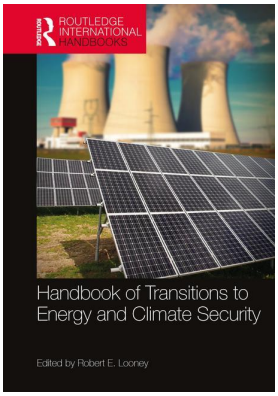

Handbook of Transitions to Energy and Climate Security

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The USA's energy and climate transition

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The USA's energy and climate transition

Partial success without a plan

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Introduction

The US energy picture is unique in a number of ways. Until recently replaced by China, the US was the world's largest consumer of energy. It is also a major producer of energy. In sharp contrast to most other developed industrial countries, US output of natural gas and oil has boomed in recent years, largely as a result of technological advances in shale technology.[1]

For all of the country's energy positives, there is one glaring negative – the country has never formulated what might be considered a comprehensive energy policy. Henry Kissinger is said to have observed: "The Energy Policy of the United States is not to have an Energy Policy,"[2] Other policy critics contend that the US actually has too many individually focused plans and programs. These are more often than not limited in scope, with little consideration given to their impacts outside their intended beneficiaries. The result is a morass of competing and conflicting outcomes.

To one critic of US energy policies, John Deutch, former Director of Energy Research at the Department of Energy the US government has been unable to formulate and sustain an effective energy policy because:[3] (1) the authorities have tended to opt for popular but unrealistic goals, (2) public attitudes often push politicians to short-term stop-gap policies rather than longer-term permanent solutions, and (3) there is an absence of objective quantitative analysis in planning, policymaking, and administration of government programs.

Many free market advocates assert that the country's energy sector is dynamic precisely because of the lack of comprehensive governmental planning. They argue that rather than constraining, bureaucratic rule making, markets have unleashed the private sector's creative talents to innovate and allocate energy related capital effectively.

Their contention is borne out by the US rankings in the World Energy Council's Trilemma Index[4] (Figure 14.1) that gauges country progress in energy equity (affordable energy), environmental sustainability, and energy security. From 2011 the starting date of the Index into 2015, the US has ranked first in the world in affordable energy. Largely as a result of the market driven surge in shale-based oil and gas the US also improved its standing in energy security,

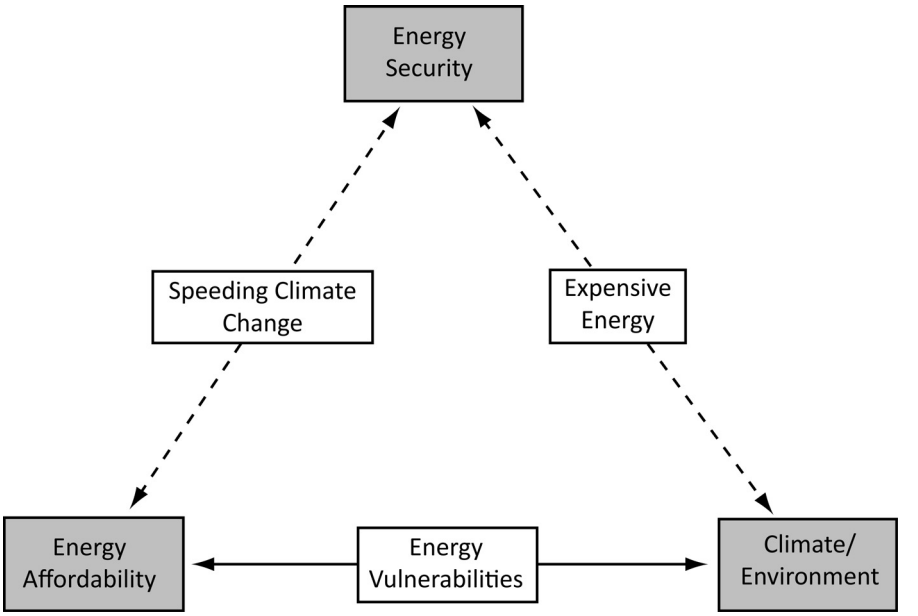

Figure 14.1 Classic energy trilemma

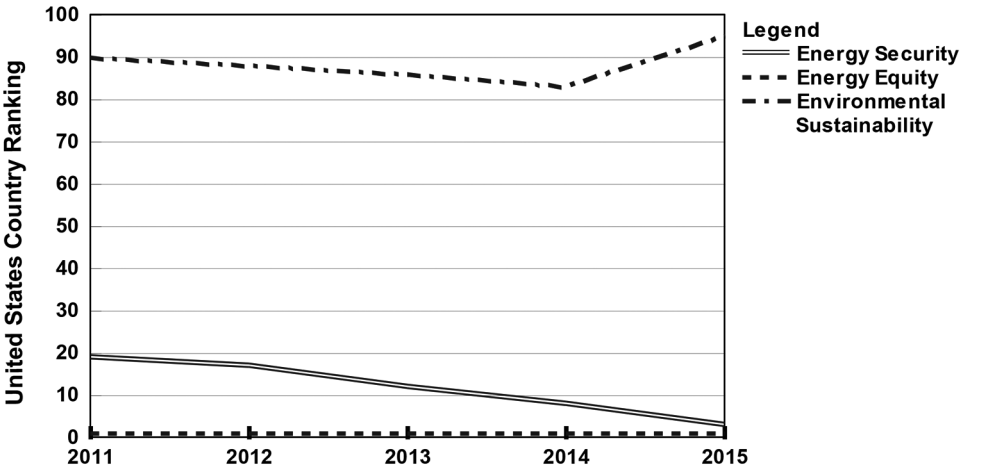

Figure 14.2 United States ranking on the Energy Trilemma Index

moving from 19th in the world in 2011 to 3rd by 2015. On the other hand, in the area of environmental sustainability where markets greatly underprice carbon, the United States ranked 95th in 2015 (Figure 14.2).

