HYDRAULIC FRACTURING (FRACKING), FEDERALISM, AND THE WATER-ENERGY NEXUS

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HYDRAULIC FRACTURING (FRACKING), FEDERALISM, AND THE WATER-ENERGY NEXUS

ROBIN KUNDIS CRAIG*

ABSTRACT

While the actual and potential water impacts of hydraulic fracturing ("fracking") are well known and the subject of sometimes intense scholarly debate, few discussions to date have situated fracking within the larger legal and policy conundrum known as the water-energy nexus. This nexus acknowledges that, just as water supply and energy production are mutually dependent, so water policy and energy policy should also develop in tandem. Thus, the water-energy nexus demands that regulators view fracking's intersections with water resources as more than "merely" an environmental law problem.

Developing water policy and energy policy in tandem, however, raises federalism issues that are relevant to the United States's increasing reliance on fracking and shale gas to supply its natural gas needs. Fracking has already been the subject of serious federalism debates, but these debates have generally focused on whether an individual state or the federal government is the more appropriate regulator of fracking and its environmental impacts—for example, the debate has concentrated around issues of how to fit fracking into more traditional governance structures for on-shore energy development, water resource management, and environmental regulation, all of which suggest that states should be the primary regulators. Viewing fracking through the lens of the water-energy nexus, however, both adds a broader context to this federalism debate and suggests that fracking should constitute both a significant focus of and potential testing ground for the increasing federal interest in integrating water management and energy policy.

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I. INTRODUCTION

Hydraulic fracturing, often better known as "fracking," is a technological method that allows oil and natural gas companies to extract more of these energy resources at economically viable production costs from previously infeasible sources—especially, most recently, to extract natural gas from shales. As the U.S. Energy Information Administration ("EIA") explains,

Shales are fine-grained sedimentary rocks that can be rich sources of petroleum and natural gas. Over the past decade, the combination of horizontal drilling and hydraulic fracturing has allowed access to large volumes of shale gas that were previously uneconomical to produce. The production of natural gas from shale formations has rejuvenated the natural gas industry in the United States.¹

^{1.} What Is Shale Gas and Why Is It Important?, U.S. ENERGY INFO. ADMIN. (Dec. 5, 2012), http://www.eia.gov/energy_in_brief/article/about_shale_gas.cfm [hereinafter What Is Shale Gas].

Development of natural gas from shale formations helped the United States to produce ninety-five percent of its natural gas domestically in 2011,² and production of this energy resource is only expected to grow into the future. The EIA, for example,

projects U.S. natural gas production to increase from 23.0 trillion cubic feet in 2011 to 33.1 trillion cubic feet in 2040, a 44% increase. Almost all of this increase in domestic natural gas production is due to projected growth in shale gas production, which grows from 7.8 trillion cubic feet in 2011 to 16.7 trillion cubic feet in 2040.3

Thus, domestic development of shale gas through fracking is an increasingly important component of the United States's overall energy policy.

Development of natural gas from shale is a national issue in other respects as well, because shale plays are located across the United States.4 From west to east, shale plays range from the Monterey and Monterey Tembloc developments in central California to the Marcellus Shale formation that spans Pennsylvania, New York, Ohio, Virginia, and West Virginia; from north to south, they range from the Bakken shale bed in Montana and North Dakota to the Eagle Ford formation in southern Texas.⁵ Regulation of such developments, however, can also fit neatly into the relevant states' general oversight of oil and gas development, while the immediate impacts of fracking projects tend to be intensely local. Thus, as several scholars have already recognized, development of natural gas from shale through fracking has implications for at least three levels of governance: local, state, and national.6

In many respects, development of the laws and policies governing fracking is still in its infancy, reflecting the recent and rapid rise of fracking as a prominent technique for extracting oil and gas. While oil and natural gas companies experimented with fracking as early as the 19th century, it was not until the 1950s that the technique became pop-

^{2.} Id.

^{3.} Id.

^{4.} Id.

See generally, e.g., Michael Burger, Fracking and Federalism Choice, 161 U. PENN. L. REV. PENNUMBRA 150 (2013); David B. Spence, Federalism, Regulatory Lags, and the Political Economy of Energy Production, 161 U. PA. L. REV. 431 (2013); Stephanie Scott, Comment, Who "Shale" Regulate the Fracking Industry?, 24 VILL. ENVIL. L.J. 189 (2013); Elizabeth Burleson, Cooperative Federalism and Hydraulic Fracking: A Human Right to a Clean Environment, 22 CORNELL J.L. PUB. POL'Y 289 (2012); Gianna Cricco-Lizza, Hydraulic Fracturing and Cooperative Federalism: Injecting Reality into Policy Formation, 42 SETON HALL L. REV. 703 (2012); Emily C. Powers, Comment, Fracking and Federalism: Support for an Adaptive Approach that Avoids the Tragedy of the Regulatory Commons, 9 J.L. & POL'Y 913 (2011).

ular as a way to stimulate oil and gas production in conventional fields. However, large-scale shale gas production through fracking did not emerge until the 1980s and 1990s, after companies such as Mitchell Energy and Development Corp. proved the technique's commercial viability in the Barnett shale formation in Texas. Moreover, according to the EIA, only since 2006 "has shale gas been recognized as a 'game changer' for the U.S. natural gas market."

While scholars have recognized and debated a variety of governance issues regarding the recent and rapid expansion of fracking, ¹⁰ they have not yet situated fracking within the much larger policy conundrum facing the United States known as the water-energy nexus. At its most basic, the water-energy nexus acknowledges the realities that: (1) production of energy is usually intensely water dependent; and (2) development and use of water resources is often highly dependent on sufficient energy. ¹¹ The water-energy nexus thus challenges natural resource policymakers to consider both resources—water and energy—simultaneously, which historically all levels of government have done only rarely.

The water-energy nexus is an important aspect of the fracking debate because fracking is both a water-intensive and potentially water polluting method of energy production. ¹² Hydraulic fracturing depends on the use of water under pressure. As the EIA describes, "Hydraulic fracturing . . . is a technique in which water, chemicals, and sand are pumped into the well to unlock the hydrocarbons trapped in shale formations by opening cracks (fractures) in the rock and allowing natural

^{7.} U.S. ENERGY INFO. ADMIN., ANALYSIS AND PROJECTIONS: REVIEW OF EMERGING RESOURCES: U.S. SHALE GAS AND SHALE OIL PLAYS (July 8, 2011), available at http://www.eia.gov/analysis/studies/usshalegas/.

^{8 1}

^{9.} Id. The EIA continued with specific statistics regarding shale gas production:

The proliferation of activity into new shale plays has increased dry shale gas production in the United States from 1.0 trillion cubic feet in 2006 to 4.8 trillion cubic feet, or 23 percent of total U.S. dry natural gas production, in 2010. Wet shale gas reserves increased to about 60.64 trillion cubic feet by year-end 2009, when they comprised about 21 percent of overall U.S. natural gas reserves, now at the highest level since 1971. Oil production from shale plays, notably the Bakken Shale in North Dakota and Montana, has also grown rapidly in recent years.

Id.

