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FRACKING: THE UNCONVENTIONAL ENERGY RESPONSE TO CLIMATE CHANGE: IMPLICATIONS FOR THE REAL ESTATE INDUSTRY

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Climate change caused by human activity, and the threat of it to our way of life, and even the practice of law, has been well established from the scientific, economic, social and legal perspectives.[1] Production of energy to meet human needs has been identified as the main source of emissions of CO_2 that causes climate change.[2]

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1. *See* Celeste Hammond, *The Evolving Role for Transactional Attorneys Responding to Client Needs in Adapting to Climate Change*, 47 J. MARSHALL L. REV. 543, 549–54 (2013) (explaining that climate change caused by human activity impacts many aspects of society including law and the practice of law).

2. *See* Sarah J. Adams-Schoen, Deepa Badrinarayana, Cinnamon Carlarne, Robin Kundis Craig, John C. Dernbach, Keith H. Hirokawa, Alexandra B. Klass, Katrina Fischer Kuh, Stephen R. Miller, Jessica Owley, Shannon

Yet, energy is something that real estate attorneys have typically known little to nothing about. Energy issues were seen as falling within the domain of utility lawyers and natural resource lawyers. However, just as real estate lawyers are not expected to be experts in federal tax law, but rather are expected to know enough to ask the right questions when dealing with tax attorneys to structure transactions, the 14th Kratovil Conference on Real Estate Law & Practice: "Fracking, Energy Sources, Climate Change & Real Estate" makes it clear that real estate lawyers need an understanding of the basics of energy sources, regulation and the second order effects of energy generation and production. This article attempts to provide some basic information on the variety of sources of energy, including coal, oil and natural gas that collectively are known as conventional "fossil fuels," renewable energy that does not cause CO_2 emissions, and the recently embraced unconventional energy produced by fracturing or fracking.[3]

Attorneys preparing to counsel their clients who wish to develop real estate that might be suitable for fracking natural gas out of shale rock, as well for clients who will be affected in their ownership, development and financing of real estate impacted by fracking, will learn about the implications of climate change and the legal response to it in the context of fracking.

This means that energy issues and concerns will need to be added to the real estate due diligence checklists used whenever ownership and transactions involving real property occur. Because the energy landscape recently has been changed by the availability of fracked natural gas, this article raises questions about fracking and the real estate industry.

Part I of this article considers the implications of evidence that climate change is principally due to human activity as humans use increasing amounts of energy.[4] The development of renewable energy to limit carbon emissions, that are the source of the problem, include wind, solar, hydraulic and wave energy as substitutes for coal and oil. Nuclear energy also has been proposed as part of the

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Roesler, Jonathan Rosenbloom, Inara Scott & David Takacs, *A Response to the IPCC Fifth Asses*sment, 45 ENVTL. L. REP. NEWS & ANALYSIS 10027 (2015), http://scholarship.law.umn.edu/faculty_articles/414 (analyzing the IPCC Fifth Assessment by members of the Environmental Law Collaborative (ELC) arguing that in United States 97% of dangerous CO_2 emissions is attributable to energy use).

3. *See infra* I.C (explaining how this fracked natural gas is a bridge to renewable energy).

4. Robin Kundis Craig, *Learning to Live with the Trickster: Narrating Climate Change and the Value of Resilience Thinking*, University of Utah S.J. Quinney College of Law, Research Paper No. 152 (2016), http://ssrn.com/abstract=2716895 (commenting on increasing difficulty of using the "Humans as Controlling Engineers narrative" to describe humans as capable of dealing with climate change as they have been in developing the systems that cause it).

solution. Society's energy needs and wants determine the economics of the energy markets, sometimes independently of policy concerns about the risks of climate change. The impact fracturing of natural gas will have on the energy markets and on the risks of climate change itself is controversial. Indeed, the concern has become whether fracking is truly a "bridge" to renewable energy or merely an energy source with a lower emission impact that causes its own set of problems.[5]

Part II looks at the relatively new business of fracking, which reflects the successes of innovation and the limitations of this fairly new industry.

Part III provides a primer of basic real property law about land that may be suitable for fracking or that may be affected by fracking. The separation of ownership between surface and sub-surface mineral rights is achieved by contract, leases, and, sometimes, by intervention of government itself. That most of the government regulation of privately owned real property, with respect to fracking, is state rather than federal law, may explain how difficult and complex government regulation of land involved in fracking to serve national and even international policies.

Part IV reviews the three categories of risk associated with fracking: environmental, social and economic in the context of implications for those owning, developing, financing, leasing and using real estate.

Part V provides a conclusion; but many questions remain on the real estate implications by fracking.

5. Joel Minor, *Completing the Bridge to Nowhere: Prioritizing Oil and Gas Emissions Regulations in the Western States*, 34 STAN. ENVTL. L. J. 57, 58 (2015).

I. THE ANTHROPOGENIC VIEW OF CLIMATE CHANGE CONCLUDES THAT HUMANS CAUSE CLIMATE CHANGE AND CARBON EMISSIONS MUST BE REDUCED DRAMATICALLY IN ORDER TO CONTROL THE THREATS OF CLIMATE CHANGE, PRINCIPALLY BY LIMITING THE BURNING OF FOSSILS LIKE COAL, OIL, AND NATURAL GAS FOR ENERGY

A. This Explanation of the Connection Between Energy and Climate Change Is Well Respected[6]

Experts have introduced the term "Anthropocene" to define the newest geological epoch.[7] Those who brought the term into common use over the past twenty years or so explain the need for the new word; "[h]uman activities have become so pervasive and profound that they rival the great forces of Nature and are pushing the Earth into planetary terra incognita. The Earth is rapidly moving into a less biologically diverse, less forested, much warmer, and probably wetter and stormier state."[8] As Rosina Birnbaum reported from her scientific perch:

> Humans are changing the Earth's climate. The physics behind this statement is not only well-understood, but has stood the test of time, dating back to the 19th century, when Svante Arrhenius projected that adding carbon dioxide (CO_2) to the atmosphere through

6. *See* Lisa V. Alexander, Simon K. Allen, Nathaniel L. Bindoff, Fancois-Marie Breon, John A. Church, Ulrich Cubasch, Seita Emoris, Piers Forster, Pierre Friedllingstein, Nathan Gillett, Jonathan M. Gregor, Dennis L. Hartmann, Eystein Jansen, Ben Kirtman, Reto Knutti, Krishna Kumar Kanikincharla, Peter Lemke, Jochem Marotzke, Valerie Massonp-Delmotte, Gerald A. Meehl, Igor I. Makhov, Shilong Piao, Gian-Kasper Plattner, Qin Dahe, Venkatachalam Ramaswamy, David Randall, Monika Rhein, Maisa Rojas, Christopher Sabine, Drew Shindell, Thomas F. Stocker, Lynne D. Talley, David G. Vaughn & Shang-Ping Xie, *Climate Change 2013: The Physical Science Basis, Summary for Policymakers*, Intergovernmental Panel on Climate Change (IPCC) (2013), www.ipcc.ch/pdf/assessment-report/ar5/wg1/WGIAR5_SPM_brochure_en.pdf (noting that the available scientific evidence indicates that average temperature is rising and that anthropogenic greenhouse gas emissions are the dominant cause of global warming).

7. Joseph Stromberg, *What is the Anthropocene and Are We in It?*, SMITHSONIAN MAG, (Jan. 2013), www.smithsonianmag.com/science-nature/what-is-the-anthropocene-and-are-we-in-it-164801414/?no-ist.

8. Will Steffen, Paul J. Crutzen & John R. McNeill, *The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?,* 36 AMBIO 614 (2007); *see also* Ian Angus, *When Did the Anthropocene Begin . . . and Why Does it Matter?*, 67 Monthly Review 1 (Sept. 1, 2015), http://monthlyreview.org/2015/09/01/when-did-the-anthropocene-beginand-why-does-it-matter/ (explaining why the word is more than a buzzword and why study of it is important to survival of humans).

> anthropogenic, or human-caused sources, such as burning carbon-based coal, oil and gas, would increase the temperature of the planet. Over one hundred years later, Arrhenius's initial projections still hold true.[9]

Because human use of energy is the cause of climate change, proposals to remedy this have ranged from producing and using "clean energy,"[10] to plugging leaks in current oil and natural gas systems,[11] to imposing an obligation on the fossil fuel energy industry to restore a viable climate system,[12] to recognizing a duty of federal agencies to implement a science-based recovery plan under the public trust doctrine,[13] to ultimately reducing human consumption of energy on an individual basis as well as globally.[14]

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9. Rosina Birnbaum, *An Essay Adapted from a Presentation Entitled, "Adaptation to Climate Change*," 47 J. MARSHALL L. REV. 487 (2013); *See also* Naomi Oreskes & Erik M. Conway, *The Collapse of Western Civilization: A View from the Future*, 142 DAEDALUS 40–58 (2013) (criticizing those who question climate change caused by human action in this work of science fiction set in 2093 where the growing tendency to ignore information and the view that all human problems including climate change can be dealt with by markets, rather than government intervention, is explored).

10. *See* discussion *infra* Part I.B (discussing renewables and nuclear) and Part I.C (describing unconventional fracking of natural gas).

11. *See* David McCabe, *Waste Not: Common Sense Ways to Reduce Methane Pollution form the Oil and Natural Gas Industry*, CLEAN AIR TASK FORCE (Nov. 2014), http://catf.us/resources/publications/view/205 (showing how EPA can cut climate warming methane pollution in half).

12. *See* Mary Christina Wood & Dan Galpern, *Atmospheric Recovery Litigation: Making the Fossil Fuel Industry Pay to Restore a Viable Climate System*, 45 ENVNTL. L. 259 (2015) (describing litigation that aims to impose costs of climate change on the fossil fuel industry); *see also* Mary Christina Wood, *Atmospheric Trust Litigation: Defining Sovereign Obligations in Climate Recovery*, Fletcher Forum of World Aff. (Mar, 27, 2014), www.fletcherforum.org/2014/03/27/wood (developing an argument that puts responsibility on government to promote climate recovery).

13. *See* Alec L. v. McCarthy, 2014 U.S. App. LEXIS 12867 (D.C. Cir. 2014), *cert. denied* 135 S. Ct. 774 (2014) (holding however that the public trust doctrine is a matter of state law and does not support federal question jurisdiction because the doctrine does not arise under the Constitution or laws of the United States); *see also* Tim Kline, *Alec L. and Federal Atmospheric Trust Litigation: Conceptual and Political Gains Amidst Legal Defeat*?, 42 ECOLOGY L. Q. 529 (2015), www.scholarship.law.berkeley.edu/elq/vol42/iss2/17 (discussing recent law suits that argue the public trust doctrine requires states and federal regulation of greenhouse gas emissions).

14. *But see, e.g., Energy Efficiency Upgrades Cost Double the Projected Benefits, Study: Additional Policy Solutions Needed to Confront Climate Change*, ENERGY POLICY INSTITUTE OF THE UNIVERSITY OF CHICAGO (June 23, 2015), http://news.uchicago.edu/article/2015/06/23/energy-efficiency-upgrades-cost-double-projected-benefits (reporting an economics study on Meredith Fowlie, Michael Greenstone & Catherine D. Wolfram, *Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program*, Becker Friedman Institute for Research in Economics Working Paper No. 2621817, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2621817).