As US priorities along with those in the rest of the world began shifting toward environmental concerns, especially those associated with climate change, policy makers confronted challenges never faced before. Typically in the US energy policy making is driven by the need

to respond to a dramatic event such as the oil price shocks in the 1970s, or the oil price increases in the years leading up to the global financial crisis in 2008–09.

In the years before major concerns over climate change, US policymakers were able to design programs and policies that were fairly straightforward. In energy trilemma terms they were able to move ahead with actions that did not involve large trade-offs with other national objectives. Coal was always there to guarantee cheap available energy. In policy circles this environment and associated problems are usually dubbed "Tame Problems."[5] Typically, tame problems involve a clear objective and the causal factors underlying the problem are simple and widely understood. Energy security a problem? – fill up the Strategic Oil Reserve. Gas prices too high? – put on price controls until new sources of supply can be developed.

Thanks to coal, piecemeal energy policies that did not distort markets were relatively effective in assuring energy security without significantly increasing the price of energy. The two nodes of the trilemma energy security and affordability were easily achieved if at the cost of the environment and climate change.

Unfortunately, climate change or rather its deterioration does not produce market signals that firms can act on to increase their profits. Nor is it a dramatic shock that governments feel compelled or are under immediate pressure to respond to. One ramification is that a high percentage of Americans do not see climate change as a serious problem and a danger to the US.[6] In part this simply reflects an ideological barrier as many conservatives see climate change as simply a left-wing urbanites' cause and tend to dig in against it.[7]

In this environment, along with the evidence that coal is a major contributor to greenhouse gases, US authorities are now confronted with what is usually referred to as a Wicked Problem.[8] Wicked problems have no definitive formulation due to their extreme complexity. Any solution causes feedback effects and tradeoffs, often making the policy environment extremely contentious. Wicked problems are in a constant process of evolution and thus are never completely solved.[9] Any solution causes feedback effects which may negate other efforts at resolving or lessening the problem. As such, solutions are usually only fleeting. Wicked problems as in the case of climate change involve many diverse groups with sharply competing interests. Often a potentially infinite solution set exists, making policy consensus on a course of action almost impossible.

Compounding the wicked energy problem in the US is the fact that most of the optimal policies in aiding the country's energy transition are unavailable. This has forced policymakers to choose from a number of "second best" (and "third best") policies. Specifically, while a carbon tax would be the most efficient way to shift usage away from greenhouse gas emissions, the government has been forced to price carbon indirectly, or subsidize wind, and solar power, but this does nothing to discourage the continued usage of fossil fuels.

After examining the US's relative position in the energy trilemma, the following sections trace US efforts at limiting climate change. They show that despite the fact that the US has never been able to develop a comprehensive energy/climate plan, and often selects conflicting policies, the country appears, thanks to fortuitous developments, to be on a successful path of transition towards a sustainable increase in climate and energy security.

Trilemma patterns

The current US situation with regard to climate change, economic security and economic affordability can be best appreciated through comparisons with other parts of the world. For purposes of classification, the US falls in a group of countries that both produce and consume large amounts of energy, with energy imports accounting for between 5% and 30% of total energy supplies (see Chapter 1, Table 1.1).

The World Energy Council Trilemma Index represents an attempt to roughly quantify the three components of the energy trilemma for the purpose of not only identifying country priorities between the three, but also identifying which countries have made the most progress in each area.

As noted previously, historically US priorities and the outcome of market forces have positioned the country with high marks in energy security and energy equity (affordability). America's average score on these two dimensions would rank the country at around 6th in the world in terms of attainment. This score is 82 country rankings ahead of the country's progress in environmental sustainability which is the most extreme difference in the countries included in the trilemma index (Table 1.2).

China has a similar pattern, although that country ranks considerably below the US in all three dimensions. The difference between China's two highest priorities, energy security and energy equity and its progress in environmental sustainability is 74 country rankings. In the case of Poland the difference is 59 country rankings, while for India it is 30 country rankings.

The UK presents a much less extreme pattern. While energy security and affordability are clearly that country's priority areas, the difference between their average and that of energy sustainability is only 9 country rankings. In Brazil's case energy security and environmental sustainability are the top priorities with their average only 4.6 country rankings ahead of energy equity.

These patterns suggest that energy producers with a large component of coal production such as the US, China, Poland and India are much more likely to encounter a "hard trilemma" where improvements in the environment, at least in the short run are likely to bring down their rankings in energy security and/or energy affordability. Countries like the UK with environmental concerns and not reliant on coal, and the financial ability to develop other energy sources such as nuclear face a "soft trilemma" where balance between the three energy dimensions is attainable without much sacrifice in any particular area. The same should be the case for Brazil, but that country, largely dependent on hydro power, has not been able to expand supplies of electricity in line with the growing demand. This represents more of a policy failure rather than inherent hard trilemma trade-off. When the country's large off-shore oil discoveries begin production, the country should score much better in the affordability area.

US efforts towards energy and climate security – the Bush Administrations

With increasing international pressure stemming from its failure to sign the Kyoto Protocol[10] (2001), the US, for the first time, began to confront a hard energy trilemma. Throughout his administration (January 2001 to January 2009) President Bush followed a strategy based on long-term CO_2 goal-setting without mandatory enforcement.

Instead, US emphasis was on encouraging the adoption of new technologies via additional research and development (R&D) funding and partnerships. Specifically, in 2002, President Bush outlined a policy of reducing the ratio of emissions intensity to GDP over ten years.[11] In 2006 and 2007, he applied this approach to global negotiations, arguing that a series of international meetings were needed to set "aspirational goals" for emissions reductions.[12] In October 2007, he convened a "climate summit"[13] in Washington to begin this task, but no agreement was reached on long-term objectives.

