

2013

Shale Gas and Clean Energy Policy

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Recommended Citation

Joseph P. Tomain, Shale Gas and Clean Energy Policy, 63 Case W. Res. L. Rev. 1187 (2013).

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SHALE GAS AND CLEAN ENERGY POLICY

Joseph P. Tomain[†]

*“America needs a new political discourse on energy. This would recognize the emerging reality that the United States has turned around as an energy producer and is on a major upswing. And the impact will be measured not just in energy security and the balance of payments. Energy development also turns out to be an engine for job creation and economic growth—something that would hardly have been considered the last time we were electing a president.”**

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INTRODUCTION

A recent report from the International Energy Agency (IEA) makes claims similar to those expressed by Daniel Yergin. Both commentators argue that new fossil fuel discoveries in the United States are having a profound impact on domestic and global energy policies. According to the IEA, “[t]he global energy map is changing” and “is being redrawn by the resurgence in oil and gas production in the United States.”¹ Industry observers project that by 2020, the

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* Daniel Yergin, *America’s New Energy Reality*, N.Y. TIMES, June 10, 2012, at SR9. Yergin argues that the increase in fossil fuel discoveries (particularly natural gas from shale formations), lower demand for imported oil, an increase in domestic oil production, and technological developments have “improved” our fossil fuel picture and that we are making gains toward “energy independence” while “rebalancing world oil.” Further, he argues that oil and gas should be seen as an “engine of economic growth.”

1. INT’L ENERGY AGENCY, WORLD ENERGY OUTLOOK 2012: EXECUTIVE SUMMARY 1 (2012).

United States will produce more oil than Saudi Arabia and more natural gas than Russia.² In addition, the IEA reports that the global energy map is changing as countries retreat from nuclear power and replace it with rapidly growing wind and solar technologies.³ Other commentators, like Professor Richard Pierce, claim that shale gas addresses *all* of our major energy problems,⁴ while still others treat this natural gas resource as a bridge fuel to the future.⁵ Indeed, in his 2012 State of the Union Address, President Obama cited experts who predicted that the natural gas industry will create 600,000 jobs by the end of the decade.⁶ As remarkable as these claims are, the United States is not scheduled to be energy independent without a robust clean energy economy, even in the brightest projections.⁷

To be sure, these new finds of natural gas have much to recommend them. First, recent discoveries reveal abundant reserves and, following abundance, consumers enjoy lower natural gas prices.⁸ Second, natural gas emits about half of the carbon dioxide released by coal. As a result of these lower prices and less drastic environmental effects, natural gas is beginning to displace coal for electricity generation.⁹ Fourth, the increase in domestic production adds jobs to

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2. See Michael Levi, *Think Again: The American Energy Boom*, FOREIGN POL'Y, July–Aug. 2012, at 55, 55 (noting industry predictions that “by 2020, the United States will become the world’s largest producer of oil and gas”).
 3. INTERNATIONAL ENERGY AGENCY, *supra* note 1, at 6 (projecting an increase in the use of renewables as the role of nuclear power declines).
 4. Richard J. Peirce, Jr., *Natural Gas Fracking Addresses All of Our Major Problems*, J. ENERGY & ENVTL. L. (forthcoming May 2013) (manuscript at 3–5), available at <http://ssrn.com/abstract=2172441>.
 5. STEPHEN P.A. BROWN ET AL., RES. FOR THE FUTURE & NAT'L ENERGY POL'Y INST., NATURAL GAS: A BRIDGE TO A LOW-CARBON FUTURE? 2 (2009); JOHN D. PODESTA & TIMOTHY E. WIRTH, CTR. FOR AM. PROGRESS & ENERGY FUTURE COAL., NATURAL GAS: A BRIDGE FUEL FOR THE 21ST CENTURY 1 (2009).
 6. President Barack Obama, Remarks by the President in State of the Union Address (January 24, 2012).
 7. Levi, *supra* note 2, at 56.
 8. STEPHEN P.A. BROWN ET AL., RESOURCES FOR THE FUTURE, ABUNDANT SHALE GAS RESOURCES: SOME IMPLICATIONS FOR ENERGY POLICY 11 (2010).
 9. See John Corrigan & Jim Hendrickson, *Shale vs. Coal*, PUB. UTIL. FORT., May 2012, at 20, 21 (noting that the “emergence of ample supplies of natural gas at moderate to low prices and the prospect of more stringent air emissions regulations” is likely to result in “a moderate, but uneven, shift from older, coal-fired plants to more efficient gas-fired plants”).

the economy.¹⁰ Fifth, the United States is beginning to reduce imports and increase exports, thus reducing the trade deficit as the United States grows more energy independent.¹¹ Not only are we less reliant on imports, natural gas can be adopted for use in the transportation sector—further reducing our reliance on oil.¹² And, sixth, new discoveries have the effect of smoothing out the price volatility experienced by the natural gas sector for the last two decades.¹³

There is other good news for the U.S. energy economy. In addition to developing our own resources, U.S. energy consumption has been declining in recent years. According to Worldwatch Institute measurements, energy use in 2012 was 7% below the 2007 level and that decline constituted the steepest five-year decrease in approximately sixty years.¹⁴ Additionally, renewable resources, particularly wind, are increasing their share of the country's energy portfolio. Most notably, we are beginning to witness a decline in carbon dioxide emissions as well as reductions in other greenhouse gas emissions such as sulfur dioxide.¹⁵

But open questions remain. If we look behind the numbers on energy consumption, how much of that declining consumption is attributable to increases in energy efficiency and how much is attributable to a poor economy? If we look more closely at shale gas production, particularly when we consider hydraulic fracturing, what environmental costs are associated with developing this domestic resource? And, from a broader perspective, what role should natural

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10. See Michael Greenstone & Adam Looney, *The Role of Oil and Gas in Driving Job Growth*, BROOKINGS (June 1, 2012, 8:23 AM), <http://www.brookings.edu/blogs/jobs/posts/2012/06/01-jobs-greenstone-looney> (“Between 2007 and 2011, employment in oil and gas extraction increased by 28,000.”).
 11. See Editorial, *Natural-Gas Exports Could Lift U.S. Trade and Economy*, BLOOMBERG (Nov. 25, 2012, 6:30 PM), <http://www.bloomberg.com/news/2012-11-25/natural-gas-exports-could-lift-u-s-trade-and-economy.html> (“Liquid natural gas exports could add billions to the U.S. economy, create tens of thousands of long-term jobs and help narrow the trade gap.”).
 12. Peter Orszag, *Natural-Gas Cars Can Drive Us Toward a Better Economy*, BLOOMBERG (June 26, 2012, 6:30 PM), <http://www.bloomberg.com/news/2012-06-26/natural-gas-cars-can-drive-us-toward-a-better-economy.html>; Floyd Norris, *Natural Gas for Vehicles Could Use U.S. Support*, N.Y. TIMES, June 22, 2012, at B1.
 13. See *Natural Gas: U.S. Natural Gas Wellhead Price*, U.S. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, <http://www.eia.gov/dnav/ng/hist/n9190us3m.htm> (last updated Feb. 28, 2013) (providing monthly statistical evidence of sharp changes in the wellhead price of U.S. natural gas).
 14. Chris Flavin, *Transforming U.S. Energy: The 2012 Story the Media Missed*, REVOLT (Jan. 16, 2013) <http://blogs.worldwatch.org/revolt/transforming-u-s-energy-the-2012-story-the-media-missed>.
 15. U.S. Energy Info. Admin., U.S. Dep't of Energy, *Environment*, MONTHLY ENERGY REV., Dec. 21, 2012, at 157, 158.

gas, including shale gas, play in the country's clean energy future? Will we continue to favor fossil-fuel incumbents at the expense of new entrants in renewable resources and energy efficiency?¹⁶

This Article will address these questions by first describing the clean energy transition in Parts I–III. Next, in Part IV, the Article will describe the role of natural gas and shale gas in our contemporary energy picture. Finally, in Part V, the Article will identify some of the costs attributable to shale gas production, including the possibility that our current focus on shale gas will simply result in a new hydrocarbon future at the expense of a vibrant and productive clean energy economy. The Article concludes in Part VI with some recommendations for future shale gas regulation. While acknowledging the reality that shale gas will play an increasingly larger role in our energy portfolio, the Article argues that natural gas should not be considered a clean energy resource.

I. CLEAN ENERGY TRANSITION

The transition from a fossil fuel economy to a clean energy economy will be socially, economically, and politically transformative. To accomplish that transformation, innovations in policy and regulation, markets and business practices, and technology policy and its implementation will be necessary. In *Ending Dirty Energy Policy*, I argued that over the last generation, the United States has developed a policy consensus in favor of clean energy.¹⁷ In short, we cannot effectively address climate change nor can we become more energy secure until we transform our energy policy away from fossil fuels to clean energy. Further, a sound business argument can be made for developing a clean energy economy on its own without necessarily tying it to climate-change initiatives. Clearly, clean energy and climate change are complementary policies; nevertheless, the United States should proceed with a clean energy transition now rather than wait for reluctant federal leadership on the climate front.

