Act. n212 One expert in the program writes the following of the period prior to permanent codification of the LIHTC:

[\*1131] Up to this point, the LIHTC program was making halting progress, given that the development community could not be sure of its future existence. With the 1993 Act, Congress finally made the program permanent. As a result, developers could begin to prepare proposals with the knowledge that the program would survive from year to year. n213

In fact, the House Committee on Ways and Means corroborated this rationale for a permanent extension, requiring the permanency of the tax credit in the interest of certainty for investment and efficiency. n214B.

III. SUNSETTING THE PTC FRUSTRATES THE POLICY GOAL OF LONG-TERM INVESTMENT

The PTC's sunset provisions frustrate the congressional policy of promoting long-term investment in renewable energy. n215 This Part first establishes that the theoretical argument favoring sunset dates as a means to promote long-term investment does not apply to the PTC and the renewable energy industry. n216 Next, this Part utilizes the LIHTC to illustrate how permanent tax credits enhance long-term investment and efficiency. n217 Other than its permanency, the LIHTC has many features analogous to the PTC: the structure of the credit, the syndication requirements, and the incentivized industry. n218 Therefore, it serves as an appropriate lens to analyze what impact the PTC's incessant sunsetting has on long-term investment. n219

A. Sunset Dates Do Not Promote Long-Term Investment in the Renewable Energy Industry

The example of the PTC contradicts any contention by tax scholars that sunset dates promote long-term investment in the renewable energy industry. n220 First, renewable energy projects are irreversible investments [\*1132] with long lead times, and therefore investors cannot easily retract their investments upon expiration of the PTC. n221 Second, the sunset dates deal with complete abrogation of the credit, not mere lessening of the incentive. n222 Finally, the PTC does not have an "illusion of certainty." n223

The argument that uncertainty in tax incentives promotes investment in reversible investments does not apply to renewable energy projects, which are not reversible investments. n224 Renewable energy investment often requires specialized syndication agreements to monetize the PTC and large amounts of debt and equity. n225 Furthermore, electricity generation is a specialized industry, rendering the equipment, property, and investments relatively illiquid. n226 Also, the length of time required to develop renewable projects, particularly wind, makes such investments irreversible. n227 Therefore, the argument that sunset dates are beneficial for reversible investments simply does not apply to the PTC. n228

The "use it or lose it" phenomenon, whereby investment increases as taxpayers seek to utilize the credit prior to expiration, also does not apply to renewable energy projects, nor to their respective tax credits. n229 Again, the assumption underlying this phenomenon is that expiration would merely revert to a less beneficial, yet still existent, tax incentive. n230 With the PTC, expiration due to sunset provisions results in the abrogation of the credit altogether; indeed, the PTC has expired on three separate occasions. n231 Such uncertainty about the actual existence of the PTC (which is required to make renewable projects cost competitive) chills private investment in the renewable energy industry. n232

The "use it or lose it" argument further does not apply because renewable energy projects typically take longer to plan and facilitate [\*1133] than the actual renewal period. n233 The behavior incentivized is not merely acquiring certain property or investing money (investment activities that can be done in a short period of time); rather, the PTC aims to incentivize placing a renewable energy project in service, an activity that entails investment, permitting, long-term contracts with utilities, construction, grid access, and NEPA review, all of which take three to seven years rather than the one to four years offered by the renewal period. n234 Furthermore, for the PTC, the electricity must be sold to a third party, which introduces more challenges. n235 Investors may endeavor to place a wind farm in service during the proper year to benefit from a tax credit, but there are a number of factors that may slow this process and prevent the ability of the investor to "use it." n236 Therefore, the unpredictability and length of renewable energy project timelines may prevent the taxpayer from "using" the credit before it sunsets. n237

The argument that sunsetted tax credits are essentially permanent does not apply to the PTC, n238 which has in fact expired on three different occasions. n239 Those in the industry continually doubt the PTC's renewal by Congress, due to political posturing during renewals. n240 Any spurring of growth that does occur may actually hurt the renewable industry as a whole due to its **irregular nature**. n241

[\*1134] The "illusion of certainty" argument is also misguided. n242 Although all investments that result from tax credits suffer from some degree of repeal risks, it is more likely that Congress will fail to renew a provision than take affirmative action to change or repeal a provision, as has been established by Calabresi. n243 Scholars refer to this tendency towards inaction as "legislative inertia." n244 After all, repeal and amendment require passage in both houses and presidential signature, whereas expiration requires no action at all. n245 As such, it is riskier for investors to rely on a tax provision with a sunset date than a permanent tax provision, even though the permanent provision is subject to repeal or revision. n246 Again, such lapse in availability is precisely what occurred with the PTC. n247

In sum, **none of the arguments** suggesting that sunset provisions actually promote long-term investment apply to the PTC and renewable energy industry. n248 Instead, the frequent sunset provisions of the PTC discourage long-term investment because those in the industry cannot rely on its continued existence; to the extent that it does spur investment, the resultant "boom-and-bust" cycle harms the industry by raising manufacturing and capital costs. n249

These concerns over long-term investment are felt by those in the renewable energy industry. n250 Many recommend a more permanent PTC to promote steadier growth. n251 The American Wind Energy Association recommends that the credit be extended for at least five more [\*1135] years. n252 The House Ways and Means Committee and the Senate Finance Committee both mirrored this recommendation in the 110th Congress. n253 Those in the industry have consistently testified to Congress regarding the importance of a predictable tax incentive policy to the industry. n254 Dean Gosselin, of Business Development for Wind Power, stated:

Unfortunately in this instance, two plus one plus one plus one does not necessarily equal five predictable years. . . . Business thrives **on the known** and fails on the unknown. The unpredictable nature of the credit has prevented the needed investment in U.S.-based facilities that will drive **economies of scale** and **efficiencies**. n255

As such, the uncertainty, despite continuous renewal, may discourage investment in the renewable industry. n256

B. Success of the Permanent LIHTC as a Lesson for the PTC

The LIHTC is a valuable tool to assess the impact of sunset provisions on the effectiveness of the PTC because it similarly incentivizes private investment in the low-income housing industry, but, unlike the PTC, has become a permanent feature of the tax code. n257   [\*1136] 1. Similarities Between the PTC and the LIHTC

Like renewable energy, low-income housing is an important social concern, particularly since the recession, as the gap has widened between the number of renting households and the availability of affordable units to rent. n258 Currently, twelve million households spend over fifty percent of household income on housing. n259 A family with only one full-time, minimum wage earner cannot afford a fair-market, two-bedroom rental anywhere in the United States. n260 The production of low-income housing is therefore necessary, much like the production of renewable energy. n261

Furthermore, affordable housing development, like renewable energy production, faces barriers to market entry. n262 Renting or selling housing units for below market rates would be a less profitable, perhaps even unprofitable, venture for developers and investors. n263 Furthermore, there tend to be many objections to siting affordable housing developments. n264

The PTC and LIHTC share many structural similarities: both require that the project comply with certain guidelines during the life of the tax credit, and both are based on production, not just initiation. n265 For the PTC, the electricity must be produced and sold, and for the LIHTC the units must be consistently occupied by low-income tenants. n266 As such, the investment is necessarily long term and irreversible for both the LIHTC and the PTC. n267

Additionally, like the renewable energy tax credits, the LIHTC requires that developers monetize the tax credits by entering financing [\*1137] agreements with tax equity investors. n268 If real estate developers do not expect to have such income tax liability and require capital investment, then tax equity investors will infuse the projects with capital and capture the tax credits during the ten-year period. n269

Finally, both programs have been successful. n270 Due to the LIHTC, millions of affordable units have been built and restored over the past twenty-five years. n271 The PTC has similarly led to increased production of renewable energy projects, and leaders in the industry opine that most such projects would not be built without the PTC program. n272  2. Promoting Permanency for Long-Term Investment

The LIHTC's success after becoming permanent supports the conclusion that permanent extension of tax credits can promote long-term investment in certain industries. n273 Both the LIHTC and the PTC, over the course of their legislative histories, have been subject to sunset provisions; unlike the PTC, which Congress continues to sunset, however, LIHTC was made permanent in 1993. n274 Those in the real estate development industry communicated the same need that those in the wind industry are communicating: certainty that the tax credit will exist is needed for long-term planning and investment. n275 Real estate developers began to make long-term plans more frequently once the LIHTC became permanent and certain. n276 In fact, the very rationale for making the LIHTC permanent was to accommodate the long-term investment interests of real estate developers. n277 A report from the House Committee on Ways and Means stated:

[T]he committee believes that a permanent extension of the low-income housing credit will provide the greater planning [\*1138] certainty needed for the efficient delivery of this Federal subsidy without sacrificing Congress's ability to exercise appropriate oversight of the administration of, and need for, programs such as the tax credit. n278

The committee addressed the need for better "planning certainty" to promote the efficiency of the credit to incentivize low-income housing. n279

Furthermore, corporate investors in low-income housing were rare before 1993, but when the program became permanent, more large-scale corporate investors began to utilize the credits. n280 Prior to 1992, most low-income projects raised equity through individual investors by way of broker-organized retail funds. n281 The permanency of the credit, however, attracted larger investors to the low-income housing market. n282

Congress renewed the LIHTC for one to three years at a time, the credit was less successful. n284 Since [\*1139] being made permanent, the total allocation has steadily increased without drastic spikes and drops. n285

Similarly, the PTC has experienced only halted and inconsistent progress due to its frequent sunset provisions. n286 Therefore, the PTC, unlike the LIHTC, has not had the opportunity to reach its full potential as a result of frequent sunset dates. n287 Production dropped during the expirations and the rate of growth has been inconsistent in the past six years. n288 To the extent that the PTC has increased renewable capacity in the United States, the "boom-and-bust" investment cycle that results from rushing projects prior to sunset dates actually harms the renewable energy industry. n289

Congress should therefore apply the same certainty and efficiency rationale to permanently extend the PTC in order to promote long-term investment. n290 The wind industry and development of renewable energy suffer from the uncertainty of the renewable tax credits due to the frequent expirations and need for renewals. n291 Furthermore, those in the renewable energy industry strongly advocate for a more permanent tax credit for planning purposes, like those in the low-income housing industry. n292

IV. THE SUNSETTING OF RENEWABLE ENERGY TAX CREDITS UNDERMINES THE GOALS OF THE TAX SYSTEM

The sunsetting feature of the PTC contravenes the underlying principles of the U.S. tax system. n293 The extensive use of sunsetting in the tax code and with respect to the PTC warrants a policy analysis. n294 This Part analyzes the frequent sunsetting of the PTC as a feature of the [\*1140] tax system within the framework of the three goals of a tax system: simplicity, equity, and economic efficiency. n295 Because budgetary manipulation and special interest involvement is the primary motivating factor of sunset provisions, the inefficiencies and complexities that these provisions create are not offset by any countervailing tax policy. n296

Analyses of tax proposals and policy, including renewable energy incentives, traditionally consider the following criteria: equity, simplicity, and efficiency. n297 Ideally, tax collection will be fair, simple to administer, and easy to understand. n298 Finally, tax collection should limit unintended distortions of the economy. n299

Creating a simple, easily understood tax system has been a public policy objective of legislators and courts for years. n300 Simplicity is typically evaluated based on the ease of taxpayer understanding and the costs of compliance. n301 Nonetheless, some scholars maintain that complexity is a necessary trade-off for achieving equity. n302 The equity analysis of tax collection falls into two categories, horizontal equity and vertical equity. n303 The former concerns equally situated taxpayers paying equal amounts of tax. n304 The latter concerns appropriate differences among taxpayers who are different. n305

[\*1141] Finally, economic efficiency measures the extent to which a tax interferes with economic behavior. n306 Taxes reduce economic efficiency to the extent that price distortion results. n307 Some scholars, however, ascribe to the "Pigouvian" theory, whereby the tax system can achieve economic efficiency by actually correcting market inefficiencies, such as positive and negative externalities. n308 As such, a higher level of economic efficiency is attained through the tax system than through imperfect, albeit natural, market activity. n309

A. Sunset Provisions Frustrate the Simplicity Goal of the Tax System

Sunset provisions make the **tax code more complex**, violating the simplicity goal, by increasing the **costs of compliance** and frustrating taxpayer **understanding**. n310 Non-seamless extensions and retroactive renewals further impose administrative costs in the form of reissued tax forms. n311 Also, the consistent threat of expiration creates transactional waste, as interest groups must lobby for extension to realize the benefits of the tax credit. n312 For instance, the American Wind Energy Association and other renewable energy companies frequently lobby for PTC renewal. n313 Furthermore, temporal gaps result from expired and then renewed sunsetting tax provisions, further complicating the code. n314 This has occurred with the PTC: the sunset provisions complicate the investment process for renewable energy because the credits are not certain until the project has been completed, such that additional care [\*1142] and expense must be taken to ensure to the degree possible that the project is placed in service prior to the sunset date. n315

Sunset provisions complicate the code as a result of the potential multifarious **amendments** to substantive provisions each time the credits must be renewed, which creates opportunities for changes in the economic incentives themselves. n316 The PTC, particularly, has been amended seven times in the past fifteen years for renewals alone. n317 Furthermore, no trade-off in enhanced equity accompanies this increased complication; in fact, the sunset provisions create inequity, as discussed in the following Section. n318

B. The Inequity of Sunset Provisions

Frequent sunsetting of the PTC also frustrates the vertical equity goal of the tax system. n319 Sunset dates and the consistent need for renewal introduce more opportunity for lobbying, which inequitably advantages those who have more lobbying resources. n320 Often, the requirement [\*1143] for renewal creates a battle between special interest groups due to the budgetary rules. n321 The pay-as-you-go (PAYGO) budgetary rules require that Congress match each increase to the deficit with a corresponding increase in revenue or decrease in deficit. n322 As such, each renewal of a sunsetted PTC must be matched with a corresponding elimination of tax credit/subsidy or an increase in tax revenue. n323 Therefore, different policies and special interests are often pitted against each other in this budgetary battle; frequently, the group with greater lobbying power prevails. n324 For example, with respect to the sunsetted PTC, the renewable industry must be prepared to increase lobbying efforts each time a renewal date approaches and often must compete against the fossil fuel industry in this endeavor. n325 In 2007, during an attempt to renew the PTC, the bill's sponsors recommended repealing subsidies to more established energy industries, such as oil and gas. n326 This prompted a strong backlash by the powerful supporters of the oil and gas industry, resulting in a failure to renew the PTC, despite increased lobbying efforts. n327 The inequitable treatment of the renewable energy industry with respect to tax benefits is also apparent through a budgetary analysis: the total cost of the production tax credit from 1994 to 2007 amounted to $ 2.7 billion and the amount of subsidies for fossil fuels in 2006 alone amounted to $ 49 billion. n328