Reducing use of energy is part of the mitigation that is necessary for sustainability.[15]

B. Renewable Energy, In The Form Of Wind, Solar, Hydraulic And Waves Promise To Substitute For Fossil Fuels and To Reduce Significantly The Carbon Emissions Responsible For Climate Change

John M. Golden and Hannah J. Wiseman argue that the innovation in nonconventional natural gas, creating the "Fracking Revolution," can be used to facilitate production of sufficient energy via renewables.[16] Many disagree, and maintain that the currently available renewable energy sources are insufficient to substitute for fossil fuels to meet world needs, and may never be able to do so. A variety of problems with the U.S. energy industry cause these doubts. These problems range from the fact that in the U.S., energy is owned and distributed via a market, but in many other nations there is government ownership of energy, to the reduction in the cost of natural gas, often because of new fracking methods of production, that reduce incentives for renewables.[17] For example,

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15. *See, e.g.,* Peter C. Frumhoff, James J. McCarthy, Jerry M. Melillo, Susanne C. Moser & Donald J. Wuebbles, *Confronting Climate Change in the U.S. Northeast*, NORTHEAST CLIMATE IMPACTS ASSESSMENT (July 2007), www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/pdf/confronting-climate-change-in-the-u-s-northeast.pdf (warning that "Mitigation (in the form of emissions reductions) and adaptation are essential and complementary strategies for addressing global warming"). President Barack Obama, in August 2015, issued requirements to reduce use of energy. *Fact Sheet: President Obama Announces New Actions to Bring Renewable Energy and Energy Efficiency to Households across the Country*, THE WHITE HOUSE (Aug. 24, 2015), www.whitehouse.gov/the-press-office/2015/08/24/fact-sheet-president-obama-announces-new-actions-bring-renewable-energy;
Contra, Robin Kundis Craig, *Learning to Live with the Trickster: Narrating Climate Change and the Value of Resilience Thinking*, PACE ENVTL L. REV. (forthcoming 2016), http://ssrn.com/abstract=2716895 (challenging the idea that sustainability is possible and arguing that adaptation to assure resilience is needed now and going forward to deal with climate change).

16. John M. Golden & Hannah J. Wiseman, *The Fracking Revolution: Shale Gas as a Case Study in Innovation Policy,* 64 EMORY L. J. 955, 1031-1037 (2015) (discussing how lessons from innovation in the fracking industry can support development of renewables in US and internationally; they compare air rights for wind and solar energy with underground rights needed for fracking); *see also* Jeffrey Thaler, *Fiddling as the World Floods and Burns: How Climate Change Urgently Requires a Paradigm Shift in the Permitting of Renewable Energy Projects*, 42 ENVTL. L. 1101 (2012).

17. *See* Patrick Parenteau & Abigail Barnes, *A Bridge Too Far: Building Off-Ramps on the Shale Gas Superhighway*, 49 IDAHO L. REV. 325, 347 (reporting that some see cheap natural gas will reduce investment in renewables but adopting the model proposed by Rocky Mt. Institute RMI which "emphasizes energy efficiency and a tempered rise in natural gas (requiring a third less natural gas than current levels) coupled with a strong renewables portfolio").

recent discussions of such problems have focused on development of distributed solar energy, such as solar installations on residential and business rooftops, where capturing solar energy from individual users' rooftops competes with the established utilities.[18] The lack of comprehensive and accurate energy consumption data itself may delay the establishment of realistic energy efficiency goals which are so important to the real estate industry, as well as in adequate planning for the transition from fossil fuels to renewables, which is the generally accepted goal to limit the disasters of climate change.[19]

Optimists report recent studies showing that renewable energy sources may be sufficient to support energy needs at least in the future. At the United Nations Climate Change Conference in Paris during talks of commitments to switch from fossil fuels to renewables, Uruguay reported it had slashed its carbon footprint in less than 10 years by using the diverse energy mix of renewables.[20] On December 16, 2015, San Diego announced that it would be all-renewable by 2035.[21] A study by scientists at Stanford University provides a roadmap[22] whereby the U.S. "could become 80% reliant on clean, renewable energy by 2030, with a full transition achieved by 2050."[23] Professor Mark Jacobson, who led the Stanford team, commented about the reality that such plans will work, said:

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18. *See*, e.g., Michael Pappas, *Defining Power Property Expectations*, 45 ENVTL. L. REP. 10542 (2015),http://digitalcommons.law.umaryland.edu/cgi/viewcontent.cgi?article=2558&context=fac_pubs (discussing how shift from voluntary incentive based efforts to mandatory government measures may "raise objections about interference with property expectations"); *see also* Troy A. Rule, *Unnatural Monopolies: Why Utilities Don't Belong in Rooftop Solar Markets*, IDAHO L. REV. (forthcoming 2015), http://ssrn.com/abstract=2572547 (arguing that allowing regulated utilities to compete with the rooftop solar industry will lead to inefficiencies and stifled innovation in developing renewable energy).

19. Alexandra B. Klass & Elizabeth J. Wilson, *Energy Consumption Data: The Key to Improved Energy Efficiency*, 6 San Diego Journal of Climate and Energy Law 69 (2015), http://ssrn.com/abstract=2602974.

20. Jonathan Watts, *Uruguay Makes Dramatic Shift to Nearly 95% Electricity from Clean Energy*, THE GUARDIAN (Dec. 3, 2015), www.theguardian.com/environment/2015/dec/03/uruguay-makes-dramatic-shift-to-nearly-95-clean-energy.

21. Matt Richtel, *San Diego Vows to Move Entirely to Renewable Energy in 20 Years,* New York Times (Dec. 16, 2015), www.nytimes.com/2015/12/16/science/san-diego-vows-to-move-entirely-to-renewable-energy-in20-years.html.

22. Mark Z. Jacobson, Mark A. Delucchi, Guillaume Bazouin, Zack A. F. Bauer, Christa C. Heavey, Emma Fisher, Sean B. Morris, Diniana J. Y. Piekutowski, Taylor A. Vencill & Tim W. Yeskoo, *100% Clean and Renewable Wind, Water, and Sunlight (WWS) All Sector Energy Roadmaps for the 50 United States*, ENERGY ENVTL. SCI., 2015, 8, 2093 (May 27, 2015), https://web.stanford.edu/group/efmh/jacobson/Articles/I/USStatesWWS.pdf.

23. Chris Wood, *Study Shows How the US Could Achieve 100 Percent Renewable Energy by 2050*, GIZMAG (June 9, 2015), www.gizmag.com/united-states-renewable-energy-2050/37938/.

> [w]hen you account for the health and climate costs-as well as the rising price of fossil fuels- wind, water and solar are half the cost of conventional systems …A conversion of this scale would also create jobs, stabilize fuel prices, reduce pollution-related health problems and eliminate emissions from the United States. There is very little downside to a conversion, at least based on this science.[24]

Nevertheless, the prices to users of energy is based upon the vagaries of a speculative market which means that in 2016, we will witness significant declines in prices for heating energy and gasoline for vehicles and electricity. Merely looking at prices to consumers, however, is not adequate to compare total costs.

Questions about what to do during the transition period before reliance on renewables is total and whether there are any intermediate energies that have a lower impact on the climate have developed with the quick, strong development of nonconventional gas from shale through fracking. Natural gas, including fracked natural gas, is cleaner than coal used for generating electricity and it is a cleaner fuel to power cars, trucks and other motor vehicles than gasoline and diesel fuel. And, it should be noted, that for many, the unspoken goal still is to "allow Americans to continue consuming energy, guilt-free, at the highest rates in the world."[25] Whether production of renewable energy will be sufficient to avoid disaster or whether it can respond adequately to increasing demand for energy as the world demands per capita levels comparable to the US remain open questions.

C. Fracturing (Fracking) of Natural Gas Is Now Recognized by Some as a Transition, or "Bridge," to Renewables.

The process of fracking for natural gas is considered to be a "game changer" that will provide the foundation fuel for the future,[26] in the form of a cleaner alternative fossil fuel that produces fewer emissions than coal or oil,[27] that provides energy

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24. *Id.* (quoting Stanford Professor Mark Z. Jacobson and the study discussed, *supra* note 22).

25. *See* Shalanda Helen Baker, *Is Fracking the Next Financial Crisis? A Development Lens for Understanding Systemic Risk and Governance*, 87 TEMP. L. REV. 229, 236 (2015) (warning that relying on fracking could leave us much worse off).

26. Patrick Parenteau & Abigail Barnes, *A Bridge Too Far: Building Off-Ramps on the Shale Gas Superhighway*, 49 Idaho L. Rev. 325, 346 (2013) (discussing *Natural Gas as a Game Changer*, WALL ST. J. (Mar. 26, 2012); www.onlinewsj.com/article0/SB10001424052702304640457729682719190); *See also* Timothy Fitzgerald, *Frackonomics: Some Economics of Hydraulic Fracturing*, 63 CASE W. RES. 1337, 1346 (2013) (describing the economics of gas from fracking compared to petroleum).

27. *See* Joel Minor, *Completing the Bridge to Nowhere: Prioritizing Oil and Gas Emissions Regulations in Western States*, 34 STAN. ENVTL. L.J. 57, 87–90

independence to US, that is more economical than renewables, and that can serve as a transition to obtaining such quantities of energy from renewables that is necessary to reduce the carbon emissions in the air.

Shalanda Helen Baker provides a fracking primer.[28] She explains how the fracking process produces the natural gas. She describes fracturing, or "fracking" the commonly used term for the activity, as involving "the injection of a combination of water, chemicals and sand into the earth to release natural gas. . . . The gas is found in geologically complex, nonconventional reservoirs such as tight (low-permeability) sands, gas-bearing shales and coalbeds."[29] The process involves drills running vertically for several thousands of feet (while in conventional gas well development the drill bores straight down into the earth into a reservoir of oil or natural gas). With this approach, multiple wells can be drilled from a single pad. Once the drilling is finished, a cocktail of chemicals and sand is pumped with water under high pressure. This pushes through perforations in the horizontal well bore, fracturing or breaking the shale rock and releasing the natural gas.[30] Then, the fracking fluid, known as "flowback," returns to the surface, and allegedly causes other problems. Fracking in the context of business operations is discussed later.[31]

Some support fracking as a way to provide energy for the transition from fossil fuels to renewables. It is seen as having environmental benefits. Burning natural gas produces much less

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(2015), https://journals.law.stanford.edu/sites/default/files/stanford-environmental-law-journal-selj/print/2015/04/minor_article.pdf (discussing conflicting research on the issue of whether fracking is cleaner than other fossil fuels). Whether unconventional gas is more dangerous than conventional natural gas is not clear from standpoint of methane. *Id.*

28. Baker, *supra* note 25, at 254.

29. *Id.* at 254 (quoting Kathryn J. Brasier et al., *Residents' Perceptions of community and Environmental Impacts from Development of Natural Gas in the Marcellus Shale: A Comparison of Pennsylvania and New York Cases*, 26 J. RURAL SOC. SCI. 32, 33, n.1 (2011), www.ag.auburn.edu/auxiliary/srsa/pages/Articles/JRSS%202011%2026/1/JRSS%202011%2026%201%2032-61.pdf).

30. *Id.* at 254 (citing Nancy D. Perkins, *The Fracturing of Place: The Regulation of Marcellus Shale Development and the Subordination of Local Experience*, 23 FORDHAM ENVTL. L. REV. 44, 48-49 (2012)); *see also* Patrick H. Martin, *What the Frack? Judicial, Legislative, and Administrative Responses to a New Drilling Paradigm*, 68 ARK. L. REV. 321 (2015) (comparing the standard model for drilling natural gas with the new paradigm/new model in great detail); *see T.W. Phillips Gas & Oil Co. v. Jedlicka*, 42 A. 3d 261, 264 n.1 (Pa. 2012) (providing a description that reflects an understanding of science and engineering concepts by the judiciary).