16. Although this Article concentrates on natural gas, the United States is also experiencing increased oil production, often from geologically difficult formations that require technological advances in exploration and drilling. See, e.g., Norimitsu Onishi, *Vast Oil Reserve May Now Be Within Reach, and Battle Heats Up*, N.Y. TIMES, Feb. 4, 2013, at A9 (“For decades, oilmen have been unable to extricate the Monterey Shale’s crude because of its complex geological formation, which makes extraction quite expensive. But as the oil industry’s technological advances succeed in unlocking oil from increasingly difficult locations, there is heady talk that California could be in store for a new oil boom.”); Chip Brown, *North Dakota Went Boom*, N.Y. TIMES MAG., Feb. 3, 2013, at 22.

17. JOSEPH P. TOMAIN, *ENDING DIRTY ENERGY POLICY: PRELUDE TO CLIMATE CHANGE* (2011).

Today, it is also the case that public opinion favors a clean energy policy.¹⁸ I further argued that a clean energy consensus is being developed from the bottom-up rather than through top-down leadership at the federal level—despite the clean energy initiatives of the Obama administration.¹⁹ In other words, although federal leadership is lacking,²⁰ clean energy activities at the state, regional, and local levels—as well as investment activities in the private sector—are pursuing a clean energy agenda.²¹ As an aside, we have yet to develop a more complete clean energy politics and that is a matter that needs to be addressed.²² Now, due to the increasing use of

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18. Justin Gillis, *Willing to Pay (a Little) More for Clean Energy*, N.Y. TIMES GREEN (May 14, 2012, 7:57 AM), <http://green.blogs.nytimes.com/2012/05/14/willing-to-pay-a-little-for-clean-energy>; News Release, Nuclear Energy Inst., Public Opinion Survey Shows Overwhelming Support for Clean Energy Loan Guarantees (Feb. 17, 2011), *available at* <http://www.nei.org/newsandevents/news-releases/public-opinion-survey-shows-overwhelming-support-f>; Ruy Teixeira, *Public Opinion Snapshot: Strong Support for Clean-Energy Economy*, CTR. FOR AM. PROGRESS (Mar. 30, 2009), <http://www.americanprogress.org/issues/public-opinion/news/2009/03/30/5810/public-opinion-snapshot-strong-support-for-clean-energy-economy>.
 19. The Obama Administration has, through the American Recovery and Reinvestment Act (commonly referred to as the Stimulus Bill), Pub. L. No. 111-5, 123 Stat. 115 (2009), and other initiatives, significantly increased clean energy research and development, negotiated higher Corporate Average Fuel Economy (“CAFE”) standards with car manufacturers and the United Automobile Workers (“UAW”) to reach 54.5 miles per gallon by 2025, and set higher ozone and mercury standards for power plants. Juliet Eilperin, *U.S., Auto Industry Agree on Long-Range Fuel Efficiency Rules*, WASH. POST, July 28, 2011, at A17; Colleen Curtis, *President Obama Announces New Fuel Economy Standards*, WHITE HOUSE BLOG (July 29, 2011), <http://www.whitehouse.gov/blog/2011/07/29/president-obama-announces-new-fuel-economy-standards>; *see also* News Release, EPA, EPA Issues First National Standards for Mercury Pollution from Power Plants (Dec. 21, 2011), *available at* <http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceac8525735900400c27/bd8b3f37edf5716d8525796d005dd086!opendocument> (estimating that the new rules will prevent up to 46,000 premature deaths and 540,000 asthma attacks among children).
 20. *See* Justin Gillis, *Politics Slows Climate Study*, N.Y. TIMES, Dec. 25, 2011, at A1.
 21. Investments in a clean energy transition continue to increase. *See* REN21, RENEWABLES 2012: GLOBAL STATUS REPORT 15 (2012) (“Global new investment in renewables rose 17% to a record USD 257 billion in 2011. This was more than six times the figure for 2004 and almost twice the total investment in 2007, the last year before the acute phase of the recent global financial crisis.”).
 22. ANTHONY GIDDENS, THE POLITICS OF CLIMATE CHANGE 1–10 (2d ed., rev. and updated 2011). I will address this issue in JOSEPH P. TOMAIN,

natural gas in general, and shale gas in particular, the timely question is: What role should natural gas play in the clean energy transition? This Article will address that issue.

It can and has been argued that a transition to clean energy is necessary if the country is to formally address climate change. But the converse is not true—a transition to clean energy is not dependent upon addressing climate change.²³ Instead, a clean energy economy is independently valuable. While the business and economic case for clean energy is sound,²⁴ barriers to this transition exist. For any regulatory program to gain traction and become implemented in the United States, it is necessary that a proposed program have a policy basis, a proper set of regulatory and legal tools, and political support.²⁵ As noted, there is ample policy support for a full-scale clean energy policy.²⁶ Nevertheless, legal and political challenges remain, including the matter of how to treat natural gas.

CLEAN ENERGY POLITICS: THE NECESSITY OF INNOVATION
(forthcoming 2014).

23. *But see* James Gustave Speth, The 10th Annual John H. Chafee Memorial Lecture, A New American Environmentalism and the New Economy (Jan. 21, 2010) [hereinafter Speth, New American Environmentalism], available at <http://neweconomicsinstitute.org/publications/lectures/speth/gus/a-new-american-environmentalism> (arguing that a green economy is not enough); *see also* James Gustave Speth, Thirtieth Annual E.F. Schumacher Lectures, Letter to Liberals: Liberalism, Environmentalism, and Economic Growth (Nov. 20, 2010), available at <http://neweconomicsinstitute.org/publications/letter-liberals-liberalism-environmentalism-and-economic-growth>; James Gustave Speth, *Off the Pedestal: Creating a New Vision of Economic Growth*, YALE ENVTL. 360 (May 31, 2011), http://e360.yale.edu/feature/off_the_pedestal_creating_a_new_vision_of_economic_growth/2409/; James Gustave Speth, *Towards a New Economy and a New Politics*, SOLUTIONS J., May 2010, at 33.
24. *See* RON PERNICK ET AL., CLEAN ENERGY TRENDS 2010, at 2 (2010), available at <http://info.cleanenergyeducation.net/pdf/Trends2010.pdf> (noting that “[c]lean energy has become a driving force for economic recovery”); *see also* BILL CLINTON, BACK TO WORK: WHY WE NEED SMART GOVERNMENT FOR A STRONG ECONOMY 139–69 (2011) (describing the economic benefits that an investment in clean energy will bring).
25. *See* SIDNEY A. SHAPIRO & JOSEPH P. TOMAIN, REGULATORY LAW AND POLICY 3 (3d ed. 2003) (“The making of regulatory policy in American government is influenced by politics, policy considerations and legal constraints.”); Joseph P. Tomain & Sidney A. Shapiro, *Analyzing Government Regulation*, 49 ADMIN. L. REV. 377, 386 (1997) (“[R]egulation in the legislative arena is the product of the interaction of politics, policy, and law.”).
26. *See* TOMAIN, ENDING DIRTY ENERGY POLICY, *supra* note 17, at 92–120 (describing the targets of and need for clean energy policy).

The legal challenges reside, first, in a body of law that has served the country well for most of the twentieth century by building a national energy infrastructure and by providing reliable and relatively inexpensive energy to fuel economic growth. Second, and unfortunately, the dominant energy model came with significant costs—it ignored environmental harms and constrained energy markets. And, third, the traditional model favored particular actors and sustained, through laws and regulations, a narrow industrial structure. Quite simply, large fossil fuel firms dominated, and continue to dominate,²⁷ our energy economy, thus retarding the development of new energy markets and a more competitive energy economy. Shale gas, then, will most likely have the effect of further strengthening our traditional hydrocarbon economy while threatening the growth of the clean energy sector.

A clean energy program must also confront multiple political challenges. Here two are highlighted. The political challenges, unsurprisingly, are consistent with and connected to the laws and regulations already in place. Those laws and regulations were shaped by and have given fossil fuel incumbents significant and continuing political power.²⁸ Even though I argue that clean energy enjoys broad

27. See Editorial, *Big Coal's Bidding*, N.Y. TIMES, Dec. 31, 2011, at A22 (noting that “it will likely take another disaster before lawmakers will be willing to buck Big Coal and pass desperately needed safety legislation”).

28. Regarding the current political economy vis-à-vis the environment:

The first step in building a green economy is to ask why the current system is so destructive. As I describe in *The Bridge at the Edge of the World*, the answer lies in the defining features of our current political economy. An unquestioning society-wide commitment to economic growth at almost any cost; powerful corporate interests whose overriding objective is to grow by generating profit, including profit from avoiding the environmental costs they create and from replicating technologies designed with little regard for the environment; markets that systematically fail to recognize environmental costs unless corrected by government; government that is subservient to corporate interests and the growth imperative; rampant consumerism spurred endlessly by sophisticated advertising; economic activity now so large in scale that its impacts alter the fundamental biophysical operations of the planet—all these combine to deliver an ever-growing world economy that is undermining the ability of the planet to sustain life. These are key issues—these issues that are more systemic—that must be addressed by our new environmentalism.