This result is contrary to Lowi's theory that sunsetting legislation will weaken the power of special interest groups in the legislative process--instead, sunset dates enhance the role of special interest groups. n329 Lowi hypothesized that a periodic review would disrupt special interest group influence. n330 Sunsetting tax provisions in particular, however have [\*1144] introduced more special interest group influence. n331 One scholar writes of how the increased presence of special interests results in inequity:

Sunset provisions are problematic because they demand the expenditure of resources by interested parties on a continual basis (until, of course, the law is sunsetted). Thus, the well-connected and well-resourced players have a significant advantage, which increases across time, in the competition over sunsetted legislation. Indeed, the expansive use of sunset provisions may lead to more tax legislation that, from the outset, benefits such well-financed players, because legislators will want to engage those interest groups that contribute upon each sunset date. n332

The experience of the PTC is inconsistent with Lowi's theory of sunset dates. n333 The PTC's sunset dates increase special interest lobbying inequitably because the powerful oil and gas industries can divert more lobbying resources to win budgetary battles. n334 Therefore, sunset provisions violate the vertical equity principle by failing to make appropriate differences between taxpayers who are different; instead they inequitably favor those with more resources to the detriment of the renewable energy industry. n335

C. Economic Inefficiencies of Sunset Dates

Sunset provisions in the PTC also violate the tax goal of economic efficiency. n336 Again, the "Pigouvian" theory permits the tax system to fix market inefficiencies, and therefore a tax system may attain a higher level of economic efficiency than an imperfect, albeit natural, market. n337 One such inefficiency can be the failure of the market to correct for externalities or divergences between the private costs of an activity and the social costs of an economic activity. n338

[\*1145] The PTC, by incentivizing the production of renewable energy, promotes efficiency because of the uncorrected positive externalities in the renewable energy market and negative externalities of non-renewable energy. n339 The positive externalities of renewable energy production include cleaner, domestic energy sources for electricity, and increased job growth. n340 These social returns of renewable energy arguably dwarf the monetary returns of investment, because high costs and risks frustrate the profitability of renewable energy projects. n341 As such, the production tax credit achieves economic efficiency by "paying for" those positive externalities through a deduction in income tax liability. n342 Furthermore, pollution from non-renewable energy sources creates negative externalities because the negative social costs of environmental degradation diverge from the cost of production for such energy. n343 Therefore, incentivizing renewable energy through tax credits leads to a more efficient outcome by accounting for such positive and negative externalities and closing the divergence between these costs/benefits and the cost of production of renewable energy. n344

Sunset provisions, however, undermine this economic efficiency and decrease the potential social benefits attained by the PTC. n345 They frustrate these **market-correcting features** of the PTC, as they **discourage long-term investment** and therefore frustrate the **externality-correcting potential** of the tax credit. n346 Furthermore, the **price of renewable energy** will reflect this uncertainty, increasing the price and decreasing the efficiency-promoting function of the credit. n347 One expert writes:

[W]e can capture economic efficiency gains by permitting taxpayers to count on [the credit's] continued availability. . . . [The reflection of uncertainty in price] is a phenomenon [\*1146] clearly visible, for example, in the wind and solar power industries, which rely on a "temporary" tax subsidy for their existence. Industry participants, including suppliers like wind turbine manufacturers, are subject to violent swings of fortune as the fate of the subsidy periodically teeters: the result is that the industry is smaller, and its cost of capital is higher, than would be true if there were greater certainty in the program. n348

Thus, not only is the uncertainty of PTC availability transferred to the price of renewable energy, but also to the costs of capital and industry **manufacturing**. n349 Therefore, the credit's ability to account for positive externalities, and hence to promote economic efficiency, is offset by the increased uncertainty costs to a renewable project. n350

CONCLUSION

The permanent extension of the PTC is **necessary to promote** renewable energy in the United States and to achieve President Obama's goal of "reinventing" the nation's clean energy economy. The frequent expiration of the PTC through sunset provisions of the PTC, by contrast, **impedes these ends**. Congress rationalizes PTC sunset provisions on political gain and budgetary manipulation alone; they are not offset by any countervailing tax policy. In fact, sunset dates frustrate all fundamental goals of tax collection. The financial incentive of the PTC spurs investment in renewable energy, making it **cost-competitive** with non-renewable energy sources. Investors and those in the renewable energy industry, therefore, require certainty with regards to the PTC's continued existence. Without such certainty, renewable projects will be substantially reduced and the renewable industry as a whole harmed. The LIHTC serves as an important example of how permanency can positively affect the incentivizing feature of a tax credit. For the foregoing reasons, Congress should heed the renewable industry's recommendation to permanently extend the PTC in the interest of realizing the social and economic benefits of renewable energy.

**Federal action is needed to ensure investors.**

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B. State Climate Change Policies

Similarly, the states have taken the initiative in addressing climate change under a devolved federalist paradigm, implementing comprehensive and crosscutting programs as well as those narrowly focused on agriculture, transportation, education, and energy. As of 2006, more than forty states have developed comprehensive greenhouse gas inventories, twenty-eight have completed climate change action plans, and fourteen have mandated greenhouse gas emissions targets. n279 The most aggressive is New York, aiming for five percent below 1990 carbon dioxide emissions levels by 2010, followed by Connecticut, Illinois, Massachusetts, Maine, New Hampshire, New Jersey, Rhode Island, and Vermont, aiming for 1990 levels by 2010. n280 Motivated to encompass a broader geographic area, eliminate duplication of work, and create more uniform regulatory environments, many states have also established regional initiatives to fight climate change such as the Western Climate Initiative on the West Coast [\*461] and the Regional Greenhouse Gas Initiative (RGGI) on the East Coast. n281

California has also tried to forge ahead in adopting greenhouse gas standards for new cars, trucks, and vans.

Effective for the 2009 model year and later, rules proposed by the California Air Resources Board (CARB) will require manufacturers to reduce emissions of carbon dioxide and other greenhouse gases by 30 percent. The standards will apply to [\*463] automakers' fleet averages, rather than each individual vehicle, and automobile manufacturers are given the option of qualifying for credits through the use of alternative compliance strategies - such as the increased use of a [sic] less greenhouse gas intensive fuels ... in certain vehicles. n284

Under increased pressure from automobile manufacturers, the EPA is currently attempting to thwart California's effort on the grounds that the Clean Air Act already establishes stringent enough regulations. n285

Furthermore, Oregon, New Hampshire, Massachusetts, and Washington, call for regulation of carbon dioxide from electric power generators. Under the ... Washington law ... new power plants must offset twenty percent of their carbon dioxide emissions by planting trees, buying natural gas-powered buses or taking other steps to cure such emissions. n286

New Hampshire and Massachusetts laws apply to existing power plants, capping emissions and allowing plants to meet the standard through energy efficiency and credit trading. n287 In their assessment of worldwide action on climate change, David G. Victor, Joshua C. House, and Sarah Joy concluded that that the "fragmented "bottom-up' approach to carbon-trading ... is pragmatic and effective." n288 Despite these impressive strides and the claims put forth from Victor and his colleagues, however, local and regional efforts to combat climate change suffer from difficulties relating to design, fairness, and legality.

1. Design.

Like RPS programs, state climate change policies lack consistency and harmony. Most states attempt to promote research, ensure economic stability, and encourage public and private cooperation. However, they tend to place very little [\*464] emphasis on mandatory standards, and they fail to create **predictable regulatory environments**. In other words, United States policy has so far provided "lots of carrots but without any sticks." n289

True to the devolved federalism thesis that states will act as laboratories of democracy, states have demonstrated great variability in addressing climate change. The states have, in short, created a "flurry of sub-federal activity" on climate change. n290 Thomas D. Peterson identified "over 200 specific policy actions with [greenhouse gas] objectives [that] are under development or have been implemented by the states... ." n291 These actions range from appliance standards to alternative fuel mandates for the transportation sector, industrial process regulations, and farm conservation programs. n292 They "use a variety of voluntary and mandatory approaches," such as codes and standards, permits, technical assistance, procurement, information, and education. n293 They also span different greenhouse-gas-emitting sources. Some focus on power supply, while others focus on transportation, land use, and waste management. n294

Even those that focus solely on particular greenhouse-gas-emitting sources such as electricity generators differ greatly. Some state standards are input-based, enabling allowances to be "auctioned to individual generators based on historical emissions or fuel input." n295 Some are load-based, allowing utilities to achieve carbon credits not from historical emissions or projections, but from real-time generation. Others are offset-based, enabling carbon-reducing actions such as the planting of trees to count. n296 Still others are set-aside-based, counting allowances retired by customers in the voluntary market through green power programs. n297

Such variability and experimentation, however, is becoming a weakness. The multitude of state greenhouse gas policies is more costly than a single, federal standard because it **creates complexity for investors**. State-by-state standards significantly increase the cost [\*465] for those attempting to conduct business in multi-state regions. n298 Statewide implementation programs also require separate inventory, monitoring, and implementation mechanisms to check progress against goals and provide feedback, adding to their cost. n299 And state programs provide incentives for local and regional actors to duplicate their research-and-development efforts on carbon-saving building technologies and energy systems, compromising efficiency. n300 Lack of a "**meaningful federal policy** on greenhouse gas emissions [also means that] investors in long-term energy assets such as power plants (the single greatest emitters of carbon dioxide) must make multibillion-dollar commitments without knowing what regulatory regime may exist in the future." n301

2. Free-riding and leakage.

State-by-state action on climate change is prone to the "free rider" phenomenon. A very high "political hurdle" exists for state-level action on climate change, mainly "because [greenhouse gases] mix globally and have global impacts, local abatement actions pose local costs, yet deliver essentially no local climate benefits." n302 Utilities operating in a region that includes states with mandatory emissions regulations and those without have an extra incentive to build new power plants only in those without. For example, PacifiCorp, a utility serving customers in the Pacific Northwest, has repeatedly attempted to build coal-fired power plants in Wyoming and Utah, states without mandatory greenhouse gas reduction targets, but not in Oregon (which has mandated a stabilization of greenhouse gas emissions by 2010) and Washington (which has mandated 1990 levels by 2020). n303 The state-by-state patchwork of climate change policies, in other words, allows stakeholders to manipulate the existing market to their advantage.

This is exactly what is happening in RGGI. RGGI is a carbon cap-and-trade program where fossil fuel plants are allotted a [\*466] certain number of allowances that permit emission of greenhouse gases. These allowances are based on the plant's historical emissions or the input of fuel needed to generate every unit of electricity, making it an "input-or generator-based" scheme. n304 Power plants that need more allowances than they are given must purchase them from another plant that has an excess number, retrofit old equipment, sequester carbon geologically or in algae, or purchase offsets. Offsets come in five categories: landfill methane capture, reductions of sulfur hexafluoride emissions, carbon sequestration due to reforestation or afforestation, reduction of fossil fuel use due to improved energy efficiency, and avoidance of methane emissions from agricultural manure management. n305 Over time, the total number of allowances is decreased, making it harder for generators to pollute. The design of the program, however, creates perverse incentives for generators to lower emissions by purchasing energy from fossil fuel plants in neighboring states that do not have carbon restrictions. Estimates for RGGI have shown leakage rates as high as sixty to ninety percent due to the importation of electricity alone, as power plants in adjacent states have increased their output to sell into the higher-priced electricity markets in RGGI states. n306 Since carbon emitted into the atmosphere has the same warming potential regardless of its geographic source, such gaming of the system does not result in meaningful carbon reductions.

Localized climate action also sends **distorted price signals**. By lowering demand for carbon-intense products, state standards reduce the regional (and even global) price for carbon-intense fuels. But in doing so, they provide further incentives for nearby states without climate regulation to do nothing because of lowered prices. n307 Put another way, states acting on climate change depress the cost of fossil fuels and other carbon-intense commodities by lowering demand for them, and thus lowering their price. Yet reduced prices encourage over-consumption in areas without [\*467] carbon caps, decrease the incentive to enact energy efficiency and conservation measures, and discourage the adoption of alternative fuels for vehicles and renewable energy technologies. After assessing state and local climate change programs, for example, Robert B. McKinstry, Jr. noted that without coordinated action, "reduction in demand for fossil fuel in the industrial sector may keep prices down and encourage growth in the transportation sector. Similarly, in the short run, reductions required in one state may benefit competitors operating in states that do not require reductions." n308

The danger of this free riding and leakage is threefold. Most obviously, it undermines the environmental effectiveness of any restrictions on greenhouse gas emissions, and if leakage exceeds 100 percent (something possible given the experiences with RGGI), net emissions of greenhouse gases could hypothetically **increase**. n309 Even if physical leakage does not occur, the fear of leakage and its adverse effects on economic competitiveness may create political obstacles to meaningful climate change action. n310 Finally, leakage has a tendency to lock in asymmetries between carbon-intensive and climate-friendly regions and commit nonparticipants to a path of future emissions. As leakage proceeds over time, it shifts greenhouse gas emissions from regulated regions to unregulated ones. It thereby renders the unregulated region's economy more emissions-intensive than it otherwise would have been, making it more difficult to persuade communities that initially decided to avoid participation ever to commit to greenhouse gas reductions. n311

3. Legality.

As is the case with state RPSs, state action on climate change risks constitutional challenge under the Compacts Clause of the constitution (states are not permitted to form compacts with each other) and the Supremacy Clause (federal regulation preempts contradicting state law). n312 The Clean Air Act expressly prohibits [\*468] state regulation of vehicle emissions standards. n313 Likewise, by mandating national corporate fuel economy standards, the federal government preempts state regulations related to the efficiency of automobiles. This means that most states are unable to legally address carbon emissions from the transportation sector (thus the current battle between California and the EPA). n314