31. *See infra* Part II.A for description of fracking in the context of the business operations timeline. *See also* David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance, and the Certain and Uncertain Risks of Hydraulic Fracturing*, 99 IOWA L. REV. 1523 (2014) (presenting a market approach to regulating energy instead of or along with government regulation).

carbon emissions than oil or coal. Alongside the strong development of the fracking industry, the use of coal, the primary source of energy in the U.S., finally, in 2012, became about equal with natural gas. Also in 2012, carbon dioxide emissions, the cause of climate change, were at their lowest level since 1992.[32] While the reduced emissions receive the most attention, others argue that shale gas means reduced prices, which should benefit the national economy.[33] Combined with cleaner energy, the human condition could be improved worldwide.[34] Shale could also help the nation reduce reliance on imports from other countries. Shalanda Helen Baker sees fracking as a transition that will "reduce America's dependence on foreign oil, provide a 'cleaner' energy future by reducing our dependence on carbon-intensive coals, keep energy costs low, and also bring desperately needed financial resources to cash-strapped regions."[35] David B Spence looks at fracking in comparison with conventional drilling and finds an economic advantage. The "shale gas boom has brought dramatic changes in the relative profitability of producing natural gas" in comparison with conventional drilling.[36]

But others, including Robert W. Howarth of Cornell, conclude that research shows fracking to be much more of a problem.[37] He concludes that shale gas has a larger carbon footprint than coal and oil when the full lifecycle of the gas production is considered. They worry that the perceived benefits are not permanent and that there are dangers associated with fracking that challenge its long-term sustainability. Criticism of fracking has been based upon a variety

32. David B. Spence, *Responsible Shale Gas Production: Moral Outrage vs. Cool Analysis*, 25 FORDHAM ENVTL. LAW REV. 141, 150, n.36 (2013) (citing *U.S. Energy-Related CO[2] Emissions in Early 2012 Lowest Since 1992*, U.S. Energy Inform. Admin. (Aug. 1, 2012), www.eia.gov/todayinenergy/detail.cfm?id=735 0).

33. *See, e.g.,* Christopher Helman, *President Obama Gets It: Fracking is Awesome*, FORBES (Feb. 12, 2013, 10:32 PM), www.forbes.com/sites /christopherhelman/2013/02/12/president-obama-gets-it-fracking-is-awesome/#5416f5123bf1 (suggesting that thanks to fracking consumers pay lower gas prices, saving consumers $100 billion a year, etc.).

34. John C. Dernbach & Marianne Tyrrell, *Federal Energy Efficiency and Conservation Laws, The Law of Clean Energy: Efficiency and Renewables* 25, 26 (Michael Gerrard ed., 2011), http://ssrn.com/abstract=1684201.

35. *See* Baker, *supra* note 25, at 234-236 (reporting the hope associated with more natural gas produced by fracking).

36. David B. Spence, *Responsible Shale Gas Production: Moral Outrage v. Cool Analysis*, 25 FORDHAM ENVTL. LAW REV. 141, 170 (2013).

37. Robert W. Howarth, *A Bridge to Nowhere: Methane Emissions and the Greenhouse Gas Footprint of Natural Gas*, Energy Sci, & Eng'r (2014), www.eeb.cornell.edu/howarth/publications/Howarth_2014_ESE_methane_emissions.pdf (concluding that shale gas has a larger carbon footprint than coal and oil when the full lifecycle of gas production is considered).

of environmental consequences[38] including earthquakes,[39] the huge amounts of water used in the process,[40] water pollution,[41] and fugitive emissions of methane that may be far greater than for conventional gas.[42]

Finally, as we evaluate the climate change issues, we must keep in mind the importance of timetables. Lowering the level of carbon emissions is key to preventing a rise in temperatures of more than 2 degrees Celsius by the end of the century which is the acceptable goal. How we do this involves not only choices among known sources of energy but the timing of implementation of such choices. For example, the transition time away from a carbon intensive source like coal to a lower level one like natural gas has been estimated at more than a century![43] The International Energy Administration (IEA) estimates that if all that is done is to substitute gas for coal, the probable temperature rise would be greater than 3.5 degrees Celsius, well above the 2-degree target[44] because burning natural gas still causes emissions of carbon dioxide. Likewise, the concern with natural gas is timing and scale of the transition to non-fossil fuel. To meet the goal of preventing a rise in temperatures, renewables must make up at least 43% of global energy by 2030 and 77% by 2050.[45]

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38. *See generally* Jason Schumacher & Jennifer Morrissey, *The Legal Landscape of "Fracking": The Oil and Gas Industry's Game-Changing Technique is Its Biggest Hurdle*, 17 TEX. REV. LAW & POLICY 239, 243-254 (2013) (discussing fracking issues as hurdles to greater use of hydraulic fracking).

39. *Id*. at 253 (pointing out that it is probably the disposal of drilling wastes, rather than the drilling itself, causing the seismic activity).

40. *See, e.g.,* Rhonda G. Jolley, *Like Grandma Said, "Oil and Water Don't Mix,"* BRANSCOMB PC (May 9, 2014), www.branscombpc.com/like-grandma-said-oil-and-water-dont-mix/ (discussing the dramatic change in water use for fracking as compared with conventional oil and gas drilling).

41. *See* Baker, *supra* note 25, at 254 (describing two recent films that have pointed out the dangers: *Gasland* and *Promised Land*).

42. Robert W. Howarth, Renee Santoro, Anthony Ingraffea, *Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations: A letter*, CLIMATIC CHANGE (Mar. 2011), www.acsf.cornell.edu/Assets/ACSF/docs/attachments/Howarth-EtAl-2011.pdf.

43. Patrick Parenteau & Abigail Barnes, *A Bridge Too Far: Building off-Ramps on the Shale Gas Superhighway*, 49 IDAHO L. REV. 325, 343, n.143 (2013) (quoting tech guru Nathan Myrvold and climate scientist Ken Caldeira on this point).

44. *Id*. at 341 (quoting *Golden Rules for a Golden Age of Gas: World Energy Outlook Special Report on Unconventional Gas*, International Energy Agency, 91–92 (2012), www.worldenergyoutlook.org/media/weowebsite/2012/goldenrles/WEO2012_GoldenRulesReport.pdf).

45. Intergovernmental Panel on Climate Change, *Renewable Energy Sources and Climate Change Mitigation: Special Report of the Intergovernmental Panel on Climate Change* (2012), http://srren.ipcc-wg3.de/report/IPCC_SRREN_Full_Report.pdf.

D. Questioning if Fracking Is the Bridge to Renewables[46]

David B. Spence points out that "[p]roponents of wind-powered and nuclear energy contend that inexpensive natural gas has dramatically slowed development of these cleaner energy resources…[and] optimism [in nuclear energy] has waned as investors worried about the ability of nuclear power to compete with cheap natural gas fired electricity."[47] By the start of 2016 the dramatic drop in price of fossil energy was already clear.[48] A topic heading in a recent article warns: "the Gas Boom Threatens to undercut Deployment of Renewables and lock in dangerous levels of Greenhouse Gas Emissions."[49] That renewables like solar energy are relatively new industries with untested business models, unanticipated regulatory shifts and the very low cost of natural gas means that, "Losses Pile Up for Solar Companies, and Future may be Stormy."[50] Yet, Amory Lovins and Jon Creyts of the Rocky Mountain Institute suggest that natural gas is not really that cheap after all. The costs of insuring against price volatility plus other factors make gas closer, in cost, to solar and wind- that produce no greenhouse gas emissions (GHG).[51] Recognition of the externalized costs will lead to the transition to renewables. Goldman Sachs published its own predictions on "The Future of Clean Energy- the Low Carbon Economy"[52] just before the Paris Climate Change talks.[53] Its perspective of the market for LED lightbulbs and

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46. *See generally* Patrick Parenteau & Abigail Barnes, *A Bridge Too Far: Building Off-Ramps on the Shale Gas Superhighway*, 49 IDAHO L. REV. 325 (2013) (warning that increased reliance on natural gas from fracking is likely to undercut efforts to develop renewables).

47. David B. Spence, *Responsible Shale Gas Production: Moral Outrage vs. Cool Analysis*, 25 FORDHAM ENVTL. LAW REV. 141, 169-170 (2013).

48. John Ydstie, *Drop in Oil Prices Complicates Effort to Combat Climate Change*, NPR (Jan. 28, 2016), www.npr.org/2016/01/28/464664794/drop-in-oil-prices-complicates-effort-to-combat-climate-change.

49. Parenteau, *supra* note 46, at 342.

50. Diane Cardwell & Julie Creswell, *Looking for Silver Linings,* N.Y. TIMES (Feb 11, 2016) at B1.

51. Amory B. Lovins & John Creyts, *Hot Air About Cheap Natural Gas*, Rocky Mountain Inst. (Sept. 6, 2012), http://blog.rmi.org/blog_hot_air_about_cheap_natural _gas; *see also* Robert W. Howarth, Renee Santoro, Anthony Ingraffea, *Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations: A letter*, CLIMATIC CHANGE (March 2011), www.acsf.cornell.edu/Assets/ACSF/docs/attachments/Howarth-EtAl-2011.pdf (questioning whether fracking is really less emissions producing than other fossil fuels).

52. Goldman Sachs, *The Future of Clean Energy, The Low Carbon Economy* (Dec. 16, 2015), www.goldmansachs.com/our-thinking/pages/report-the-low-carbon-economy.html.

53. In December 2015, Paris hosted a climate conference in which over 195 countries signed the Paris Agreement, a "bridge between today's policies and climate-neutrality before the end of the century." The Agreement creates legal

hybrid/electric automobiles is the basis for expecting increased development of solar energy and onshore wind energy between 2015 and 2020 at a greater amount than US shale oil production did from 2010 to 2015.[54]

The debate about the impact of fracking on climate is ongoing and evolving. While early on it had been seen as a means for meeting our needs to reduce emissions,[55] Michael Levi reports a quick turn against shale gas by environmental groups, starting in 2010, to such an extent that by summer 2015 the Environmental Defense Fund stood alone in seeing shale gas as part of the solution to climate change.[56] Levi seems to see fracking as part of a broad energy policy where the result is those using coal would turn to natural gas and those using natural gas would turn to renewables.[57] Still, Parenteau and Barnes warn that natural gas may be a "bridge too far for a stable climate change."[58] Here, it is both the choices about how fracking is used and what timetable sets up implementation that may make the difference between impeding renewables and complementing them to meet carbon reduction goals.

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obligations to reduce emissions for these countries. *See* European Commission, *Paris Agreement* (April 21, 2016), http://ec.europa.edu/clima/policies/international/negotiations/paris/index_en.htm (providing the text of the document).

54. *See* Goldman Sachs, *The Future of Clean Energy The Low Carbon Economy* (Dec. 16, 2015), www.goldmansachs.com/our-thinking/pages/report-the-low-carbon-economy.html (using LED lightbulbs as the reason to expect increasing development of renewable energy).

55. *See* Michael Levi, *Fracking and the Climate Debate*, DEMOCRACY J. (July 6, 2015), http://democracyjournal.org/magazine/37/fracking-and-the-climate-debate/ (discussing the widespread agreement in 2009 of groups as diverse as the Sierra Club, Robert F. Kennedy, Jr., Joe Romm of the Center for American Progress and President Barack Obama who was seen as calling fracking the most obvious first step towards saving our planet).

56. *Id.*; *see also* Jason Schumacher & Jennifer Morrissey, *The Legal Landscape of "Fracking": The Oil and Gas Industry's Game-Changing Technique Is Its Biggest Hurdle*, 17 TEX. REV. LAW & POL. 239, 256 (describing key stakeholders in the national discussion, including the environmental groups that are less enthusiastic than a few years ago).

57. *See* Joe Nocera, *Opinion Pages: Shale Gas and Climate Change*, N.Y. TIMES (July 14, 2015), www.nytimes.com/2015/07/14/opinion/joe-nocera-shale-gas-and-climate-change.html?_r=0 (reviewing Michael Levi, *Fracking and the Climate Debate*, DEMOCRACY J. (July 6, 2015) and concluding that environmentalists should rethink their opposition to fracking).