^{10.} See generally, e.g., Burger, supra note 6; Spence, supra note 6; Scott, supra note 6; Holly A. Vandrovec, The Fight Over Fracking, 74 Tex. B.J. 390 (2011); Heather Ash, EPA Launches Hydraulic Fracturing Study to Investigate Health And Environmental Concerns While North Dakota Resists Regulation: Should Citizens Be Concerned?, 87 N.D. L. Rev. 717 (2011).

^{11.} See discussion infra Part IV.A.

^{12.} See U.S. DEP'T OF ENERGY, MODERN SHALE GAS DEVELOPMENT IN THE UNITED STATES: A PRIMER ES-4, ES-5 (2009), available at http://www.netl.doe.gov/technologies/oilgas/publications/EPreports/Shale_Gas_Primer_2009.pdf (discussing both water quality protections and water use) [hereinafter 2009 SHALE GAS PRIMER].

gas to flow from the shale into the well." ¹³ Currently, fracking is "used in nine out of 10 natural gas wells in the United States, where millions of gallons of water, sand and chemicals are pumped underground to break apart the rock and release the gas." ¹⁴ Moreover, fracking is also intensely consumptive of water, in large part because the fracking process so pollutes water that it cannot be returned to the source stream. ¹⁵ Finally, most fracking is occurring in areas that are already water-stressed, with the result that impacts on local water supplies can be significant. ¹⁶

This article situates fracking and the debate over how to regulate it within the larger water-energy nexus challenge currently facing the United States. It begins by examining two aspects of fracking's intersection with water use: the potential threats that fracking poses to water quality (Part II) and the demands that fracking places on water supply (Part III). In Part IV, the article describes the larger water-energy nexus challenge for the United States, specifically in terms of issues that that nexus poses for resolving fracking's federalism issues. The article concludes that fracking's nexus with water use requires both a more detailed and a more elevated perspective on the regulatory system for fracking than current debates over federalism have acknowledged.

II. FRACKING AND WATER QUALITY CONCERNS

In many respects, the "environmental considerations associated with shale gas production are common to all oil and gas development." Two aspects of shale gas production, however, create certain new concerns about this industry's environmental impacts, especially impacts on water: the horizontal drilling and the hydraulic fracturing. 18 This discussion will focus on the risks to water resources potentially created by the hydraulic fracturing. Notably, however, "[b]oth horizontal drilling and hydraulic fracturing are established technologies with significant track records; horizontal drilling dates back to the 1930s and hydraulic fracturing has a history dating back to the 1950s." 19

As has become obvious by now, one of the key differences between shale gas wells and conventional natural gas wells is the use of large-

^{13.} What Is Shale Gas, supra note 1.

^{14.} What Is Hydraulic Fracturing?, PRO PUBLICA (2013), http://www.propublica.org/special/hydraulic-fracturing-national [hereinafter PRO PUBLICA].

^{15.} See Felicity Barringer, "Spread of Hydrofracking Could Strain Water Resources in West, Study Finds," *The New York Times*, May 2, 2013, at A12 (noting that produced water from fracking is often highly polluted and expensive to treat).

^{16 .} *Id*; Monika Freyman & Ryan Salmon, CERES, Hydraulic Fracturing & Water Stress: Growing Competitive Pressures for Water 5 (May 2013).

^{17. 2009} SHALE GAS PRIMER, supra note 12, at 43.

^{18.} *Id*.

^{19.} *Id.* at 46.

scale hydraulic fracturing.²⁰ The use of water and other liquids at high pressure in fracking has raised several concerns about fracking's effects on water quality, both as a possible result of groundwater contamination and as a result of spills and other sources of contamination on the surface.²¹ Specifically, the EIA emphasizes three aspects of fracking as particular areas of concern in this regard. First, "if mismanaged, hydraulic fracturing fluid-which may contain potentially hazardous chemicals—can be released by spills, leaks, faulty well construction, or other exposure pathways. Any such releases can contaminate surrounding areas." 22 Second, "fracturing also produces large amounts of wastewater, which may contain dissolved chemicals and other contaminants that could require treatment before disposal or reuse. Because of the quantities of water used and the complexities inherent in treating some of the wastewater components, treatment and disposal is an important and challenging issue."23 Finally, after fracking fluids and formation waters are returned to the surface, drilling companies often dispose of them by injecting them through injection wells, through which, typically, the wastewater is discharged into "non-potable salt-water aquifers."24 Both the EIA and the U.S. Geological Survey have indicated that this injection disposal method can cause small earthquakes, 25 leaving questions as well about the long-term integrity of the receiving aquifers.

A. Contamination from Fracking Fluids During Drilling and Storage

1. Aquifer Risks During Well Drilling

While, as the EIA noted, contamination from fracking fluids remains a concern, fracking practices do provide certain safeguards against water contamination. The U.S. Department of Energy ("DOE"), for example, has emphasized that "[g]round water is protected during the shale gas fracturing process by a combination of the casing and cement that is installed when the well is drilled and the thousands of feet of rock between the fracture zone and any fresh or treatable aquifers." ²⁶ Moreover, "[w]ater and sand make up over 98% of the fracture fluid, with the rest consisting of various chemical additives that improve the effectiveness of the fracture job." ²⁷ It is these other chemical additives,

^{20.} Id.

^{21.} PRO PUBLICA, supra note 14.

^{22.} What Is Shale Gas, supra note 1.

^{23.} Id.

^{24.} Id.

^{25.} Id.

^{26. 2009} SHALE GAS PRIMER, supra note 12, at ES-4.

^{27.} *Id.* "A typical fracture treatment will use very low concentrations of between 3 and 12 additive chemicals depending on the characteristics of the water and the shale formation being fractured. Each component serves a specific, engineered purpose." *Id.* at 61. *See*

however, that have been the source of much concern over water quality and public health, ²⁸ especially given that a typical fracking operation can involve the injection of millions of gallons of fracking fluid, ²⁹ and fracking companies have thus far been reluctant to reveal their exact chemical composition to the public.

Protection of groundwater resources has been a primary focus of state regulation of fracking to date.³⁰ As a result, states require shale gas developers to "install[] multiple layers of protective steel casing and cement that are specifically designed and installed to protect fresh water aquifers and to ensure that the producing zone is isolated from overlying formations."³¹ In addition, casings "can be set to isolate different water-bearing zones from each other."³² In addition,

state oil and gas regulatory agencies often specify the required depth of protective casings and regulate the time that is required for cement to set prior to additional drilling. These requirements are typically based on regional conditions and are established for all wildcat wells and may be modified when field rules are designated.³³

Based on these regulations and studies of underground injection wells, the DOE has concluded that "the potential for groundwater to be impacted by injection is low," especially considering that shale formations have natural "seals" against leaking as well³⁴—at least so long as 100 percent of horizontal wells follow the applicable requirements.³⁵ In its opinion, "hydraulic fracturing uses a number of chemical additives that could be hazardous, but are safe when properly handled according to requirements and long-standing industry practices."³⁶ Of course, as BP's *Deepwater Horizon* oil platform proved in a different energy production context, human error and the culture of energy extraction operations should always remain concerns for protection of water quality.³⁷

also id. at 62, ex. 35 (presenting a graphic representation of the composition of fracking fluid).

^{28.} Fracking additives can include, for example, biocides, oxygen scavengers, and acids. *Id.* at 61. *See also id.* at 63, ex. 36 (providing a table of common fracking fluid additives).