Speth, *New American Environmentalism*, *supra* note 23 (referencing JAMES GUSTAVE SPETH, *THE BRIDGE AT THE EDGE OF THE WORLD: CAPITALISM, THE ENVIRONMENT, AND CROSSING FROM CRISIS TO SUSTAINABILITY* (2008) [hereinafter SPETH, *THE BRIDGE*]).

political support, incumbency hinders transition efforts. The first political challenge, then, is to overcome the power and influence of fossil fuel incumbency. Simply put, increased oil and gas production empowers incumbents. Second, although public opinion favors clean energy, public opinion is less supportive of climate change legislation. More problematically, federal legislators show no interest in introducing climate change legislation despite President Obama's recognition of the necessity to "roll back the specter of a warming planet" in his Second Inaugural Address.²⁹ One danger for clean energy advocates, then, is that the politics of clean energy run the risk of getting entangled in and confused with climate change initiatives, thus impeding the energy transition.³⁰ Any confusion between clean energy and climate change can be dispelled by making the case that economic growth will accompany a clean energy agenda while the relationship between economic growth and climate change is currently contested.³¹ Although shale gas may help the economy for the time being, it is not responsive to the challenges of climate change. For that reason, and for others addressed immediately below, while shale gas is a cleaner burning fossil fuel than coal, it is not a clean energy resource.

II. DEFINING CLEAN ENERGY

There are significant reasons for and consequences attached to labeling a resource, such as shale gas, a clean energy resource. Although clean energy is generally understood to encompass a greater use of renewable resources and to capture increased gains from energy efficiency,³² it is necessary to more precisely identify those resources that constitute a clean energy portfolio for several reasons. First, simply as a matter of interest-group politics, the correct naming and framing of policy issues is necessary. Second, it must be noted, and emphasized, that sound clean energy politics is not inimical to

29. President Barack Obama, Inaugural Address (Jan. 20, 2009).

30. See, e.g., Naomi Klein, *Capitalism vs. The Climate*, THE NATION, Nov. 28, 2011, at 11, 12 (noting that, from 2007 to 2011, there was an abrupt downward shift in the percentage of Americans who believed that "the continued burning of fossil fuels would cause the climate to change").

31. See SPETH, THE BRIDGE, *supra* note 28, at 89–107 (2008) (describing the potential major contributions of environmental economics).

32. See THE LAW OF CLEAN ENERGY: EFFICIENCY AND RENEWABLES 1–18 (Michael B. Gerrard, ed., 2011) (describing the role of energy efficiency and renewable resources in creating clean energy); AMORY LOVINS, ROCKY MOUNTAIN INST., REINVENTING FIRE: BOLD BUSINESS SOLUTIONS FOR THE NEW ENERGY ERA xiii (2011) ("[Clean energy] combines two elements: it uses energy very efficiently, and it gets that energy from diverse and mainly dispersed renewable sources.").

economic growth; instead, clean energy is necessary for a vibrant economic future.³³ Third, and correlatively, a clear definition will enable policymakers and analysts to more accurately define the metrics and set the goals needed to measure the gains in an emerging clean energy economy. And, fourth, defining clean energy has direct legal consequences. Once a resource, such as solar or wind power, is defined as a clean energy resource, then it can qualify for particular regulatory treatment or for government subsidies, as examples.

Currently, the definition of clean energy differs according to particular applications.³⁴ As states move forward and establish renewable portfolio standards (RPS), for example, the resources that qualify under those standards differ from state to state. Some states include nuclear power while others exclude it. Another open issue is whether to include “clean coal” in an RPS program. Indeed, in contrast to RPS programs, electricity advocates favor clean energy standards (CES) that explicitly include clean coal and nuclear power as central to their definition of clean energy.³⁵ Another unresolved issue is whether or not RPS or CES programs should be rationalized across the country or if states should be free to use distinct definitions in order to take advantage of differences in regional energy resources.³⁶

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33. See DANIEL YERGIN, *THE QUEST: ENERGY, SECURITY, AND THE REMAKING OF THE MODERN WORLD* 4 (2011) (noting that oil, coal, and natural gas alone are unlikely to meet the world’s increasing demand for energy); JEFFREY D. SACHS, *THE PRICE OF CIVILIZATION: REAWAKENING AMERICAN VIRTUE AND PROSPERITY 201–04* (2011) (arguing for a pathway to a self-financing clean energy system); THOMAS L. FRIEDMAN & MICHAEL MANDELBAUM, *THAT USED TO BE US: HOW AMERICA FELL BEHIND IN THE WORLD IT INVENTED AND HOW WE CAN COME BACK* 199–211 (2011) (describing how a clean energy policy can make America “healthier, more prosperous, more secure, and more resilient”).
34. The clean energy economy has also been characterized as “sustainable capitalism,” defined as “a framework that seeks to maximize long-term economic value by reforming markets to address real needs while integrating environmental, social and governance (ESG) metrics throughout the decision-making process.” Al Gore & David Blood, *A Manifesto for Sustainable Capitalism*, WALL ST. J., Dec. 14, 2011, at A21 (arguing that longer-term thinking about investments according to ESG metrics will: (1) develop sustainable products and services for longer term profits; (2) reduce waste and increase energy efficiency; (3) increase the effectiveness of risk management by, for example, more efficient compliance practices; and, (4) lower the cost of debt).
35. See CTR. FOR CLIMATE AND ENERGY SOLUTIONS & REG. ASSISTANCE PROJECT, *CLEAN ENERGY STANDARDS: STATE AND FEDERAL POLICY OPTIONS AND IMPLICATIONS* 1 (Nov. 2011).
36. Compare Lincoln L. Davies, *Power Forward: The Argument for a National RPS*, 42 CONN. L. REV. 1339, 1339 (2010) (favoring national standards), with Jim Rossi, *The Shaky Political Economy Foundation of a National Renewable Electricity Requirement*, 2011 U. ILL. L. REV. 361,

Clean energy, then, must be clearly defined. The most problematic energy resource in this regard remains nuclear power. Nuclear power generation, of course, emits no carbon dioxide, yet the carbon footprint for the entire nuclear fuel cycle is not completely carbon neutral.³⁷ Regardless of its carbon footprint, however, nuclear power is the quintessential example of a traditional energy form in that it is large scale, centralized, and capital intensive. Further, the industry would not exist without government support.³⁸ The argument, then, can be made that nuclear power should not be considered an environmentally friendly, clean resource because it fits so comfortably within the hard-path paradigm. Still, the issue of whether nuclear power should be considered a clean energy resource remains contentious.

Similar challenges attend shale gas. Although shale gas emits less carbon than coal, it is still a dirty resource. Further, shale gas is underpriced—even given its current abundance—because the cost of carbon is not included in the cost. Shale gas, then, is simply an extension of our traditional hydrocarbon economy, favored by government for over a century.

Although clean energy constitutes approximately 9% of today's U.S. fossil fuel economy, it is making notable gains.³⁹ Renewable resources, particularly wind power, are outstripping the installation of new fossil fuel electricity generation.⁴⁰ Further, energy efficiency is increasing notably, and the costs of solar and wind resources are decreasing.⁴¹ Even though clean energy is not currently cost competitive and enjoys government subsidies, no energy resource operates in unfettered competitive markets. Clean energy gains must

361 (disfavoring a national RPS); see also David B. Spence, *Federalism, Regulatory Lags, and the Political Economy of Energy Production*, 161 U. PA. L. REV. 431, 507 (2013) (arguing that the federal government should “restrict its regulation of fracking to those aspects of the industry that produce inter-state effects or implicate established national interests”).

37. See generally Amory B. Lovins, *Renewable Energy's “Footprint” Myth*, 24 ELEC. J. 40 (2011) (comparing the land-use footprint of renewable electricity with that of nuclear power and finding that nuclear power requires more land).

38. Joseph P. Tomain, *Nuclear Futures*, 15 DUKE ENVTL. L. & POL'Y F. 221, 227 (2005).

39. U.S. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY REVIEW 2011, at 6, 278 (2012).

40. See NAT'L RENEWABLE ENERGY LAB., WIND ENERGY UPDATE 8 (Jan. 2012) (illustrating how new wind energy capacity increases outpaced fossil fuel capacity increases for three of the four years from 2007 to 2010).

41. See INT'L ENERGY AGENCY, WORLD ENERGY OUTLOOK ch. 9 (2010) (positing that short-term government support for renewable energy is necessary to ensure long-term cost competitiveness with fossil fuels).

be tracked and reliable metrics must be established to fully understand the dollar value of investments in clean energy and the corresponding reductions in greenhouse gases, particularly carbon dioxide. Here lies the rub: although pricing carbon is notoriously difficult,⁴² the failure to account for this harmful externality caused by shale gas in the price of electricity leads directly to underpricing the resource and over consuming it, to the direct detriment of the environment and human health.

III. THE POLITICAL ECONOMY OF CLEAN ENERGY

In addition to identifying the resources that satisfy the definition of clean energy, the assumptions behind a clean energy policy must be articulated with equal clarity. Identifying the policy assumptions behind a clean energy economy will distinguish the new economy from traditional energy firms and markets and will have a direct impact on how shale gas is perceived and regulated. The clean energy assumptions, in turn, will signal the structure and design of clean energy firms and markets. First enunciated by Amory Lovins in his book *Soft Energy Paths*,⁴³ a clean, or smart, energy economy is in many ways the diametric opposite of our traditional and current energy system.