58. Parenteau, *supra* note 46, at 342.

II. THE BUSINESS OF FRACKING HAS BEEN A RECENT SUCCESS STORY THAT REQUIRES MULTIFACETED RESPONSE TO CONTROL DOWNSIDES AND RISKS

A. The Fracking Business

The comparison of fracking with the standard model of oil and gas exploration that began with the first oil well near Titusville, Pennsylvania in 1859 suggests why fracking is characterized as a "new model" or even a "new paradigm."[59] Responding to the common law "rule of capture,"[60] a standard developer recovers only the oil located directly below the surface at a certain depth. This approach allows a draining of oil "from eighty acres or more, while a vertically completed gas well can efficiently drain 800 acres or more."[61] Thus, the rule of capture encouraged dense drilling with "too many wells, with wells too close together."[62] As with other activities involving real property, traditional oil and gas drilling required governmental land use regulation, mainly at the state and local level.[63]

The new model uses horizontal lateral drilling that drain at the surface only a few hundred feet around the borehole but that extend over a mile underground. Courts have defined fracking as: "[A] method used to stimulate production of a well. A specially blended liquid is pumped down the well and into a formation under pressure high enough to cause the formation to crack open, forming passages through which oil or gas can flow into the wellbore."[64] Because water is not compressible and shale is not permeable, pressurized water breaks down the rock allowing oil and gas to flow up to the surface. This method has allowed developers to recover oil and gas from shale – a result not possible or commercially feasible under the standard methods.[65] Fracking plus horizontal drilling has greatly increased the amount of oil and natural gas available for use in the US and for export.[66]

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59. *See* Patrick H. Martin, *What the Frack? Judicial, Legislative, and Administrative Responses to a New Drilling Paradigm*, 68 ARK. L. REV. 321 (2015) (comparing the standard model for drilling natural gas with the new paradigm/new model for drilling natural gas by fracking).

60. *See infra* Part III.H (primer on acquiring interests in real estate sufficient for fracking natural gas).

61. Martin, *supra* note 59, at 323.

62. *Id*.

63. *Id*.

64. T.W. Phillips Gas & Oil Co. v. Jedlicka, 42 A.3d 261, 264 n.1 (Pa. 2012).

65. Martin, *supra* note 59, at 326. The common law rule of trespass means that the driller must get the permission (or a legal right) to extend under the land of owners beyond the boring area. *Id.* Holdouts make the fracking method economically or physically impossible; compulsory pooling rules offset this limitation of common law trespass. *Id.*

66. *See* Jason Schumacher & Jennifer Morrissey, *The Legal Landscape of "Fracking": The Oil and Gas Industry's Game-Changing Technique Is Its Biggest*

Commercial hydraulic fracking of oil wells goes back to 1949,[67] though widespread use did not begin until the 1980's with greatly increased production since 2005, coinciding with a federal policy that put fracking beyond the regulations on oil and gas – the "Halliburton" exception.[68] William E. Hefley and Shaun M. Seydor of the University of Pittsburg Joseph M. Katz Graduate School of Business provide critical information on the impact of drilling and extracting shale gas by using a Marcellus shale well located in Southwestern Pennsylvania.[69] Their report emphasizes the "direct economic impact rather than just focusing on the perceived benefits and impacts affecting the region."[70] The Interfaith Center on Corporate Responsibility and the Investor Environmental Health Network published its article, *Extracting the Facts: An Investor Guide to Disclosing Risks from Hydraulic Fracturing Operations,* to provide investors with "assurance that company managers are reducing business risks by addressing operational hazards and are capturing the genuine, measurable business rewards flowing from environmental management practices that have the potential to lower costs, increase profits and enhance community acceptance."[71]

If the natural gas produced by the fracking industry is to have an appropriate role in meeting energy needs, appreciating both the potentially great benefits, as well as the likely harms, is critical to its expansion in the timeframe of reducing Greenhouse gas (GMG) emissions by 2050 and beyond.

Hurdle, 17 TEX. REV. LAW & POL. 239 (2013) (reporting the predictions of International Energy Agency that US will surpass Arabia as largest oil producer and will be nearly energy independent by 2035); *see also* Shalanda Helen Baker, *Is Fracking the Next Financial Crisis? A Development Lens for Understanding Systemic Risk and Governance*, 87 TEMPLE L. REV. 229, 254 (featuring a fracking primer which describes the fracking process).

67. *See* Shooters - A "Fracking" History, AM. OIL & GAS HIST. SOC'Y, http://aoghs.org/technology/hydraulic-fracturing/ (last visited Feb. 8, 2016) (providing an excellent history of the fracking method) (cited in Martin, *What the Frack? Judicial, Legislative, and Administrative Responses to a New Drilling Paradigm*, 68 ARK. L. REV. 321, 323-324).

68. Energy Policy Act of 2005, Pub. L. 109-58, 119 Stat. 594, § 322-323 (2005). The Bill exempts certain fluids used in fracking from regulations, and has been referred to as the "Halliburton Loophole." See *infra* note 75-76 (discussing this exemption in great detail).

69. *See* William E. Hefley & Shaun M. Seydor, *The Economic Impact of the Value Chain of a Marcellus Shale Well*, (University of Pittsburgh Pitt Business Working Paper, August 30, 2011), www.business.pitt.edu/faculty/papers/PittMarcellusShaleEconomics2011.pdf (emphasizing the economic perspective in their report).

70. *Id.*

71. Richard A. Liroff, *Extracting the Facts: An Investor Guide to Disclosing Risks from Hydraulic Fracturing Operations*, INVESTOR ENVT'L HEALTH NETWORK (Dec. 2011), http://iehn.org/publications.reports.frackguidance.php.

B. The Fracking Business is Heavily Supported by Governments in Spite of the Downsides: Government Support and Lack of Consistent Government Regulation.

1. Government Direct Financial Support

Fracking has benefitted from government support by way of publicly funded research, tax relief, regulatory exemptions and other relief.[72] Previous tax credits for unconventional gas under the Section 29 tax credit for gas drilled between 1980 and 1992 (later extended until 2002) generated tax savings totaling nearly $10 billion for fracking operators.[73] This economic benefit is credited as being as large as direct monetary contributions by the federal government.[74] Additionally, there were a variety of "lenient rules regarding the recognition, timing, character, and calculation of taxable profits [that] create[d] large [effective] subsidies for taxpayers engaged in"[75] oil and gas production.[76]

2. Exemptions From Federal Environmental Regulation

The Halliburton Loophole, or Halliburton Exceptions, benefitted the oil and gas industry greatly.[77] That industry,

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72. *See* John M. Golden & Hannah J. Wiseman, *The Fracking Revolution: Shale Gas as a Case Study in Innovation Policy*, 64 EMORY L. J. 955, 974-983 (2015) (providing the history of government providing infrastructure including pipelines and "pipeline neutrality" and reforming gas markets that spurred on the nonconventional natural gas production).

73. *Id*. at 989.

74. *Id*.

75. John Bogdanski, *Reflections on the Environmental Impacts of Federal Tax Subsidies for Oil, Gas, and Timber Production*, 15 LEWIS & CLARK L. REV. 323, 324 (2011).

76. *See* Jean L. Bertrand & Lindsey N. Berg, *MCLE Self-Study Article: Fracking: Expected Lawsuits*, State Bar of California (2013), www.schiffhardin.com/Templates/media/files/Other%20PDFs/Fracking--Expected-Lawsuits---California-Real-Property-and-Environmental-Law-News---J--Bertrand-and-L--Berg---Fall-2013.pdf (originally published in Environmental Law News & California Real Property Law Journal, State Bar of California (2013)) (reporting on a study by University of Southern California scientists that the positives in creating 500,000 jobs and over "$25.6 billion in state and local tax revenue in 2020 alone."); *see also Fracturing in California,* WALL ST. J. (June 7, 2013, 6:57 PM), www.wsj.com/articles/SB10001424127887 324767004578488821344316236.

77. Energy Policy Act of 2005, Pub. L. No. 109-58, § 322–23, 119 Stat. 594, 694 (2005) (creating the "Halliburton Loophole" which exempts certain fluids for natural gas from the Safe Water Drinking Act and reduces the reporting requirements for oil and gas companies). *See also* Environmental Integrity Project, *Fracking's Toxic Loophole* (Oct. 22, 2014), http://environmentalintegrity.org/wp-content/uploads/FRACKINGS-TOXIS-LOOPHOLE.pdf ("because of a gap in the Safe Drinking Water act, companies are allowed to

including fracking, succeeded in exempting the industry from key federal laws. Thus, compliance with the Safe Drinking Water Act and the otherwise applicable hazardous waste disposal regulations under the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation and Liability Act, the Emergency Planning and Community Right–to–know Act and the Toxic Substances Control Act is not mandated.[78] The impact of the Halliburton Loophole to real estate will be examined in Part IV, *infra*. Moreover, there is no federal law requiring the disclosure of the composition of fracking fluids which arguably is a water pollutant.[79]

C. The Shale Gas Boom Brings Suggestions for Reform of the Industry

Joshua P. Fershee uses fracking in West Virginia as a case study in the Boom that accompanies discovery of energy sources as it did the Gold Rush. He reviews the positive benefits as well as the negative impacts.[80] It is the shale gas boom[81] and the fracking business that Golden & Wiseman use as a case study in innovative policy.[82] They summarize their analysis of the innovation, pointing out that a "wide array of actors beyond George Mitchell, a wide variety of technologies and innovations, moderate use of patents, mixed practices of secrecy and information sharing, vital roles for private property rights in minerals and land, and a long history of government research support, tax benefits, and regulatory and tax exemptions" tell the story.[83] Communities and private actors that

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inject other petroleum products (beyond diesel) without a permit.")

78. Resource Conservation and Recovery Act, 42 U.S.C. § 6921 (b)(2)(A) (1976); Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. § 9601-9675 (1980); Emergency Planning and Community Right-to-Know Act, 42 U.S.C. § 11023(b)(1)(A) (1986); and Toxic Substances Control Act, 15 U.S.C. § 2601-2629 (1976). *See also* Adam Vann, Brandon J. Murrill & Mary Tiemann, Cong. Research Serv., R43152, Hydraulic Fracturing: Selected Legal Issues 1, 5-8, 9-13, 20-22, 24 (2014), http://fas.org/sgp/crs/misc/R43152.pdf (discussing all of the mentioned acts).

79. David B. Spence, *Federalism, Regulatory Lags, and the Political Economy of Energy Production,* 161 U. PA. L. REV. 431, 450 (2013).

80. Joshua P. Fershee, *The Oil and Gas Evolution: Learning from the Hydraulic Fracturing Experiences in North Dakota and West Virginia*, 19 TEXAS WESLEYAN L. REV. 23, 27-30 (2012) (providing the data to support this Boom analysis); *see infra* Part IV.B (discussing three categories of risks associated with fracking that have implications for real estate).

81. *See, e.g.*, *The Economics of Shale Oil: Saudi America; The Benefits of Shale Oil are Bigger than Many Americans Realise,* THE ECONOMIST (Feb. 15, 2014), www.economist.com/news/united-states/21596553-benefits-shale (indicating how widespread and pervasive the excitement and enthusiasm for the Boom has been).

82. John M. Golden & Hannah J. Wiseman, *The Fracking Revolution: Shale Gas as a Case Study in Innovation Policy*, 64 EMORY L. J. 955 (2015).

83. *Id*. at 1037-1038.

are involved with the business of fracking experience the benefits without experiencing all the costs.[84] So, while the authors conclude that fracking may be a bridge to renewables, they warn that, "In a post- Great Recession world highly concerned with promoting economic growth," appropriate regulation of both the extraction process and use of the nonconventional natural gas product will be necessary.[85]

It is this business perspective that signals both the importance of real property to the fracking industry (and thereby to climate change risks) and to consideration of ways to handle those risks.[86] Dana and Wiseman compare the production of energy by fracking to the Industrial Revolution.[87] For example, they suggest that like the industrial revolution, fracking presents opportunities for the creation of great wealth with strong risks of damages to the country and the planet from both an environmental and public health standpoint.[88] As they recognize the need for regulation of the fracking business/industry as a way to be more forward looking than we have been in the past, Dana & Wiseman suggest insurance and assurance bonds as market devices that will mitigate harm and provide funds to remediate damage that could not be avoided.[89]

Shalanda Helen Baker uses a development lens to argue that only thinking about the sources of government regulation and its features is not the best way to approach the fracking business.[90] She compares fracking to the seemingly unrelated businesses of securitizing and global marketing of subprime residential mortgages that led to the 2008 financial crisis,[91] and of deep-sea drilling for oil that led to the BP oil spill in 2010, which showed the world the serious economic damage that a single blow-out could produce.[92] All three are modern examples of economic development

84. *Id*. at 998.