^{29.} Id. at 59, 61.

^{30.} Id. at 51.

^{31.} *Id.* at 51–52.

^{32.} *Id.* at 52.

^{33.} Id. at 52-53.

^{34.} *Id.* at 54.

^{35.} *Id.* at 53.

^{36.} Id. at 62.

^{37.} NAT'L COMM'N ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING, DEEP WATER: THE GULF OIL DISASTER AND THE FUTURE OF OFFSHORE DRILLING: REPORT TO THE PRESIDENT 79–85, 122–27 (2011), available at http://www.oilspillcommission.gov/sites/default/files/documents/DEEPWATER_ReporttothePresident_FINAL.pdf.

2. Contamination Risks from Drilling Fluid Storage and Retention Pits

Drilling fluids are necessary to fracking operations and, as the DOE has recognized, "[i]n order to maintain sufficient volumes of fluids onsite during drilling, operators typically use pits to store make-up water used as part of the drilling fluids." Storage pits can thus represent another potential source of contamination, although they "are typically lined to minimize the loss of water from infiltration."

B. Fracking Wastewater

As the DOE acknowledges, "[a]fter the drilling and the fracturing of the well are completed, water is produced along with the natural gas. Some of this water is returned fracture fluid and some is natural formation water." While in most cases "[t]he majority of fracturing fluid is recovered in a matter of several hours or a couple of weeks," "[i]n some cases flow back of fracturing fluid in produced water can continue for several months after gas production has begun." Produced water generally ranges from thirty to seventy percent of the original volume of fluid used for fracturing itself. The rest of the fracking fluid is assumed to be contained within the shale formation.

This produced water represents a wastewater stream that needs to be handled properly in order to avoid contaminating surface waters, groundwater, and the surrounding land.⁴⁴ Shale gas developers currently manage this wastewater through "underground injection, treatment and discharge, and recycling," although new techniques are being developed to allow this wastewater to be treated to standards where it can be used in other sectors, "allow[ing] shale gas produced water to be viewed as a potential resource in its own right."⁴⁵

C. Existing Regulatory Mechanisms for Addressing Water Contamination from Fracking

Several regulatory mechanisms already exist that do or potentially could address the risks of water resource contamination from fracking, as many scholars have already acknowledged.⁴⁶ This section provides a

^{38. 2009} SHALE GAS PRIMER, supra note 12, at 55.

^{39.} Id. at 56.

^{40.} Id. at ES-4.

^{41.} *Id.* at 66.

^{42.} *Id*.

^{43.} Id. at 67.

^{44.} Id. at ES-4.

^{45.} Id.

^{46.} E.g., Hannah J. Wiseman, Risk and Response in Fracturing Policy, 84 U. COLO. L. REV. (forthcoming 2013), available at http://ssrn.com/abstract=2017104; Hannah Coman, Balancing the Need for Energy and Clean Water: The Case for Applying Strict Liability in Hydraulic Fracturing Suits, 39 B.C. ENVTL. AFF. L. REV. 131, 137–60 (2012); Thomas Swartz, Hydraulic Fracturing: Risks and Risk Management, 26 NAT. RESOURCES & ENVT. 30, 30–31

brief overview of those regulatory programs, noting most significantly that both states and the federal government currently regulate water quality in ways that can impact fracking.

1. The Clean Water Act

The Federal Clean Water Act⁴⁷ prohibits the "discharge of any pollutant from any point source" without a permit.⁴⁸ For example, fracking companies that deal with their produced water and returned wastewater by discharging it into nearby surface water bodies are generally subject to the Clean Water Act—specifically, to the Act's National Pollutant Discharge Elimination System, or NPDES, permit program.⁴⁹ However, both Congress and the Federal Environmental Protection Agency ("EPA") have broadly exempted uncontaminated storm water discharges associated with oil and gas construction and field operation activities from the NPDES permit requirement, ⁵⁰ although the U.S. Court of Appeals for the Ninth Circuit invalidated portions of the EPA's regulation that would have exempted contaminated discharges as well.⁵¹ As a result, contaminated discharges of storm water from fracking operations are also subject to the NPDES permit requirement.⁵²

The NPDES permit sets effluent limitations for discharges of polluted wastewater, especially for industrial dischargers, limiting how much pollution and in what concentrations the discharger can add to waters of the United States.⁵³ Most states have taken over the NPDES permit program from the EPA.⁵⁴ As a result, as the DOE has noted, "it is not uncommon to have varying requirements from state to state. This variation can affect how the oil and gas industry manages produced water within a drainage basin located within two or more states, such as the Marcellus shale in the Appalachian Basin."⁵⁵ However, the EPA can continue to serve as a unifying force by establishing effluent limitation guidelines—in effect, recommended effluent limitations for particular pollutants—for particular industries.⁵⁶ The EPA established effluent limitation guidelines for the industrial category of Oil and Gas Extrac-

(Fall 2011); Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 FORDHAM ENVIL. L. REV. 115, 142–92 (Spring 2009).

- 47. 33 U.S.C. §§ 1251–1387 (2012).
- 48. *Id.* § 1311(a).
- 49. *Id.* § 1342(a).
- 50. *Id.* § 1342(1)(2); 71 C.F.R. § 33.628 (2006).
- $51.\,$ Natural Res. Def. Council, Inc. v. U.S. Envtl. Prot. Agency, $542\,$ F.3d 1235, 1250-51 (9th Cir. 2008).
 - 52. 2009 SHALE GAS PRIMER, supra note 12, at 31–32.
 - 53. 33 U.S.C. §§ 1311(b), 1362 (2012).
 - 54. 33 U.S.C. § 1342(b) (2012).
 - 55. 2009 SHALE GAS PRIMER, supra note 12, at 30.
 - 56. 33 U.S.C. § 1312 (2012).

tion in 1979, and the guidelines for the more specific subcategory of onshore oil and gas extraction apply to discharges of pollutants from shale gas development and production.⁵⁷

2. The Safe Drinking Water Act

The Federal Safe Drinking Water Act⁵⁸ works to protect the nation's public drinking water supplies by requiring that all such drinking water meet national health-based quality standards.⁵⁹ More directly relevant to fracking, however, the Safe Drinking Water Act sets up an Underground Injection Control program to protect aquifers from wastewater injections.⁶⁰ Thus, when fracking operations inject water and other materials into wells to enhance production of natural gas or dispose of their wastewater through underground injection, they are potentially subject to the Safe Drinking Water Act.⁶¹

The Underground Injection Control program works by classifying injection wells into categories. ⁶² As the DOE has observed, "[m]ost injection wells associated with oil and gas production are Class II wells" ⁶³—that is, wells that "may inject brines and other fluids associated with oil and gas production." ⁶⁴ In regulating underground injection wells through the Safe Drinking Water Act, the EPA sets minimum requirements for state programs, ⁶⁵ and both levels of government seek to ensure that injected fluids do not endanger or have the potential to endanger current or future sources of public water supply. ⁶⁶ However, state program details are and must be tailored to local resources, ⁶⁷ and states can acquire primary authority for permitting injection wells associated with oil and gas production without having to receive full Underground Injection Control program authority from the EPA. ⁶⁸ Forty states have received delegated authority to regulate Class II oil and gas injection

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^{57. 40} C.F.R. §§ 435.30–435.32 (2012); 2009 Shale Gas Primer, supra note 12, at 31.