It is fundamental that energy is valued as a primary input into the economy. This proposition is more nuanced than may first appear. Energy is a more important input for developing economies than for developed ones.⁴⁴ Further, depending on the amount of fossil fuels in

42. See Frank Ackerman & Elizabeth A. Stanton, *The Social Cost of Carbon*, REAL-WORLD ECON. REV., June 26, 2010, at 129, 129 (“Any estimate of the [social cost of carbon] rests on a number of value judgments and predictions about uncertain future events.”); Philip Q. Hanser & Mariko Geronimo, *What Price, GHGs?: Calculating the Implied Value of CO₂ Abatement in Green Energy Policies*, PUB. UTIL. FORT., Oct. 2012, at 12, 12 (“No [calculation] mechanism is necessarily right or wrong: each is designed to address region- or state-specific concerns that sometimes go beyond CO₂ abatement.”); WARWICK J. MCKIBBIN ET AL., BROOKINGS, PRICING CARBON IN THE UNITED STATES: A MODEL-BASED ANALYSIS OF POWER SECTOR ONLY APPROACHES (2012) (examining the merits of various cap-and-trade calculation approaches).

43. AMORY B. LOVINS, *SOFT ENERGY PATHS: TOWARD A DURABLE PEACE* 4 (1977) (“The basic tenet of high-energy projections is that the more energy we use, the better off we are. But how much energy we use to accomplish our social goals could instead be considered a measure less of our success than of our failure.”).

44. See Catherine A. O’Neill & Cass R. Sunstein, *Economics and the Environment: Trading Debt and Technology for Nature*, 17 COLUM. J. ENVTL. L. 93, 96–98 (1992) (discussing potential solutions for industrialized nations to encourage sustainable growth in developing nations).

the energy mix, energy can become an economic drag.⁴⁵ Notably, in the United States, as a matter of historic policy, we have constructed an economy that requires energy that must be relatively cheap, reliable, available on demand, and central to economic growth. For most of the twentieth century, those parameters dictated that oil, natural gas, and coal form the basis of our energy economy. Thus, dirty energy has been buoyed by public policy and government support, and cheap fossil fuel energy has been treated as a public good, creating a much-relied-upon consumer expectation that energy prices will remain low and energy will remain abundant.

Similarly, the commercial nuclear power industry was the creation of government and cannot exist without its life-sustaining public financial support.⁴⁶ In other words, nuclear power and fossil fuel resources do not compete in truly competitive markets. Instead, they benefit from a system of legal regulations and institutions, which have fostered and continue to sustain their development and expansion.⁴⁷ No longer should these resources receive such favored treatment. The social costs of dirty energy are too high and the opportunity to pursue clean energy should not be squandered.

Further, traditional U.S. energy policy generated an identifiable model with specific industrial characteristics, which has been criticized as unsuitable for continuing to meet the nation's long-term energy demands.⁴⁸ Most notably, traditional energy firms are national

45. See generally Joseph P. Tomain, *To a Point*, 52 LOY. L. REV. 1201 (2006) (assessing the societal and economic costs of climate change resulting from excessive fossil fuel use).

46. See AMORY B. LOVINS & IMRAN SHEIKH, ROCKY MOUNTAIN INST., *THE NUCLEAR ILLUSION 1* (2008) (arguing that nuclear power is “grossly uncompetitive”); DOUG KOPLOW, UNION OF CONCERNED SCIENTISTS, *NUCLEAR POWER: STILL NOT VIABLE WITHOUT SUBSIDIES 1* (2011) (arguing that taxpayer subsidies “enabled the nation’s existing [nuclear] reactors to be built . . . [and] supported their operation for decades”).

47. See Matthew L. Wald, *Approval of Reactor Design Clears Path for New Plants*, N.Y. TIMES, Dec. 23, 2011, at B6 (illustrating streamlined administrative regulations and loan programs initiated by Congress to offset nuclear power’s competitive deficiencies).

48. See TOMAIN, *ENDING DIRTY ENERGY POLICY*, *supra* note 17, at 65–91 (tracing the evolution of energy policy to encompass notions of conservation); MICHAEL J. GRAETZ, *THE END OF ENERGY: THE UNMAKING OF AMERICA’S ENVIRONMENT, SECURITY AND INDEPENDENCE* (2011) (examining the relationship between continued reliance on fossil fuels and national stability); Lincoln Davies, *Alternative Energy and the Energy-Environment Disconnect*, 46 IDAHO L. REV. 473 (2010) (examining the disjunction between traditional energy regulation and environmental regulation); David B. Spence & Robert Prentice, *The Transformation of American Energy Markets and the Problem of Market Power*, 53 B.C. L. REV. 131 (2012) (arguing that the “manipulation and deceit” emphasis of securities law makes it a poor model for protection

in scope, large scale, capital intensive, and highly centralized.⁴⁹ In the areas of electricity and natural gas, moreover, they operate as regional monopolies.⁵⁰ A clean energy economy will look dramatically different. Most prominently, it will not be fossil fuel based. Secondarily, a clean energy economy will be decentralized and scaled to task. In the words of Amory Lovins, using nuclear power to boil water is “like cutting butter with a chainsaw.”⁵¹ Therefore, as an example of smarter and smaller-scale energy sources, a clean energy economy would substitute distributed electricity generation for nuclear behemoths. Distributed generation is closer to end users, can relieve stress from an overburdened transmission grid, will increase energy efficiency, and can make better use of local renewable resources rather than continuing to rely upon large-scale fossil fuels like shale gas.⁵²

Third, a clean energy market will be structured differently than existing energy markets. The traditional energy market has been dominated by a handful of large firms that exercise their competitive advantage as incumbents to keep out new entrants. Clean energy providers, such as solar, wind, distributed generation, and energy efficient appliance producers, all threaten to reduce the market share of fossil fuel incumbents. Firms and markets in a clean energy economy will be smaller, more numerous, and more competitive than those in the existing energy economy. Thus, these new entrants promise to open new energy markets, increase competition, increase consumer choice, and promote technological innovation.

Additionally, while traditional energy markets were regional and national in scope, a clean energy economy will be both local and global. At the global level, for example, the European Union is actively promoting clean energy initiatives.⁵³ It has established a

against the market power problems that energy regulation presents); David B. Spence, *Can Law Manage Competitive Energy Markets?*, 93 CORNELL L. REV. 765 (2008) (pointing out the difficulties energy markets have experience in transitioning from a regulatory-based model to a market-based model).

49. Joseph P. Tomain, *The Dominant Model of United States Energy Policy*, 61 U. COLO. L. REV. 355, 375–76 (1990) [hereinafter Tomain, *The Dominant Model*]; see also Spence & Prentice, *supra* note 48, at 149 (providing a helpful chart of industry-specific characteristics).

50. Davies, *supra* note 48, at 482; Spence & Prentice, *supra* note 48, at 148.

51. Amory Lovins, *Energy Strategy: The Road Not Taken?*, 55 FOREIGN AFF. 65, 79 (1976).

52. See Melissa Powers, *Small is (Still) Beautiful: Designing U.S. Energy Policies to Increase Localized Renewable Energy Generation*, 30 WISC. INT’L L.J. (forthcoming 2013).

53. See generally EUROPEAN CLIMATE FOUNDATION, ROADMAP 2050: A PRACTICAL GUIDE TO A PROSPEROUS, LOW-CARBON EUROPE (Apr.

technical regime for the expansion of the smart grid. Indeed, the vast majority of households in Italy have had smart meters installed to reduce the cost of electricity.⁵⁴ As another example, Germany is scheduled to decommission all of its nuclear power and has adopted rules promoting renewable resources to generate electricity.⁵⁵ On the other side of the globe, China is the world leader in the development of commercial solar and wind technologies,⁵⁶ and India is ramping up its solar capacity as an alternative to coal-fired electricity.⁵⁷ At the local level, smaller-scale power production, new energy-saving buildings and appliances, smarter meters and controls, and consumer energy audits will have the effect of increasing consumer choice through increased competition.

All of these efforts have two direct effects on U.S. clean energy development. First, the experiences of other countries provide us with valuable information that has the effect of reducing the slope of the learning curve for further clean energy development and implementation. Second, more clean energy technologies and products will be increasingly traded in global and local markets. Whereas the traditional energy economy was decidedly national, clean energy stretches the borders of energy markets and can operate at the local scale.

Finally, the political economy of clean energy will be advanced to the extent that clean energy can be pursued independently from climate change. Climate change is threatening in no small part

2010) (discussing the strategy for dramatically reducing greenhouse gases in Europe over the coming decades).