Finally in 2008 the Bush Administration shifted from focusing on reducing emissions intensity by 2012, to targeting a halt in the growth of US emissions by 2025. Moreover, the administration's projections for meeting this goal anticipated 17 years of increasing emissions (currently growing by a few percentage points per year), so the 2025 level would be

significantly above current levels. It also did not specify an actual target; even large and repeated year-on-year increases would be consistent with this goal as long as the pace of increase dropped to zero in 2025.[14]

In addition to setting this distant target, the Bush administration outlined a preferred method of reaching the goal. Ideally it would involve all major emitters, including China, India and Russia; it would focus on encouraging innovation in low-carbon technologies while making nuclear power and coal part of any "solution." The idea was to provide a smooth transition for the economy while undertaking an "honest assessment of the costs, benefits and feasibility"[15] of any emissions reduction effort.

The administration's strategy was to achieve progress in CO_2 emissions, but not if it involved imposing the costs of improving efficiency and reducing emissions on industry or the public, or significantly tightening US regulation. In this regard, the administration strongly opposed mandatory approaches which they feared might sharply increase costs, reduce US competitiveness, or stifle the diffusion of new technologies.

While the Bush Administration was steadfast in its emissions position, momentum was building in the US for greater efforts towards averting climate change. First, Congress began debating legislation for the creation of a US domestic cap-and-trade program along the lines of the EU Emissions Trading Scheme (ETS).[16] In addition, several of the states, California and those in the north-east, began considering trading initiatives.[17]

Second, in the area of regulation, a slowly moving battle in the courts was developing between the Environmental Protection Agency (EPA) – which as an executive agency falls under the Bush White House – and various states and interest groups that were attempting to use a pre-existing statute, the Clean Air Act, to force the EPA to regulate greenhouse gases.

In an April 2007 ruling, the US Supreme Court found that the Clean Air Act does, in fact, allow the EPA to regulate greenhouse gases, and said that the Agency could only avoid taking remedial action on emissions "if it determines that greenhouse gases do not contribute to climate change" or otherwise provides some "reasonable explanation." However, the Court did not impose a timetable for such a determination, and the EPA has chosen to proceed slowly.

Little progress towards environmental sustainability and the reduction of CO_2 emissions was made during the Bush years. At the time, the United States was the only major developed economy to have remained significantly uncommitted to international climate policy. In contrast to previous administrations that made significant improvements to energy security and in the provision of affordable energy. Ideologically, the Bush Administration was unable to design a credible climate change policy. It was also unable to cope with the increased complexity associated with climate change. Instead the Administration reverted to its free-market orientation, and the hope that new technologies would provide a low-cost solution to the CO_2 problem. However free markets only provide solutions and new technologies if they are profitable, and the administration did little to assure this outcome.

US efforts towards energy and climate security – the first Obama Administration

By the end of the Bush administration climate change had moved from being a niche environmental concern to one with broad national and international interest. The shift in US leadership was expected to give climate change a high priority and thus shift the US approach to international climate negotiations.

President-elect Barack Obama had been a consistent supporter of a US cap-and-trade system. During the campaign for the presidency he also proposed setting long-term goals of a 20% reduction in emissions (below 1990 levels) by 2020 and 80% reduction by 2050.[18] He also

expressed a desire to engage in international negotiations through the UN Framework Convention on Climate Change (UNFCCC) and G8+5 processes.[19] At the same time there was concern in environmental circles that the nation's economic problems stemming from the lingering financial crisis of 2008 would divert his attention to more pressing issues.

These concerns were quickly addressed by the Administration's actions concerning the environment. In this regard, much of the President's climate agenda was integrated into the administration's response to the on-going economic and financial crisis. As part of the administration's fiscal stimulus, provision was made for a significant expansion of expenditures directed toward the creation of "green jobs" and the development of "green technologies." Included in the package were: 20 billion dollars in continued tax credits for renewable energy; 15 billion dollars for building mass transit projects; more than 5 billion dollars for energy R&D projects; 5 billion dollars for the weatherization of houses; and 500 million dollars to train workers in conducting efficiency improvements.[20]

Another sign of the administration's seriousness at combatting climate change was the appointment of Steven Chu as secretary of energy and John Holdren as White House science adviser. Dr. Chu, a Nobel laureate, was the director of the Lawrence Berkeley National Laboratory in California. John Holdren was a long-time energy technology and climate science expert, former president of the American Association for the Advancement of Science (AAAS), and professor at the Kennedy School of Government at Harvard.[21]

Other tangible signs of the importance given climate and environmental issues by the Obama administration were signaled by the signing of executive orders reversing Bush decisions on automobile fuel efficiency. In this regard the administration instructed the Department of Transportation to issue guidelines to bring the US auto fleet fuel efficiency standard to 35 miles per gallon by 2020 or earlier.

Instructions were also given to the EPA to consider granting a waiver to California and 13 other states that would allow them to regulate greenhouse gas emissions from automobiles. Such waivers, which would cover nearly half the US auto market, would likely drive even greater changes in the overall market – and were long opposed by the industry. For example, the California rules would seek to cut vehicle emissions by 30% by 2016.[22]

Looked at from a broader perspective, the administration's energy and climate policies can be seen as integral parts of an overriding strategy of linking the goals of: (1) remaking the US energy and transportation systems; (2) reducing carbon dioxide emissions that lead to climate change; and (3) attempting to ensure that this process provides domestic economic benefits through job creation.