^{58. 42} U.S.C. §§ 300f–300j-25 (2012). For a lengthier overview of the relationship between the Safe Drinking Water Act and hydraulic fracturing, see generally Keith B. Hall, Regulation of Hydraulic Fracturing under the Safe Drinking Water Act, 19 BUFF. ENVIL. L.J. 1 (2011–2012). For an example of how the U.S. Environmental Protection Agency ("EPA") has applied its emergency authorities under the Act to hydraulic fracturing, see Holly A. Vandrovee, Feature: New Frontiers in Environmental Law: The Fight Over Fracking: Recent Hydraulic Fracturing Litigation in Texas, 74 Tex. B.J. 390, 391 (2011).

^{59. 42} U.S.C. §§ 300f(1), 300g-1 (2012).

^{60.} Id. § 300h.

^{61. 2009} SHALE GAS PRIMER, supra note 12, at 33.

^{62.} Id.

^{63.} Id.

^{64.} Id. at 32.

^{65. 42} U.S.C. § 300h (2012).

^{66.} Id.

^{67. 42} U.S.C. § 300h(b)(3)(A) (2012).

^{68.} Id. § 300h-4.

wells; the EPA regulates such wells in the other ten states, which include seven oil and gas states, and on federal lands and Indian lands.⁶⁹

NEXUS

3. State and Regional Regulation

As the discussion above notes, states can take over many federal permitting and regulatory programs relevant to fracking and its potential impact on water resources, including the Clean Water Act's NPDES permit program and the Class II injection well program under the Safe Drinking Water Act. States can also directly influence the stringency of the effluent limitations in NPDES permits by setting particularly protective water quality standards for the water bodies within their respective borders.⁷⁰

Beyond these federally derived authorities, however, states have inherent police power authority to regulate water quality within their borders, and many are beginning to enact regulations specifically for fracking.⁷¹ In particular, "[s]tate oil and gas programs place great emphasis on protecting groundwater" through detailed well construction requirements.⁷² As one example, in May 2013 concerns over groundwater quality prompted Colorado to pass legislation requiring stricter monitoring of groundwater in fracking operations.⁷³

In addition, large interstate water bodies may be subject to regional water quality regulation as a result of an interstate compact. For example, the Delaware River Basin Commission was created through a 1961 interstate compact among Delaware, New Jersey, New York, Pennsylvania, and the federal government to manage and regulate the water resources in the Delaware River Basin. He cause fracking techniques [in the Marcellus Shale] involve the use of water resources of the Delaware River Basin, natural gas activity would require [the Commission's] approval. To December 2010, the Commission published draft regula-

^{69. 2009} SHALE GAS PRIMER, supra note 12, at 33.

^{70.} See 33 U.S.C. §§ 1312 (requiring effluent limitations based on the water quality standards when technology-based effluent limitations are not sufficiently stringent to achieve the desired water quality in a specific water body), 1313 (requiring states to set water quality standards and requiring NPDEs permit adjustments and total maximum daily loads when water bodies do not meet their water quality standards) (201212).

^{71.} See generally Hannah Wiseman, State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing, available at http://ssrn.com/abstract=1992064 (a recent overview of state enforcement efforts).

^{72. 2009} SHALE GAS PRIMER, *supra* note 12, at 51–52.

^{73.} Amy Linn, "Colorado House Approves Stricter Groundwater Monitoring at Drilling Sites," *Bloomberg Law: State Environment Daily*, May 3, 2013.

^{74.} Delaware River Basin Compact, Pub. L. No. 87-328, 75 Stat. 688, 692 (1961).

^{75.} George C. Hopkins, Jeremy Marwell, & Brandon Tuck, *Overcoming NEPA Challenges to Fracking Rules in the Delaware River Basin*, BLOOMBERG BNA: DAILY ENV'T REPORT (Nov. 1, 2012), at 3, http://www.velaw.com/uploadedFiles/VEsite/Resources/hopkins marwellfracking.pdf.

tions that would govern the use of Delaware River water resources in fracking and effectively imposed a moratorium on fracking in the Basin until the rules are finalized. The Commission's rules are currently being challenged in federal court. The Susquehanna River Basin Commission has similarly recently considered regulation of fracking within that Basin.

III. FRACKING AND WATER USE

The EIA has emphasized that "[t]he fracturing of wells requires large amounts of water. In some areas of the country, significant use of water for shale gas production may affect the availability of water for other uses and can affect aquatic habitats."⁷⁹ Indeed, the DOE estimates that a horizontal shale gas well needs between two and four *million* gallons of water to drill and fracture the well, "depending on the basin and formation characteristics;" ⁸⁰ certain fracking operations in Texas can require up to 13 million gallons of water per well.⁸¹ While such demands on water may be small in comparison to other water uses or the total amount of water being used in a given basin, they can still be significant, especially in drier areas of the West.⁸² Indeed, the DOE acknowledges that "[o]ne key to the successful development of shale gas is the identification of water supplies capable of meeting the needs of a development company for drilling and fracturing water without interfering with community needs."⁸³

While technologies are decreasing the amount of water that fracking operations require,⁸⁴ there is no question that fracking is contributing to the energy sector's overall dominance regarding water demand in the United States. In its last report on the subject, for example, the U.S. Geological Survey reported that in 2005—notably, *before* fracking became a significant source of natural gas production in the United States—withdrawals of water for thermoelectric power plants already constituted forty-seven percent of the nation's water withdrawals—a higher percentage of the water withdrawn than public water supply and

^{76.} *Id*.

^{77.} *Id*.

^{78. 2009} SHALE GAS PRIMER, supra note 12, at 35.

^{79.} What Is Shale Gas. supra note 1.

^{80. 2009} SHALE GAS PRIMER, supra note 12, at ES-4, 64.

^{81.} Heather Cooley & Kristina Donnelly, Pacific Institute, Hydraulic Fracturing and Water Resources: Separating the Frack from Fiction 15 (June 2012), available at http://www.pacinst.org/reports/fracking/full_report.pdf [hereinafter 2012 Pacific Institute Fracking Study]. See also Freyman & Salmon, supra note 16, at 10 ("Development of shale energy resources requires a large amount of water, with estimates ranging between two to 10 million gallons per well.").

^{82. 2009} SHALE GAS PRIMER, supra note 12, at ES-4, 64; FREYMAN & SALMON, supra note 16, at 5, 10.

^{83. 2009} SHALE GAS PRIMER, supra note 12, at ES-4, 64.

^{84.} *Id*

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irrigation combined. 85 Indeed, thermoelectric power plants withdrew 201,000 million gallons of water per day for their operations. 86

Like water used in thermoelectric power plants, 87 fracking operations generally use surface water withdrawals for their operations.88 Moreover, while water demand for fracking operations is currently considerably less than water demand for other forms of energy production, that demand is nevertheless reasonably comparable and significant overall. For example, electricity generation in the Susquehanna River Basin currently requires almost 150 million gallons of water per day, while the total peak demand for water for shale gas development from the Marcellus Shale in the same geographic area is projected to be about 8.4 million gallons of water per day. 89 This is also considerably more water demand than is required either for conventional gas wells or extraction of coalbed methane. 90 More importantly, under current norms for dealing with fracking produced water—namely, injection of the water into underground injection wells91—use of water in fracking is one hundred percent consumptive, entirely removing the water used from the relevant watershed and from reuse anywhere. In this respect, fracking significantly differs from thermoelectric power plants, which return most of their cooling water to the source waters.