4. Insufficiency.

Finally, even the most aggressive climate statutes will make only a negligible contribution to offsetting greenhouse gas emissions. In the Northeast, states with mandatory greenhouse gas regulations all rank relatively low in greenhouse gas emissions, with the exceptions of New York and New Jersey (which rank ninth and seventeenth respectively). According to the EIA, by 2030, total energy-related carbon dioxide emissions in the United States will equal approximately 8.115 billion metric tons per year, equal to a sixty-two percent increase from 1990 levels with an average increase of 1.2 percent per year. n315 "Yet those states that had committed to achieving time-bounded, quantitative reduction targets for greenhouse gas emissions as of 2006 accounted for only around twenty percent of nationwide emissions in 2001." n316 Even if all attained their targets, which is not certain, state policies would result in a reduction of around just 460 million metric tons of carbon dioxide by 2020, or a reduction of 6.38 percent compared to business as usual. Furthermore, the other states would not just offset these gains; the overall growth rate still would increase at 1.06 percent each year. n317

[\*469] A few examples help prove this point. If Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee were considered a country, it would rank fifth in the world for greenhouse gas emissions, ahead of even India and Germany - yet none of these states have mandatory greenhouse gas targets. n318 Similarly, on the West Coast, most states emit more greenhouse gases than a majority of countries on the planet: California exceeds the emissions of 211 nations; Arizona and Colorado, 174 nations each; Oregon, 151 nations; and Idaho, 129 nations. n319 The scale of the challenge is enormous, and as Scott Segal from the Electric Reliability Coordinating Council put it, "the notion that any one state or group of states could make a material contribution to solving the problem [of global climate change] is **farcical**." n320

Local and state efforts to address climate change are also inadequate in a second sense: they do nothing to significantly reduce ambient levels of carbon dioxide. Jonathan B. Wiener argues that no single city, state, or region can effectively control ambient levels of carbon dioxide and other greenhouse gases on its own. n321 Ambient concentrations of carbon dioxide are determined only by worldwide concentrations in the atmosphere. Wiener concludes that the nature of greenhouse gas emissions demonstrates why attempts to regulate carbon dioxide as a pollutant under the National Ambient Air Quality Standards and State Implementation Plans of sections 109 and 110 of the Clean Air Act will face immense challenges. **No state mechanism**, in isolation, could attain serious reductions in the ambient level of CO2 without significant international cooperation. n322

As a result, state-by-state reductions do not lower emissions quickly enough nor do they reduce ambient levels of carbon dioxide. They "are nowhere near the magnitude of reductions needed to bring the United States into compliance with the Kyoto Protocol's call for reductions of five percent below 1990 levels from 2008 to 2012 - much less the reductions needed to avert [\*470] "dangerous anthropogenic interference with the climate system.'" n323

V. Part Four: The Case for Federal Interaction

The above examples with state-based RPS and climate change policies demonstrate that there are situations in which federal interaction is desirable, or even essential, to avoid many of the shortcomings presented by centralized, devolved, and dual federalist attempts to protect the environment. As a rule of environmental policy, such examples seem to suggest that the prevalence of four distinct conditions warrant federal interaction.

First, general agreement must exist on the magnitude of the environmental problem, and existing state actions must be insufficient to prevent it. n324 Unless the worst offenders can be persuaded to join them, state and regional attempts to improve the environment, particularly when they are voluntary, will do little to substantially enhance environmental quality. As the previous section on renewable energy and climate change demonstrates, this is **especially the case** concerning renewable energy (which will grow to only four percent of national capacity by 2030 under state initiatives) and greenhouse gases (where state action will do nothing to slow, let alone equalize or reverse, emissions).

Second, the states must face constitutional challenges to dealing with the problem individually. Innovative state programs dealing with interstate spillovers will always face challenges alleging that they interfere with interstate commerce under the dormant commerce clause. Moreover, attempts to forge interstate and international cooperation face legal questions based upon the Compacts Clause and the Supremacy Clause of the Constitution. For these reasons, federal interaction is needed to remove the underlying tensions between state-by-state environmental action and the United States Constitution.

Third, the existing state regulatory environment must impose additional costs on businesses and consumers. Differing state statutes can complicate efforts to conduct business in multiple states. They risk creating incentives for multiple firms to duplicate costly research and development. And they can significantly increase transaction costs associated with enforcing and [\*471] monitoring a plethora of distinct individual programs. Federal interaction can provide investors with a level of **simplicity and clarity** needed to facilitate sound decisions. n325 Redundant and overlapping state regulation can **lead to confusion**, high compliance costs, and a drag on otherwise beneficial activities. A multiplicity of regulators that do not match well with an underlying social ill can lead to a regulatory commons problem, where neither potential regulators nor those desiring regulation know where to turn. n326

Fourth, the matching principle must illustrate that the proper scale in addressing the problem is national or international, not local. When problems are national or international in scale, the matching principle in environmental law suggests that the level of jurisdictional authority should best "match" the geographic scale of that very problem. n327 The current state-by-state approach ensures that the distribution of the costs and benefits of providing public goods remains **uneven and asymmetrical**. n328 Generally, it is more efficient and effective to address national or international environmental problems through **institutions of equivalent scope** of the problem in question. The matching principle ensures that "ecologies of scale" are created so that environmental degradation or pollution extending beyond individual state borders can be addressed. n329 When interstate spillovers or public goods are involved, federal intervention is needed to equalize disparities between upstream and downstream communities. n330

[\*472] The **historical support** for federal interaction based on these four conditions seems strong. Examples of areas where state action made the way for an eventual federal statute include air quality, low emissions vehicles, hazardous waste, water quality, land reclamation, energy efficiency, acid rain, mercury emissions, and wetlands development. When Congress wants uniformity but still wants to enable the states to experiment, it can allow for the development of a single standard met by all of the states themselves, but should set a "floor" instead of a "ceiling." Federal floors allow for greater state stringency, as well as diversity and creativity in implementing federal regulatory standards. Especially in the setting of environmental regulation, with its developed delegated program structure, the process of setting federal floors can achieve many of the benefits of both devolution and centralization at once. n331

Congress did something similar with the Clean Air Act of 1965, which allowed California to establish air pollution emission standards for vehicles. All other states were given the opportunity to adopt California's standards or remain subject to the federal standards developed by the Environmental Protection Agency. n332 Similarly, California implemented its Low Emission Vehicle Standards (Cal LEV) in the 1990s, well before a national standard. n333 California mandated that the state phase in four categories of progressively lower-emitting vehicles. The automobile industry reacted negatively, fearing the spread of California's stringent standards. The federal government brokered a compromise in which the industry produced automobiles meeting nationally uniform standards that were less stringent than California's but more stringent than the existing ones. The states were free to adopt nationally low emission vehicles (NLEV) or Cal LEV, but not both. n334

**The free market fails to correct market imperfections.**

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Reality, part II: trouble in the market

But carbon pricing doesn't merely face political problems. "Market-driven solutions" like cap-and-trade are also subject to myriad market **inefficiencies** and **inelasticity’s**. Max highlights a few of these, but the fact is, these troublesome dynamics are everywhere. A wide variety of factors, of which price is one, influence people's decision making about how much energy they'll consume, or what sort of car, factory, or power plant they want to buy - so in most cases, simply nudging the prices in play **isn't enough**.

Generally, the phenomena I'm referring to are known as "**market failures**" - situations where, for one reason or another, people or firms don't make decisions that would be a net positive for society - or even for their own pocketbooks. These are extremely common in the areas near and dear to energy policymakers' hearts. After all (to cite one example), if people made decisions based simply on overall cost vs. benefit, then every house in America would already be outfitted with a solar water heater and decent insulation - measures that are already profitable for both individual actors and society at large, even without a carbon price. Or consider the serious dearth of energy research - total basic energy R&D in the U.S. is less than the R&D budget of one biotech company.

Market failures like these have a million causes, which perhaps explains why most cap-and-trade advocates tend to avoid talking about them beyond a generic "the government should fix them." However, not only do carbon-price proposals generally not seek to "fix them," but these failures are far more widespread than most admit.

Take electricity production, for example. As a recent article on this subject opined, "Ultimately, the belief that prices alone will solve the climate problem is **rooted in the fiction** that investors in large-scale and long-lived energy infrastructures sit on a fencewaiting for higher carbon prices to tip their decisions." Investors in power plants aren't likely to choose clean options (cogeneration, renewables, even natural gas) if there's **uncertainty** over the future price of carbon, or over the lifetime emissions of a proposed project. Moreover, insufficient **public infrastructure** (like transmission lines) and **human capital** (solar installers, wind turbine technicians) often obstruct clean energy development.

There's also pervasive inelasticity’s in the areas that carbon pricing targets. As I alluded to before, heating and transportation - which together account for over half of American emissions - have really inelastic demand, meaning that big price hikes don't translate to big changes in behavior. People drive and heat their homes because they have to, not because it's affordable.

Some of these dynamics (e.g., inelasticity) can't be changed through policy, making a carbon price somewhat irrelevant in those instances. But most market failures can. However, if legislation doesn't address a fair few of them (and I'm not aware of an existing carbon price proposal that does), then the impact of a carbon price could be seriously compromised. Were the levels of CO2 pricing currently being thrown around in legislative proposals (low double digits per ton) to be implemented directly, via a carbon tax or cap-and-trade "safety valve" mechanism, we might achieve the worst of both worlds - real financial costs to consumers, but little change in emissions. On the other hand, if the government stood firmly by the principles of cap-and-trade, limited overall emissions, and allowed the market to set its carbon price autonomously, the presence of failures would drive the price up higher and higher, bringing us back to a tricky political problem likely to result in the weakening of the regime.

Market failures don't invalidate the idea of carbon pricing per se - any energy policy will have to take them on. However, they do demonstrate that it would be unwise to focus excessively on pricing as a panacea. Max writes, "The government should stick to targets and let the market figure out how to achieve them. Government action should be targeted to address specific market failures." But when you consider the vast array of dynamics (including, but not limited to, classical market failures) that conspire to limit the impact of a carbon price, it becomes clear that a wide variety of government interventions will be necessary, and not simply a quick fix tacked on here and there. And if these interventions aren't made, as I discussed above, big problems materialize.

The alternative

Pursuing a cap-and-trade-led regime today would entail taking a massive political risk. The payoff, were it to materialize, would be a complicated regulatory regime, one whose efficacy would require costs far above the realm of the politically possible - making it an instant non-starter.

You'll forgive me for being underwhelmed.

Max is right to point out that the challenge we aim to tackle is vast, and we're going to need all the tools we can get to take it on. Would an ideally administered, quickly implemented, high carbon price (supported by various complementary policies) be a good tool to have? Sure. But debating idealized policies doesn't help anything. In the real world, the American polity and the American market are not ready for a tough carbon price. With this in mind, the proper response is not to continue to advocate an unimplementable strategy. Instead, we believe that the best way to respond to the climate challenge right now is to **massively expand** the role of the federal government in researching, developing, and deploying clean technology.

Unlike cap-and-trade, such a strategy is politically feasible; Americans are eager for an energy initiative based not on limits and regulation, but on large-scale investment and a public push for energy independence. With energy prices at the top of Americans' concerns, a policy focused on providing new, clean and affordable energy sources - rather than pricing our way to greenhouse gas emissions reductions - would stand on significantly stronger political footing.

And importantly, this strategy isn't a simple compromise, or a capitulation to the prevailing political winds. Government action can spark real change - and in fact, it always has. Stepping up public involvement to such a degree is often dismissed as "picking winners" - substituting the imperfect expertise of the government for the invisible hand of the market. However, leaving the very real imperfections of the market (not to mention every extant cap-and-trade proposal) aside, **history** indicates that the government can and almost always does play a key role in technological transition. From R&D support for civil aviation, lasers, and software to the demonstration and deployment of technologies like computer networks and modern wind turbines, direct public intervention has been essential over the past century - in every step of the development process, not simply basic research.

(As an aside: it's interesting that Max brings up the PC revolution in this context. While the U.S. government might not have subsidized the IBM 5150 (as Max dryly observes), it actually did buy copious amounts of early microchips, leading to a precipitous decline in per-unit cost and fueling the development of today's semiconductor and personal computer industries. Government deployment strategy at work!)

It's time to embrace the role the government can play. There's no doubt that a government-led investment strategy comes with many problems of its own. We are aware, for example, that public investment and continuing subsidies have all too effectively created mature fossil fuel and corn ethanol industries. But a well-designed, investment-centered policy - a policy that mobilizes public and private capital through direct funding and indirect incentives, addresses pervasive market failures, and inspires Americans to help create our new energy future - has the potential to be truly transformative. We're still working through the details of what such a policy looks like, and we'd love the help of other policy and political minds. But for now, given the circumstances of our time and the nature of the challenge we face, we're confident that this is the direction to choose.

## \*\*\* 2AC

**2AC—T**

**We meet US code.**

**US Code 12 (**42 USCS § 16491, TITLE 42. THE PUBLIC HEALTH AND WELFARE CHAPTER 149. NATIONAL ENERGY POLICY AND PROGRAMS MISCELLANEOUS \*\*\* Current through PL 112-128, approved 6/5/12 \*\*\*, US Code Service. Lexis)

§ 16491. Energy production incentives

(a) In general. A State may provide to any entity--

(1) a **credit against** any tax or fee owed to the State under a State law, or

(2) any other tax incentive, determined by the State to be appropriate, in the amount calculated under and in accordance with a formula determined by the State, for **production** described in subsection (b) in the State by the entity that receives such credit or such incentive.

(b) Eligible entities. Subsection (a) shall apply with respect to the production in the State of electricity from coal mined in the State and used in a facility, if such production meets all applicable Federal and State laws and if such facility uses scrubbers or other forms of clean coal technology.

(c) Effect on interstate commerce. Any action taken by a State in accordance with this section with respect to a tax or fee payable, or incentive applicable, for any period beginning after the date of the enactment of this Act [enacted Aug. 8, 2005] shall--

(1) be considered to be a reasonable regulation of commerce; and

(2) not be considered to impose an undue burden on interstate commerce or to otherwise impair, restrain, or discriminate, against interstate commerce.

HISTORY: (Aug. 8, 2005, P.L. 109-58, Title XIV, Subtitle A, § 1402, 119 Stat. 1061.)