85. *Id*. at 966.

86. *See* NAOMI KLEIN, THIS CHANGES EVERYTHING: CAPITALISM VS. THE CLIMATE, (2014) (arguing that climate change generally is the result of capitalism, not carbon, implying that careful consideration of the market forces and proper limits on their power are needed). *See also infra* Part IV (providing a comprehensive discussion of the impact of fracking on the commercial real estate industry).

87. David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance, and the Certain and Uncertain Risks of Hydraulic Fracturing*, 99 IOWA L. REV. 1523, 1526 (2014).

88. *Id*. (discussing their view that much of modern environmental law has been dealing with cleaning up water and the soil contaminated by the industrial revolution and decades of unregulated coal mining).

89. *Id*. at 1532-33.

90. *See* Baker, *supra* note 25, at 269 (criticizing the current debate focusing on the "federalism binary").

91. *Id*. at 245-247.

92. *Id*. at 247–48, n.93; *see also* Report: Gulf of Mexico Permanent Deepwater Structures, Bureau of Safety and Environmental Enforcement (last accessed Feb. 1, 2016 at 9:44AM), www.data.bsee.gov/homepg/data_center /other/tables/dpstruct.asp (reporting permanent production platforms in the

initiatives that respond to economic needs of the moment. Securitized mortgages developed as a way to provide opportunities for all Americans to own their housing. Deep-oil drilling used new technology to produce oil and gas from areas not previously used for production. During the current U.S. "moment" that views economic growth as critical to deal with underlying "extremes: extreme poverty, extreme gaps in wealth, extreme challenges to food production, extreme variability with the ecosystem, and extreme civil unrest,"[93] fracking takes advantage of the ability to produce a cleaner form of energy than coal and oil, to provide jobs in areas where economic downturns made that prospect attractive, and to provide energy independence.[94] However, like securitization and deep-sea drilling before, fracking threatens worse problems than the economic advantages it promises.

In what Baker terms the "U.S. development moment" (2008-2015), those three contemporary methods of economic development "appear to be happening haphazardly, disconnectedly, and in isolation."[95] Thus, banks made loans to borrowers who were unlikely to be able to pay them off. Combining subprime mortgages, characterized by adjustable interest rates that are likely to spike soon after they are made, with securitization meant that no one had "skin" in the game if the loans went into default. The exemption of these securities from ordinary regulation[96] and the unknown fraud of American ratings agencies meant that investors around the globe could not make meaningful evaluations of this investment product. The focus and beneficial goals of bringing more Americans into the "ownership society" covered up the unappreciated risks to investors. And, the resulting mortgage defaults on both subprime and then prime mortgage loans has meant the loss of homeownership and economic devastation for many Americans. Likewise, with the BP Amoco spill, the deep-sea drilling business used technology that was

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Gulf of Mexico).

93. *See* Baker, *supra* note 25, at 238.

94. Richard Martin, *America's Energy Job Machine is Heating Up*, FORTUNE (April 12, 2012), http://fortune.com/2012/04/12/americas-energy-job-machine-is-heating-up (characterizing deep sea drilling and fracking to be "Just the elixir the U.S. economy needs"); *but see* John Burnett, *Excitement Over Mexico's Shale Fizzles as Reality Sets In*, NPR (March 16, 2015, 3:23PM), www.npr.org/sections/parallels/2015/03/16/393334733/excitement-over-mexicos-shale-play-fizzles-as-reality-sets-in (describing the quick turnaround in attitude regarding fracking in Mexico once the above ground complications like water scarcity and lack of pipeline infrastructure became apparent).

95. *See* Baker, *supra* note 25 at 244.

96. *See* Celeste Hammond & Ilaria Landini, *The Global Subprime Crisis as Explained by the Contrast between American Contracts Law and Civil Law Countries' Laws, Practices, and Expectations in Real Estate Transactions: How the Lack of Informed Consent and the Absence of Civil Law Notary in the United States Contributed to the Global Crisis in Subprime Mortgage Investments*, 11 J. INT'L BUS. & L. 133 (2013) (explaining that the Securities and Exchange Commission does not regulate mortgage backed securities).

untested and not subject to real oversight. There was no real regulation of that technology because the industry controlled the regulators in all meaningful ways.[97] Similarly, the fracking industry shares with these examples the fact that activities by private actors work with an inconsistent patchwork of regulation, which subjects the economy to a systemic risk.[98]

All three of these examples exhibit what Baker terms "hybridity" in their development. Novel technology - financial technology in the case of the mortgages and engineering technology in the deep-sea oil drilling and in fracking - took advantage of three characteristics of what Baker terms, "hybridity."[99] Hybridity means that the development approach is not easily regulated, engages a public good and creates system wide risks. All of these businesses were quick to develop without consistent government regulation. All involved a public good (financial markets, ecosystem of the Gulf waters, and natural resources). All created a systemic economic risk.[100]

Focusing on the hydraulic fracking business, there definitely is a public good or asset that is engaged as a necessary component of the business. In addition to the natural gas resources, many of which are privately owned in the U.S., in contrast to other countries where they are publicly owned, the public goods of land and water supplies affected are public goods. The helter-skelter regulation is reflected in the industry led exemption of fracking from key federal laws to protect the environment.[101] The so called "Halliburton Loophole"[102] combined with "substantial regulatory gaps and opacity concerning the chemicals used"[103] and the "mash-up of inconsistent regulatory regimes"[104] has motivated the industry to work very quickly to get local community approval of activities in hopes of avoiding future state and/or federal restrictions and requirements. The industry also tries to effect state law by arguing and lobbying that federal regulation (where enforcement might be

97. *See* Baker, *supra* note 25, at 248.

98. *See* Golden & Wiseman, *supra* note 16 at 1037 (noting the private actors, wide variety of technologies, secrecy and information sharing, private property rights, and a "long history of government research support, tax benefits, and regulatory and tax exemptions" are at the base of the business and its problems).

99. *See* Baker, *supra* note 25 at 245-246 (clarifying the term as referring to an extreme approach to development utilized with little oversight or regulation).

100. *See infra* Part IV focusing on how the hybridity of fracking affects the commercial real estate industry).

101. *Id.* at 256 (for a detailed list of those statutes).

102. *See* Editorial: *The Halliburton Loophole*, N.Y. TIMES (Nov. 3, 2009), www.nytimes.com/2009/11/03/opinion/03tue3.html (exempting fracking from federal regulation); *see also* Baker, 87 TEMP. L. REV. 229, 257.

103. *See* Baker, *supra* note 25 at 257 (noting that the chemicals used in hydraulic fracking also are not regulated or even disclosed).

104. *Id.*

more likely to occur) is not needed. The systemic environmental risk of fracking activity includes use of water at a rate far beyond natural replenishment and water pollution.[105] Systemic social risk includes the transformation of rural communities, especially the boomtown phenomena.[106] Additionally, Baker points to the economic systemic risk in fracking of obtaining leases on land already subject to mortgages, other security interests and private regulation. Her concern is beyond the lenders themselves to the financial markets to which lenders likely would spread that risk.[107]

Finally, Baker argues that once we understand hybridity in a particular approach to development we appreciate why government regulation alone is not sufficient to protect the society. She urges the development of an "interruption" in the hybridity by using transactional devices where the fracking business will take on more of the risks. The fracking business, like the securitization of mortgages and deep-sea oil drilling in this current moment of development, should internalize more of the risks and therefore keep risks lower.[108] The industry should recalibrate the sharing of both risk and benefit through public private partnerships and use of transactional and ownership structures. Moreover, such an interruption would reduce the scale of fracking projects in ways that can reduce the systemic risks of fracking.

Because of the potential for profits and meeting other social and economic goals already discussed, many argue for the enhancement of this industry. Yet, even proponents like Dernbach and Levi see need for public concern and control. Dana and Wiseman call for insurance and assurance bonds rather than just regulation to control risks of fracking.[109] Bonds provide money to pay for loses resulting from fracking that is allowed.

D. Suggestions for Better Approaches for the Fracking Process

Dick Roddewig and Jim Hughes go beyond transactional devices and regulation to deal with risks and challenges of fracking in their symposium article.[110] They herald the great increase of oil

105. *Id*. at 263; *see infra* Part IV.B(1) (explaining fracking's risk of polluting water in the area).

106. *Id*. at 266; *see infra* Part IV.B(2) (discussing the social and community harms because of fracking).

107. *Id*. at 267; *see also, infra* Part IV.B(3) (describing economic risks the fracking industry places on both individuals and communities).

108. *Id*. at 277-281.

109. *See* Golden & Wiseman, *supra* note 16.

110. Richard J. Roddewig & W. James Hughes, *Underbalanced Drilling: Can It Solve the Economic, Environmental and Regulatory Taking Problems, Associated with Fracking?,* 49 J. MARSHALL L. REV. 511 (2015) (suggesting a new technology called underbalance drilling (UBD) that would enhance production of nonconventional shale gas without the risks and legal challenges

and natural gas from fracking that makes "the United States the largest combined producer of oil and gas in the world, having surpassed Russia in 2012 and in 2014 surpassing even Saudi Arabia in the production of oil alone."[111] With one of the authors having significant experience as a fracker, the article provides both a description of the boom of the industry,[112] as well as the main environmental problems.[113] The article offers an alternative to the conventional "overbalanced" drilling which has led to extreme government regulation including even outright bans in New York.[114] Focusing on new interests in underbalanced drilling (UBD) as a possible solution to environmental and regulatory takings issues in both Texas and Colorado, the authors present an introduction to the process of UBD, describe how UBD eliminates the environmental problems associated with fracking, compare the economics of UBD with overbalanced fracking and discuss whether state and local governments have the legal authority to require underbalanced drilling rather than fracking.[115] Their ten-point agenda to get recognition of UBD as the solution for the issues facing the U.S. oil and gas production industry is innovation that must be considered now.[116]

III. PRIMER ON ACQUIRING & SELLING AND PRESERVING & PROTECTING INTERESTS IN REAL ESTATE FOR HYDRAULIC FRACTURING FOR NATURAL GAS

A. Introduction

Hydraulic fracturing has increased the nation's supplies of natural gas but has also raised issues, which real estate attorneys need to know more about. This is especially true for those practicing in regions in which, before the recent boom in fracking, natural gas was not being produced. These are the attorneys whose clients are

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of fracking).

111. *Id*. at *2.

112. *Id*. at *3–4.

113. *Id*. at *5–7.

114. Underbalanced drilling (USD) is offered as an alternative to the traditional overbalanced drilling because underbalanced drilling "reduces formation damage" and requires less underground pressure for drilling. Ramona M. Graves, *Drilling Operations: An Overview*, ROCKY MT. MIN. L. INST. 4-1 2001 (2015). UBD is considered advantageous for two reasons: (1) maximized hydrocarbon recovery, and (2) minimized pressure-related drilling problems. *See* Society of Petroleum Engineers, *Underbalanced Drilling (UBD),* Petrowiki (June 26, 2015 3:29PM), http://petrowiki.org/Underbalanced_drilling (UBD) (providing an engineer's perspective on the fracking process).

115. See Roddewig & Hughes, *supra* note 110, at 26–44 (providing an excellent analysis of the argument favoring underbalanced drilling over conventional overbalanced drilling).