Even in the East, where water supplies are more abundant, this is not a trivial new demand on water resources, and shale gas development is prompting new approaches to water management, including the construction of new impoundments for fracking operations to capture peak water flow. 92 Notably, during a 1999 drought in the Susquehanna region, water-dependent industries had a difficult time securing sufficient water for their operational needs, 93 and during an August 2011 drought the Susquehanna River Basin Commission suspended eleven permits previously granted to natural gas operations because of low wa-

^{85.} U.S. Geological Survey, Fact Sheet 2009-3098: Summary of the Estimated Water Use in the United States in 2005 1 (Oct. 2009), available at http://pubs.usgs.gov/fs/2009/3098/pdf/2009-3098.pdf.

^{86.} Id.

^{87.} U.S. GEOLOGICAL SURVEY, supra note 85, at 1.

^{88. 2009} SHALE GAS PRIMER, supra note 12, at 65.

^{89.} *Id.*; J. Daniel Arthur, Mike Uretsky, & Preston Wilson, ALL Consulting LLC, Water Resources and Use for Hydraulic Fracturing in the Marcellus Shale Region 3 (2011), *available at* http://www.netl.doe.gov/technologies/oil-gas/publications/ENV reports/FE0000797_WaterResourceIssues.pdf.

^{90. 2012} PACIFIC INSTITUTE FRACKING STUDY, supra note 81, at 15.

^{91.} See supra note 46 & accompanying text.

^{92. 2009} SHALE GAS PRIMER, supra note 12, at 65–66.

^{93.} U.S. DEPT. OF ENERGY, ENERGY DEMANDS ON WATER RESOURCES: REPORT TO CONGRESS ON THE INTERDEPENDENCY OF ENERGY AND WATER 30 (2006), available at http://www.sandia.gov/energy-water/docs/121-RptToCongress-EWwEIAcomments-FINAL.pdf [hereinafter 2006 DOE ENERGY-WATER REPORT].

ter levels.⁹⁴ In the far more arid West, fracking operations may have to engage in considerable effort, creativity, and expense to secure the necessary water. In Colorado, for example, fracking operations are projected to increase demand for water withdrawals by 18,700 acre-feet, or over 609 million gallons, by 2015.95 However, most sources of water in Colorado are already over-appropriated, meaning that most fracking operations will have to either bring in water from another state, buy senior irrigation water rights from landowners, purchase water from a water supplier, lease and treat waste water from sources such as cities, pump groundwater, or re-process produced water. 96 This problem is not limited to Colorado: Recent studies note that "almost half (47 percent) of shale gas and tight oil wells are being developed in regions with high to extremely high water stress"—that is, regions where "over 80 percent of the annual available water is being withdrawn by municipal, industrial, and agricultural users in these regions"—while "[o]verall 75 percent of wells are located in regions with medium or higher baseline water stress levels."97 These water stress realities, combined with the fact that water use at most fracking operations is currently almost one hundred percent consumptive, means that the water demanded by fracking can present, in and of itself, legal and policy—not to mention economic—issues for the nation's growing dependence on shale gas production.

IV. THE WATER-ENERGY NEXUS AND THE POTENTIAL POLITICS OF FRACKING REGULATION

Fracking's intersection with water resources is both well known and much discussed and presents, as Parts II and III have discussed, a number of legal issues regarding the protection of water quality and the overall management of water resources. However, to date, discussions of these issues have focused on the immediate intersections of fracking operations with water—how to better protect water quality through specific state and federal statutes and regulations or how to supply water in specific locations to particular fracking projects.

This Part places shale gas fracking operations into a larger policy context: the water-energy nexus. It begins by describing what that nexus is, then explores two implications that arise from the recontextualization of fracking: (1) implications for the federalism debate over fracking; and (2) implications for water and energy policy in the United States more generally.

^{94. 2012} PACIFIC INSTITUTE FRACKING STUDY, supra note 81, at 16.

^{95.} Colo. Div. of Water Resources, Colo. Water Conservation Bd. & Colo. Oil & Gas Conservation Comm'n, Water Resources and Demand for the Hydraulic Fracturing of Oil and Gas Wells in Colorado from 2010 through 2015 at 2 & n.2 (2009), available at http://cogcc.state.co.us/Library/Oil_and_Gas_Water_Sources_Fact_Sheet.pdf.

^{96.} *Id.* at 6–8.

^{97.} Freyman & Salmon, supra note 16, at 5.

A. Basics of the Water-Energy Nexus

As noted, recognizing the water-energy nexus acknowledges that water policy and energy policy should be inextricably intertwined because water resources and energy production are mutually dependent. 98 Some examples are obvious: water generates power at hydroelectric facilities, and energy converts salt water to fresh water at desalination plants. Moreover, policy decisions in either arena can have immediate implications for the other. For example, the federal government's decision to encourage biofuels in the early twenty-first century generated significant concern over the resulting potential impacts on water. 99

Also as noted, the energy sector, including shale gas fracking, is a major withdrawer and user of water. In 2005, thermoelectric power generation accounted for approximately fifty percent of all water withdrawals in the United States. ¹⁰⁰ However, there are important regional differences regarding the connections between electricity generation and water use: Because western states can rely heavily on hydropower, eighty-four percent of thermoelectric power withdrawals occur in the eastern United States. ¹⁰¹

Electricity production is particularly water-intensive. For example, to produce one megawatt-hour of electricity, gas/steam combined cycle plants need 7,400 to 20,000 gallons of water, while coal- and oil-fired power plants require 21,000 to 50,000 gallons, and nuclear power plants require 25,000 to 60,000 gallons. Most of this water is used for cooling, and much is returned to the water body for reuse 103—but the water must be there in the first place, and water supply is a factor in locating new power plants. 104

However, the energy demands for water supply are also high. Pumping water from aquifers to supply cities with drinking water requires approximately 1,800 kilowatt-hours per million gallons delivered; treating wastewater requires 2,350 to 3,300 kilowatt-hours, while desalinating seawater requires 9,780 to 16,500 kilowatt-hours. Noving water around so that it can be used where desired is also energy intensive.

^{98.} Michael E. Webber, *Catch 22: Water vs. Energy*, SCI. AM. SPECIAL ISSUE: EARTH 3.0, 3 (2008) (noting that "each of these precious commodities might soon cripple our use of the other. We consume massive quantities of water to generate energy, and we consume massive quantities of energy to deliver clean water.").

^{99.} See generally Gov't Accountability Office, Energy-Water Nexus: Many Uncertainties Remain About National and Regional Effections of Increased Biofuel Production on Water Resources (Nov. 2009).

^{100.} U.S. GEOLOGICAL SURVEY, supra note 85, at 1.

^{101.} Id. at 2.

^{102.} Webber, supra note 98, at 6.

^{103.} Id.

^{104. 2006} DOE ENERGY-WATER REPORT, supra note 93, at 9.

^{105.} Webber, supra note 98, at 7.