**Counter interpretation – the DESIRE list.**

**DESIRE 12** (Database of State Incentives for Renewables and Efficiency, DSIRE Clickable Incentives and Efficiency Map, <http://www.mrsolar.com/content/dsire.php#.UBAIwrRCapW>)

What types of renewable energy incentives does DSIRE track?

The DSIRE project tracks information on state, utility, local, and selected federal incentives that promote the use of renewable energy technologies. For more information on federal incentives, see What federal incentives does DSIRE track. On the DSIRE website, incentives are grouped into two categories as follows:

(1) **Financial Incentives**: **tax incentives**, grants, loans, rebates, industry recruitment, bond programs, and production incentives.

(2) Rules, Regulations, & Policies: public benefits funds, renewables portfolio standards, net metering, interconnection, extension analysis, generation disclosure, contractor licensing, equipment certification, solar/wind access laws, and construction & design standards (including building energy codes and energy standards for public buildings), required utility green power options, and green power purchasing/aggregation policies.

**Increase means to extend in duration**

**Words and Phrases 76** (Words and Phrases Cumulative Supplementary Pamphlet, Volume 20A, 07, 76)

Increase: A durational modification of child support is as much an “increase” as a monetary modification. State ex rel. Jarvela v. Burke, 678 N.W.2d 68.15.

**Prefer our interpretation –**

**Core of the topic. Most precise.**

**Gouchoe 2k** (Susan, North Carolina State University, National Renewable Energy Laboratory, December 2000, Local Government and Community Programs and Incentives for Renewable Energy— National Report, <http://seg.fsu.edu/Library/casestudy%20of%20incentives.pdf>)

DSIRE Project Overview

The Database of State Incentives for Renewable Energy (DSIRE) serves as the nation’s **most¶ comprehensive** source of information on the status of programs and incentives for renewable¶ energy. The database tracks these programs at the state, utility, local, and community level.¶ Established in 1995, DSIRE is an ongoing project of the Interstate Renewable Energy Council¶ (IREC) and is managed by the North Carolina Solar Center with funding from the U.S.¶ Department of Energy’s Office of Power Technologies.

The first three phases of the DSIRE project—surveys of state financial incentives, state¶ regulatory policies, and utility programs and incentives—have been completed. Information¶ from these databases has been published in three previous reports:

National Summary Report on State Financial Incentives for Renewable Energy (1997);

National Summary Report on State Programs and Regulatory Policies for Renewable Energy

(1998); and

National Summary Report on Utility Programs and Incentives for Renewable Energy (1999).¶ These reports summarize incentives, programs, and policies that promote active and passive¶ solar, photovoltaics, wind, biomass, alternative fuels, geothermal, hydropower, and waste¶ energy sources. Given the rapidly changing status of state activities, an updated report—¶ National Summary Report on State Financial and Regulatory Incentives for Renewable¶ Energy—has been produced concurrently with this report on local initiatives.¶ While reports serve as a snapshot of the status of incentives and programs, **constant revisions**¶ and additions to the database maintain DSIRE’s role as the **most up-to-date**, national¶ **clearinghouse** of information on incentives and programs for renewable energy. Through¶ DSIRE on Line, the DSIRE database is accessible via the web at:¶ http://www.ncsc.ncsu.edu/dsire.htm. In 2001, federal incentives will be added to the database,¶ thereby providing a **complete** and **comprehensive** database of renewable energy incentives at¶ all levels—national, state, and local.

IREC is a **nonprofit** consortium of state and local government renewable energy officials and¶ is **uniquely situated** to oversee the effort to compile information on state, local, and utility¶ incentives. IREC ensures that all information products produced are disseminated widely to¶ federal, state and local agencies, federal laboratories, and other appropriate audiences.¶ The primary subcontractor to IREC for the DSIRE project is the North Carolina Solar Center.¶ Established in 1988, the Solar Center is located in the College of Engineering at North¶ Carolina State University in Raleigh, NC and is sponsored by the State Energy Office in the¶ North Carolina Department of Administration. The Solar Center conducts programs in four¶ areas: policy analysis, research and commercialization, technical assistance and training, and¶ education and outreach.

### 2AC—Economy

**Economy low now.**

**NYT 1/30**/13 ["U.S. Growth Halted as Federal Spending Fell in 4th Quarter," 1-30, http://www.nytimes.com/2013/01/31/business/economy/us-economy-unexpectedly-contracted-in-fourth-quarter.html?\_r=0]

Disappointing data released Wednesday underscore how tighter fiscal policy may continue to weigh on growth in the future as government spending, which increased steadily in recent decades and expanded hugely during the recession, plays a diminished role in the United States economy. Significant federal spending cuts are scheduled to take effect March 1, and most Americans are also now paying higher payroll taxes with the expiration of a temporary cut in early January. The economy contracted at an annual rate of 0.1 percent in the last three months of 2012, the worst quarter since the economy crawled out of the last recession, hampered by the lower military spending, fewer exports and smaller business stockpiles, preliminary government figures indicated on Wednesday. The Fed, in a separate appraisal, said economic activity “paused in recent months.”

**Manufacturing low now.**

**Belz** **1/13**/13Adam. “Report shows U.S. manufacturers continue to lag,” Minneapolis Star Tribune, http://www.startribune.com/business/186574671.html?refer=y.

American manufacturing is still falling behind its foreign competitors.

The nation's overall trade deficit widened by 16 percent in November as foreign imports of consumer goods outpaced domestic sales. And U.S. industry is losing ground at home to overseas businesses in advanced manufacturing, the making of high-value goods that has been touted as key to the future of the American economy, according to a report from the U.S. Business and Industry Council.

"Contrary to widespread optimism about an American industrial renaissance, domestic manufacturing's highest-value sectors keep falling behind foreign-based rivals," the report's author, Alan Tonelson, wrote.

Amid hopes that American manufacturers are bringing jobs back to U.S. soil as the economy recovers from the recession, Tonelson's report is a cold shot of realism.

He analyzed 106 high-tech and capital-intensive manufacturing sectors from the Census Bureau's Annual Survey of Manufacturers and found that imports accounted for 37.5 percent of the $2 trillion in high-value manufactured goods sold in the United States in 2011, a larger share than 2010.

Early indicators show foreign imports likely took a larger share of the market in 2012, the report said. U.S.-based manufacturers have gained market share against foreign competition in only eight of the more than 100 categories since 1997.

It's not that manufacturers aren't thriving. Companies that survived the recession snapped back quickly, with total U.S. manufacturing output rising 19 percent between 2009 and 2011, to $1.8 trillion. Minnesota manufacturing output rose 25 percent over the same period.

But overseas industry continues to win a larger share of the U.S. market, one reason manufacturing has failed to put together sustained job gains. In Minnesota, manufacturer hiring grew steadily in the first half of 2012 and then stalled, declining more than 2 percent between July and November, according to state job data.

"I think there is some level of [reshoring], but I don't think it's as big as the hype says it is," said Paul Skehan, director of operations for BTW Inc., a Coon Rapids firm that makes various electronics parts for other manufacturers.

BTW has grown 15 to 20 percent each of the past three years. But 90 percent of the firm's customers have no plans to bring jobs back to the United States, Skehan said. Those companies who do move production to the United States are building goods that are time-sensitive or don't fit efficiently into a shipping container.

When it comes to high-volume products that account for a huge share of the manufactured goods sold in the United States, including consumer goods, the economics of offshoring are tough to resist.

"When they're over $100 million, companies are being forced more and more to send stuff overseas," Skehan said.

In November, the U.S. trade deficit grew 16 percent from $42.1 billion to $48.7 billion, the Commerce Department said Friday.

Nationally, goods for which imports account for more than half of U.S. sales are construction equipment, electricity measuring and test equipment, turbines and turbine generator sets, metal-cutting machine tools, mining machinery and equipment, industrial process controls, and broadcast and wireless communications equipment.

Minnesota's strongest manufacturing is in computer and related electronics products, machinery and fabricated metal products. These are sectors where imports have taken a larger share of the U.S. market in recent years, Tonelson said.

Mark Thomas, CEO of Victoria-based HEI Inc., said some reshoring has occurred as Asian companies facing an improved economy dump smaller contracts.

Companies that want long-term relationships with suppliers, low inventory, design flexibility and attention to quality will pay for goods made in the United States. But those business relationships are rare and confined largely to specialty goods that command top dollar. For instance, HEI makes complex microelectronics for hearing aids, medical devices and military radios, among other things, at locations in Minnesota, Colorado and Arizona.

Even in those special cases, Thomas said, the return of manufacturing jobs to the U.S. is more exception than rule.

"We have not seen a significant amount of reshoring," Thomas said. "I think there's an element of wishful thinking."

### 2AC--Warming

#### And, action now can reverse warming

Peters, et al December 12 [Peer Reviewed Journal, Glen, Center for International Climate and Environmental Research – Oslo (CICERO) The challenge to keep global warming below 2 [deg]C, Glen P. Peters, Robbie M. Andrew, Tom Boden, Josep G. Canadell, Philippe Ciais, Corinne Le Quéré, Nature Climate Change, <http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html>]

