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Book Review: Regulating Water Security in Unconventional Oil and Gas

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In 2018, the United States became king of oil and, until recently, oil was king. Now, though its future reign suddenly appears uncertain, oil and gas still decisively dominate the energy industry. And when the United States surpassed Saudi Arabia and Russia to become the world's largest producer of crude oil for the first time this millennium, it had hydraulic fracturing to thank. But this "fracking" process that frees previously unrecoverable oil and gas from tight formations by fracturing the rock with highly pressurized fluid uses 5 to 11 million gallons of water per well. It's also no secret that, as the human population continues to grow, having enough freshwater resources available to sustain them will become an increasing challenge. Meanwhile, many places in the U.S. (and Texas, in particular) have suffered through extreme drought, with some communities facing the possibility that their water supply could run out.

Against this backdrop comes *Regulating Water Security in Unconventional Oil and Gas*, a collection of articles authored by professionals from disciplines as diverse as agriculture, zoology, law, and economics. The book takes a multidisciplinary look at how issues related to water for unconventional oil and gas production affect water security of a nation, state, community, or sector of industry—and possible pathways toward regulations that balance economic development with the human right to water. The authors examine what other regions have been experiencing to illustrate some of the common difficulties and differing perspectives, challenges, and solutions being attempted. Authors' contributions are presented in four parts, making the dense subject matter digestible. Before delving into the details, Part I sets the stage by providing a general framework in which the authors examine the complex issues raised. Parts II, III, and IV of the book then dig deeper, using case studies to explore first how operators procure water, then issues involved in disposal of water used and produced in fracking, and finally macro-scale regulatory planning.

A consistent theme of the book is the need to look at these issues in an integrated way, recognizing the trade-offs involved in every decision related to water management for unconventional oil and gas production. Of primary concern is that, given the water-energy nexus, the two must be considered holistically. Rather than adopt a silo mentality in which institutions and sectors manage water resources independently, industry, agriculture, energy, and municipalities (to name a few) must collaborate with each other and with stakeholders who will be affected by the policies or decisions made. The book also notes a gap between decision-makers and the most current science necessary to inform regulations, law, and policy applied to water for this sector of the energy industry.

Sustainability is another key piece of this framework. Given that water is often scarce in the most significant oil and gas production zones, authors question whether unconventional oil and gas production practices are sustainable over the long term. And, even in the near term, public concern over water use, environmental contamination, and seismicity threaten the "social license to operate." Losing that social license makes public demonstration against oil and gas development more likely.

In examining water acquisition, the authors' main areas of concern are the water footprint of practices like fracking and the unpredicted effects this water usage has had on ecosystems. Throughout the book, authors reiterate the massive water footprint of each hydraulic fracturing well. Meanwhile, in the United States, the pressure to develop shale gas is only expected to increase. Unfortunately, the hottest shale plays in the world are often located where water is least secure, such as the Permian Basin in Texas, in which 87% of unconventional wells are drilled in areas of high or extremely high water stress.

As these case studies indicate, many governing systems may be incapable, or unwilling, to incorporate these impacts into regulations and permitting processes. For instance, China, having set aggressive goals for shale gas development, has been secretive about the volumes of water used and the related environmental impacts. Likewise, Ukraine sought to develop unconventional oil and gas resources as a way to reduce Russia's control over it, but environmental impacts and a Russia-backed civil war have held Ukraine back. By destabilizing potential rivals, Russia has successfully used its energy resources as an economic and political tool. In stark contrast, the United Kingdom's new charging system places a higher price on water from high risk/low resilience sources and a lower price on water from abundant sources. But in Texas, groundwater is personal property that operators can buy directly from the owner, with few regulatory obstacles, complicating governance attempts.

Indigenous groups in many of the countries studied have felt the impact of the industry's water practices and have had varying degrees of success asserting their rights. Most notably, the Standing Rock Sioux tribe's protest played a significant role in opposing the Dakota Access Pipeline in Canada and the United States, garnering popular support. And, in Canada, First Nations groups have had limited success challenging fracking when companies failed to consult and accommodate the groups, as required by procedural rules. Sadly, the Khanty people in Russia altered their millennia-old cultures, tradition, and ways of life in response to energy industry obstructing and polluting watercourses in their lands.