In one of the most prominent examples of this energy dependence, "[t]he California Aqueduct, which transports snowmelt across two mountain ranges to thirsty coastal cities, is the biggest electricity consumer in the state." ¹⁰⁶

These mutual interdependencies strongly suggest that the United States should develop water resource management policies and energy policies conjunctively, especially because climate change will increasingly exacerbate already growing problems at the water-energy interface. 107 As the World Business Council noted in 2009, "[c]limate change acts as an amplifier of the already intense competition for water and energy resources." 108 Water shortages, for example, have already threatened power production in Georgia, North Carolina, and at the Hoover Dam, 109 and increased drought has already proven its ability to affect energy production. For example, "[d]uring California's energy crisis in the summer of 2001, the state faced the risk of even larger, more frequent blackouts because a severe drought in the Pacific Northwest had drained hydroelectric power resources." 110 Climate change impacts on the Colorado River, Lake Mead, and Hoover Dam provide one example of a potentially very conflicted future:

Research scientist Gregory J. McCabe of the U.S. Geological Survey reiterated the message to Congress in June. He noted that an increase in average temperature of even 1.5 degrees Fahrenheit across the Southwest as the result of climate change could compromise the Colorado River's ability to meet the water demands of Nevada and six other states, as well as that of the Hoover Dam. Earlier this year scientists at the Scripps Institution of Oceanography in La Jolla, Calif., declared that Lake Mead could become dry by 2021 if the climate changes as expected and future water use is not curtailed. ¹¹¹

There are also likely to be direct correlations between energy consumption and water demand as a result of climate change. The U.S. Global Change Research reported in 2009 that "[h]igher temperatures

107. See U.S. GOVT. ACCOUNTABILITY OFFICE, GAO-12-880, ENERGY-WATER NEXUS: COORDINATED FEDERAL APPROACH NEEDED TO BETTER MANAGE ENERGY AND WATER TRADEOFFS 23 (Sept. 2012), available at http://www.gao.gov/assets/650/648306.pdf [hereinafter 2012 GAO ENERGY-WATER NEXUS REPORT] (citing climate change as a significant source of uncertainty for effectively managing the water-energy nexus).

^{106.} Id. at 5.

^{108.} WORLD BUS. COUNCIL FOR SUSTAINABLE DEV., WATER, ENERGY, AND CLIMATE CHANGE: A CONTRIBUTION FOR THE BUSINESS COMMUNITY 3 (Mar. 2009), available at http://www.wbcsd.org/web/WaterEnergyandClimateChange.pdf. See also Water Energy Tech. Team, Climate Change, LAWRENCE BERKELEY NAT'L LABORATORY, http://waterenergy.lbl.gov/node/11 (last visited Feb. 12, 2010) ("Global climate change directly affects both the energy and water sectors. Changes in climate have forced cities and regions to choose between energy production and water distribution.").

^{109.} WORLD BUS. COUNCIL FOR SUSTAINABLE DEV., supra note 108, at 35–36.

^{110.} Water Energy Tech. Team, supra note 108.

^{111.} Webber, supra note 98, at 4.

are projected to increase cooling water withdrawals by electrical generating stations. In addition, greater cooling requirements in summer will increase electricity use, which in turn will require more cooling water for power plants."¹¹²

In 2006, the DOE discussed one of the first steps in thinking about the water-energy nexus as a comprehensive policy issue in a report to Congress entitled Energy Demands on Water Resources. 113 Relevant to fracking, it emphasized that "[w] ater is an integral element of energy resource development and utilization."114 Regarding natural gas generally, the DOE noted that "[n]atural gas processing and pipeline operations consume . . . 0.4 billion gallons of water per day "115 As a testament to the rapid and recent importance of shale gas development, the DOE did not even address that particular section of energy production. Nevertheless, it did report that shale oil production consumed two to five gallons of water for every gallon of refinery-ready oil produced, 116 and "[p]roviding 25 percent of U.S. oil demand [from oil shale] would require 400 to 1000 million gallons of water per day." ¹¹⁷ Moreover, "because shale oil resources are predominantly located in areas where water has a high value, oil shale development may be constrained by both water availability and value."118

Overall, the DOE concluded that conjunctive management of energy and water was a necessary development in U.S. law and policy:

[T]he U.S. should carefully consider energy and water development and management so that each resource is used according to its full value.... Given current constraints, many areas of the country will have to meet their energy and water needs by properly valuing each resource, rather than following the current U.S. path of largely managing water and energy separately while making small improvements in freshwater supply and small changes in energy and water-use efficiency. 119

It recommended that the United States close existing gaps in considering these resources together, including by actively considering "the impact that water policies and regulations have on energy supplies and demands, and the impact energy policies and regulation have on water

 $^{112.\,}$ Cambridge Univ. Press, Global Climate Change Impacts in the United States 49 (Thomas R. Karl et al. eds., 2009).

^{113. 2006} DOE ENERGY-WATER REPORT, supra note 93.

^{114.} Id. at 9.

^{115.} Id. at 20 (citation omitted).

^{116.} Id. at 20, 43.

^{117.} Id. at 43.

^{118.} Id. at 20; see also id. at 43 (making the same point).

^{119.} *Id.* at 11.

demands and availability."¹²⁰ It also recommended integrated planning and management of energy and water resources with collaboration among the federal, regional, and state agencies, as well as industrial and other stakeholders.¹²¹

In September 2012, the Government Accountability Office ("GAO") in essence updated both the DOE's 2006 report and its own series of reports on the water-energy nexus when it released *Energy-Water Nexus:* Coordinated Federal Approach Needed to Better Manage Energy and Water Tradeoffs. 122 Like the DOE, the GAO has emphasized that "many aspects of energy development and delivery, including resource extraction, refining and processing, generation, storage, and transportation, can affect water resources. Conversely, supplying water in an urban setting requires energy to extract, treat, and supply water to consumers."123 It noted the range of local variations in the water-energy nexus, concluding that "it will be important for Congress and federal agencies to consider the effects that national policies related to energy production and water use can potentially have at the local level."124 Notably, the GAO has come to regard water as an undervalued resource in most parts of the United States, contributing to its overuse and the unnecessary use of more energy to produce more water. 125 It also identified a number of regulatory and economic barriers to better management of the water-energy nexus, which it advised federal agencies to consider in setting federal policies. 126

Most importantly, however, the GAO reported that "in general, energy and water planning are [still] 'stove-piped' and frequently split across federal, state, and local levels, which results in decision making that does not adequately account for the interactions between energy and water." ¹²⁷ It recommended improved planning for both resources and improved coordination both among the federal agencies with authority over those resources and "with other stakeholders, such as state and local agencies, academia, industry, and environmental groups." ¹²⁸

B. The Water-Energy Nexus, Fracking, and Federalism

1. General State and Federal Authority over Water, and Energy

Both water and energy already generate federalism issues on many levels. As a gross (but nevertheless fairly accurate) generalization, the following aspects of energy extraction, production, and transportation

^{120.} Id. at 49.

^{121.} *Id.*

^{122. 2012} GAO ENERGY-WATER NEXUS REPORT, supra note 107.

^{123.} Id. at 4.

^{124.} *Id.* at 10.

^{125.} Id. at 12.

^{126.} *Id*.