On-going climate negotiations have recognized a “significant gap” between the current trajectory of global greenhouse-gas emissions and the “likely chance of holding the increase in global average temperature below 2 °C or 1.5 °C above pre-industrial levels”[1](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref1). Here we compare recent trends in carbon dioxide (CO2) emissions from fossil-fuel combustion, cement production and gas flaring with the primary emission scenarios used by the Intergovernmental Panel on Climate Change (IPCC). Carbon dioxide emissions are the largest contributor to long-term climate change and thus provide a good baseline to assess progress and examine consequences. We find that current emission trends continue to track scenarios that lead to the highest temperature increases. Further delay in global mitigation makes it increasingly difficult to stay below 2 °C. Long-term emissions scenarios are designed to represent a range of plausible emission trajectories as input for climate change research[2](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref2), [3](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref3). The IPCC process has resulted in four generations of emissions scenarios[2](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref2): Scientific Assessment 1990 (SA90)[4](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref4), IPCC Scenarios 1992 (IS92)[5](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref5), Special Report on Emissions Scenarios (SRES)[6](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref6), and the evolving Representative Concentration Pathways (RCPs)[7](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref7) to be used in the upcoming IPCC Fifth Assessment Report. The RCPs were developed by the research community as a new, parallel process of scenario development, whereby climate models are run using the RCPs while simultaneously socioeconomic and emission scenarios are developed that span the range of the RCPs and beyond[2](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref2). It is important to regularly re-assess the relevance of emissions scenarios in light of changing global circumstances[3](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref3), [8](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref8). In the past, decadal trends in CO2 emissions have responded slowly to changes in the underlying emission drivers because of inertia and path dependence in technical, social and political systems[9](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref9). Inertia and path dependence are unlikely to be affected by short-term fluctuations[2](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref2), [3](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref3), [9](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref9) — such as financial crises[10](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref10) — and it is probable that emissions will continue to rise for a period even after global mitigation has started[11](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref11). Thermal inertia and vertical mixing in the ocean, also delay the temperature response to CO2 emissions[12](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref12). Because of inertia, path dependence and changing global circumstances, there is value in comparing observed decadal emission trends with emission scenarios to help inform the prospect of different futures being realized, explore the feasibility of desired changes in the current emission trajectory and help to identify whether new scenarios may be needed. Global CO2 emissions have increased from 6.1±0.3 Pg C in 1990 to 9.5±0.5 Pg C in 2011 (3% over 2010), with average annual growth rates of 1.9% per year in the 1980s, 1.0% per year in the 1990s, and 3.1% per year since 2000. We estimate that emissions in 2012 will be 9.7±0.5 Pg C or 2.6% above 2011 (range of 1.9–3.5%) and 58% greater than 1990 ([Supplementary Information](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#supplementary-information) and ref. [13](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref13)). The observed growth rates are at the top end of all four generations of emissions scenarios ([Figs 1](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f1) and [2](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f2)). Of the previous illustrative IPCC scenarios, only IS92-E, IS92-F and SRES A1B exceed the observed emissions ([Fig. 1](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f1)) or their rates of growth ([Fig. 2](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f2)), with RCP8.5 lower but within uncertainty bounds of observed emissions. Figure 1: Estimated CO2 emissions over the past three decades compared with the IS92, SRES and the RCPs. The SA90 data are not shown, but the most relevant (SA90-A) is similar to IS92-A and IS92-F. The uncertainty in historical emissions is ±5% (one standard deviation). Scenario data is generally reported at decadal intervals and we use linear interpolation for intermediate years. [Full size image (386 KB)](http://www.nature.com/nclimate/journal/v3/n1/fig_tab/nclimate1783_F1.html) [Figures index](http://www.nature.com/nclimate/journal/v3/n1/fig_tab/nclimate1783_ft.html) [Next](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f2) Figure 2: Growth rates of historical and scenario CO2 emissions. The average annual growth rates of the historical emission estimates (black crosses) and the emission scenarios for the time periods of overlaps (shown on the horizontal axis). The growth rates are more comparable for the longer time intervals considered (in order: SA90, 27 years; IS92, 22 years; SRES, 12 years; and RCPs, 7 years). The short-term growth rates of the scenarios do not necessarily reflect the long-term emission pathway (for example, A1B has a high initial growth rate compared with its long-term behaviour and RCP3PD has a higher growth rate until 2010 compared with RCP4.5 and RCP6). For the SRES, we represent the illustrative scenario for each family (filled circles) and each of the contributing model scenarios (open circles). The scenarios generally report emissions at intervals of 10 years or more and we interpolated linearly to 2012; a sensitivity analysis shows a linear interpolation is robust ([Supplementary Fig. S14](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#supplementary-information)). [Full size image (112 KB)](http://www.nature.com/nclimate/journal/v3/n1/fig_tab/nclimate1783_F2.html) [Previous](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f1) [Figures index](http://www.nature.com/nclimate/journal/v3/n1/fig_tab/nclimate1783_ft.html) Observed emission trends are in line with SA90-A, IS92-E and IS92-F, SRES A1FI, A1B and A2, and RCP8.5 ([Fig. 2](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f2)). The SRES scenarios A1FI and A2 and RCP8.5 lead to the highest temperature projections among the scenarios, with a mean temperature increase of 4.2–5.0 °C in 2100 (range of 3.5–6.2 °C)[14](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref14), whereas the SRES A1B scenario has decreasing emissions after 2050 leading to a lower temperature increase of 3.5 °C (range 2.9–4.4°C)[14](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref14). Earlier research has noted that observed emissions have tracked the upper SRES scenarios[15](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref15), [16](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref16) and [Fig. 1](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f1) confirms this for all four scenario generations. This indicates that the space of possible pathways could be extended above the top-end scenarios to accommodate the possibility of even higher emission rates in the future. The new RCPs are particularly relevant because, in contrast to the earlier scenarios, mitigation efforts consistent with long-term policy objectives are included among the pathways[2](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref2). RCP3-PD (peak and decline in concentration) leads to a mean temperature increase of 1.5 °C in 2100 (range of 1.3–1.9 °C)[14](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html" \l "ref14" \o "Rogelj, J., Meinshausen, M. & Knutti, R. Nature Clim. Change 2, 248-253 (2012).). RCP3–PD requires net negative emissions (for example, bioenergy with carbon capture and storage) from 2070, but some scenarios suggest it is possible to stay below 2 °C without negative emissions[17](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref17), [18](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref18), [19](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref19). RCP4.5 and RCP6 — which lie between RCP3–PD and RCP8.5 in the longer term — lead to a mean temperature increase of 2.4 °C (range of 1.0–3.0 °C) and 3.0 °C (range of 2.6–3.7 °C) in 2100, respectively[14](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref14). For RCP4.5, RCP6 and RCP8.5, temperatures will continue to increase after 2100 due to on-going emissions[14](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref14) and inertia in the climate system[12](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref12). Current emissions are tracking slightly above RCP8.5, and given the growing gap between the other RCPs ([Fig. 1](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#f1)), significant emission reductions are needed by 2020 to keep 2 °C as a feasible goal[18](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref18), [19](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref19), [20](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref20). To follow an emission trend that can keep the temperature increase below 2 °C (RCP3-PD) requires sustained global CO2 mitigation rates of around 3% per year, if global emissions peak before 2020[11](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref11), [19](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref19). A delay in starting mitigation activities will lead to higher mitigation rates[11](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref11), higher costs[21](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref21), [22](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref22), and the target of remaining below 2 °C may become unfeasible[18](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref18), [20](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref20). If participation is low, then higher rates of mitigation are needed in individual countries, and this may even increase mitigation costs for all countries[22](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref22). Many of these rates assume that negative emissions will be possible and affordable later this century[11](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref11), [17](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref17), [18](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref18), [20](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref20). Reliance on negative emissions has high risks because of potential delays or failure in the development and large-scale deployment of emerging technologies such as carbon capture and storage, particularly those connected to bioenergy[17](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref17), [18](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref18). Although current emissions are tracking the higher scenarios, it is still possible to transition towards pathways consistent with keeping temperatures below 2 °C (refs [17](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref17),[19](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref19),[20](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref20)). The historical record shows that some countries have reduced CO2 emissions over 10-year periods, through a combination of (non-climate) policy intervention and economic adjustments to changing resource availability. The oil crisis of 1973 led to new policies on energy supply and energy savings, which produced a decrease in the share of fossil fuels (oil shifted to nuclear) in the energy supply of Belgium, France and Sweden, with emission reductions of 4–5% per year sustained over 10 or more years ([Supplementary Figs S17–19](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#supplementary-information)).A continuous shift to natural gas — partially substituting coal and oil — led to sustained mitigation rates of 1–2% per year in the UK in the 1970s and again in the 2000s, 2% per year in Denmark in the 1990–2000s, and 1.4% per year since 2005 in the USA ([Supplementary Figs S10–12](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#supplementary-information)). These examples highlight the practical feasibility of emission reductions through fuel substitution and efficiency improvements, but additional factors such as carbon leakage[23](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref23) need to be considered. These types of emission reduction can help initiate a transition towards trajectories consistent with keeping temperatures below 2 °C, but further mitigation measures are needed to complete and sustain the reductions. Similar energy transitions could be encouraged and co-ordinated across countries in the next 10 years using available technologies[19](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref19), but well-targeted technological innovations[24](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref24) are required to sustain the mitigation rates for longer periods[17](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref17). To move below the RCP8.5 scenario — avoiding the worst climate impacts — requires early action[17](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref17), [18](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref18), [21](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref21) and sustained mitigation from the largest emitters[22](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref22) such as China, the United States, the European Union and India. These four regions together account for over half of global CO2 emissions, and have strong and centralized governing bodies capable of co-ordinating such actions. If similar energy transitions are repeated over many decades in a broader range of developed and emerging economies, the current emission trend could be pulled down to make RCP3-PD, RCP4.5 and RCP6 all feasible futures. A shift to a pathway with the highest likelihood to remain below 2 °C above pre-industrial levels (for example, RCP3-PD), requires high levels of technological, social and political innovations, and an increasing need to rely on net negative emissions in the future[11](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref11), [17](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref17), [18](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref18). The timing of mitigation efforts needs to account for delayed responses in both CO2 emissions[9](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref9) (because of inertia in technical, social and political systems) and also in global temperature[12](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1783.html#ref12) (because of inertia in the climate system). Unless large and concerted global mitigation efforts are initiated soon, the goal of remaining below 2 °C will very soon become unachievable.

#### Defo alt cause doesn’t matter

Manjaro, 11 [[mpact of deforestation on global warming varies with latitude](http://thewatchers.adorraeli.com/2011/11/19/impact-of-deforestation-on-global-warming-varies-with-latitude/), Chilly, The Watchers, <http://thewatchers.adorraeli.com/2011/11/19/impact-of-deforestation-on-global-warming-varies-with-latitude/>]

The new research, from a team of scientists representing 20 institutions from around the world, discovered that **the impact** of deforestation on global warming **varies with latitude**. It depends where the deforestation is. It could have some cooling effects at the regional scale, at higher latitudes, but there’s no indication deforestation is cooling lower latitudes, and in fact may actually cause warming. The surprising finding calls for new climate-monitoring strategies. According to study, surface station observations are made in grassy fields with biophysical properties of cleared land and that’s why they do not accurately represent the state of climate for 30 percent of the terrestrial surface covered by forests. Researchers found that deforestation in the boreal region, north of 45 degrees latitude, **results in a net cooling effect**. While cutting down trees releases carbon into the atmosphere, it also increases an area’s albedo, or reflection of sunlight. Surface temperatures in open, non-forested, high-latitude areas were cooler because these surfaces reflected the sun’s rays, while nearby forested areas absorbed the sun’s heat. At night, without the albedo effect, open land continued to cool faster than forests, which force warm turbulent air from aloft to the ground. Scientists are debating whether afforestation is a good idea in high latitudes. Study points that tree planting cause absorbing of carbon, which is a benefit to the climate system. At the same time, tree planting warm the landscape because trees are darker compared to other vegetation types. So they absorb solar radiation. But researchers points that the findings should not be viewed as a “green light” to cut down forests in high latitudes. The intent is to clarify where we can see these regional effects using actual temperature measurements.

### 2AC--CP

**Perm – do the plan with revenue from the CP.**

**Yin 12** (Clifton, Clean Energy Policy Analyst at the Information Technology and Innovation Foundation, The Carbon Tax Fantasy, Originally published at The Innovation Files, http://thebreakthrough.org/index.php/programs/energy-and-climate/the-carbon-tax-fantasy/)

As such, a carbon tax can only be seen as effective climate change policy in the extent to which it funds clean energy innovation. In contrast to the neoclassical economic doctrine, innovation economics recognizes that the government can and should play a much more proactive role in supporting the clean energy innovation process. Fittingly, the Brookings scholars recommend setting aside at least $30 billion in carbon tax revenue annually for “an independently managed fund for supporting top-quality energy-system RD&D activity.” That policy proposal mirrors the “innovation carbon price” concept put forward by ITIF last year that called for a portion of revenue to go towards funding “a Clean Energy Innovation Trust Fund that would support clean energy innovation initiatives.” Establishing a dedicated revenue stream for clean energy innovation in this way would simultaneously reduce policy uncertainty and tackle climate change mitigation in a meaningful way. Nor would it be without precedent – gas tax revenue, for example, is dedicated to the Highway Trust Fund.

Of course, policymakers are currently looking at a carbon tax primarily as a possible revenue raiser as part of a grand bargain on deficit reduction. But ITIF and Brookings’ proposals **would not preclude** carbon tax revenue being directed towards that endeavor. The Brookings report goes on to call for the vast majority of the revenue to be spent on “tax cuts and deficit reduction as well as rebates to affected low-income households, as determined by Congress and the president,” while the ITIF report proposes that any remaining funding be “recycled back into the economy as growth and innovation inducing business tax incentives.” What the proposals do preclude is the idea – as informed by neoclassical economic doctrine – that a carbon tax is all that is needed to spur massive greenhouse gas emission reductions. As debate continues, Congress and the president would do well to more carefully consider all the products of the “wonkish energy” being expended on possible carbon tax designs.

**Shale gas revolution disproves.**

**Nordhaus 12** (Ted – Chairman of the Breakthrough Institute, Michael Shellenberger – President of the Breakthrough Institute, Beyond Cap and Trade, A New Path to Clean Energy, http://e360.yale.edu/feature/nordhaus\_shellenberger\_beyond\_cap\_and\_trade\_a\_new\_path\_to\_clean\_energy/2499/)

The proximate cause of the decline in recent years has been the recession and slow economic recovery. But the reason that EIA is projecting a long-term decline over the next decade or more is the glut of cheap natural gas, mostly from unconventional sources like shale, that has profoundly changed America’s energy outlook over the next several decades.

But the shale gas revolution, and its rather significant impact on the U.S. carbon emissions outlook, offers a stark rebuke to what has been the dominant view among policy analysts and environmental advocates as to what it would take in order to begin to bend down the trajectory of U.S. emissions, namely a price on carbon and a binding cap on emissions. The existence of a better and cheaper substitute is today succeeding in reducing U.S. emissions where efforts to raise the cost of fossil fuels through carbon caps or pricing — and thereby drive the transition to renewable energy technologies — have failed.

In fact, the rapid displacement of coal with gas has required little in the way of regulations at all. Conventional air pollution regulations do represent a very low, implicit price on carbon. And a lot of good grassroots activism at the local and regional level has raised the political costs of keeping old coal plants in service and bringing new ones online.

But those efforts have become increasingly effective, as gas has gotten cheaper. The existence of a better and cheaper substitute has made the transition away from coal much more viable economically, and it has put the wind at the back of political efforts to oppose new coal plants, close existing ones, and put in place stronger EPA air pollution regulations.

Yet if cheap gas is harnessing market forces to shutter old coal plants, the existence of cheap gas from unconventional places is by no means the product of those same forces, nor of laissez faire energy policies. Our current glut of gas and declining emissions are in no small part the result of 30 years of federal support for research, demonstration, and commercialization of non-conventional gas technologies without which there would be no shale gas revolution today.

Starting in the mid-seventies, the Ford and Carter administrations funded large-scale demonstration projects that proved that shale was a potentially massive source of gas. In the years that followed, the U.S. The European Emissions Trading Scheme has had no discernible impact on emissions. Department of Energy continued to fund research and demonstration of new fracking technologies and developed new three-dimensional mapping and horizontal drilling technologies that ultimately allowed firms to recover gas from shale at commercially viable cost and scale. And the federal non-conventional gas tax credit subsidized private firms to continue to experiment with new gas technologies at a time when few people even within the natural gas industry thought that firms would ever succeed in economically recovering gas from shale.

The gas revolution now unfolding — and its potential impact on the future trajectory of U.S. emissions — suggests that the long-standing emphasis on emissions reduction targets and timetables and on pricing have been misplaced. Even now, carbon pricing remains the sine qua non of climate policy among the academic and think-tank crowds, while much of the national environmental movement seems to view the current period as an interregnum between the failed effort to cap carbon emissions in the last Congress and the next opportunity to take up the cap-and-trade effort in some future Congress.

And yet, the European Emissions Trading Scheme (ETS), which has been in place for almost a decade now and has established carbon prices well above those that would have been established by the proposed U.S. system, has had no discernible impact on European emissions. The carbon intensity of the European economy has not declined at all since the imposition of the ETS. Meanwhile green paragon Germany has embarked upon a coal-building binge under the auspices of the ETS, one that has accelerated since the Germans shut down their nuclear power plants.

Even so, proponents of U.S. emissions limits maintain that legally binding carbon caps will provide certainty that emissions will go down in the future, whereas technology development and deployment — along with efforts to regulate conventional air pollutants — do not. Certainly, energy and We’ve already made a huge down payment on the cost-effective technologies we will need. emissions projections have proven notoriously unreliable in the past — it is entirely possible that future emissions could be well above, or well below, the EIA’s current projections. But the cap-and-trade proposal that failed in the last Congress, like the one that has been in place in Europe, would have provided no such certainty. It was so riddled with loopholes, offset provisions, and various other cost-containment mechanisms that emissions would have been able to rise at business-as-usual levels for decades.

Arguably, the actual outcome might have been much worse. The price of the environmental movement’s demand for its “legally binding” pound of flesh was a massive handout of free emissions allocations to the coal industry, which might have slowed the transition to gas that is currently underway.

Continuing to drive down U.S. emissions will ultimately require that we develop low- or no-carbon alternatives that are better and cheaper than gas. That won’t happen overnight. The development of cost-effective technologies to recover gas from shale took more than 30 years. But we’ve already made a huge down payment on the technologies we will need.

Over the last decade, we have spent upwards of $200 billion to develop and commercialize new renewable energy technologies. China has spent even more. And those investments are beginning to pay off. Wind is now almost as cheap as gas in some areas — in prime locations with good proximity to existing transmission. Solar is also close to achieving grid parity in prime locations as well. And a new generation of nuclear designs that promises to be safer, cheaper, and easier to scale may ultimately provide zero-carbon baseload power.

All of these technologies have a long way to go before they are able to displace coal or gas at significant scale. But the key to getting there won’t be more talk of caps and carbon prices. It will be to continue along the same path that brought us cheap unconventional gas — developing and deploying the technologies and infrastructure we need from the bottom up.