In pursuit of these political and policy objectives, the Obama administration initiated a major tactical shift away from the Bush administration. Specifically, the administration showed its willingness to (1) re-engage with international environmental negotiations, both on climate and other topics; (2) direct federal agencies to identify and pursue regulatory changes that would reduce emissions or encourage low-carbon energy technologies; (3) allow latitude to states that wish to pursue more aggressive policies on emissions – in a manner similar to his approach towards auto fuel-economy standards.

The administration's move towards greater state involvement reflected the political reality that it is now rare in the United States for major policy changes to emerge initially on the federal level. Since the 1970s, most successful national reforms (such as welfare reform) were based on policies originally developed at the state level and then extended by Congress to the rest of the country. In contrast, in cases where major changes were first introduced at the federal level, these were largely unsuccessful (e.g. the Kyoto climate policy).

In short, the Obama administration's initial policy initiatives were intended to establish a critical link between economic recovery and climate change. As opposed to previous failed top-down approaches, the administration opted for a bottom-up approach to regulatory change.

The first major piece of legislation addressing climate under the Obama administration was the American Clean Energy and Security (ACES) Act of June 2009.[23] Although it had little support from Republicans, the ACES's significance lay in the fact that it represented the legislation passed by the House of Representatives that set limits on greenhouse gas emissions. Specifically, its goals were: (a) to cut emissions by 83% below 2005 levels by 2050; (b) to establish a renewable energy standard (percentages) for electric utilities; (c) subsidies for carbon capture and storage demonstration plants; and (d) additional financial assistance for advanced vehicle technology and battery research.[24]

A key concession that helped force ACES through the House was an agreement to largely grant free carbon credits to energy intensive businesses for the first 15 years of the scheme, which helped to mute opposition.[25] One important missing element in the bill was a significant commitment to nuclear power.

While President Barack Obama pushed for a similar bill in the Senate, little progress was made. Failure in the Senate illustrates the extreme difficulty in passing broad sweeping legislation at the national level. Ironically, business pressure and lobbying may not have been the deciding factor. Historically, US businesses have been fairly unified in opposition to a GHG emissions cap. Such limits were seen as a burdensome cost, and constraint on economic growth. Yet this monolithic view is changing. Some companies simply prefer policy certainty on the issue, so they can plan multi-billion dollar capital investments and build generating capacity.[26]

One factor that may have prevented the bill's passage in the Senate was the attachment many senators or representatives had to specific technologies. Those from coal producing states tended to favor carbon capture and storage (CCS), while liberal Democrat legislators tend to favor renewables such as wind and solar power. Conservatives are often inclined to favor nuclear power while representatives and senators representing coal, gas and oil rich states advocate expanding domestic production as the proper solution. Reconciling these diverse views has proved extremely difficult if not impossible.

Another stumbling block and part of the wicked problem aspect of climate change is uncertainty over the costs involved in reducing green-house gas emissions. However costs are critical in garnering public support for legislation in the area. In 2009, the year the ACES was passed by the House of Representatives, the country was divided on a cap-and-trade policy with 52% of the public supporting the proposed scheme. However 58% of respondents backed cap-and-trade if it raised their monthly electricity bills by 10 dollars or less per month, but support dropped to just 39% if electric bills increased by 25 dollars per month.

Unfortunately independent estimates of the impact of bills like the ACES often produce dramatically different estimates of future costs and energy price increases – it all depends on the assumptions built into the analysis. Most studies at the time showed a wide range of price estimates to achieve the ACES target emissions reductions. In its base case, the Department of Energy's Energy Information Administration (EIA) found costs at 32 dollars per metric ton by 2020 and 65 dollars per ton by 2030. However, with rapid deployment of nuclear power and CCS technology, and with the widespread availability of international offsets, the study estimated that 2030 costs could be as low as 41 dollars per ton. Under a less favorable scenario, costs could be nearly five times higher – 191 dollars per ton by 2030.[27]

In sum, economic modeling at the time suggested the costs to the economy of imposing a cap-and-trade scheme could be anywhere from manageable to painful, depending upon key assumptions themselves subject to a wide variation in probabilities. Even a greater variation in

results was produced by studies estimating the likely economic benefits associated with the planned ACES reduction in CO_2 emissions. With no clear and unambiguous statement of future costs and benefits, most legislation in the US is dead even before it is put to a vote.

Summing up, there are three potential ways to begin reducing greenhouse gas emissions: (1) setting norms and standards (i.e., a "command-and-control" policy); (2) a carbon market (i.e, "cap-and-trade," which is embodied in the EU's current Emissions Trading Scheme, and was the centerpiece of the failed ACES program); and/or (3) through a carbon tax.

During President Obama's first term, the administration attempted both to establish a carbon market through the ACES, and cut emissions through a command-and-control approach – by mandating a doubling of fuel-economy standards in cars and trucks. The former failed spectacularly, while the latter succeeded – and, at the same time helped increase US energy security by reducing imports.

The possibility of a consensus on a carbon tax received a boost in July 2012, when a conference organized by the American Enterprise Institute brought together conservative and liberal analysts and scholars and achieving a surprising degree of consensus on the benefits of such a tax. There were also hopes that tax negotiations during on-going fiscal reform talks could be "greened," with some of the necessary new revenues being achieved through a carbon tax. However, as with many discussions in Washington, good ideas alone don't carry much weight.

Nevertheless, despite any significant Congressional legislation in the climate area, between 2009 and 2012, the end of President Obama's first term in office, the US made progress in reducing greenhouse gas emissions. CO_2 intensity declined at an average annual rate of 3.0% while CO_2 emissions per capita declined at an average annual rate of 1.6%. In part the CO_2 emissions stem from the administration's "stealth" climate policy, in the form of encouraging utilities to switch from coal to gas-fired power plants (which are half as carbon intensive). In 2011 for example, energy produced via gas increased by 3% while energy produced from coal fell 6%.[28] Other factors contributing to the reduction in greenhouse gases were the administration's measures to increase the percentage of renewables in the final energy supply.