^{127.} Id. at 18.

^{128.} *Id.*

are considered entirely or predominantly the province of the federal government: nuclear power, hydropower production and facility construction on the navigable waters, offshore oil and gas production more than three miles out to sea, interstate electricity transmission, and interstate oil and gas transportation. Environmental impacts from energy production and facilities are also subject to the requirements of a number of federal statutes, including the federal Clean Air Act and Endangered Species Act as well as the Clean Water Act and Safe Drinking Water Act, most of which employ a cooperative federalism arrangement of imposing federal minimum protections but allowing states to take over various programs and make them more stringent, if desired. 129

Nevertheless, most other aspects of energy production and distribution, including facility siting, are predominantly subject to state law, and states, as noted in Part II, can contribute environmental regulations as well. As a result, many commentators view hydraulic fracturing for shale gas as an "industry regulated first and foremost by [the] states." Proponents of state-based regulation of fracking argue that "state regulators better understand the unique social, hydrologic, and geologic characteristics of their shale basins" and that "state regulations best balance the economic and environmental benefits and risks of hydraulic fracturing." Indeed, even proponents of federal regulation argue most strongly for extensions of cooperative federalism so that states can continue to play a prominent role in regulating fracking.

In sharp contrast, authority over water allocation—the law governing who has the right to remove fresh water from its natural watercourse and to use that water for some consumptive purpose, such as irrigation, drinking water, or industrial manufacturing—is deemed, sometimes obsessively, to belong to the states. ¹³³ Indeed, the exact prin-

^{129.} For a recent overview of these federal environmental regulations, their cooperative federalism arrangements, and their application to fracking, see generally Bruce M. Cramer, Environmental Impacts of Oil and Gas: Federal Legislative and Administrative Regulation of Hydraulic Fracturing Operations, 44 Tex. Tech. L. Rev. 837 (2012).

^{130.} Symposium, Environmental and Social Implications of Hydraulic Fracturing and Gas Drilling in the United States: An Integrative Workshop for the Evaluation of the State of Science and Policy, 22 DUKE ENVIL. L. & POLY F. 245, 253 (2012) [hereinafter Workshop Report]. See also John D. Furlow & John R. Hays, Jr., Disclosure with Protection of Trade Secrets Comes to the Hydraulic Fracturing Revolution, 7 Tex. J. OIL GAS & ENERGY L. 289, 343 (2011–2012) (arguing that the "new push to regulate on the federal level runs in contravention to the history of state regulation as well as the principles of federalism. Historically, the regulation of the onshore oil and gas industry has been left primarily to the states. Likewise, the regulation of groundwater has also been left primarily to the states.").

^{131.} Workshop Report, supra note 130, at 253.

^{132.} Id. at 253-54; Gianna Cricco-Lizza, supra note 6, at 704.

^{133.} GEORGE A. GOULD ET AL., CASES AND MATERIALS ON WATER LAW 23 (7th ed. 2005); Reed D. Benson, *Deflating the Deference Myth: National Interests vs. State Authority under Federal Laws Affecting Water Use*, 2006 UTAH L. REV. 241, 242 (2006); Charlton H.

ciples and requirements governing the withdrawal and consumptive use of water vary considerably from location to location. ¹³⁴ Of course, water allocation is not a pure example of exclusive state control, as Reed Benson has discussed at length. ¹³⁵ Nevertheless, the federal government generally goes to significant effort to preserve states' rights with respect to water allocation. ¹³⁶

Thus, from the perspectives of both traditional regulation of onshore oil and gas development and traditional regulation of water law,
water resource issues created by hydraulic fracturing would appear to
be primarily the states' problems to deal with—subject, perhaps, to the
newer but well-entrenched mode of cooperative federalism for fracking's
direct environmental impacts. This view of fracking's federalism, however, ignores the fact that fracking operations are never just individual
energy production operations with local environmental impacts. Instead,
fracking should also be contextualized as part of the much larger—
national level—policy conundrum that arises at the water-energy nexus,
about which the federal government assumes, and probably needs to
assume, a much more dominant role.

2. Fracking, Federalism, and the Water-Energy Nexus

Scholars and politicians alike have been debating the proper federalism perspective on fracking almost since shale gas was recognized as a

Bonham, Perspectives from the Field: A Review of Western Instream Flow Issues and Recommendations for a New Water Future, 36 Envil. L. 1205, 1208 (2006).

Nothing in this Act shall be construed as affecting or intended to affect or to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this Act, shall proceed in conformity with such laws

^{134.} Jacqueline M. Wilkose, Note, Thirsting for Change: How Growth in the Biofuel Industry Can Stimulate Advancements in Water Law, 2009 U. ILL. L. REV. 583, 592–601 (2009); Robert Haskell Abrams, Water Follies: Groundwater Pumping and the Fate of America's Fresh Waters, by Robert Glennon, 46 ARIZ. L. REV. 473, 478 n. 17 (2004); Mary Ann King, Getting Our Feet Wet: An Introduction to Water Trusts, 28 HARV. ENVIL. L. REV. 495, 499, 533 (2004).

^{135.} See generally Benson, supra note 133.

^{136.} For example, the Desert Land Act of 1877, 43 U.S.C. § 321 (2012), applies to lands in California, Oregon, Nevada, Colorado, Washington, Idaho, Montana, Utah, Wyoming, Arizona, New Mexico, North Dakota, and South Dakota that were public (federal) at the time of enactment. Cal. Or. Power Co. v. Beaver Portland Cement Co., 295 U.S. 142, 165 (1935). As interpreted by the Supreme Court, in that statute Congress both severed non-navigable waters from the public lands, ending common-law riparian rights, and gave control over water rights in those waters to the states, effectively shifting the definition of the accompanying water rights from the federal government to the states. *Id.* Similarly, in section 8 of the Reclamation Act of 1902, Congress declared that:

significant new source of energy in the United States.¹³⁷ However, fracking's contextualization into the water-energy nexus both intensifies those debates and suggests that the federal government has a more pervasive interest in fracking than many scholars suggest, despite the fact that water allocation traditionally resides with the states.

Currently, for example, natural gas provides about twenty percent of the nation's total energy supply, 138 and it is often touted as a "bridge fuel" that can reduce the United States's contributions to climate change. 139 The DOE, moreover, has repeatedly declared that the natural gas produced from hydraulic fracturing specifically is "an important part of the nation's energy supply. As a clean-burning, affordable and reliable source of energy, natural gas will continue to play a significant role in the energy supply picture for years to come. Unconventional sources of natural gas have become a major component of that future supply, and shale gas is rapidly emerging as a critical part of that resource." 140

Congress has a long history of addressing energy policy at the national level, and the federal government can legitimately be deemed to be the dominant government level in large-scale energy governance. ¹⁴¹ As I have already suggested elsewhere, ¹⁴² national-level interest in energy policy suggests that the federal government will be paying increasing attention to water resources and water allocation. Indeed, Congress has already explicitly endorsed, in the Energy Policy Act of 2005, the federal government's taking the lead in addressing the water-energy nexus. ¹⁴³ The DOE emphasized in 2006 that state-level protests and "[t]he lack of integrated energy and water planning and management has already impacted energy production in many basins and regions across the country," ¹⁴⁴ similarly suggesting a need for a stronger federal role in managing the nexus. In turn, in 2012 the GAO endorsed "a top-down emphasis on collaboration among federal agencies and with groups outside the federal government," ¹⁴⁵ and it recommended that

^{137.} Workshop Report, supra note 130, at 253–55; Furlow & Hays, supra note 130, at 343.