116. *Id*. at *45–48.

now interested in acquiring for investment or in selling lands that can be used by fracking developers or whose clients may own or possess land affected by fracking. Thanks to the rise of this new industry it is again necessary for real estate attorneys to remember legal concepts they covered in law school or even to learn about them for the first time.

The increased interest in fracking is a result of stories about the profits that have been realized by those who invested in real estate that could be fracked.[117] Many real estate investors have seen their investments multiplied through the advancement and innovation of hydraulic fracturing. However, without real estate, getting in a position to profit from the fracking boom is not possible. Golden and Wiseman characterized real estate as a complementary asset in the hydraulic fracturing business. They point out the relatively less important role of intellectual property rights than one might expect with such an innovative product.[118] Thus, entry into this new aspect of the energy industry requires the acquisition of interests in real estate. The ability to obtain interests in real estate contributed to the development of shale gas industry and enabled early investors who bought interests at low prices to reap the benefits as shale gas fields were developed and started to produce natural gas.[119] Even now, "speculating firms" can obtain an interest in property and treat the property as a complementary asset through the property value increase resulting from demand.[120]

To reap these profits from the sale of natural gas produced by hydraulic fracturing investors need to obtain rights in real estate, which will enable them to initiate the fracking process. To do this, they need attorneys able to advise on how to acquire the necessary rights and, after such rights are acquired, how to protect those rights. This knowledge is equally important for those attorneys whose clients currently own real estate that potentially could be used for fracking. Unfortunately, there is not one set of rules that attorneys representing developers and/or landowners need to follow. This primer will show that this is yet another area of law where the applicable rights and restrictions arise primarily under state law. Good advice in Pennsylvania may not be good advice in Ohio. The difficulty is knowing which rights to acquire, how they

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117. Golden & Wiseman, *supra* note 16, at 1000 (discussing Alan Krupnick, Zhongmin Wang & Yushuang Wang, *Sector Effects of the Shale Gas Revolution in the United States*, Resources for the Future, 36–39 (2013), www.rff.org/RFF/Documents/RFF-DP-13-21.pdf).

118. *Id.*

119. Zhongmin Wang & Alan Krupnick, *A Retrospective Review of Shale Gas Development in the United States: What Led to the Boom?*, RESOURCES FOR THE FUTURE (April 2013), www.rff.org/RFF/documents/RFF-DP-13-12.pdf.

120. *Id.* at 30. "Speculating firms" are those "entrepreneurial natural gas firms" seeking to benefit from the shale play. *Id.* By leasing land at low prices, firms learned that "it is through land acquisition, not innovations per se, that early movers obtained their financial returns for their early investments." *Id.*

are acquired, and how they are protected because these rights are regulated on a state-to-state basis.

Hydraulic fracturing can occur on: "federal, Native American, state, and private lands," which has the geology that indicates that if fracked, will produce natural gas. Geology determines if lands can be fracked. Thus, if the geology is "right," fracking "can occur virtually anywhere, absent an explicit regulation" which prohibits fracking.[121] This primer is designed to provide an introduction to or a revisiting of some of the existing legal concepts that can help practitioners gain an understanding of an evolving area of the law. It can help them to ask the right questions and do research about the law in their jurisdictions so that they can properly advise clients. This primer will focus only on private lands leaving it to others to consider the matter of fracking on federal, Native American and state lands. [122] In addition, since states, not the federal government, establish the laws which establish ownership rights in land and mineral rights therein, this primer will consider only state laws and regulations.[123]

The dramatic and widespread use of fracking to produce natural gas is a recent development. Fracking was not something that was contemplated when the legal doctrines that this primer will discuss were developed. Thus when looking at old deeds, leases and other instruments granting interests in real estate, it is important to ask: do provisions in this instrument prohibit or prevent the use of the land for hydraulic fracturing? This is an important question to ask because until very recently there was no likelihood that anyone involved in real estate transactions would have considered fractured natural gas as a possible benefit of the land, certainly not in the expansive way that the business has developed. Standard clauses, or even definitions, in deeds and contracts for giving a property right may not work for land used for fracking. Mikal C. Watts and Emily C. Jeffcott review the rules that are being developed on even the basic question of whether shale gas

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121. *See* Baker, *supra* note 25, at 256 (pointing to privately owned land, public land owned by local, state and federal government, and Native American land).

122. *See, e.g.,* David L. Callies, *Federal Laws, Regulations, and Programs Affecting Local Land use Decision Making: Hydraulic Fracturing,* SV003 ALI-ABA 409 (August 2013) (describing federal law affecting local decisions about fracking).

123. Alex Ritchie, *Proceedings of the Sixtieth Annual Rocky Mountain Mineral Law Institute*, 60 RMMLF PROC 11, 11.03[2][b][ii], n.215 (2014) (stating "The Supreme Court resorts to state law to define the range of interests that qualify for protection as 'property' under the Fifth and Fourteenth Amendments") (relying on Bd. of Regents of State Colls, v. Roth, 408 U.S. 564, 577 (1972); and Ruckelshaus v. Monsanto Co., 467 U.S. 986, 1011–13 (1984)).

is included in the classification of minerals or even all minerals.[124] It depends.

Some courts have determined that old decisions regarding coal rights do not apply to fracking. For example, the Pennsylvania Supreme Court adopted the principle that reserving "minerals" in a deed does not include the right to frack natural gas, because "the word 'minerals' was not intended by parties" to include natural gas or oil.[125] And because states vary greatly in treatment of mineral rights, States may define "minerals" more broadly than Pennsylvania, states may restrict landowners from fully exercising mineral rights, and states may regulate the severing of the mineral estate from the surface estate. Therefore, state treatment of mineral rights, including fracking, varies greatly.

B. Old Principles Predicated on Production of Coal May No Longer Apply

The common law principle of *Cuius est solum, eius est usque ad coelum et ad inferos*, meaning "[T]o whomsoever the soil belongs, he owns also to the sky and to the depths," is somewhat misleading now, because landowners can sever surface rights from mineral rights.[126] In early coal cases, the Supreme Court shed light on treatment of mineral rights. In *Pennsylvania Coal Co. v. Mahon*,[127] the Supreme Court adopted the principle that "the right to coal consists in the right to mine it," which gives rise to the principle that mineral rights include rights to access the minerals.[128] In *Texaco v. Short*, the Supreme Court upheld state dormant mineral statutes. In that case, Indiana's statute, which allowed mineral rights to revert to the surface owner when the owner of the severed mineral interest fails to use the minerals, was validated.[129] Yet and more relevant for our analysis, the Supreme Court recognized a difference between coal and coalbed methane gas in *Amoco v. Southern Ute*, where an Indian tribe asserted that a reservation of "coal" included the gas.[130] The Court relied on coal's property as a

124. Mikal C. Watts & Emily C. Jeffcott, *Does He Who Owns the "Minerals" Own the Shale Gas? A Guide to Shale Mineral Classification*, 8 TEX. J. OIL & ENERGY L. 27 (2012-2013).

125. Butler v. Charles Powers Estate ex rel. Warren, 620 Pa. 1, 11 (Pa. 2013). *See generally* Laura H. Burney, *Oil, Gas, and Mineral Titles: Resolving Perennial Problems in the Shale Era*, 62 KAN. L. REV. 97, 136, n.228 (2013) (focusing on how wording in old laws and legal documents complicates rule making about fracking).

126. *See* 1 Coke on Littleton § 1(4) (1628).

127. Pennsylvania Coal Co. v. Mahon, 260 U.S. 393 (1922).

128. *Id*. at 414 (citing Commonwealth ex rel. Keator v. Clearview Coal Co., 256 Pa. 328, 330 (1917)).

129. Texaco v. Short, 454 U.S. 516 (1982).

130. Amoco v. Southern Ute, 526 U.S. 865 (1999).

"solid rock substance" when asserting that when "coal" is reserved, the gas is not included in the reservation.[131]

This distinction is relevant and significant when extending legal principles from coal cases to oil and gas cases, because coal is a hard mineral, unlike oil and gas, which are fugacious, and capable of moving from one tract of land to another. Some suggest that oil and gas may even be "liken[ed] . . . to wild animals" and the *ferae naturae* concept.[132] Oil and gas are not solid or "hard" minerals because they are found in fluid states, so, in "some ways" it is "easier to handle than solid minerals."[133] Unlike mining, oil and gas can be accessed when fractures in rock formations "[open] pathways for oil or gas to flow to the well."[134] Thus, the common law for coal may not apply to fracked natural gas and even if it did, the significance of that rule may be reduced for coal because of the reduced amounts being mined today. In the words of Michael Levi, "natural gas has killed new coal-fired power," and the "brewing" natural gas revolution has led to a severe decline in the demand for coal.[135] Shale gas presents possible reconsideration of traditional legal principles applied to subsurface minerals.

1. Splitting Interests in Real Estate to Facilitate Fracking

There are two particular interests to keep track of: surface rights and mineral rights.[136] It is possible for one person to own the surface estate, and another person to own the mineral estate such that there is a "split estate." Where a landowner has a unified estate (also referred to as a full estate or fee simple), the landowner will own the surface estate and the mineral estate, and the "right to explore for and produce [the] minerals" in the mineral estate.[137] Unencumbered fee simple ownership, in property law, gives an owner the right to use, to exclude, and to transfer.[138] A landowner

131. *Id*. at 875.

132. J. Thomas Lane, *Oil and Gas*, WEST VIRGINIA YOUNG LAWYERS SECTION (2000), www.wvyounglawyers.com/wp-content/uploads/2013/10/chapter26.pdf.

133. Keith B. Hall, *Hydraulic Fracturing: If Fractures Cross Property Lines, is There an Actionable Subsurface Trespass?*, 54 NAT. RESOURCES J. 361, 364, n.8 (2014).

134. *Id*. at 365.

135. Michael Levi, *Fracking and the Climate Debate*, DEMOCRACY (2015), http://democracyjournal.org/magazine/37/fracking-and-the-climate-debate/.

136. *See generally* Christopher S. Kulander, *Common Law Aspects of Shale Oil and Gas Development*, 49 IDAHO L. REV. 367, 369–77 (2013) (providing basic property law analysis).

137. Keith B. Hall, *Hydraulic Fracturing: If Fractures Cross Property Lines, is There an Actionable Subsurface Trespass?*, 54 NAT. RESOURCES J. 361, 365, n.20 (2014); *see also* John Dernbach, *Can Shale Gas Help Accelerate the Transition to Sustainability?*, ENVTL. MAG. (Jan. 2015) (explaining the basic property rules).

138. Clifford A. Lipscomb, Yongsheng Wang & Sarah J. Kilpatrick,

with a unified estate may be able to sever the mineral estate from the surface estate. Landowners may do this by lease, by sale, or by contracts that offer limited rights (like exploration or limited production). And, those rights may be impaired by way of contract or agreement.[139]

While the *sale* of subsurface rights creates a "split estate," *leasing* subsurface rights only creates an encumbrance, a leasehold interest, on the overall property.[140] These encumbrances and sales both tend to impact the value of property. Generally, the more rights a landowner has, the greater the property value.[141] Changes to subsurface ownership "have a direct and measurable impact on both *fee simple* values as well as the value of the surface rights taken alone."[142]

Oil and gas leases provide a lessee with the opportunity to drill on a property for a primary term, which is a set number of years, and the option for a secondary term, which arises if the property is producing minerals. In exchange, a lessor will receive royalties from the resulting mineral production. A mineral lease is merely an interest in the property's mineral estate, and the rights required to exercise that interest.[143]

A lease requires at least an identification of the parties, a granting clause, a description of premises to be leased, term of the lease, and consideration.[144] Consideration usually includes payment by royalties, delay payment clauses, regular payments by schedule, and bonuses.[145] Lessees will negotiate to maximize profit and minimize costs, while lessors seek large royalty fractions, high bonuses, and short primary terms for agreements.[146] After a lessor verifies unencumbered ownership of oil and gas, lessors try to maximize the value of their subsurface minerals. Maximized value

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Unconventional Shale Gas Development and Real Estate Valuation Issues, THE REVIEW OF REGIONAL STUDIES 42(2): 161, 164 (2012).