54. Mark Scott, *How Italy Beat the World to a Smarter Grid*, BLOOMBERG BUSINESSWEEK, Nov. 16, 2009, http://www.businessweek.com/globalbiz/content/nov2009/gb20091116_319929.htm (“Some 85% of Italian homes are now outfitted with smart meter—the highest percentage in the world and more such devices than exist in the whole of the U.S.”).
55. *Nuclear Power in Germany*, WORLD NUCLEAR ASSOCIATION, <http://www.world-nuclear.org/info/Country-Profiles/Countries-G-N/Germany> (last updated Mar. 2013) (“A coalition government formed after the 1998 federal elections had the phasing out of nuclear energy as a feature of its policy. With a new government in 2009, the phase-out was cancelled, but then reintroduced in 2011, with eight reactors shut down immediately.”).
56. SOLIDIANCE, CHINA'S RENEWABLE ENERGY SECTOR: AN OVERVIEW OF KEY GROWTH SECTORS 6 (2013), available at <http://www.solidiance.com/whitepaper/china-renewable.pdf> (“China’s demand for energy as well as its capabilities and capacity for energy production are now positioning China to seize the opportunity to take the lead in the development of sustainable energy technologies, so as to further cement its position as an international leader in renewable energies.”).
57. Vikas Bajaj, *India’s Investment in the Sun*, N.Y. TIMES, Dec. 29, 2011, at B1.

because it appears to require notable changes in lifestyle and, perhaps, in quality of life. Whether these threats are true or not is beside the point. Public opinion sometimes fears climate change in ways that it does not fear clean energy. Currently, clean energy can remain “invisible” and, therefore, can be seen as more politically benign. Similarly, transitioning to a clean energy economy does not appear as daunting as responding to climate change. Compared with climate change, clean energy science and technologies are simpler. Clean energy initiatives can be implemented on shorter time frames. Clean energy consumer education can be done expeditiously and more intelligibly and clean energy consumers can more quickly see results. And producers have more reliable markets. Consequently, jobs, investments, and markets can likewise develop quicker than more complex climate change efforts.⁵⁸

IV. NATURAL GAS AND THE ENERGY PORTFOLIO

For over fifty years, the U.S. energy economy was stable and predictable, even if problematic. From 1949 until about 2005, U.S. energy exports were flat, but imports, particularly of petroleum, continued to rise, and production and consumption largely grew in tandem.⁵⁹ In 1970, as domestic oil production peaked, consumption and production began to separate from each other.⁶⁰ Domestic production could not keep pace with consumption and, as a consequence, we grew more dependent on foreign energy resources, especially OPEC oil.⁶¹ In addition, fossil fuels dominated our energy economy, with renewable resources barely scratching 2–3% of total U.S. energy production until recently.⁶²

Dramatic changes began to occur around 2005. Production and consumption grew closer together, exports increased, and imports decreased.⁶³ Further, on the domestic production side, we began to experience a decline in coal production, an increase in natural gas and crude oil production, the flattening of nuclear power, and an uptick in

58. Cf. PEW CTR. ON GLOBAL CLIMATE CHANGE, IN BRIEF: CLEAN ENERGY MARKETS: JOBS AND OPPORTUNITIES 1 (July 2011), available at <http://www.c2es.org/publications/brief-clean-energy-markets-jobs-and-opportunities> (estimating global investments of approximately \$2.3 trillion over the next decade, with corresponding job creation).

59. ANNUAL ENERGY REVIEW 2011, *supra* note 39, at 118–19.

60. U.S. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY OUTLOOK 2012, at 3 (2012).

61. Tomain, *The Dominant Model*, *supra* note 49, at 373.

62. ANNUAL ENERGY REVIEW 2011, *supra* note 39, at 278–79.

63. ANNUAL ENERGY OUTLOOK 2012, *supra* note 60, at 3.

energy produced by renewable resources.⁶⁴ Correspondingly, on the consumption side, also from the middle of the last decade, we experienced declines in oil and coal consumption and increases in natural gas and renewable resource consumption.⁶⁵

Aside from a notable, and recent, increase in wind power production,⁶⁶ no other resource has had as notable a turnaround as natural gas. Natural gas production in the United States has increased dramatically in recent years, rising from approximately 16 trillion cubic feet (tcf) in 1990 to over 22 tcf in 2010, with projections rising to in excess of 27 tcf by 2035.⁶⁷ Those projections indicate that the United States has over 100 years of natural gas at current levels of consumption,⁶⁸ although such estimates are contestable.⁶⁹ Shale gas is largely responsible for this trend, increasing from approximately 1.3 tcf in 2007, to in excess of 5.3 tcf in 2010,⁷⁰ while accounting for nearly half of all projected domestic natural gas production by 2035.⁷¹ As a consequence, the United States is expected to go from a net importer of 11% of our natural gas needs in 2010 to a net exporter of 5% by 2035.⁷²

Natural gas currently plays a large role in the U.S. energy portfolio, providing 25% of our electric power generation, 30% of the feedstock consumed in the industrial sector, and heating 56 million homes.⁷³ What is notable about natural gas is that it transcends the traditional energy divide between the transportation and electricity sectors and serves a diversity of end users. Virtually no oil is used to generate electricity⁷⁴ and virtually no electricity is used to power cars

64. ANNUAL ENERGY REVIEW 2011, *supra* note 39, at 6.

65. ANNUAL ENERGY OUTLOOK 2012, *supra* note 60, at 3–9.

66. *Id.* at 75.

67. *Id.* at 92.

68. BIPARTISAN POL'Y CTR., SHALE GAS: NEW OPPORTUNITIES, NEW CHALLENGES 5 (Jan. 2012).

69. See Peter Behr, *Natural Gas: 'There is No Way to Tell' How Much Gas the U.S. Can Produce*, ENERGYWIRE (Feb. 11, 2013), <http://www.eenews.net/energywire/2013/02/11/1> (explaining that current shale production projections are based on computer modeling that extrapolates data on a number of variables, resulting in a large variance in possible outcomes).

70. *Shale Gas Production*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/dnav/ng/ng_prod_shalegas_s1_a.htm (last visited May 13, 2013) (providing a useful spreadsheet tracking shale gas production by state).

71. ANNUAL ENERGY OUTLOOK 2012, *supra* note 60, at 93.

72. *Id.* at 92.

73. BIPARTISAN POL'Y CTR., *supra* note 68, at 5.

74. See ANNUAL ENERGY OUTLOOK 2012, *supra* note 60, at 48–50.

(although that is changing).⁷⁵ Natural gas, by way of contrast, is currently used, and is expanding its use, in both sectors.⁷⁶ Additionally, combined-cycle natural gas can significantly improve the use of intermittent power producers such as solar and, therefore, facilitate the integration of solar power into the grid.⁷⁷

With such notable growth come economic and environmental benefits. The role of natural gas in our energy portfolio has increased to about 30%, almost exclusively in the electricity sector. Consistently, coal-fired electricity has declined from over 50% to 42% of power production in recent years,⁷⁸ while only one new coal plant has been constructed during the same time period.⁷⁹ Indeed, old coal plants are retiring and new projects are facing closer scrutiny by state regulators.⁸⁰ Experts project that by 2016 approximately 10% of installed capacity of coal plants will be retired.⁸¹

The even better news is job creation. An industry-sponsored study reports that by 2035, shale gas production alone will account for up to 1.6 million jobs—having increased from 601,348 in 2010—and a total economic value of \$231 billion, up from \$76 billion in 2010.⁸² Further, shale gas will buoy the manufacturing sector by lowering energy costs and raising investment in the chemical, metal, and other industries.⁸³ The increase in manufacturing and job creation directly leads to increased tax revenues for the local, state, and federal governments.⁸⁴

75. *Id.* at 30–35.

76. *Id.* at 84–89.

77. See BIPARTISAN POL'Y CTR., *supra* note 68, at 11 (referencing a “hybrid” plant that alternates between solar-generated steam and natural gas, resulting in a cost savings of 20 percent).

78. ANNUAL ENERGY OUTLOOK 2012, *supra* note 60, at 87.

79. See Herbert Wheary, *Defying the Odds: Virginia Brings a New Coal-Fired Plant Online*, PUB. UTIL. FORT., Dec. 2012, at 30 (describing the factors that led to a new plant’s completion in the face of mounting environmental regulations).

80. See Melissa Powers, *The Cost of Coal: Climate Change and the End of Coal as a Source of “Cheap” Electricity*, 12 U. PENN. J. BUS. L. 407, 424–32 (2010) (explaining that states have been reluctant to permit construction of new coal plants due to the risk of dramatically increased utility rates that might result from potential national climate legislation).

81. METIN CELEBI ET AL., BRATTLE GRP., POTENTIAL COAL PLANT RETIREMENTS: 2012 UPDATE, at 1 (2012).

82. IHS GLOBAL INSIGHT, THE ECONOMIC AND EMPLOYMENT CONTRIBUTIONS OF SHALE GAS IN THE UNITED STATES 1 (2011).

83. PRICEWATERHOUSECOOPERS, LLP, SHALE GAS: A RENAISSANCE IN US MANUFACTURING? 1 (2011).

84. IHS GLOBAL INSIGHT, *supra* note 82, at 2.

From the environmental perspective, carbon emissions have been declining and are expected to continue to do so. It has been estimated that by replacing coal with natural gas, we can reduce greenhouse gas emissions from electricity generation by 45%, with attendant improvements in health.⁸⁵ There are several reasons for this development. Some of the decline is attributable to a weak economy during the Great Recession and a corresponding reduction in energy demand. Further, the increase in wind power, the decrease in coal-fired electricity, the increased use of natural gas, and increased fuel economy standards all led the Department of Energy to reduce its most recent 2013 emissions projections by roughly 30% from 2006 estimates.⁸⁶

Thus, there are several good news items on the fossil fuel front, but we cannot ignore the multiple challenges presented by shale gas development.

V. ENVIRONMENTAL CHALLENGES

Historically, natural gas production has been a byproduct of oil production. Oil producing states such as Louisiana, Texas, Oklahoma, and California have had long experience regulating both natural resources. But today shale gas formations are occurring in a wider array of states such as Arkansas, Colorado, Ohio, Pennsylvania, New York, and West Virginia—as well as Texas and Louisiana. Several of the newcomer states are not familiar with natural gas regulation and some, such as New York, Maryland, and New Jersey, have adopted moratoria on shale gas production in order to better understand the exploration and exploitation of this natural resource.⁸⁷ These states, reasonably enough, are concerned primarily about the environmental consequences of increased natural gas production.