US efforts towards energy and climate security – the second Obama administration

At the start of his second term in office, President Obama renewed his administration's efforts to reduce the country's greenhouse gas emissions. This apparent revival of a priority buried after the failure of cap-and-trade legislation in 2009 comes after the previous year's historic drought, the devastation caused by Hurricane Sandy, and record high national average temperatures in 2012. The key question was how much meaningful regulatory action is possible in the absence of new legislation, given that the Republican controlled House of Representatives would reject any new climate change bill.

As a result, President Obama has been forced to resort to a series of "second best"[29] actions to combat climate change. Early on in his second term the president initiated his Climate Action Plan,[30] a framework incorporating cuts in carbon usage, formulating responses to climate change impacts, and participating at international forums to develop cooperative arrangements leading to the reduction in greenhouse gases.

Another objective of the plan is to indirectly reduce CO_2 emissions by encouraging and promoting renewable energy and efficiency. Given the stand-off in Congress, the Climate Action Plan largely resorts to the use of executive orders to reduce greenhouse gases directly: (1) The Clean Power Plan, (2) Standards for Heavy-Duty Engines and Vehicles, (3) energy efficiency standards, and (4) economy-wide measures. Although not explicit in the Plan, the administration's

strategy includes actions in specific cases like the Keystone Pipeline where the administration feels an adverse effect on greenhouse gases was likely.

The philosophy of the Climate Action Plan's regulatory orientation is to seek to establish partnerships between the federal government and states, permitting flexibility towards reaching EPA-mandated emission rate-based carbon dioxide goals – through improvements to existing power plants, lower-carbon alternative generating capacity or energy efficiency schemes.

Of these measures, the EPA's actions toward the coal sector will probably have the greatest effect on greenhouse gases. In June 2014 the EPA under the Climate Action Plan introduced a plan to reduce carbon emissions from the power generation sector by 30% from 2005 levels by 2030. The new regulations do not represent a comprehensive carbon reduction plan. Instead they address only the power generation sector. The EPA reports that power generation is the primary source in the United States for GHG emissions. Specifically this sector accounts for 32% of the total, and carbon dioxide is the primary GHG, at 82% of US emissions.[31]

The plan will not include a federally-mandated program of carbon reduction. It will instead set carbon emission rate targets for each state for existing fossil fuel plants. States must submit implementation plans for EPA approval between 2016 and 2018. The regulations on new power plant construction are so stringent that coal-fired plants cannot meet them. Specifically coal plants are now mandated to capture and store 20–40% of carbon they produce.[32]

Utility companies and states whose political climate is opposed to the EPA (e.g., Texas) or that are dependent on the coal industry (e.g., West Virginia) will challenge the plan in court. Such lawsuits are unlikely to succeed. In Massachusetts v. EPA in 2007, the Supreme Court ruled that carbon dioxide falls under the EPA's jurisdiction under existing Clean Air Act (CAA) statutory authority. Therefore, the EPA has promoted the health benefits of GHG reduction (one of the main reasons for the CAA), arguing that there will be 140,000 fewer asthma attacks in children by 2030.

The Supreme Court ruled in EPA v. EME Homer City Generation[33] in April that states do not need a second opportunity to file a state implementation plan if the first is rejected by the EPA for not meeting federal guidelines. This gives the EPA ultimate authority on the issue; by inviting state partnerships, it has avoided the legal issue of federal mandates. This should prevent most challenges against the core of the EPA's new rules from being upheld.

How effective are the new regulations likely to be in reducing greenhouse gases? Coal plants are the oldest within the US fossil fuel power sector – with an average age of 42 years – compared to an average of 14 years for gas-fired plants. Since coal plants are mostly nearing the end of their lifespan and natural gas plants emit about half of the carbon while becoming increasingly cheap, it is likely that most coal plants will be phased out by the rule's 2030 target. What will happen to coal? Unless similar actions are taken by other coal consuming countries, US coal will simply be diverted to export markets. Given that global emissions are what really matter, the regulations are not nearly as effective as they might appear at first glance.

On the other hand, the plan is likely to lead to greater investment in renewable energy; states targeting reduced carbon emissions per MWh will have an incentive to subsidize or prefer new installations in wind or solar. Investment is likely to lead to technological innovation, and public support for home installation of solar panels (especially if households are allowed to sell power to the grid) could spread the technology rapidly.

The Administration's climate strategy over its last several years will likely be one of increased EPA regulation. The president has directed several departments and agencies, most notably the EPA, to issue directives and regulations that would impose progressively lower ceilings on GHG emissions. For example, on June 10, 2015 the EPA announced that it will begin to craft rules to limit greenhouse gas (GHG) emissions from airplanes.[34]

As with the cuts to carbon emissions, none of these regulations followed passage of new legislation – all relied on expansive interpretations of existing statutory authority for executive agencies. The strategic political problem that induced Obama to direct agencies to promulgate all these wide-ranging regulations is his lack of a working majority in Congress.

Further complicating the issue, Democrats from consumer states (such as Missouri, which relies on coal for 80% of its energy) worry about the impact of higher energy prices that may result from new emissions controls. In states that produce oil and coal, Democrats have already paid a price, as in West Virginia, Ohio and Pennsylvania, especially in the state legislatures.

In the international arena Obama has been willing to pay the price of electoral vulnerability as part of a larger strategy to implement international agreements that can make a serious dent in emissions by demonstrating US credibility. Even so, international agreements are not likely to be approved by Congress. Consequently, Obama's White House will probably rely on a variant of the arms control agreements known as parallel unilateral policy declarations (PUPDs)[35] in which the parties to an accord do not sign a binding international treaty, or conclude an executive agreement, but rather simultaneously declare that they will each unilaterally implement a limitation.