139. *Id*.

140. *Id*. at 163–64.

141. *Id*.

142. *Id*.

143. *See generally* Jared B. Fish, *The Rise of Hydraulic Fracturing: A Behavioral Analysis of Landowner Decision-Making*, 19 BUFF. ENVTL. L. J. 219 (2011-2012) (arguing that asymmetric information encourages landowners to lease shale minerals even though there are hazards).

144. Andrew Graham, *The Basics of the Oil and Gas Lease*, Steptoe & Johnson, http://anr.ext.wvu.edu/r/download/92955 (last accessed Dec. 31, 2015); *See also* Ross H. Pifer, *What a Short, Strange Trip It's Been: Moving Forward After Five Years of Marcellus Shale Development*, 72 U. PITT. L. REV. 615 (2011) (reviewing litigation arising from fracking leases in Marcellus region).

145. Patrick H. Martin & Bruce M. Kramer, WILLIAMS & MEYERS, OIL AND GAS LAW, § 3-6 (LexisNexis Matthew Bender 2015).

146. John B. McFarland, *Checklist for Negotiating an Oil and Gas Lease*, GRAVES, DOUGHERTY, HEARON & MOODY, P.C., www.gdhm.com /images/pdf/jbm-ogleasechecklist.pdf.

is accomplished through greater royalties, larger bonuses, and shorter agreement terms.[147]

Delay rental payment clauses are problematic in oil and gas leases. Delay rental payments are owed when a lessee seeks to delay the start of drilling. Lessor is concerned because delays may extend so long that they impede prompt development of mineral rights and associated economic benefits to lessor.[148] Although the lessee compensates the lessor for the postponed drilling in the form of delay rental payments, the lessor may lose the opportunity to make alternative agreements where a substitute lessee is prepared to begin drilling and generating revenue much more quickly. New York allows delay rental payments to extend an oil and gas lease, while Ohio "provides that a lease terminates at the end of the primary term when no well is producing, even if delay rentals continue."[149]

In response to possible delays in starting to drill, lessors include termination clauses in lease agreements for situations when a well fails to produce so that the lessee can protect his ability to enter alternate agreements and ensure profits from the subsurface minerals. Parties involved in real estate transactions for mineral rights should also be aware of force majeure clauses, pooling and unitization clauses, and assignment clauses that may enable or restrict transfers of rights.[150]

John McFarland suggests a number of variables that impact valuation in a lease.[151] First, if production in the area has already begun, lease terms are likely to reflect that industry's success. Competition for leases also drives up bonuses and royalties. A lessor with more property is likely to get better lease terms. A lessor willing to take risks may be able to negotiate terms. Parties should be aware of whether neighboring tracts are engaged in drilling. Lessors should also realize that property value for the fee simple might drop significantly as a result of oil and gas development on the property or on surrounding properties.[152] The industry practice for royalties is at a fraction of production, so the lessor gets a benefit from successful production.[153]

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147. *Id*.

148. Aaron Richardson, *Hite v. Falcon Partners: A Model Rule for Marcellus and Utica Shale States Precluding the Use of Delay Rental Payments to Extend the Primary Term in an Oil and Gas Lease*, 46 AKRON L. REV. 1133 (2013).

149. *Id*.

150. *See infra* Part.IV (where the implications of fracking for real estate, real estate law and real estate practice are developed).

151. *Id*.

152. Clifford A. Lipscomb, Yongsheng Wang & Sarah J. Kilpatrick, *Unconventional Shale Gas Development and Real Estate Valuation Issues*, THE REVIEW OF REGIONAL STUDIES 42(2): 161-175 (2012).

153. Andrew Graham, *The Basics of the Oil and Gas Lease*, STEPTOE & JOHNSON (last accessed Dec. 31, 2015), http://anr.ext.wvu.edu/r/download/92955.

In a third option, a landowner may offer to a party "limited rights," giving the party, for example, an opportunity to enter the property, explore, conduct tests, and assess mineral viability without the risk of long-term payments to a lessor. As part of such transactions, the grantee of such limited rights may also acquire an option to buy subsurface rights or to lease them if the investigation shows likelihood of success. Both oil and gas leases and agreements for limited rights to subsurface minerals are bound by principles of contract law.[154]

While sales are "forever" transactions (except when a state has a dormant mineral act),[155] leases and agreements for limited rights may be much shorter. But, leases and agreements may actually run for a very long time. In *T.W. Phillips Gas & Oil Co. v. Jedlicka*, the court upheld a lease for rights to drilling and operating for oil and gas for two years, to be extended "as long… as oil or gas is produced in paying quantities, or operations for oil or gas are being conducted thereon," that continued around 80 years.[156] The court identified that the habendum clause of the lease, specifically the words "in paying quantities," is "regarded as for the benefit of the lessee, as a lessee would not want to be obligated to pay rent for premises which have ceased to be productive, or for which the operating expenses exceed the income."[157]

2. Need for Certainty of Title

Certainty of ownership of the fee simple/unified estate and, if severed, the ownership of the resulting mineral and surface rights is critical to advise real estate clients. The principle of *nemo dat quod non habet*, from property and contract law, tells us that landowners cannot divest rights that they do not have.[158] There are two principle reasons why a landowner would not have full ownership of the property. First, the subsurface (mineral) estate is federally owned. Thus, in few states, like Montana, the subsurface and mineral estate rights are federally owned, and a landowner only has private rights in the surface.[159] Approximately 11.7 million

154. T.W. Phillips Gas & Oil Co. v. Jedlicka, 615 Pa. 199, 208 (2012).

155. *See* discussion, *infra*, notes 171 through 190, on dormant mineral legislation.

156. *T.W. Phillips*, 615 Pa. at 204.

157. *Id*. at 210.

158. BLACK'S LAW DICTIONARY 1037 (6th ed. 1991) ("Nemo dat qui non habet" means "He who hath not cannot give").

159. Stock Raising Homestead Act, 43 U.S.C. §299(a) (2000); *see also* Do you really OWN the minerals under your land?, MONTANA STATE OFFICE BLM, www.blm.gov/style/medialib/blm/mt/blm_programs/mining.Par.72349.File.dat/minerals.pdf (last accessed Feb. 8, 2016) (addressing the creation of the Stock Raising Homestead Act as a way for the government to hold an interest in minerals for fueling the community while the landowner could use the surface for ranching).

acres of private land in the Rocky Mountain West are "split estate."[160] Additionally, in these states, the government is also entitled to use the surface as is "reasonably necessary" to develop subsurface assets.[161] In such situations, landowners or those seeking to acquire ownership in the land and their attorneys should contact the local Bureau of Land Management office to assess their rights.

The second reason why a landowner would not have a unified estate is that a previous fee simple holder split the estate and those subsurface rights already have been divested, or a previous fee simple holder retained the subsurface estate for himself when transferring title to a grantee.

Yet, title searches and title insurance may not provide needed answers to the questions of who owns the land and which type of ownership rights different owners have. A buyer may not know, at the time of purchase, that their purchase does not include the subsurface rights. While buyers should conduct title searches as part of due diligence, they may not know what they should be looking for or how to discover interests in subsurface property because title searches will not reveal unrecorded oil and gas leases. Buyers should fully investigate title through whatever means possible. In the American system, characterized by limited reliance on recordation, rather than title registration, if a buyer has constructive notice of a transfer, but fails to properly investigate the full extent of the transfer, the buyer is bound by the terms of the transfer.[162] Generally, though, lack of recording makes a contractual obligation or a lease of mineral rights unenforceable against a good faith purchaser but this assumes that the purchaser had *no* constructive notice.[163]

Because it is not always obvious when there is a split estate, mineral rights owners should also take affirmative steps to protect their interests by recordation. For example, Ohio and North Carolina both mandate that oil or gas leases constitute title

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160. *Do you really OWN the minerals under your land?,* MONTANA STATE OFFICE BLM www.blm.gov/style/medialib/blm/mt/blm_programs/mining.Par.72349.File.dat/minerals.pdf (last accessed Feb. 8, 2016).

161. *Oil & Gas: Caution*, NORTHERN PLAINS RESOURCE COUNCIL (Winter 2014), www.northernplains.org/wp-content/uploads/2014/02/NEWBeartooth FrontPostalPatronMailer_2014-2-13_-FNL.pdf.

162. Guerin v. Sunburst Oil & Gas Co., 68 Mont. 365, 368 (1923) (holding that a buyer had constructive notice of an unrecorded lease because the unrecorded lease was referenced in a later-recorded option such that the buyer was charged with all references made in any document in her chain of title and the buyer had a duty to inquire about rights under the unrecorded lease); *see also* Andrew Barksdale, *Fracking: Many in NC don't control rights to gas under their land*, WRAL NEWS, www.wral.com/fracking-many-in-nc-don-t-control-rights-to-gas-under-their-land/13660362/ (June 6, 2014) (describing how mineral rights, split estates and forced pooling are new concepts to owners in Sandhills of North Carolina).

163. *Id*.

transactions that must be recorded for a mineral rights owner to preserve rights in the subsurface.[164] Buyers should search recording offices for full chains of title.[165] However, recording does not usually require recordation of the full lease. Often a memorandum lease or part of the lease, which only provides limited information about the transaction, is legally sufficient.[166] In these situations, buyers must seek affirmative information such as the complete document for review as well as representations from their sellers.

Finally, and very significantly, mineral rights are typically excluded from title insurance.[167] This means that title insurers are less inclined to fully investigate titles to mineral interests, leaving interested parties to search for information on their own, which is costly and time consuming.[168] Landowners should also become aware of any royalties paid from oil and gas leases. Few courts have held that royalties from oil and gas leases are "real property" such that a conveyance of the real estate is a conveyance of the royalty too, despite the lease being unrecorded.[169]

3. Dormant Mineral Legislation and Reunified Estates function to reduce the number of owners and to keep title marketable.[170]

Some states have enacted "dormant mineral" legislation to ensure that the "dormant severed mineral ownership pattern" that

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164. Chesapeake Exploration, L.L.C. v. Buell, 2015 Ohio LEXIS 2971 (2015); *Oil & Gas Leases in North Carolina: Summary of Landowner and Public Protections in the Law*, NORTH CAROLINA DEPARTMENT OF JUSTICE, P.L. 2012 and S.L. 2011-276 (Dec. 20, 2012), www.ncrec.gov/pdfs/OilGasSummaryofLaw.pdf.

165. Joe Wilson, *Title Searches: Proof of mineral rights ownership*, GREENE COUNTY MESSENGER (Nov. 28, 2014), www.heraldstandard.com/gcm/opinion/guest_columnists/title-searches-proof-of-mineral-rights-ownership/article_adc5b61b-1d11-5c73-b639-a8d33f07a525.html.

166. This means that good faith and diligent buyers may be unable to discover the extent of subsurface rights that are leased to another. *See* Judon Fambrough, *Hints on Negotiating an Oil & Gas Lease*, TEXAS A & M UNIVERSITY REAL ESTATE CENTER (July 2015), https://assets.recenter.tamu.edu/documents/articles/229.pdf.

167. Jane Easter Bahls, *Guide to Home Ownership – Chapter Three: Defending Your Title*, AMERICAN BAR ASSOCIATION (1999), www.americanbar.org/content/dam/aba/migrated/publiced/practical/books/home_ownership/chapter_3.authcheckdam.pdf.

168. Matt Moberg, *The Mystery of Mineral Rights: A Lesson for Lenders*, Porter Wright Banking & Fin Law Rep. (March 15, 2013), www.bankingandfinancelawreport.com/2013/03/articles/real-estate/the-mystery-of-mineral-rights-a-lesson-for-lenders/.