^{138.} ARTHUR, URETSKY & WILSON, supra note 89.

^{139. 2012} PACIFIC INSTITUTE FRACKING STUDY, supra note 81.

^{140.} SHALE GAS PRIMER, supra note 12, at ES-43.

^{141.} Energy Policy and Conservation Act of 1975, Pub. L. No. 94·163, 89 Stat. 871 (1975); Energy Policy Act of 1992, Pub. L. No. 102·486, 106 Stat. 2776 (1992); Energy Act of 2000, Pub.L. No. 106·469, 114 Stat. 2029 (2000); Energy Policy Act of 2005, Pub. L. No. 109·58, 119 Stat. 594 (2005).

^{142.} Robin Kundis Craig, Adapting Water Federalism to Climate Change Impacts: Energy Policy, Food Security, and the Allocation of Water Resources, 5 ENVTL. & ENERGY L. & POLY J. 216–33 (2010).

^{143.} Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 (Aug. 8, 2005).

^{144. 2012} GAO ENERGY-WATER NEXUS REPORT, supra note 107, at 11.

^{145.} Id. at 20.

"the Secretary of Energy take the actions necessary to establish a program to address the energy-water nexus, with involvement from other federal agencies as described in the Energy Policy Act of 2005." ¹⁴⁶

Notably, fracking provided a primary example of what the GAO considered a positive step forward: In furtherance of the White House's March 2011 Blueprint for a Secure Energy Future, which directed the federal government to investigate the impact of hydraulic fracturing on water resources, the U.S. Environmental Protection Agency, DOE, and the Department of the Interior entered into a Memorandum of Agreement in April 2012 to coordinate in such investigations for unconventional oil and gas extraction and development—a development that apparently required the White House's strong leadership. However, the GAO also emphasized that shale gas development "could have significant impacts on the quality and quantity of water resources" but that those risks were largely unknown currently, contributing to the uncertainties of managing the water-energy nexus. 148

The federal government's increased interest in fracking and water policy resulting from the water-energy nexus may be further accelerated by the failure of states to adequately address the issue. In a November 2009 report, for example, the National Conference of State Legislatures could identify only sixteen states that had *any* legislation that acknowledged the water-energy nexus: Arizona, California, Colorado, Connecticut, Illinois, Indiana, Michigan, Minnesota, New York, Nevada, Ohio, Pennsylvania, South Dakota, Washington, West Virginia, and Wisconsin. Of these, only a handful offered anything more than general policy statements, and only California specifically recognized the issue of providing water for alternative energy supplies. In addition, scholars have already argued that Congress's initial abdication of regulatory authority over fracking to the states places undue pressure on the states to allow fracking even at severe environmental costs, including to water resources.

^{146.} Id. at 27.

^{147.} Id. at 20-21.

^{148.} *Id.* at 24.

^{149.} Overview of the Water-Energy Nexus in the United States, NAT'L CONFERENCE OF STATE LEGISLATURES (Nov. 2009), http://www.ncsl.org/issues-research/envres/overviewofthewaterenergynexusintheus.aspx.

^{150.} See id.

^{151.} Emily C. Powers, *supra* note 6, at 913–14 (noting that "Congress exempted hydrofracking and its roughly thirty affiliated and component processes from key portions of federal environmental laws, leaving regulation largely to the States. As a result, policymakers in gas-rich states like New York are under unusually high pressure to make difficult trade-offs between significant economic benefits and uncertain harms to public health and the environment, some of them potentially catastrophic and long lasting. The difficult choices hydrofracking poses and the nature of its potential harms illustrate the character of federalism concerns within the context of environmental problems."). See also Heather Ash, *EPA Launches Hydraulic Fracturing Study to Investigate Health and Environmental Concerns While North Dakota Resists Regulation: Should Citizens Be Concerned?*, 87 N.D. L. REV. 717, 717–18 (2011) (describing how, "[a]t the direction of Congress, the Environmental Pro-

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Thus, situated within the water-energy nexus, fracking's intersections with water resources become something more than merely an assessment of the immediate environmental impacts of particular natural gas production operations. Domestic natural gas production in general, and shale gas hydraulic fracturing in particular, are increasingly important components of both the United States's drive toward energy independence and its increasingly urgent need, as a result of climate change, to transition to less greenhouse gas-intensive fuels than oil or coal. As such, fracking can only be viewed as a significant component of national energy policy, which traditionally has emanated from the federal government. At the same time, the federal government itself has increasingly recognized that it must account for the water-energy nexus in its national energy policies, as well as in other national-level concerns such as overall food security, water quality, and human health and safety.

V. CONCLUSION

It is remarkably easy to view hydraulic fracturing—and most any other aspect of domestic energy production that impacts water resources—as a series of individual, facility-specific, local or state permitting or regulatory issues. As environmental and natural resources law have long acknowledged, however, the cumulative impacts of such projects can and often do become national-level issues.

Acknowledging the water-energy nexus, however, pushes this realization one step further, beyond mere cumulative impacts. It requires governance institutions to acknowledge not just a tragedy of the resource commons and the potential regulatory fragmentation that a federalist system routinely invites, but also larger interconnectedness of multiple resource use and the national-level dangers of continuing to "silo" energy policy from water resource management. To put it bluntly, acknowledging the water-energy nexus requires a simultaneous acknowledgement that leaving fracking regulation almost entirely to the individual states may not be in the *nation*'s overall best interest, with respect to either energy policy or water resource protection. Pervasive state regulation of individual fracking operations' impacts on the environment also poses, somewhat perversely, a threat to the much needed, and currently federally led, nascent attempts to integrate energy policy and water resources management. In other words, to the extent that

tection Agency (EPA) launched a 1.9 million dollar study to investigate fracking's impact on drinking water and groundwater. In response to the study, the North Dakota Industrial Commission (NDIC) encouraged North Dakota residents to support the oil and gas industry by submitting a formal complaint to the EPA, urging it to discontinue the study. State law-makers backed the NDIC request by unanimously approving a bill that declared fracking an acceptable recovery process in North Dakota.").

fracking's impacts and potential impacts on water resources are viewed "merely" as environmental problems, efforts to address the larger conundrum of the water-energy nexus are undermined.

While states could in fact advance resolution of the water-energy nexus, few have actively tried to do so to date—and, as always, their authorities end at their own borders. As a result, and as the federal government is slowly realizing, addressing the water-energy nexus requires the development of a national-level perspective on how to best balance energy independence with other necessary and desirable uses of water resources, such as agriculture, water supply, and recreation, while at the same time remembering that many of these other water uses (especially public water supply) contribute to overall energy demand.

Because significant implementation of hydraulic fracturing is so new, is expected to increase, and is already prompting intensive review of energy and environmental regulation, fracking provides an opportune issue around which to seriously consider the water-energy nexus and larger, integrated goals for both energy production and water resource management. This article aims to encourage regulators—both federal and state—to make the most of that opportunity and to begin creating new governance structures for the water-dependent production of energy in the United States.