Dealing with wastewater produced during fracking raises unique concerns, the authors observe. Water used in the fracking process contains chemicals and proppants (sand or ceramic beads used to prop open fractures in rock to allow oil and gas to escape the formation), while produced water forced from the geologic formations being fractured is often contaminated with naturally occurring dissolved solids, heavy metals, and radioac-

tive materials. Because treating this water is so expensive, operators most commonly inject these fluids back into the ground into non-producing formations, where geology and state regulations permit; where it does not, it may be discharged into surface waters or (least often) onto land. The EPA in 2016 noted that all these disposal methods frequently or severely degrade water. Given that injection wells and surface disposal may trigger both state and federal regulations, the regulatory process can be complex.

Induced seismicity has also been connected with wastewater injection (in the United States) and with the fracking process itself (Canada, United Kingdom, and the Netherlands), prompting additional government action. In response to studies connecting a sudden rise in earthquake activity in Oklahoma and Texas, Oklahoma has seriously limited fracking-related injections in certain areas with increased seismicity. In the United Kingdom, operations near seismic events were suspended, while the Netherlands plans to cease production from fracking entirely by 2030.

For these reasons, injection well disposal has been controversial. On a promising note, regulations, geology, and environmental concerns have prompted operators in states like Pennsylvania and Texas to ramp up treatment, reuse, and recycling of this wastewater—water otherwise permanently removed from the hydrologic cycle. Similarly, in Australia, the use of water and disposal of produced water resulting from the production of coal seam gas has been met with resistance, with Queensland adopting an adaptive management approach, New South Wales enacting a five-year moratorium from 2011 to 2016, and Victoria permanent banning the process.

The groundwater contamination potential associated with fracturing presents equally complex scientific and legal problems. Because fracturing operations occur so deeply below the groundwater-saturated strata, toxic fluids from the fractures themselves are unlikely to directly reach aquifers. This makes it difficult for a plaintiff in a civil case for contamination to prove that fracturing operations legally caused the water contamination alleged—a threshold question before the operator can be held liable. And, even if pathways could be found, often there is no baseline groundwater sample to show that the contamination did not pre-date drilling operations. It is also a challenge to prove that a particular contaminant was introduced by a specific fracking operation because trade secret law is often used to conceal what chemicals are used. Apart from fracturing fluids, however, it is possible that naturally occurring contaminants like "methane could migrate up into aquifers from the fractured shale seam through pre-existing, natural fissures in the overlying rock, or even through fissures created or enlarged by fracturing."

On a macro scale, the book highlights several key issues that—taken with those above—influence regulatory planning, including sustainability; national energy independence and conflicts between national and super-national governance; and funding regulation and enforcement. For instance, energy development applicants in South Africa must consider sustainable development principles, including "the integration of social, economic, and environmental factors into planning, implementation, and decision making so as to ensure that mineral and petroleum resources development serves present and future generations." On the other hand, Argentina pursued energy independence through fracking before establishing any policy to prevent negative environmental or social impacts. And Poland, a European Union member country, has ignored European Union directives to require that operators conduct strategic environmental assessments or environmental impact assessments to obtain license to drill well less than 5,000 meters deep. Dealing with a lack of funding and transparency, Mexico has struggled to enforce regulations on the industry, prompting civil campaigns by indigenous groups. Meanwhile, indigenous groups, local authorities, and environmental groups have had success in Brazilian courts and commonly bring civil claims opposing oil and gas operators trying to secure concessions and licenses.

The book's editors conclude by suggesting several steps and research to address these issues. They emphasize that the human right to water and sanitation recognized by some countries and international bodies like the United Nations must become "hard law" everywhere. There must be regulation on water use in unconventional oil and gas production that considers the related nature of the water-energy nexus as a crucial part of water security. Environmental regulations must not only be consistent with science but also should provide a fail-safe against environmental damage, incorporating sustainability principles and precautions to prevent the damage all together. The silo mentality should be rejected in favor of an approach to water management in which regulation is the product of collaboration between institutions, industry sectors, and communities like indigenous and environmental groups.

Regulating Water Security for Unconventional Oil and Gas articulates important lessons for managing how freshwater resources are used in the hydraulic fracturing process. Perhaps more importantly, it uses fracking as a lens through which to see how interconnected humans are to the water, energy, and environment that sustains us—and how critical it is that we manage those resources in a way that does not value one resource without considering the impact to others.