The United States has been producing natural gas for over a century. Domestic shale gas production, however, presents new challenges. Shale gas production has increased twelvefold over the last decade and now comprises approximately 25% of our total domestic natural gas yield.⁸⁸ Further, the success of shale gas production is directly attributable to horizontal drilling and hydraulic fracturing, which are used in approximately two-thirds of the natural gas wells in the United States and up to 95% of all oil and gas wells currently being

85. Pierce, *supra* note 4 (manuscript at 5).

86. U.S. ENERGY INFO. ADMIN., AEO2013 EARLY RELEASE OVERVIEW 12–13 (2012) (comparing emissions projections from 2006 report to those projected in 2013).

87. BIPARTISAN POL'Y CTR., *supra* note 68, at 4.

88. *Id.* at 13.

drilled.⁸⁹ Fracturing has received a significant amount of attention, most notably for the possible environmental harms that attend that production process.

A. *Air Pollution*

Shale gas drilling operations can cause air pollution from a number of sources. Diesel engines, rigs, trucks, and other equipment emit greenhouse gases. Additionally, gases are released from operating the wells themselves, especially through venting and flaring. The gas production process and the various activities associated with it “combine to release large amounts of methane, fine particulate matter and VOCs. VOCs are ground level ozone precursors, and methane is a highly [toxic] greenhouse gas.”⁹⁰ Gas leakage from all of these activities has the potential for environmental harms.⁹¹ It is significant that, while natural gas has a lower carbon content than coal, most estimates of carbon emissions do not take into account production activities, which, given estimates of increased shale gas production, simply raise the importance of the air pollution caused by hydraulic fracturing.⁹²

Methane, a component of natural gas, gives the greatest cause for concern. Although the amount of methane emissions are much lower than the emissions of carbon dioxide, methane is seventy-two times more potent than carbon dioxide at the time of release and is twenty-five times more potent over a 100 year period.⁹³ Consequently, as oil

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89. NAT'L PETROLEUM COUNCIL, PRUDENT DEVELOPMENT: REALIZING THE POTENTIAL OF NORTH AMERICA'S ABUNDANT NATURAL GAS AND OIL RESOURCES 21 (2011), available at <http://www.npc.org/reports/rd.html>.
90. Beren Argetsinger, Comment, *The Marcellus Shale: Bridge to a Clean Energy Future or Bridge to Nowhere? Environmental, Energy and Climate Policy Considerations for Shale Gas Development in New York State*, 29 PACE ENVTL. L. REV. 321, 336 (2011) (citation omitted).
91. Hannah J. Wiseman, *Risk and Response in Fracturing Policy*, 84 U. COLO L. REV. (forthcoming 2013) (manuscript at 67–70), available at <http://ssrn.com/abstract=2017104> (“Both new and spent drilling fluids and muds can spill when transferred between pits or tanks and the well. Further, oil or gas-containing substances produced from the well may spill from the wellhead or storage tanks and pollute the site or nearby areas.” (internal citation omitted)).
92. Argetsinger, *supra* note 90, at 337–38. See also Donald McCubbin & Benjamin K. Sovacool, *Quantifying the Health and Environmental Benefits of Wind Power to Natural Gas*, 53 ENERGY POL'Y 429 (2013) (noting the lower carbon emissions from wind compared to shale gas).
93. See ERIC POOLEY, ENVTL. DEF. FUND, NATURAL GAS—A BRIEFING PAPER FOR CANDIDATES 5–6 (Aug. 10, 2012), available at <http://blogs.edf.org/energyexchange/2012/08/10/natural-gas-a-briefing-paper-for-candidates> (discussing the impact of natural gas leakage on climate change).

and gas exploration and production expand, methane leakage can occur throughout the development of those resources from extraction to transportation, storage, and delivery. To date, the EPA has failed to regulate methane even as it has adopted new rules for oil and gas producers,⁹⁴ even though a Department of Energy advisory committee recommended that “[m]easures should be taken to reduce emission of air pollutants, ozone precursors, and methane as quickly as practicable.”⁹⁵ In short, methane needs to be monitored, regulated, and where it can be, captured. Indeed, methane capture itself has economic value by increasing producer profits and royalties.⁹⁶

Still, the hydraulic fracturing process can involve methane seepage either into the air or into aquifers.⁹⁷ After a well is drilled, it must be encased. Then, either during the fracturing process or after a well has run its course, well integrity can become compromised, resulting in leakage. There is evidence that improper drilling activity or inadequate well encasing can increase the risk of air contamination due to methane leakage. Unsurprisingly, regulators and industry types testify “that fracturing has never caused contamination,” while those opposed to fracturing “list dozens of likely contamination events.”⁹⁸ In either case, caution is advisable and monitoring and improving drilling techniques is prudent.

Recent studies suggest that the immediate impact of shale gas production on greenhouse gas emissions, including methane, may not be as dire as some predictions suggest. One study concludes that while increased efforts at emissions reductions are both warranted and possible, “it is also clear is that the production of shale gas and specifically, the associated hydraulic fracturing operations have not materially altered the total [greenhouse gas] emissions from the

94. See, e.g., DAVID MCCABE, CLEAN AIR TASK FORCE, EPA’S NEW STANDARDS FOR OIL & GAS: WHAT THEY DO, AND DON’T DO 1–2 (2012), available at http://www.catf.us/resources/filings/oil_and_gas (describing the emission reduction measures in the EPA’s new standards and remaining gaps in the rules).

95. SEC’Y OF ENERGY ADVISORY BD., SHALE GAS PRODUCTION SUBCOMMITTEE SECOND NINETY DAY REPORT 4 (2011), available at <http://www.shalegas.energy.gov>.

96. See SUSAN HARVEY ET AL., NAT. RES. DEF. COUNCIL, LEAKING PROFITS: THE U.S. OIL AND GAS INDUSTRY CAN REDUCE POLLUTION, CONSERVE RESOURCES, AND MAKE MONEY BY PREVENTING METHANE WASTE 3 (Mar. 2012), available at <http://www.nrdc.org/documents.asp?topicid=12> (noting the economic and environmental benefits of curbing methane leakage).

97. See Wiseman, *supra* note 91 (manuscript at 49–56) (discussing the risks of methane leakage and the state regulatory response).

98. *Id.* (manuscript at 52).

natural gas sector.”⁹⁹ And another study concludes that under appropriate scenarios, methane leakages are “modest.”¹⁰⁰

Like any discussion of a complex policy matter, the devil is in the details. There are studies indicating that methane leakage from natural gas production can have negative greenhouse gas effects.¹⁰¹ These studies indicate that a transition from coal to natural gas actually could reduce or negate the climate benefits of lower carbon dioxide emissions. The trick in the studies resides, of course, in the assumptions. In the short term, as natural gas replaces coal in the electricity sector, CO₂ reductions will take place. When analyzing the long-term effects of increased natural gas production, the issue becomes twofold. First, what is the target number regarding CO₂ in the atmosphere? Is it 450 ppm or 550 ppm, by way of example? Second, how long should we envision natural gas serving as a “bridge fuel?” The point simply is that methane leakage presents an environmental risk, and that risk increases the longer the duration for the use of natural gas in our energy portfolio. Precisely because natural gas does emit greenhouse gases including the toxic methane, and even though it can replace coal-fired power production, we cannot rely on this long term if the goal is to transition to a clean energy future.

B. Water Pollution

Water is a significant input into the hydraulic fracturing process. Consequently, several water issues emerge. First, drilling requires large volumes of water to be withdrawn from both ground and surface waters.¹⁰² Second, during drilling, various chemicals are mixed into the

99. Francis O’Sullivan & Sergey Paltsev, *Shale Gas Production: Potential Versus Actual Greenhouse Gas Emissions*, 7 ENVTL. RES. LETTERS No. 044030, at 1, 5 (2012), available at <http://globalchange.mit.edu/research/publications/2368>.

100. Michael Levi, *Climate Consequences of Natural Gas as a Bridge Fuel*, CLIMATIC CHANGE (Jan. 3, 2013), <http://link.springer.com/content/pdf/10.1007%2Fs10584-012-0658-3>.

101. See, e.g., Tom M.L. Wigley, *Coal to Gas: The Influence of Methane Leakage*, 108 CLIMATIC CHANGE 601, 607 (2011) (finding that replacing coal with natural gas “results in increased rather than decreased global warming” due to methane leakage); Robert W. Howarth, Renee Santoro & Anthony Ingraffea, *Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations: A Letter*, 106 CLIMATIC CHANGE 679, 688 (2011) (“[S]ubstituting shale gas for these other fossil fuels may not have the desired effect of mitigating climate warming.”).