While it is very unlikely appeals will succeed, states can slow enforcement whether or not Congress and courts act against the EPA's new regulations. On the other hand states may back national regulation because national standards prevent one state from exporting its pollution downstream to another. States may also participate in national intergovernmental programs to avoid losing out on available funds.

When a regulatory regime promises significant costs and where costs are highly concentrated, it is a blueprint for state resistance. In many states (especially those dominated by Republicans), governors, state legislatures and attorney generals will oppose the new rules. In 32 states, officials are readying to resist that part of the regulations.[36] Coal-burning states are starting to pass laws that provide for cost-benefit analyses for each new power plant. While it is too early for many of the assumed benefits of the administration's regulatory regime to be felt, the country's declining energy sustainability ranking in the World Energy Council's Energy Trilemma Index from 90th in 2011 to 95th in 2015[37] is not encouraging.

The EPA strategy is to reduce state opposition by getting more of the corporate sector on board. This strategy has worked with coal sludge, methane reduction in pipelines and natural gas leaks, sea drilling rules and miles per gallon increases mandated for automobiles.

The price of obtaining such cooperation involves some dilution of rule-making authority and targets, which is likely to occur in each individual state plan over the next two years. This also involves a great deal of industry self-reporting. Good faith efforts at reporting in many industries are often lacking while information is received late and incomplete; penalties for non-compliance or uneven compliance are often token. They will not be as effective as mandatory regulating.

Market factors will continue to be more significant than government action in determining the mix of energy in the electrical grid. Government policy is more likely to be successful when it involves distributive politics, such as loans, loan guarantees, subsidies for research and development and guaranteed procurement of product.

To the extent that regulation is promoted, it is more likely to be successful when it co-opts the major energy and emissions producers, or water and air polluters. They often have a stake in promoting national standards. This is a more costly way to proceed if one simply counts up federal expenditures and guarantees, but may be far cheaper in the long run, when counting up the societal and economic costs of failing to lower emissions through development of new technologies and energy sources.

In sum, neither Congress nor the judiciary will overturn the principle that the EPA may regulate greenhouse emissions. However, weak enforcement capability at the national level, the

reliance on state officials when a majority of state governments are controlled by the Republican Party and the pattern of self-reporting by industry will slow implementation. Markets and price effects will have a greater impact in the short-term than regulations. Finally, the risk of executive orders is that they can always be rescinded or dismantled by a new administration.

Alternative strategies

As we reach the end of the Obama presidency the limitations of the administration's top-down regulatory approach suggest that other avenues may be more effective in combatting climate change. Several possibilities include (1) a bottom-up strategy where cities and/or states take more of the initiative in designing and implementing their own climate plans, and (2) a reoriented national strategy that builds on the US shale oil and gas boom in a manner that eliminates many of the harsh trade-offs inherent in the hard trilemma. Inherent in the first strategy is an economic security dimension associated with climate change, while in the latter climate change is seen more from a national security perspective.

Bottom-up approach

Jeffrey Sachs contends that "[i]n the US, because Congress has been stalemated and lot of our politicians bought by the oil, coal, and gas sector, things haven't happened at the federal level except through the regulatory apparatus. The real action has been happening at the state and city level."[38]

In combatting climate change US local jurisdictions often have the advantage of being more homogenous politically. They are also likely to see the effects of climate change first hand – droughts in California, coastal erosion in Florida, intense storms along the Atlantic coast – and thus have a much easier time forging consensus as to the best way to combat climate change. In addition to begin to get Republican political support for combatting climate change these jurisdictions are able to shift climate discussions away from problematic long-run global warming concerns and towards more immediate issues – economic security.[39] While economic security is most often thought of on an individual basis – the ability to achieve a stable income or standard of living into the future, on a regional or local basis economic security simply means the ability of that jurisdiction to follow its choice of policies to develop in the manner desired.

As noted, much of the local effort to avert climate change is taking place at the city level. While there are obstacles to cities cutting emissions, there is a growing political impetus at the city level for mitigation initiatives, in part driven by a growing realization that cities can be the best social unit for driving innovation on tackling climate change.

Cities have advantages tackling climate change compared to state governments: (1) they are large enough to put into practice pilot programs, yet sufficiently close to communities to be faster and more effective in meeting public aspirations; (2) they are better placed for central planning for water, energy and waste management, and establishing citywide building codes; (3) they can drive immediate changes in public transportation and longer-term changes in land-use planning; and (4) they can offer local level subsidies for renewable sources of energy or loans to make buildings more efficient.

In addition, cities often find cooperating with each other easier than with federal or even state jurisdictions who are often restricted by the demands of geopolitics. For example, over 1,000 US cities have made commitments to meet or exceed the Kyoto Protocol targets of GHG emissions (6% below 1990 levels by 2012), even though the Protocol has never been ratified at the federal level.

The Pew Foundation estimated that voluntary actions from cities and local governments in the United States cut over 23 million tons of GHGs in 2009. The Pew study calculates that such actions from around 150 cities and counties could meet 10% of the goal President Barack Obama offered (but never ratified in the Senate) of reducing emissions by 17% below 2005 levels by 2020.[40]

US cities have also been quite innovative in reducing greenhouse emissions:[41] (1) Boston has introduced the country's first green building code; (2) Ashville, North Carolina, city employees started a "compressed workweek" in which they worked ten hours per day, four days a week, to save energy on travel and heating; (3) Santa Monica aims for net zero emissions energy by 2020 mainly by using energy efficiency measures and solar power; (4) Chicago has raised local taxes to allow it to invest more than 330 million dollars in a flood control program over the next ten years.