When all is said and done, a cap, or a carbon price, may get us the last few yards across the finish line. But a more oblique path, focused on developing better technologies and strengthening conventional air pollution regulations, may work just as well, or even better.

For one thing should now be clear: The key to decarbonizing our economy will be developing cheap alternatives that can cost-effectively replace fossil fuels. There simply is **no substitute** for making clean energy cheap.

**Mandates do not solve – consensus of studies.**

**Nordhaus 12** (Ted – Chairman of the Breakthrough Institute, Michael Shellenberger – President of the Breakthrough Institute, Alex Trembath – Policy Analyst, Energy and Climate Program at the Breakthrough Institute, Carbon Taxes and Energy Subsidies, http://thebreakthrough.org/index.php/carbon-taxes-and-energy-subsidies/)

Analysis Summary

Carbon taxes like the ones being proposed by current and former member of Congress are unlikely to increase the deployment of zero-carbon energy technologies and would only modestly increase the incentive for utilities to shift from coal to gas, a new Breakthrough Institute analysis finds. Absent continued Congressional authorization of existing low-carbon energy subsidies, the price incentive for the deployment of zero-carbon energy sources would decline by between 50 to **80 percent**.

These findings are consistent with the findings of other **recent studies** (MIT 2012) that find that a $20 per ton carbon tax — rising slowly to $90 per ton by 2050 — would have an only modest effect on emissions. Where those studies looked at the first-, second-, and third-order effects of carbon pricing, including effects on price indexes, equity of taxation, and broader emissions reductions, ours is focused exclusively on the impact of carbon pricing on the deployment of zero carbon energy sources.

The analysis also finds that current carbon tax proposals would impose greater costs upon the U.S. energy economy than would simply funding existing subsidy supports for deployment of zero carbon energy through a carbon tax that recycled all of its revenues to support those programs. Current annual federal spending on clean tech deployment subsidies totaled $11 billion in 2012, equivalent to a tax of $2.10/ton CO₂. At its recent peak in 2009, federal spending on clean energy subsidies amounted to $29.6 billion, equivalent a tax of $5.50/ton CO₂. By contrast, a $20/ton carbon tax would impose a cost of $100 billion annually on the U.S. energy economy, **900% more** than the carbon tax that would be necessary to sustain today’s current level of clean energy subsidies if the proceeds from the tax were used to fund those programs and 333% more than would be necessary to sustain the record levels of spending on clean energy subsidies in 2009.

In order to make an apples-to-apples comparison of the economic incentives to zero-carbon energy deployment, we calculated the "carbon tax-equivalent” (sometimes referred to as the carbon price-equivalent, or implicit carbon price) of deployment subsidies in the United States for solar, wind and nuclear. Calculating the carbon tax-equivalent is a way to compare the economic incentives for the deployment of zero-carbon energy provided by different policy mechanisms including subsidies, regulations, and taxes.

The carbon tax equivalent of the federal subsidy for wind (the production tax credit) ranges between $24 and $55 per ton, depending on whether wind is competing against coal or natural gas. For solar, the federal investment tax credit (ITC) provides a higher per-megawatt-hour incentive hour depending on the size of the system, so the ITC’s carbon price equivalent ranges between $33 and $125 per ton. The carbon price equivalent of the production tax credit for nuclear power is between $20 and $45 per ton.

A carbon tax in the $10 - $20 per ton range would thus provide a far smaller incentive to deployment of nuclear, solar, and wind than existing subsidies. A carbon tax of $20 per ton would provide about **one-third the incentive** of wind subsidies when competing against natural gas, one-fifth the incentive of solar subsidies, and less than half the incentive of nuclear subsidies.

Our analysis finds that a carbon tax in the $10 - $20 per ton carbon tax would provide a minor incentive for utilities to switch from coal to gas. A $20 carbon tax would provide about half as much incentive as the current price gap between coal and gas provides.

This analysis may underestimate the incentive provided by direct subsidies compared to the indirect incentive provided by a carbon tax. Federal tax incentives, combined in many cases with state-level requirements for utilities to purchase zero-carbon power, provide direct support for energy technologies that are currently more costly and technically challenging than incumbent coal and natural gas. Solar, wind, and nuclear also suffer from high upfront capital costs, and tax credits open up tax-equity markets so developers can attract project finance. The combination of the subsidies’ **price signal** and the **vehicle for project finance** provided by tax breaks helps developers and utilities overcome the economic and technical challenges posed by renewable, while loan guarantees and insurance subsidies help lower the risk and finance costs of nuclear projects. By contrast, a carbon tax simply raises the cost of the incumbent **without helping the challengers** enter the market, weakens the incentive more than a carbon tax-equivalent methodology suggests. Because of the complexity of those interactions, it is difficult to estimate those non-price costs.

### 2AC—Wind DA

**Wind solves blackouts and transmission risks.**

**Sovacool 8** (Benjamin K., Assistant Professor at the Lee Kuan Yew School of Public Policy, part of the National University of Singapore. He is also a Research Fellow in the Energy Governance Program at the Centre on Asia and Globalization. He has worked in advisory and research capacities at the U.S. National Science Foundation’s Electric Power Networks Efficiency and Security Program, Virginia Tech Consortium on Energy Restructuring, Virginia Center for Coal and Energy Research, New York State Energy Research and Development Authority, Oak Ridge National Laboratory, Semiconductor Materials and Equipment International, and U.S. Department of Energy’s Climate Change Technology Program. He is the co-editor with Marilyn A. Brown of Energy and American Society: Thirteen Myths (2007) and the author of The Dirty Energy Dilemma: What’s Blocking Clean Power in the United States (2008). He is also a frequent contributor to such journals as Electricity Journal, Energy & Environment, and Energy Policy, The intermittency of wind, solar, and renewable electricity generators: Technical barrier or rhetorical excuse?, ScienceDire, Utilities Policy 17 (2009) 288–296)

**FINISHING CARD**

4.2. Construction lead times

The quicker lead times for solar and wind projects enable a more accurate response to load growth, and minimize the financial risk associated with borrowing hundreds of millions of dollars to finance plants for 10 or more years before they start producing a single kW of electricity. Florida Power & Light says it can take as little as 3–6 months from groundbreaking to commercial operation for new wind farms (Flavin et al., 2006, p. 16). In 2005, Puget Sound Energy proved that FPL’s boast was achievable in practice when it brought eighty-three 1.8 MW wind turbines to its Hopkins Ridge Wind Project from groundbreaking to commercial operation in exactly 6 months and 9 days (Garratt, 2005).

Solar panels can be built in various sizes, placed in arrays ranging from watts to megawatts, and used in a wide variety of applications, including centralized plants, distributed sub-station plants, grid connected systems for home and business use, and off- grid systems for remote power use. PV systems have long been used to power remote data relaying stations critical to the operation of supervisory control and data acquisition systems used by electric and gas utilities and government agencies. Solar installations may require even less construction time than wind or geothermal facilities since the materials are pre-fabricated and modular. Ravis (2007), a project finance manager for TD BankNorth, recently told industry analysts that utility-level PV systems can come online in as little as two months if the panels are available.

Utilities and investors can cancel wind and solar plants easier, so abandoning a project is not a complete loss (and recoverable value exists should the technologies need to be resold as commodities in a secondary market). Smaller units with shorter lead times reduce the risk of purchasing a technology that becomes obsolete before it is installed, and quick installations can better exploit rapid learning, as many generations of product development can be compressed into the time it would take to build one giant power plant. In addition, outage durations tend to be shorter than those from larger plants and repairs for reciprocating gas and diesel engines take less money, time, and skill. As Lovins et al., (2002) concluded, ‘‘tech- nologies that deploy like cell phones and personal computers are faster than those that build like cathedrals. Options that can be mass produced and adopted by millions of customers will save more carbon and money sooner than those that need specialized institutions, arcane skills, and suppression of dissent.’’

4.3. Improved capacity factors

A capacity factor is the ratio of a generating facilities’ actual output over time compared to its theoretical output if it were operating at maximum efficiency. The U.S. EIA (2000) estimated that the average capacity factor for all power plants in the United States was approximately 55 percent. That is, over a long period of time, an average power plant actually contributes to the electricity grid only 55 percent of its theoretical maximum output. Nuclear and hydroelectric generators have boasted the highest capacity factors, occasionally exceeding 90 percent. Coal ranks near the middle, with a capacity factor of about 60 percent. Less reliable natural gas generators have much lower capacity factors of 29 percent, in part, because gas-fired plants are often ‘‘peaking’’ units (i.e., they are designed to have a low capacity factor).

Historically, all forms of electricity generation have followed the same general trend: the more the technologies get deployed, the higher their capacity factor (and the lower their costs). The inter- relationship between rising capacity factors and installed capacity suggests that deploying more clean energy technologies will significantly improve their capacity factors, except with renewables, the ‘‘fuel’’ is free for the taking. Recent experience with wind energy seems to confirm this rule. In 2000, wind turbines reported capacity factors in the low teens. But by 2006, when installed wind energy had more than tripled in the United States, wind turbines registered capacity factors in the high 30 percent range and even the low 40 percent range. Newer wind projects in Oahu, Hawaii, and San Gorgonio, California, have even achieved capacity factors of 36 and 38 percent. In a 2006 analysis, the EIA observed that wind turbine capacity factors appeared to be improving over time and concluded that ‘‘capacity factor grows as a function of capacity growth’’ (Namovicz, 2006).

Solar energy appears to follow this same pattern. In the early 1980s, with 10 MW of solar panels installed globally, the average capacity factor was around 9 percent. By 1995, however, after more than 70 MW had been installed, the average efficiency of panels jumped to almost 15 percent, and in the past five years has sur- passed 21 percent (Kammen, 2004). The central lesson seems to be the more wind and solar technologies get physically deployed, the more efficient they become.

4.4. Less unplanned outages

Closely connected to the improving capacity factor of renewables is their high technical reliability. Modern wind turbines and solar panels have less unplanned outages, operating reliably more than **97.5 percent** of the time (IEA, 2005). Moreover, such high reliability is for one wind turbine, so any amount of significant wind power in an electricity system would never see all (hundreds of thousands of turbines) down at the same time. In fact, the IEA (2005) recently concluded that:

Initially, it was believed that only a small amount of intermittent capacity was permissible on the grid without compromising

system stability. However, with practical experience gathering, for example, in the Western Danish region where over 20 percent of the yearly electricity load is covered with wind energy, this view has been refuted. Bigger units of power plants bring with them the need for both greater operational and capacity reserve since outages cause greater disturbances to the system. The higher the technical availability, the lower the probability of unexpected outages and thus the lower the requirements of short-term operational reserve. Wind power plants actually score favorable against both criteria, since they normally employ small individual units (currently up to 5 MW) and have a record of high technical availability (43–44).

Renewable energy technologies also improve overall system reliability because they tend to be dispersed and decentralized. It is considered a general principle in electrical and power systems engineering that the larger a system becomes, the less reserve capacity it needs. Demand variations between individual consumers are mitigated by grid interconnection in exactly this manner.

Just like consumers average out each other in electricity demand, individual wind farms average out each other in electricity supply. As the European Wind Energy

Association concluded:

Wind power is variable in output but the variability can be predicted to a great extent . variations in wind energy are smoother, because there are hundreds or thousands of units rather than a few large power stations, making it easier for the system operator to predict and manage changes in supply as they appear within the overall system. The system will not notice the shut-down of a 2 MW wind turbine. It will have to respond to the shut-down of a 500 MW coal-fired plant or a 1000 MW nuclear plant instantly (EWEA, 2005, pp. 7–9).

In other words, the modular and dispersed nature of technologies such as wind and solar improves overall system reliability because outages, when they rarely to occur, can be better managed.

One study, conducted by the nonpartisan Midwest ISO, pro- jected the operation of 152 wind sites (nominally 40 MW each) in the state of Minnesota, and calculated their operation every 5 min as the simulation progressed through three years. The study found that the additional cost of reserves required to manage the overall system were about one tenth of a cent/kWh. As the study noted:

Wind generation does make a calculable contribution to system reliability in spite of the fact that it cannot be dispatched like most conventional resources . The addition of wind generation to supply 20 percent of Minnesota retail electric power can be reliably accommodated by the electric power system (EnerNex and MISO, 2006, p. xiii, xxi).

A similar assessment performed by General Electric for the New York ISO investigated a 10 percent wind penetration scenario in New York State, or the addition of about 3300 MW of nameplate wind capacity on a 33,000 MW peak-load system. Researchers also assumed that wind capacity was located across 30 different sites. The study found ‘‘no credible single contingency’’ that led to a significant loss of generation, and that since the system was already designed to handle a loss of 1200 MW due to the unreli- bility of conventional generators, it had more than enough resil- iency to enable the incorporation of wind (Piwko et al., 2005). This could be why even though the United States has more than 12,000 MW of installed wind capacity, not a single conventional unit has been installed as a backup generator (DeMeo et al., 2005).

4.5. Effective load carrying capability

Not all electricity is created equal. A better metric for deter- mining the availability of electricity resources in any given region is the ‘‘effective load carrying capability,’’ or ELCC. The ELCC refers to the difference between the amount of energy a generating unit produces and the amount of energy that can actually be used by consumers at any given time (Perez, 1996). For example, nuclear and hydropower units have relatively low ELCCs because they are producing about the same amount of electricity 24 h a day. In times of low demand, these units are throttled back or shut-down.

Photovoltaics have great value as a reliable source of power during extreme peak-loads. Substantial evidence from many peer- reviewed studies demonstrates an excellent correlation between available solar resources and periods of peak demand. Because solar generators tend to produce the greatest amount of energy during the same times consumer demand is highest, solar has an amazingly high ELCC relative to other technologies (Perez, 1996). In many parts of the country, solar PV has an ELCC above 70 percent. In many parts of the Southeast, solar’s ELCC exceeds 60 percent (Silcker, 2004). Researchers in Sacramento, California, estimated that the ELCC for solar PV within the city was so high that the actual value of solar energy was more than $6000/kW (Robertson and Cliburn, 2006). That is, because solar PV generated electricity at periods of high demand, its value was greater than electricity generated by other units throughout the day.