102. REBECCA HAMMER & JEANNE VANBRIESEN, NAT. RES. DEF. COUNCIL, IN FRACKING’S WAKE: NEW RULES ARE NEEDED TO PROTECT OUR HEALTH AND ENVIRONMENT FROM CONTAMINATED WASTEWATER 11 (2012) (contaminated “flowback” and “produced water” may “reach into the millions of gallons” over the lifetime of a shale gas well).

water, and consequent surface spills can affect drinking water resources.¹⁰³ Third, well injection also has an impact on drinking water resources.¹⁰⁴ Fourth, wastewater must be transported and stored and spillage from either process can also have health effects.¹⁰⁵ And, finally, wastewater needs to be treated and disposed, and this can impact drinking water resources.¹⁰⁶ The Environmental Protection Agency was directed by Congress to study and review the effect of hydraulic fracturing on drinking water resources.¹⁰⁷ In December 2012, the EPA issued a progress report on its study.¹⁰⁸

The EPA study is a result of eighteen research projects as well as data collected directly from both the oil and natural gas industries as well as from states with high levels of oil and gas activity.¹⁰⁹ Additionally, the EPA analyzed data from FracFocus, which is a national hydraulic fracturing chemical registry operated by the Groundwater Protection Council and the Interstate Oil and Gas Compact Commission¹¹⁰ and is funded by two fossil fuel lobbying groups: the American Petroleum Institute and America's Natural Gas Alliance.¹¹¹ The EPA is also conducting laboratory research and is engaging in consultation with other federal state and interstate agencies, industry, nongovernmental organizations, and other stakeholders. It is the goal of the EPA to inform the public and provide decision makers at all levels of high-quality scientific information to be used in the decision-making process. In short, the EPA progress report details the steps the agency is taking to satisfy its charge from Congress. Although the administration has not issued

103. *Id.* at 1 (discussing the attendant dangers of “flowback” and “produced water” as wastewater by-products of hydrofracking).

104. *Id.* at 6 (discussing the risk of contaminating groundwater when wastes are injected into Class II disposal wells).

105. *Id.* (discussing the risk of “accidental release” anywhere wastewater is handled).

106. *Id.* (discussing the risks of discharging inadequately treated waste water and the creation of residuals following treatment).

107. H.R. REP. NO. 111-316, at 109 (2009) (Conf. Rep.).

108. EPA, STUDY OF THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES: PROGRESS REPORT (2012).

109. *Id.* at 1–2.

110. *Id.* at 54–61; FRACFOCUS: CHEMICAL DISCLOSURE REGISTRY, <http://fracfocus.org> (last visited Feb. 24, 2013).

111. See Mike Soraghan & Ellen M. Gilmer, *Hydraulic Fracturing: Revised Interior Rule Loops in Industry-Favored FracFocus*, ENERGYWIRE (Feb. 8, 2013), <http://www.eenews.net/public/energywire/2013/02/08/1> (discussing a new rule promulgated by the Department of the Interior allowing companies to report chemicals used in fracturing through FracFocus's database).

its final report and continues its work, its plan of action is instructive. The EPA will examine the several uses of water used in the hydraulic fracturing process as well as undertake a detailed analysis of the chemicals used and their effects on drinking water.¹¹²

Initial discussions on drinking water suggest that hydraulic fracturing will have minimal impact on freshwater aquifers “because fracturing typically takes place at a depth of 6,000 to 10,000 feet, while drinking water tables are typically less than 1,000 feet deep.”¹¹³ The average well requires from three to five million gallons of water for drilling and hydraulic fracturing. While these withdrawals are significant, they involve significantly less water than that used for nuclear or coal power generation. To the extent that shale formations are developed in the eastern United States, this amount of water withdrawal is manageable. Further, producers can use water recycling to reduce the total amount of consumption as well as potential environmental impact.¹¹⁴

Nevertheless, more recent developments on the use of water, its pollution, and possible human health effects are disturbing. The New York State Department of Environmental Conservation, for example, estimates that each well “requires anywhere from 2.9 million to 7.8 million gallons of injected water,” not to mention all the additional chemicals in that water.¹¹⁵ That agency also reports that over the next thirty years there could be up to 40,000 wells developed through hydraulic fracturing technologies thus indicating a significant increase in water withdrawal.¹¹⁶

More problematically, water that is injected into a well will flow back. Anywhere from 10 to 50% of the injected water can be returned to the surface, and that flowback water contains chemicals used

112. EPA, *supra* note 108, at 163–71 (providing a summary of research progress and next steps).

113. BIPARTISAN POL’Y CTR., *supra* note 68, at 13; *see also* SCOTT KELL, GROUND WATER PROT. COUNCIL, STATE OIL AND GAS AGENCY GROUNDWATER INVESTIGATIONS AND THEIR ROLE IN ADVANCING REGULATORY REFORMS: A TWO-STATE REVIEW: OHIO AND TEXAS 102 (2011) (noting that neither Ohio nor Texas has a single documented incident of groundwater contamination from hydraulic fracturing).

114. *See* BIPARTISAN POL’Y CTR., *supra* note 68, at 14 (discussing the potential effects of hydraulic fracturing on drinking water resources).

115. *See* Argetsinger, *supra* note 90, at 331 (citing N.Y. STATE DEP’T OF ENVTL. CONSERVATION, REVISED DRAFT: SUPPLEMENTAL GENERIC ENVIRONMENTAL IMPACT STATEMENT ON THE OIL, GAS AND SOLUTION MINING REGULATORY PROGRAM 8 (2011)).

116. N.Y. STATE DEP’T OF ENVTL. CONSERVATION, *supra* note 115, § 6.1.1.7, at 6-6.

during the fracturing operation.¹¹⁷ Wastewater chemicals are often toxic, including organic pollutants, heavy metals, and radioactive materials, some of which are naturally occurring.¹¹⁸ Industry has been reluctant to fully disclose the chemical composition of wastewater, thus hiding risks to environmental health.¹¹⁹

Consequently, these chemically tainted waters must be managed and treated properly. One regulatory option is to require disclosure of the exact composition of the chemical fluids used in the process.¹²⁰ Many producers have self-reported and use the public website FracFocus to disclose volumes as well as the chemical makeup of the fluids. In most shale regions, the flowback and produced water can be disposed of by injection into deep geologic formations. But in some regions, most notably in the Marcellus Shale, those formations are limited. Consequently, in such regions, flowback must be treated, recycled, disposed of, or delivered to water treatment facilities.¹²¹

Unfortunately, the EPA, pursuant to the Energy Policy Act of 2005,¹²² is prohibited from regulating hydraulic fracturing operations under the Safe Drinking Water Act.¹²³ This gaping loophole is known as the “Halliburton exception” named for the oil and gas industry firm that lobbied for it and patented hydraulic fracturing in the 1940s.¹²⁴

117. See O’Sullivan & Paltsev, *supra* note 99, at 2 (detailing the flowback process).

118. See OHIO ENVTL. PROT. AGENCY, DRILLING FOR NATURAL GAS IN THE MARCELLUS AND UTICA SHALES: ENVIRONMENTAL REGULATORY BASICS 3 (2012) (describing the environmental concerns related to drilling).

119. See Argetsinger, *supra* note 90, at 332–36 (discussing the difficulty in gauging the risks posed by chemicals used in hydraulic fracturing due to industry nondisclosure and lax federal environmental regulations).

120. See Wiseman, *supra* note 91 (manuscript at 34–35) (discussing the pros and cons of disclosure).

121. See O’Sullivan & Paltsev, *supra* note 99, at 2 (analyzing potential gas emissions produced during well flowback).

122. Pub. L. No. 109-58, 117 Stat. 594 (2005).

123. 42 U.S.C. § 300h(d)(1) (2006).

124. See JEFFREY D. DINTZER & ELIZABETH M. BURNSIDE, LAW360, TAKE IT EASY ON FRACKING (2011), available at <http://www.gibsondunn.com/publications/Documents/DintzerBurnside-TakeItEasyOnFracking.pdf> (noting that while an initial EPA report found no threat to groundwater from hydraulic fracturing, the EPA is currently conducting a revised study); Amy Tiemann, *Why You Need to Know About Fracking—It May be Coming to a Field or Neighborhood Near You* (Oct. 8, 2011), <http://amytiemann.com/tag/halliburton-exception> (discussing the insufficient federal and state regulation of hydraulic fracturing); *The Halliburton Loophole*, EARTHWORKS, http://www.earthworksaction.org/issues/detail/inadequate_regulation_of_hydraulic_fracturing (last visited

Fortunately, the EPA has initiated a rulemaking to set water discharge standards for wastewater from shale gas production.¹²⁵ Additionally, industry environmental groups and state regulators have devised a program to develop, under the acronym STRONGER, “guidelines for better management and disposal of oil and gas wastes.”¹²⁶

Thus, water use involves several environmental issues including the amount used during injection and the possible environmental and human health effects that can result from the effects of the use of chemicals in the process. Noted risks include the introduction of invasive species between water resources, increased surface water temperatures, increased pollutant concentrations, harmful water plants and wildlife, and reduced water quality for all users. These effects will vary depending upon levels of toxicity, how the chemicals are introduced into the environment, and the routes by which humans, wildlife, and plant life are exposed to them, including chemical spills.¹²⁷

C. *Community Disruption*

As noted above, shale gas development is occurring in regions, particularly in the eastern United States, that are unfamiliar with oil and gas exploration and production. Developing sites require the use of trucks and other heavy equipment, as well as the possible construction of new roads, drill pads, and gathering lines. These activities affect the immediate area and effect air emissions, odors, noise, spill risk, land use, wildlife, and the general life styles of these communities.

The shale gas boom has seen a significant increase in drilling activity. More wells are being drilled, and with that increase there is a greater need for more surface usage. Operators need more access roads; habitats are disturbed; transportation activity increases dramatically; soil erosion occurs; and storm water quality is adversely

Feb. 23, 2013) (detailing efforts by Congress and local governments to close the Halliburton Loophole).