Sometimes sub-national entities enter into agreements with national governments. This was the case with a 2013 agreement between California Governor Jerry Brown and Chinese President Xi Jinping. It commits them to joint efforts on combatting climate change, including Californian authorities sharing policy approaches with Shenzhen to help it develop an emissions trading system.[42] In contrast to the Obama administration's early failure[43] to initiate a national cap and trade system, California[44] had little difficulty in introducing a sophisticated system to reduce carbon.

Reoriented efforts at the national level

While the US has not been able to develop a comprehensive plan or even a national consensus towards an approach capable of guiding the country's transition to a lower carbon environment, consistent with international standards for reducing greenhouse gases, the EPA efforts along with several other initiatives may still be capable of putting the US on a sustainable path to a low carbon economy.

For one thing, the country is no longer facing a hard trilemma where improvements in the environment must come at the expense of either (or both) energy security and affordable energy. Break-throughs in shale technology have fundamentally changed the US energy picture from one of long run decline to one of being a major competitive exporter of oil and gas.[45]

It is likely that US shale gas production will continue increasing through 2014. However, the path will not be smooth. Currently shale oil and gas are encountering the effects of the dramatic fall in oil prices beginning in the fall of 2014. In 2014, US oil output grew by 16.2%, in large part due to fracked shale plays in North Dakota and Texas. Production growth will not be as strong in 2015 and 2016 – 8.1% in 2015 and 1.5% in 2016, due to lower prices and thus falling profitability.[46]

Cuts to capital expenditure have started to hit certain shale regions. The US rig count has dropped from 1,473 to 825[47] over the past year, although many of those retired were older and less efficient rigs. Producers have increased efficiency by adopting new techniques such as "pad drilling" (multiple wells drilled in tight clusters with fewer rigs). There is considerable confidence within the industry that further efficiency gains are possible and that even if prices are depressed for several years the shale industry, while slowing down, will remain viable and competitive.

With the continued expansion of US shale oil and gas assured, the hard energy trilemma facing US policy makers will soften and may even go away. Oil expansion increases energy security, while the gas will be increasingly used in power generation reducing CO_2 levels associated with coal. In this situation US policymakers will be faced with what might be called a virtuous trilemma (Figure 14.3). With abundant energy, economic security replaces energy affordability.

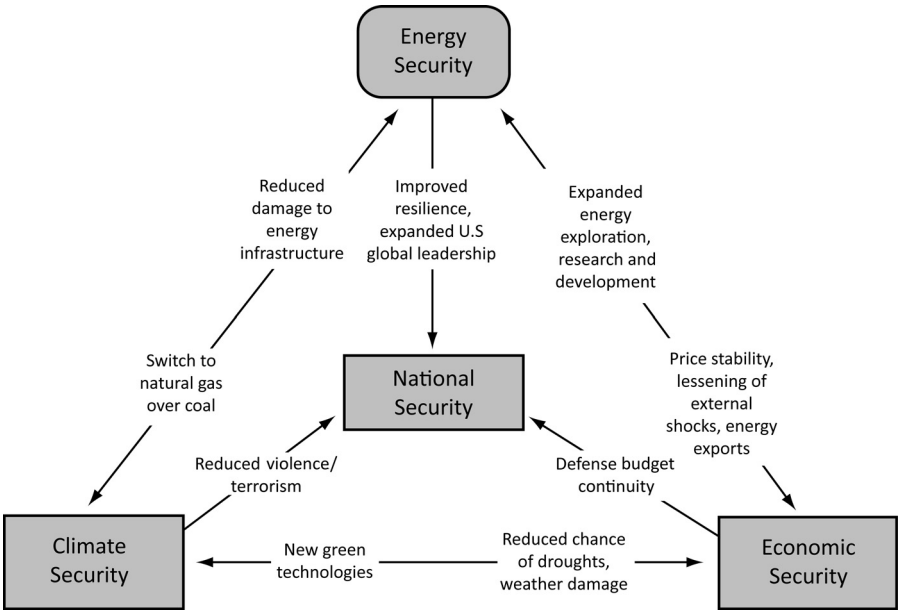

Figure 14.3 The virtuous trilemma

Other changes from the conventional trilemma include national security as a goal that is enhanced by improvements in energy security, climate security, and economic security. Regarding national security, the traditional US view has been to look at national security largely in military and intelligence terms – the growth in potential advisory defense budgets, nuclear proliferation, cyber security threats, and the rise of rogue nuclear states. However broader definitions of national security are coming into the picture. For example, the 2010 National Security Strategy[48] includes economic instability along with climate change as security threats. Similarly, the 2010 Quadrennial Defense Review draws a number of connections between climate change and conflicts, both now and increasingly in the future.[49]

In the US context, rather than a series of conventional trilemma tradeoffs, the virtuous trilemma will be increasingly centered on a series of complementarities: increased energy security enhances economic security, in turn improved economic security contributes to climate security which in turn improves energy security, with improvements in each contributing positively to national security. These shifts from the conventional trilemma are reflective not only of the effects of the shale oil and gas boom but also of a number of recently observed phenomena and empirical relationships.

The lesson from cities is that when the effects of climate change are close at hand it is much easier to gain support. At the national level National Security is an encompassing concept that often unites parties that are often opposed on a wide spectrum of issues.

A number of linkages in the virtuous trilemma are straightforward and in need of no further elaboration. Improved economic security contributes directly towards funding those expenditures contributing to national security. Improved climate security improves energy security through reducing the threat to the energy grid or energy facilities stemming from excessive heat, or violent coastal storms.[50] Other critical linkages are less obvious and in need of further elaboration.