NREL researchers compared the recorded ELCC of solar PV deployed by utilities in nearly every region of the country to earlier theoretical estimates of ELCC. Not only did NREL find that actual ELCC closely matched expectations, its analysis demonstrates that valuable amounts of solar PV are available in every region of the United States (Perez et al., 2006). In California, a PV array with a capacity of 5000 MW reduces the peak-load for that day by about 3000 MW, cutting in half the number of natural gas ‘‘peakers’’ needed to ensure reserve capacity (Herig, 2002).

4.6. Spatial diversification

Perhaps incongruously, no less than **nine studies show** that the variability of renewables becomes easier to manage the more they are deployed (not the other way around, as some utilities suggest). In one study conducted by the Imperial College of London, researchers assessed the impact that large penetration rates (i.e., above 20 percent) of renewable energy would have on the power system in the United Kingdom. The study found that the benefits of integrating renewables would far exceed their costs, and that ‘‘intermittent generation need not compromise electricity system reliability at any level of penetration foreseeable in Britain over the next 20 years.’’ Let me repeat this conclusion for emphasis: renewable energy technologies can be integrated at any level of foreseeable penetration without compromising grid stability or system reliability.

A second study noted that when done on a regional scale, renewables contribute to overall system reliability slightly more. Engineers in Ontario, Canada, assessed the impact of 20 percent wind penetration on its regional electricity grid (AWS, 2005). The study accounted for seasonal wind and load patterns, daily wind and load patterns, changing capacity value for delivering power during peak-load, and geographic diversity. It used wind and load data for May 2003 to April 2004, and concluded that the more wind that existed on the system and the more geographically dispersed it was, the more it reduced volatilitydin some cases by up to 70 percent.

A third study conducted a meta-analysis of utility experience with large wind farms in six locations: Xcel Energy North in Min- nesota; the California ISO in Northern California; We Energies in Wisconsin; PacifiCorp in Oregon and Wyoming; NYISO in New York; and Xcel Energy West in Colorado (DeMeo et al., 2005). The authors argue that modern wind plants help grid operators handle major outages and contingencies elsewhere in the system, since they generate power in smaller increments that are less damaging than unexpected outages from large plants.

A fourth study from the European Wind Energy Association assessed the wind portfolios of all major European power providers and concluded the same way, noting that:

A large contribution from wind energy . is technically and economically feasible, in the same order of magnitude as the individual contributions from the conventional technologies developed over the past century. These large shares can be realized while maintaining a high degree of system security (EWEA, 2005, p. 13).

In California, Kahn (1979) investigated the reliability and ELCC of arrays of different generators in California, varying from 2 to 13 connected sites. He found that most parameters, such as the availability of wind and capacity factor, improved as the size of the array increased.

Looking inversely at the risk of sudden reductions in wind availability, another study from Stanford University demonstrated that the frequency of zero- and low-wind events over a network of eight sites in the central US was less than 2 percent (Archer and Jacobson 2003). Seventh, the American Wind Energy Association compared wind power capacity factors from individual wind farms with an array of 28 interconnected sites in the central United States and concluded that interconnection reduced variability in energy production by a factor of 1.75–3.4 (Simonsen and Stevens, 2004). The authors also found that the combined energy output from interconnected sites had a smoother diurnal pattern and maximum output in the afternoon, during the peak time of electrical demand.

Eighth, Archer and Jacobson (again from Stanford University) looked at the benefits of interconnecting wind farms at 19 sites located in the Midwestern United States and found that an average of 33 percent and a maximum of 47 percent of yearly averaged wind power from interconnected farms can be used as reliable, baseload electric power. They concluded that almost all parameters from wind power showed substantial improvements as the number of interconnected sites increased, including standard deviations of array-average wind speed and wind power, reliability, and the need for energy storage or reserve capacity. They also found no satura- tion of benefits, meaning that positive marginal improvements always occurred as the number of interconnected farms increased (Archer and Jacobson, 2007).

Ninth, when interconnecting wind and solar farms is not prac- ticable or possible, such systems can be integrated with energy storage technologies to operate as baseload plants. Paul Denholm and his colleagues from NREL note that attaching wind turbines to compressed air energy storage technologies can improve their capacity factor above 70 percent, making them ‘‘functionally equivalent to a conventional baseload plant’’ (Denholm et al., 2005). Pumped hydro storage systems can also improve the potential of renewables to offset baseload generation. Bonneville Power Administration, a large federal utility in the Pacific North- west, uses its existing 7000 MW hydroelectric and pumped hydro storage network to do just that. Starting in 2005, Bonneville offered a new business service to ‘‘soak up’’ any amount of intermittent renewable output, and sell it as firm output from its hydropower network one week later. Such storage technologies can have greater than 1000 MW of capacity (depending on location), and operate according to fast response times and relatively low operating costs. Pumped hydro and compressed air storage systems are already commercially available and offer a combined 22.1 GW of installed capacity in the United States (University of Oregon, 2001).

Each of these studies suggest that significant benefits occur with the geographic dispersion of renewable energy technologies, espe- cially if winds, sunlight, and other renewable fuels vary considerably over large regions. Claiming that the variability of renewable energy technologies means that the costs of managing them are too great has **no factual basis** in light of the operating experience of renewables in Denmark, Germany, the United Kingdom, Canada, and a host of renewable energy sites in the United States.

5. Conclusions

Conventional power systems suffer variability and reliability problems, just to a different degree than renewables. Conventional power plants operating on coal, natural gas, and uranium are subject to an immense amount of variability related to construction costs, short-term supply and demand imbalances, long term supply and demand fluctuations, growing volatility in the price of fuels, and unplanned outages. Contrary to proclamations stating other- wise, the more renewables that get deployed, the more not less stable the system becomes. Wind- and solar-produced power is very effective when used in large numbers in geographically spaced locations (so the law of averages yields a relative constant supply). The issue, therefore, is not one of variability or intermit- tency per se, but how such variability and intermittency can best be managed, predicted, and mitigated.

Given the **preponderance of evidence** referenced here in favor of integrating renewable(s), utility and operator objections to them may **be less about tech**nical limitations and more about tradition, familiarity, and arranging social and political order. The work and culture of people employed in the electricity industry promote ‘‘business as usual’’ and tend to culminate in dedicated constitu- encies that may resist change. Managers of the system obviously prefer to maintain their domain and, while they may seek increased efficiencies and profits, they do not want to see the introduction of new and disruptive ‘‘radical’’ technologies that may reduce their control over the system. In essence, the current ‘‘technical’’ barriers to large-scale integration of wind, solar, and other renewables may not be technical at all, and more about the social, political, and practical inertia of the traditional electricity generation system.

#### Fukushima disproves.

#### Low magnitude

WNA 2008 [World Nuclear Association June 2008 Safety of Nuclear Power Reactors http://www.world-nuclear.org/info/inf06.html]

It has long been asserted that nuclear reactor accidents are the epitome of low-probability but high-consequence risks. Understandably, with this in mind, some people were disinclined to accept the risk, however low the probability. However, the physics and chemistry of a reactor core, coupled with but not wholly depending on the engineering, mean that the consequences of an accident are likely in fact be much less severe than those from other industrial and energy sources. Experience bears this out.

#### Plants don’t blow up like bombs

Hogan 9

[James, Former Digital Systems Engineer and Computer Sales Executive, “Nuclear No-Contest”, 9-19, http://www.lewrockwell.com/orig9/hogan3.1.1.html]

More people seem to be realizing that a nuclear power plant cannot explode like an atom bomb. The detonating mechanism for a bomb has to be built with extreme precision for the bomb to work at all, and a power plant contains nothing like it. Besides that, the materials used are completely different. Natural uranium contains about 0.7 percent of the fissionable U-235 isotope, which has to be enriched to more than 90 percent for bomb-grade material. For the slow release of energy required in power reactors, the fuel is enriched to only 3.5 percent. It simply isn't an explosive. So what about a meltdown? Even if TMI wasn't one, mightn't the next accident be? Yes, it might. The chance has been estimated – using the same methods that work well in other areas of engineering where there have been enough actual events to verify the calculations – as being about the same as that of a major city being hit by a meteorite one mile across///

. Even if it happened, simulations and studies indicate that it wouldn't be the calamity that most people imagine. If the fuel did melt its way out of the reactor vessel, it would be far more likely to sputter about and solidify around the massive supporting structure than continue reacting and burrow its way down through the floor. The British tested an experimental reactor in an artificial cave in Scotland for over twenty years, subjecting it to every conceivable failure of the coolant and safety systems. In the end they switched everything off and sat back to see what happened. Nothing very dramatic did. The core quietly cooled itself down, and that was that. But what if the studies and simulations are flawed and the British experience turns out to be a fluke? Then, mightn't the core turn into a molten mass and go down through the floor? Yes, it might. And then what would happen? Nothing much. We'd have a lot of mess down a hole in the ground, which would probably be the best place for it. But what if there was a water table near the surface? In that case we'd create a lot of radioactive steam that would blow back up into the containment building, which again would be the best place for it. But what if some kind of geological or structural failure caused it to come up outside the containment building? It would most likely expand high into the sky and dissipate. But what if . . . Now we're beginning to see the kinds of improbability chains that have to be dreamed up to create disaster scenarios for scaring the public. Remembering the odds against any major core disintegration in the first place, what if there happened to be an atmospheric inversion that held the cloud down near the ground, and if there was a wind blowing toward an urban area that was strong enough to move the cloud but not enough to disrupt the inversion layer? . . . Then yes, you could end up killing a lot of people. The statistical predictions work out at about 400 fatalities per meltdown. Perhaps not as bad as you'd think. And that's if we're talking about deaths that couldn't be attributed directly to the accident as such, but which would materialize as a slight increase in the cancer rate of a large population over many years, increasing an individual's risk from something like 20.5 percent to 21 percent. Since air pollution from coal burning is estimated to cause 10,000 deaths annually in the U.S., for nuclear power to be as dangerous as coal is now would require a meltdown somewhere or other every two weeks. But if we're talking about directly detectable deaths within a couple of months from acute radiation sickness, it would take 500 meltdowns to kill 100 people. On this basis, even having 25 meltdowns every year for 10,000 years would cause fewer deaths than automobiles do in one year.

### 2AC--Pltx

**Manufacturing turns the DA, but sequestration affects the wind PTC.**

**National Review Online 9/17**  “Fears Over Sequestration Are Overblown” <http://www.nationalreview.com/corner/321658/fears-over-sequestration-are-overblown-veronique-de-rugy>

As you can see, with a few exceptions, after sequestration, the non-war defense spending is still growing. One important factor in weighing the effect of sequestration is that war spending is not capped to meet certain spending levels outlined in the BCA. In other words, Congress can set the level of war spending above and beyond what is needed, if they wanted to do so to offset the impact of the sequester and BCA caps. So while there is uncertainty about the application of the sequester on war spending (see[this article](http://thehill.com/blogs/defcon-hill/policy-and-strategy/230245-war-funding-would-be-affected-by-sequestration-pentagon-says) in the Hill), it is guaranteed that there are preemptive measures policymakers can take to limit sequestration’s effect, including propping up war spending to make up for losses in non-war accounts.

**Conservatives won’t negotiate**

**Krauthamer 2/7/**13Opinion Writer for the Washington Post [Charles Krauthammer, Call Obama’s sequester bluff, <http://www.washingtonpost.com/opinions/charles-krauthammer-call-obamas-sequester-bluff/2013/02/07/5f64a24e-7150-11e2-ac36-3d8d9dcaa2e2_story.html>]

For the first time since Election Day, President Obama is on the defensive. That’s because on March 1, automatic spending cuts (“sequestration”) go into effect — $1.2 trillion over 10 years, half from domestic (discretionary) programs, half from defense.

The idea had been proposed and promoted by the White House during the July 2011 debt-ceiling negotiations. The political calculation was that such draconian defense cuts would drive the GOP to offer concessions.

It backfired. The Republicans have offered no concessions. Obama’s bluff is being called and he’s the desperate party. He abhors the domestic cuts. And as commander in chief he must worry about indiscriminate Pentagon cuts that his own defense secretary calls catastrophic.

So Tuesday, Obama urgently called on Congress to head off the sequester with a short-term fix. But instead of offering an alternative $1.2 trillion in cuts, Obama demanded a “balanced approach,” coupling any cuts with new tax increases.

What should the Republicans do? Nothing.

Republicans should explain — message No. 1 — that in the fiscal-cliff deal the president already got major tax hikes with no corresponding spending cuts. Now it is time for a nation $16 trillion in debt to cut spending. That’s balance.

The Republicans finally have leverage. They should use it. Obama capitalized on the automaticity of the expiring Bush tax cuts to get what he wanted at the fiscal cliff — higher tax rates. Republicans now have automaticity on their side.

If they do nothing, the $1.2 trillion in cuts go into effect. This is the one time Republicans can get cuts under an administration that has no intent of cutting anything. Get them while you can.

**Winners win and PC not key.**

**Hirsh 2/7**/13 (Michael, Chief correspondent for National Journal, Previously served as the senior editor and national economics correspondent for Newsweek, Overseas Press Club award for best magazine reporting from abroad in 2001 and for Newsweek’s coverage of the war on terror which also won a National Magazine Award, There’s No Such Thing as Political Capital, http://www.nationaljournal.com/magazine/there-s-no-such-thing-as-political-capital-20130207)

But the abrupt emergence of the immigration and gun control issues illustrates how suddenly shifts in mood can occur and how political interests can align in new ways just as suddenly. Indeed, the pseudo-concept of political capital masks a larger truth about Washington that is **kindergarten simple**: You just don’t know what you can do until you try. Or as Ornstein himself once wrote years ago, “**Winning wins**.” In theory, and in practice, depending on Obama’s handling of any particular issue, even in a polarized time, he could still deliver on a lot of his second-term goals, depending on his skill and the breaks. Unforeseen catalysts can appear, like Newtown. Epiphanies can dawn, such as when many Republican Party leaders suddenly woke up in panic to the huge disparity in the Hispanic vote.