125. See EPA, EPA INITIATES RULEMAKING TO SET DISCHARGE STANDARDS FOR WASTEWATER FROM SHALE GAS EXTRACTION (2011) (discussing EPA efforts to research and reevaluate the treatment of shale gas wastewater).

126. Wiseman, *supra* note 91 (manuscript at 41). STRONGER is the State Review of Oil & Natural Gas Environmental Regulations initiated by the EPA. *Id.* (manuscript at 40); see also Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes, 53 Fed. Reg. 25,445, 25,456–57 (July 6, 1988) (noting the development of a review system for the adequacy of state regulations).

127. See Wiseman, *supra* note 91 (manuscript at 29–31) (describing the composition and dangers of fracturing chemicals and the impact of chemical spills).

affected.¹²⁸ In addition to growing conflicts between local, state, and federal authorities regarding the extent of hydraulic fracturing and its regulation, conflicts about the use of and disruption to public lands are also increasing.¹²⁹

VI. RECOMMENDATIONS

Given the potential environmental consequences of hydraulic fracturing, there is no shortage of recommendations regarding this drilling process. At the federal level, the EPA continues to research the consequences of hydraulic fracturing on drinking water. Additionally, the Bureau of Land Management has proposed a rule to regulate fracturing on public and Indian lands. This rule would require disclosure of chemicals used throughout the drilling process, attempt to improve the well-bore integrity, and address issues on flow-back waters.¹³⁰

Additionally, federal regulators should reconsider both the Halliburton exemption and the exemption of fracking under the Resource Conservation and Recovery Act. Further, Congress has had legislation introduced, known as the “Fracturing Responsibility and Awareness of Chemicals Act,” that promotes public disclosure.¹³¹ Indeed, national regulations have the advantage of making fracking regulation even across state boundaries, and that uniformity should benefit the industry as it will not have to comply with multiple state regulatory schemes.¹³²

Professor Hannah Wiseman has written an important analysis of shale gas production and the environmental concerns generated by its rapid growth.¹³³ Equally important are the recommendations that she makes. Her paper is premised on the idea that the most pressing risks

128. *See id.* (manuscript at 62–70) (discussing the challenges presented by the construction of well pads and access roads and potential solutions).

129. *See, e.g.,* Jack Healy, *Colorado Communities Take on Fight Against Energy Land Leases*, N.Y. TIMES, Feb. 3, 2013, at 15 (noting the opposition of local residents in Colorado to opening up federal land for oil and natural gas drilling).

130. Oil and Gas; Well Stimulation, Including Hydraulic Fracturing, on Federal and Indian Lands, 77 Fed. Reg. 27,691 (proposed May 11, 2012) (to be codified at 43 C.F.R. pt. 3160).

131. *See* DAVID SPENCE, ENERGY MGMT. AND INFO. CTR., FRACKING REGULATIONS: IS FEDERAL HYDRAULIC FRACTURING REGULATION AROUND THE CORNER? (2010) (describing the federal government’s recent attempts to regulate hydraulic fracturing).

132. *Cf.* Jody Freeman, *The Wise Way to Regulate Gas Drilling*, N.Y. TIMES, July 6, 2012, at A23 (arguing for federal baseline standards for the regulation of hydraulic fracturing).

133. Wiseman, *supra* note 91.

may not arise from the injection of chemicals and water into wells, but from other stages of the natural gas development process, including a higher rate of well drilling.¹³⁴ Additionally, given the magnitude of gas production operations, risks are introduced throughout the process. Spills, transportation, storage, and disposal of wastewater must also be given attention.¹³⁵

From her analysis of identified risks and regulatory innovations that have been occurring in several states, she provides a list of ten regulations that states should consider including:

- detailed spill prevention and response plans for all oil and gas sites;
- ensure that surface water withdrawals do not reduce in-stream flow below levels needed to support aquatic life;
- use closed-loop tanks for storage drilling in fracturing wastes;
- increased setbacks between well pads and natural resources;
- require that wastewater treatment plants provide evidence that they can treat flowback water;
- adopt requirements for preventing well leakage;
- encourage or require the reuse of flow-back water;
- prohibit the use of used well casings;
- require well operators to pressure test the wells before fracturing up to maximum pressure and use blowout prevention equipment;
- adopt a rebuttable presumption that methane contamination within a certain distance from drilling operations can occur within a certain time drilling; and
- require air emissions monitoring and reporting.¹³⁶

Professor Wiseman notes that these recommendations are directed to state regulators.¹³⁷ Therefore, there are a range of possible regulatory activities and the appropriate level of governance must also be addressed.¹³⁸

134. *Id.* (manuscript at 8–10).

135. *Id.* (manuscript at 23–47).

136. *Id.* (manuscript at 77–78).

137. *Id.* (manuscript at 77).

138. Regarding the appropriate level of governance, that is, whether the federal government or the states should have primary jurisdiction,

CONCLUSION

From the above analysis, I conclude that natural gas, particularly shale gas, should not be included in the definition of clean energy. For all its environmental improvements and economic benefits, shale gas continues our traditional fossil fuel energy model. For most of the twentieth century that model yielded great benefits, including a robust economy and the construction of a national infrastructure, and it served as the backbone of U.S. world leadership, particularly during the two world wars.

But that model benefited from a series of government supports, including tax breaks and other subsidies; under enforcement of royalty, environmental, and safety obligations; and an energy bureaucracy that has played an intentionally supportive role that has buoyed domestic oil and gas producers to phenomenal levels of wealth.¹³⁹ In short, the playing field between fossil fuels and clean energy is not level regardless of the increasing, but too often episodic, financial supports afforded new and cleaner technologies.¹⁴⁰

compare David B. Spence, *Federalism, Regulatory Lags, and the Political Economy of Energy Production*, 161 U. PA. L. REV. 431 (2013) (arguing for narrow federal regulation), with Michael Burger, *Fracking and Federalism Choice*, 161 U. PA. L. REV. ONLINE 150 (2013), <http://www.pennumbra.com/responses/02-2013/Burger.pdf> (contending that greater federal regulation is necessary).

139. In the first quarter of 2012, for example, ExxonMobil posted profits of \$9.45 billion or \$104 million per day. See Rebecca Leber, *Exxon Makes \$104 Million in Profit per Day So Far in 2012, While Americans Are Stuck with a Higher Gas Bill*, THINKPROGRESS (Apr. 26, 2012, 10:08 AM), <http://thinkprogress.org/climate/2012/04/26/471469/exxon-takes-104-million-profits-per-day-so-far-in-2012-while-americans-are-stuck-with-a-higher-gas-bill/> (breaking down Exxon's profits and discussing the company's political influence). The company's second quarter profits almost doubled to nearly \$16 billion. See Steve Hargreaves, *Exxon Reports Record Profit of Nearly \$16 Billion*, CNNMONEY (July 26, 2012, 10:50 AM), <http://money.cnn.com/2012/07/26/news/companies/exxon-profit/index.htm> (noting that given the decline in oil and gas prices, Exxon's record profits were largely due to the divestment of foreign operations).

140. See CONG. BUDGET OFF., FEDERAL FINANCIAL SUPPORT FOR THE DEVELOPMENT AND PRODUCTION OF FUELS AND ENERGY TECHNOLOGIES (Mar. 2012) (detailing the tax preferences and direct government investments for fuel and energy technologies). According to the CBO study, in 2011 energy efficiency and renewable resources received 78% of the energy-related tax preferences. *Id.* at 5. But the tax code contains only four *permanent* tax breaks, and three go to fossil fuels and one goes to nuclear power. In addition, historically, from 1916 into the 1970s, all such expenditures went to fossil fuel industries and fossil fuel industries received more than two-thirds of government largesse through 2007. *Id.* at 2.

Today, the natural gas industry is highly competitive as prices continue to fall, sometimes to the dismay of gas exploration companies and those that finance them.¹⁴¹ But the fact that some explorers cannot turn a profit is indicative of competition rather than a market failure. Neither oil nor gas producers need the helping hand of government. Additionally, as natural gas displaces coal for electricity generation, we will witness a lowering of carbon dioxide emissions, particularly as natural gas continues to serve that sector. In short, we are substituting a cleaner burning fuel in the electric sector but we are not using a clean fuel. If the clean energy transition is to be successful, then the United States, and indeed the world, must move away from fossil fuels. In the United States, we can improve national security, reduce economic threats, and reduce environmental degradation through clean energy. We must continue a commitment to a clean transition by expanding the use of renewal resources and energy efficiencies. Shale gas plays no role in that picture.

By concentrating on natural gas development we run the risk of diminishing the importance of our concentration on clean energy activities.¹⁴² As a realist, I recognize that natural gas will play a large role in our energy economy. Further, I do not dismiss its positive environmental and economic benefits. Nevertheless, even though natural gas has been a major component of our hydrocarbon economy and even though it will continue to play significant role, as a matter of a sound future energy policy, we cannot allow it to distract us from a more important and economically promising clean energy future.

141. *See, e.g.*, Clifford Krauss & Eric Lipton, *After the Boom in Natural Gas*, N.Y. TIMES, Oct. 21, 2012, at BU1 (noting that a market surplus and low prices have led to financial hardship for natural gas companies).

142. *See* John Broder, *After Federal Jolt, Clean Energy Seeks New Spark*, N.Y. TIMES, Oct. 24, 2012, at F2 (noting the lack of funding for alternative energy investments as federal stimulus money runs out).