Climate security – national security

US Republicans would be more supportive of efforts at combatting greenhouse gases if climate change were seen as a critical component of national security. There is growing evidence that this is the case. In his definitive study of the subject,[51] Daniel Moran sees "climate change less as a direct threat than as an additional source of stress on the sinews of public life, which cause fragile governments to fall or may provide a new impetus for a range of violent outcomes, ranging from social upheaval to aggressive war."[52] In this vein Gwynne Dyer a military historian, notes that "in a number of the great powers, climate-change scenarios are already playing a large and increasing role in the military planning process."[53]

For its part, the Pentagon is integrating climate change threats into all of its "plans, operations, and training" across the entire Defense Department, signaling a comprehensive attempt to tackle the impacts of global warming.[54] In its 2014 Climate Change Adaptation Roadmap[55] the Pentagon details its strategic blueprint to address climate change, calling it a "threat multiplier" that has the power to "exacerbate" many of the challenges the US faces today, including "infectious diseases and terrorism."

Empirical studies confirm climate's impact on conflict. For example a recent study conducted at Stanford University found[56] that shifts from normal weather patterns are likely to increase the risk of conflict. Nowhere is this pattern more visible than in the Middle East and Africa. As Secretary of State John Kerry has observed, "It's not a coincidence that, immediately prior to the civil war in Syria, the country experienced its worst drought on record. As many as 1.5 million people migrated from Syria's farms to its cities, intensifying the political unrest that was just beginning to roil and boil in the region."[57] In a similar vein the rise of Boko Haram in northern Nigeria can be traced in part to climate change[58] and the drought in the Lake Chad region that disenfranchised[59] large segments of the population, impoverishing the region[60] and created an expanding pool or recruits to radical causes. It provided the right environment for ISIS to expand enough to become a global threat.[61]

The danger of attempting to link climate change to violence, terrorism or other acts of violence is that one can easily overstate the case and thus lose credibly. Instead it is best to consider climate change as one element of several elements that increase the likelihood of conflict. As Peter Gleick, President of the Pacific Institute observes,[62] "As the climate changes, as water systems fail, as energy reliability vanishes, these factors are piled on top of the misery already in play. Will they cause conflict? I think that's the wrong question. Will they increasingly influence the risks of conflict and war in some regions? Unquestionably." This alone should qualify climate change as a national security issue.

Energy security – national security

Increasingly there are situations where improved energy security and national security are complementary. The US shale boom is clearly a case in point. In the military area the classic link between energy security and national security is a lessening imperative to maintain and preserve unstable regimes in hostile areas. For their part the US military are developing a spectrum of new fuels, technologies and new usage patterns in strengthening their own operations which also enhance US national security.[63]

In a broader context, economic power enhances the ability of the US to shape world developments in line with its interests. For example, during the period of sanctions against Iran, increased oil supplies and lower energy prices stemming from the US shale boom aided US efforts to finalize a comprehensive nuclear treaty with that country.

In a similar manner the shale boom and the likelihood of increased gas exports has likely contributed to the United States' ability to form a coalition of Asian nations willing to form a Trans-Pacific Partnership (TPP), a key element in the US efforts to assure a peaceful Pacific Basin.[64]

In the case of the Caribbean Central America – expanding LNG exports to the region would not only contribute to US energy security, but it would also contribute to national security through creating a more stable region with improved economic performance.

Energy security – economic security

Increased energy security stemming from the shale oil and gas boom will also have some clear benefits through assuring improved economic security. Sudden spikes in energy prices have been associated with nearly all of the post-World War II recessions. At other times, rapid increases in energy prices have had a retarding effect on economic growth and job creation. Households are left with less to spend on goods and services in general, causing slack in the economy, resulting in declines in productive investment.

Before the shale boom energy prices were increasingly variable.[65] This variability often created a vicious circle whereby energy price variability increased uncertainty about future energy prices which, in turn, deterred investments in conventional types of energy. With lower future supplies, sharp increases in oil prices occurred then economic growth picked up. Insofar as volatile energy prices reduce investments in domestic alternatives they exacerbate the initial instabilities by concentration in less stable regions. Because oil supplies can be increased quickly and incrementally from new shale wells, there is a dampening effect on prices "not possible from high cost long development period conventional oil wells."[66] In effect, this property of shale means the United States may replace Saudi Arabia as the world's swing producer.

Conclusions

In its November 2015 survey of climate change, the *Economist* magazine noted that "It is often said that climate change is an urgent problem. If that were true, it might be easier to tackle. In fact, it is a colossal but slow-moving problem, spanning generations."[67] As a body of clear scientific evidence as to the link between house gases and climate change accumulates, climate skeptics in the US are likely to decline in number and influence. However broad political support for climate change may still be hard to garner because it is still viewed as a situation where the costs are up front and the benefits far into the future.

In classic trilemma terms the costs of reducing greenhouse gases are either increased energy vulnerability or expensive energy. A broader national security view of efforts to reduce climate change, a Virtuous Trilemma, suggests broad complementarities flowing from efforts at reducing climate change. With the advent of the US shale oil and gas boom, rather than costly tradeoffs between climate change, energy security and energy affordability, these complementarities produce immediate benefits in terms of improved energy security, economic security and national security. Most importantly, shale gas greatly reduces the costs of transitioning to a lower-carbon economy where new green technologies can assume a dominant role in power generation.

Because of the shale boom, US energy policy has shifted from being a wicked problem back to one that is relatively straightforward. Hopefully, this development along with the growing city and state bottom-up efforts at combatting climate change will provide the momentum that enables the US to take advantage of its fortuitous energy boom. Rather than all or nothing

approaches like the Keystone Pipeline, government policy at the federal level can still be highly effective in this regard as it moves away from its current regulatory approach toward market-based[68] solutions that balance growth with concerns for the climate.

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