Some political scientists who study the elusive calculus of how to pass legislation and run successful presidencies say that political capital is, at best, an empty concept, and that almost nothing in the academic literature successfully **quantifies or even defines it**. “It can refer to a very abstract thing, like a president’s popularity, but there’s no mechanism there. That makes it kind of useless,” says Richard Bensel, a government professor at Cornell University. Even Ornstein concedes that the calculus is far more complex than the term suggests. Winning on one issue often changes the calculation for the next issue; there is never any known amount of capital. “The idea here is, if an issue comes up where the conventional wisdom is that president is not going to get what he wants, and he gets it, then each time that happens, it changes the calculus of the other actors” Ornstein says. “If they think he’s going to win, they may change positions to get on the winning side. It’s a **bandwagon effect**.”

**Controversial fights ensure agenda success.**

**Dickerson 1/18**/13 (John, Chief Political Correspondent at the Slate, Political Director of CBS News, Covered Politics for Time Magazine for 12 Years, Previous White House Correspondent, Go for the Throat!, http://tinyurl.com/b7zvv4d)

On Monday, President Obama will preside over the grand reopening of his administration. It would be altogether fitting if he stepped to the microphone, looked down the mall, and let out a sigh: so many people expecting so much from a government that appears capable of so little. A second inaugural suggests new beginnings, but this one is being bookended by dead-end debates. Gridlock over the fiscal cliff preceded it and gridlock over the debt limit, sequester, and budget will follow. After the election, the same people are in power in all the branches of government and they don't get along. There's no indication that the president's clashes with House Republicans will end soon.

Inaugural speeches are supposed to be huge and stirring. Presidents haul our heroes onstage, from George Washington to Martin Luther King Jr. George W. Bush brought the Liberty Bell. They use history to make greatness and achievements seem like something you can just take down from the shelf. Americans are not stuck in the rut of the day.

But this might be too much for Obama’s second inaugural address: After the last four years, how do you call the nation and its elected representatives to common action while standing on the steps of a building where collective action goes to die? That **bipartisan** bag of tricks has been tried and it didn’t work. People don’t believe it. Congress' approval rating is 14 percent, the lowest in history. In a December Gallup poll, 77 percent of those asked said the way Washington works is doing “serious harm” to the country.

The challenge for President Obama’s speech is the challenge of his second term: how to be great when the **environment stinks**. Enhancing the president’s legacy requires something more than simply the clever application of predictable stratagems. Washington’s **partisan rancor**, the size of the problems facing government, and the limited amount of **time** before Obama is a lame duck all point to a single conclusion: The president who came into office speaking in lofty terms about **bipartisanship** and cooperation can only cement his legacy if he **destroys the GOP**. If he wants to transform American politics, he must **go for the throat**.

President Obama could, of course, resign himself to tending to the achievements of his first term. He'd make sure health care reform is implemented, nurse the economy back to health, and put the military on a new footing after two wars. But he's more ambitious than that. He ran for president as a one-term senator with no executive experience. In his first term, he pushed for the biggest overhaul of health care possible because, as he told his aides, he wanted to make history. He may already have made it. There's no question that he is already a president of consequence. But there's no sign he's content to ride out the second half of the game in the Barcalounger. He is approaching gun control, climate change, and immigration with wide and excited eyes. He's not going for caretaker.

How should the president proceed then, if he wants to be bold? The Barack Obama of the first administration might have approached the task by finding some Republicans to deal with and then start agreeing to some of their demands in hope that he would win some of their votes. It's the traditional approach. Perhaps he could add a good deal more schmoozing with lawmakers, too.

That's the old way. **He has abandoned that**. He doesn't think it will work and he doesn't have the time. As Obama explained in his last press conference, he thinks the Republicans are dead set on opposing him. They cannot be unchained by schmoozing. Even if Obama were wrong about Republican intransigence, other constraints will limit the chance for cooperation. Republican lawmakers worried about primary challenges in 2014 are not going to be willing partners. He probably has at most 18 months before people start dropping the lame-duck label in close proximity to his name.

Obama’s **only remaining option is to pulverize**. Whether he succeeds in passing legislation or not, given his ambitions, his goal should be to delegitimize his opponents. Through a series of **clarifying fights over controversial issues**, he can force Republicans to either side with their coalition's most extreme elements or cause a rift in the party that will leave it, at least temporarily, in disarray.

This theory of political transformation rests on the weaponization (and slight bastardization) of the work by Yale political scientist Stephen Skowronek. Skowronek has written extensively about what distinguishes transformational presidents from caretaker presidents. In order for a president to be transformational, the old order has to fall as the orthodoxies that kept it in power exhaust themselves. Obama's gambit in 2009 was to build a new post-partisan consensus. That didn't work, but by exploiting the weaknesses of today’s Republican Party, Obama has an opportunity to hasten the demise of the old order by increasing the political cost of having the GOP coalition defined by Second Amendment absolutists, **climate science deniers**, supporters of “self-deportation” and the pure no-tax wing.

**No PC – fiscal fights.**

**Hughes 1/30** Brian, Washington Examiner, /13, Deja vu for Obama: Economic blues threaten second-term agenda, washingtonexaminer.com/deja-vu-for-obama-economic-blues-threaten-second-term-agenda/article/2520110

President Obama opened his second term focused on gun violence and immigration. But Wednesday's bleak news that the economy is again contracting suggests that the president's next four years, like his first, will instead be defined by his handling of the long-ailing economy. In his second inaugural address just a week ago, Obama declared that "an economic recovery has begun" and that he would turn his attention to a series of issues, from guns to climate change, important to his core supporters, The latest economic developments, however, paint a more dismal portrait than the president suggested. The Commerce Department reported Wednesday that the U.S. economy contracted between October and December, for the first time since mid-2009. And the White House spent the day blaming both Republicans and a natural disaster, Hurricane Sandy, for the setback. Sign Up for the Politics Digest newsletter! "There is more work to do, and our economy is facing headwinds ... and that is Republicans in Congress," White House press secretary Jay Carney said before conceding, "I don't think anytime you see a reduction in economic growth that it's good news." And Alan Krueger, chairman of the Council of Economic Advisers, pointed to "signs that Hurricane Sandy disrupted economic activity and federal defense spending declined precipitously, likely due to uncertainty stemming from the sequester." Even more important for the president, economists generally agree that the only way to significantly curtail unemployment is to maintain 3 percent economic growth over an extended period. Obama, who through much of his first term blamed former President George W. Bush for persistently high unemployment, now faces the challenge of taking ownership of the economy. And some Republicans were quick to accuse the president of intentionally trying to distract the American public from the issue of jobs. "For a president who barely talks about the economy anymore or the nearly 23 million Americans struggling for work, today's number might be a wake-up call," said Joe Pounder, research director at the Republican National Committee. Yet, the strategy is paying dividends for the president. Recent polls show his approval ratings have jumped since the start of his second term. But other analysts warned that **Obama's entire agenda** -- and his legacy -- could be overshadowed by economic hardships. "The fact that the underlying economy is so anemic, it has always weakened every president eventually," said Matt Schlapp, former political director for President George W. Bush. "**He won't be immune to that**. It could **weaken his standing on other issues."** Further complicating the economic forecast is the so-called **sequestration**, automatic, across-the-board spending cuts that kick in on March 1 and that economists warn could undo fragile economic gains. The Commerce Department cited the impact of those cuts on the Pentagon as the primary cause of the economy's fourth-quarter contraction.

#### Heg doesn’t solve war

Fettweis 10—Professor of national security affairs @ U.S. Naval War College [Christopher J. Fettweis, “Threat and Anxiety in US Foreign Policy,” [*Survival*](http://www.informaworld.com.proxy.library.emory.edu/smpp/title%7Edb=all%7Econtent=t713659919), Volume [52](http://www.informaworld.com.proxy.library.emory.edu/smpp/title%7Edb=all%7Econtent=t713659919%7Etab=issueslist%7Ebranches=52#v52), Issue [2](http://www.informaworld.com.proxy.library.emory.edu/smpp/title%7Edb=all%7Econtent=g920313969) April 2010 , pages 59—82//informaworld]

One potential explanation for the growth of global peace can be dismissed fairly quickly: US actions do not seem to have contributed much. The limited evidence suggests that there is little reason to believe in the stabilising power of the US hegemon, and that there is no relation between the relative level of American activism and international stability. During the 1990s, the United States cut back on its defence spending fairly substantially. By 1998, the United States was spending $100 billion less on defence in real terms than it had in 1990, a 25% reduction.29 To internationalists, defence hawks and other believers in hegemonic stability, this irresponsible 'peace dividend' endangered both national and global security. 'No serious analyst of American military capabilities', argued neo-conservatives William Kristol and Robert Kagan in 1996, 'doubts that the defense budget has been cut much too far to meet America's responsibilities to itself and to world peace'.30 And yet the verdict from the 1990s is fairly plain: the world grew more peaceful while the United States cut its forces. No state seemed to believe that its security was endangered by a less-capable US military, or at least none took any action that would suggest such a belief. No militaries were enhanced to address power vacuums; no security dilemmas drove insecurity or arms races; no regional balancing occurred once the stabilising presence of the US military was diminished. The rest of the world acted as if the threat of international war was not a pressing concern, despite the reduction in US military capabilities. Most of all, the United States was no less safe. The incidence and magnitude of global conflict declined while the United States cut its military spending under President Bill Clinton, and kept declining as the George W. Bush administration ramped the spending back up. Complex statistical analysis is unnecessary to reach the conclusion that world peace and US military expenditure are unrelated.

## \*\*\* 1AR

### 1AR—Warming

**Plus overshooting is possible.**

**Washington 11** (Haydn and John, An environmental scientist of 35 years’ experience. His PhD ‘The Wilderness Knot’ was in social ecology \*\* the Climate Communication Fellow for the Global Change Institute at the University of Queensland. He studied physics at the University of Queensland, Australia. After the graduating, he majored in solar physics in his post-grad honors year and created the website skepticalscience.com, Climate Change Denial: Heads in the Sand, Published in 2011 by Earthscan, Page 30-31)

It has been suggested that warming the world by more than two degrees could push us into the area where we may cause runaway climate change. It may then take thousands of years to get back to current world temperatures. The world has already warmed by .7 degrees Celsius (Houghton, 2008; Pittock, 2009) and another .6 degrees is in the pipeline (Hansen, 2009). Runaway climate change means that human actions would then be unlikely to stop the temperature increase (short of massive government engineering). Hansen et al. (2008) define the ‘tipping point’ as the climate forcing threat that, if maintained for a long time, gives rise to a specific consequence. They define the ‘point of no return’ as a climate state beyond which the consequence is inevitable, even if climate forcings are reduced. A point of no return **can be avoided**, even if the tipping level is **temporarily exceeded**. This has been called an ‘overshoot’ scenario, where one exceeds the ‘safe’ CO2 level but then removes CO2 to return to that level (Pittock, 2009). Ocean and ice sheet inertia permit overshoot ‘provided the climate forcing is returned below the tipping level **before initiating** irreversible dynamic change’ (Hansen et al, 2008). Points of no return are difficult to define. We may be at a tipping level already at 387 ppm CO2, and it will require strong action to reduce CO2 levels so that we don’t pass the point of no return and can return CO2 levels below 350 ppm. Hansen et al (2008) note we may been to drop CO2 below 325 ppm to restore sea ice to the area it had 25 years ago (and so remove this positive feedback).

### 1NC Meltdowns D

#### No meltdowns—backup power

Spencer 11 [Jack Spencer, Research Fellow in Nuclear Energy in the Thomas A. Roe Institute for Economic Policy Studies at The Heritage Foundation “U.S. Nuclear Policy After Fukushima: Trust But Modify,” 5/18/11)[http://www.heritage.org/research/reports/2011/05/us-nuclear-policy-after-fukushima-trust-but-modify](http://opencaselist.paperlessdebate.com/xwiki/bin/create/%2F%2Fwww.heritage/org%2Fresearch%2Freports%2F2011%2F?parent=Harvard.Herman%2DTandet+Neg)]

One of the problems with the emerging dialogue is that some commentators and U.S. policymakers have assumed that America’s nuclear industry and regulatory bodies and policies mirror those of Japan. They do not. The United States has an effective, multifaceted regulatory regime that has already addressed many of the mistakes and weaknesses that Fukushima seems to have exposed, including earthquake and tsunami preparedness and the modification of older reactors to meet new and evolving safety standards. On the other hand, the accident should raise serious questions about America’s lack of nuclear-waste disposal plans.

Earthquakes and Tsunamis

While building nuclear plants to withstand earthquakes and tsunamis (and other severe natural phenomena) is a new issue for many Americans, the U.S. nuclear industry and U.S. nuclear regulators have spent a great deal of time developing specific protocols for just such events. American regulators mandate that all U.S. reactors be built not only to withstand the most powerful earthquake ever recorded for their respective sites, but also to withstand the strongest earthquakes that geologists think are possible for each site. Current earthquake, tsunami, and flooding regulations are now under review, as indicated by the Nuclear Regulatory Commission (NRC).

As these reviews are conducted, the NRC and policymakers must ensure that additional regulations promote true safety, not just the perception of safety. Further, policymakers must recognize that plant owners and operators are highly motivated to maintain safe operations and are in many ways better prepared to ensure public health and safety than federal regulators. Under current U.S. policy, the plant operators are primarily responsible for plant safety. That is why the best approach will be for nuclear regulators to set and enforce high standards—and allow plant operators in the industry to determine how best to meet them.

The Mark I Containment System

According to the Nuclear Energy Institute, 23 U.S. boiling-water reactors share the same basic containment design, the Mark I, as the Fukushima reactors.[1] At first glance, this is troubling, especially in light of past NRC studies that had identified problems with the containment systems of those reactors. Often ignored, however, are the significant safety modifications made to these designs as a result of ongoing assessments of reactor safety///

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The history of the Mark I containment design in the U.S. is a testament to the effectiveness of the American system of nuclear regulation for maintaining public health and safety. Federal regulators identified a number of shortcomings with the original design that posed potential safety problems. The industry responded by forming a Mark I Owners Group to determine how to change the designs to address the safety concerns; the plants were then modified accordingly. Additional reviews led to further upgrades. For example, procedures to supply off-site power and water to reactors and fuel pools have been developed in the event that all on-site power and backup power is lost. Hardened containment venting has been added to every plant to ensure that pressure can be safely released from the containment should there be a system breakdown. Recent reports indicate that a similar modification may have been added to the Japanese reactors but could have malfunctioned.[2] Regardless, U.S. plants have the new venting and nuclear operators should ensure that they are working properly.