169. Martin J. McMahon, *Oil and Gas Royalty as Real or Personal Property*, 56 A.L.R.4TH 539, *39b (discussing Mark v. Bradford, 23 N.W.2d 201 (1946)).

170. Dormant Mineral Legislation mirrors Marketable Title Acts and the Rule Against Perpetuities in trying to limit the number and kind of interests in real estate; the goal is to have most land owned in fee simple absolute to meet the public policy goals of easy buying and selling.

is "an incurable title disease" is resolved.[171] The "incurable title disease" arises when an estate is split, but the subsurface estate owner abandons the property or becomes absent. The legislation is designed to reunify the estate. A recent count shows dormant mineral acts in about 21 states including Illinois, Ohio, Pennsylvania, and North Dakota.[172]

The National Conference of Commissioners on Uniform State Laws proposed model legislation returning mineral rights to a surface owner if, after twenty years, the mineral rights owner has failed to exploit the mineral rights and has received notice of nonuse.[173] State legislations vary, but typically, failure to use mineral rights in the requisite term (commonly twenty years) will result in the rights being deemed "abandoned." The mineral rights holder can prevent abandonment through a "savings" event, like making a recorded transfer of rights, actual production of subsurface rights, or filing of a claim of interest.[174] In Ohio, a recent case ruled that a "recorded oil and gas lease" constitutes a savings event because a lease has an "effect on ownership, possession, and custody" of property, thereby resolving the incurable title disease.[175] Further, the court ruled that the unrecorded expiration of a recorded lease does not restart the dormancy clock.[176] The expiration must be recorded or filed to constitute a savings event

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171. Patrick J. Garver & Patricia J. Winmill, *Medicine for Ailing Mineral Titles: An Assessment of the Impact of Adverse Possession, Statutes of Limitation, and Dormant Mineral Acts*, 29 ROCKY MT. MIN. L. INST. 7-1 (1983); *see also* Michigan Act 42 of 1963: Termination of Oil and Gas Interests on Land (explaining how basic property concepts like adverse possession and Dormant Mineral Acts affect ownership of mineral rights).

172. ROBERT J. AALBERTS, REAL ESTATE LAW (Cengage Learning, 9th ed. 2014). *See generally* Gregory D. Russell and Lauren N. Fromme, *Dormant Mineral Acts: Addressing Severed Mineral Interests in a Fractional World*, 33 ENERGY & MIN. L. INST. 8, 8.03 (2012), www.emlf.org/clientuploads /directory/whitepaper/russell_fromme_12.pdf (for a greater discussion of types of dormant mineral legislation).

173. *Dormant Mineral Interests Act, Model Summary*, UNIFORM LAW COMMISSION (1986), www.uniformlaws.org/shared/docs/dormant%20mineral% 20interests/udmia_final_86.pdf (the Uniform Dormant Mineral Interests Act was converted to the Model Dormant Mineral Interests Act). The Act was adopted, in its entirety, by Connecticut, and in part by California, Georgia, Illinois, Indiana, Kansas, Louisiana, Michigan, Minnesota, Nebraska, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Virginia, Washington, and West Virginia. *See also* Laura Lindley, *Proceedings of the Rocky Mountain Mineral Law Foundation Annual Institute – 2014 Jan (Advanced Mineral Title Examination – Oil & Gas and Mining)*, 2014-1 RMMLF PROC 2 (2015).

174. Gregory D. Russell and Lauren N. Fromme, *Dormant Mineral Acts: Addressing Severed Mineral Interests in a Fractional World*, 33 ENERGY & MIN. L. INST. 8, 8.03 (2012), www.emlf.org/clientuploads/directory/whitepaper/ russell_fromme_12.pdf.

175. Chesapeake Exploration, L.L.C. v. Buell, 144 Ohio St. 3d 490 (2015); Ohio Rev. Code Ann. § 5301.56 (2016).

176. *Id*.

such that there is "record notice on the chain of title that the mineral rights have reverted."[177] Another savings event, the transfer of mineral rights, will restart the clock and give the bona fide mineral rights purchaser the specified term to exercise the newly received mineral rights.[178] It should be noted that this only applies to transfers of mineral rights; the transfer of surface estate title does not constitute a "savings" event.[179]

Generally where states have taken legislative action to deal with "abandoned" or dormant minerals, three common options are: (1) mineral rights automatically revert to the surface owner,[180] (2) mineral rights revert to the surface owner after he gives notice to the mineral rights owner,[181] or (3) the state creates a trust to hold mineral rights for the benefit of the mineral rights owner.[182] The states intend to cure situations where "owners… are unaware of their rights [or] too remote to care" by imposing dormant mineral acts that either seek to identify unknown or missing owners, or declaring the abandonment of mineral interests after a certain period of time.[183]

Dormant mineral legislation has been constitutionally challenged as "takings" of private property without notice and compensation, but withstood judicial scrutiny at the United States Supreme Court in *Texaco, Inc. v. Short*.[184] In that case, an Indiana statute provided that a severed mineral interest that goes unused for 20 years will automatically lapse and revert to the current surface owner unless the mineral owner acted to protect its interest.[185] The Supreme Court affirmed the Indiana Supreme Court, which upheld the statute because an unused mineral interest is "mischievous and contrary to the economic interests and welfare of the public… creates uncertainties in title and constitutes an impediment to the development of the mineral interests."[186]

Some states have adopted marketable title statutes, which generally recognize dormant mineral legislation as an exception to the claims cut off by a marketable title.[187] Marketable title statutes

177. *Id*.

178. Ohio Rev. Code Ann. § 5301.56; Michigan Dormant Minerals Act, MCL § 554.291 (2016).

179. *Id*.

180. Mich. Comp. Laws Ann. § 554.291, Ind. Code §§ 32-23-10-1 through 8 (2016).

181. Ohio Rev. Code Ann. § 5301.56; Tenn. Code Ann. § 66-5-108 (2015).

182. Pennsylvania's act embodies the three options. 58 Pa. Cons. Stat. § 701.1 et seq., the "Dormant Oil and Gas Act," (effective July 11, 2006).

183. *Dormant Minerals Acts and the Marcellus and Utica Shale Plays*, JONES DAY (April 2013), www.jonesday.com/dormant_minerals_acts/.

184. Texaco, Inc. v. Short, 454 U.S. 516 (1982).

185. *Id*.

186. *Id*. at 789 (citing Texaco v. Short, 406 N.E.2d at 627).

187. *Uniform Marketable Title Act*, NATIONAL CONFERENCE OF COMMISSIONERS ON UNIFORM STATE LAWS (1990), www.uniformlaws.org /shared/docs/marketable%20title/umta_final_90.pdf.

typically state that if an owner has a clear chain of title for a specified period, ranging from 20 to 40 years, then the title is clear of all claims or defects that were recorded before the owner's root of title.[188] The Uniform Marketable Title Act does not make an exception for mineral rights, but provides an optional provision "for states which choose to exclude mineral rights from the interests cut off by the Act," adding that "states which wish to give special treatment to mineral interests should consider adopting the Uniform Dormant Mineral Interests Act."[189]

C. Limitations on and Consequences of Severing the Mineral Estate

A landowner's ability to sever the mineral estate may be impaired if he has a mortgage on the property. This restriction arises because when land is mortgaged, "banks ultimately hold the risk associated with the mortgage."[190] Because banks and lenders do not want to take on the risks associated with hydraulic fracturing, contractual provisions in the mortgage documents may impair a landowner's ability to sever a mineral estate.[191] In contrast, this is not the case in Ohio, where oil and gas leases that are recorded after a mortgage have a "super priority" over mortgages![192] The "super priority" will preserve a lease from being terminated or extinguished in the case of foreclosure, as long as the lease was recorded after the mortgage and the lease is not in default. Therefore, a mortgage lender in Ohio must "take special care to protect its collateral because a foreclosure of a prior mortgage will *not* divest a subsequent oil and gas lease."[193] Oklahoma has created unique legislation for protecting the owners of oil and gas rights giving oil and gas interest owners a superior priority over other lienholders and secured creditors.[194] While Ohio gives priority to the oil and gas lease, Oklahoma gives a priority to mineral rights owners in produced oil and gas.[195] This puts mineral rights owners in a position to ensure payment, but it is important

188. *Id*.

189. *Id*.

190. Baker, *supra* note 25.

191. *Id*.

192. Ohio Rev. Code § 1509.31(D) (2016).

193. Steven M. Regan, *Client Alert: Oil and Gas Leasing and Development: A Real Estate Lending Perspective*, REED SMITH (Dec. 31, 2012), www.reedsmith.com/en-US/Oil-and-Gas-Leasing-and-Development-A-Real-Estate-Lending-Perspective-12-31-2012/.

194. Oil and Gas Owners' Lien Act of 2010, 52 Okla. Stat. Ann. tit. 52, § 549.1 cmt. 1 (2010).

195. Sahar Jooshani, *There's a New Act in Town: How the Oklahoma Oil and Gas Owners' Lien Act of 2010 Strengthens the Position of Oklahoma Interest Owners*, 63 OKLA. L. REV. 133 (2012), www.law.ou.edu/sites/default/files/files/FACULTY/04%20jooshani%20note%20blu2.pdf.

to note that, in Oklahoma, interest owners will *not* trump mortgage lenders.[196]

Additionally, there may be consequences when the fee simple estate is split. A landowner's rights may be impaired or restricted by the severing of the mineral estate. First, some states impose severance taxes. Although there is no federal income tax on severing, states impose severance taxes "based on the monetary value of the oil or gas produced" or on the "volume of production." Oklahoma imposes a 2% tax rate on the gross value of oil and gas production within the first 36 months of production, and a 7% tax rate for any production thereafter.[197] On the other hand, Pennsylvania currently has no tax and continues to debate the need for a severance tax after realizing that other states generate significant revenue from severance taxes.[198]

Second, the mineral estate often becomes the dominant estate, so the landowner's surface rights may be subverted. The individual holding the mineral interest may have a right superior to the surface right, because the owner of the mineral rights should be able to access the minerals located sub-surface. When a landowner divests the subsurface rights by sale or lease, the landowner is usually offering an implied, or even an express, easement on the surface of the property.[199] Because "the right to coal consists in the right to mine it," most states follow the principle that a mineral rights owner is entitled to use the surface property to the extent that it is "reasonably necessary" for the owner to access the mineral beneath.[200]

However, this principle has been challenged with the rise of horizontal drilling (an important element of hydraulic fracturing). In conventional vertical drilling a mineral interest owner needed only the "surface location directly above that targeted location."[201] A well was placed on the property surface directly above minerals because that was *only* way to access minerals. In vertical drilling,

196. Oil and Gas Owners' Lien Act of 2010, 52 Okla. Stat. tit. 52, §§ 549.1-12 (2010).

197. 68 Okla. Stat. § 1001 (2014).

198. Jon Hurdle & Reid Frazier, *Feds show Pennsylvania gas revenues sharply lower than other leading producers*, NPR STATE IMPACT PENNSYLVANIA (Aug. 21, 2015 5:17 PM), https://stateimpact.npr.org/pennsylvania/2015/08/21/feds-show-pennsylvania-gas-revenues-sharply-lower-than-other-leading-producers/. For a greater discussion and a state survey of severance taxes, see *Oil & Gas Production Taxes*, LexisNexis 50-State Surveys, Statutes & Regulations (Nov. 2015) (providing a survey of all 50 states).

199. HOWARD R. WILLIAMS & CHARLES J. MEYERS, 1-2 OIL AND GAS LAW § 218 (2015).

200. *Id*.

201. Bret Wells, *The Dominant Mineral Estate in the Horizontal Well Context: Time to Extend Moser Horizontally*, 53 HOUS. L. REV. 193 (2015).

the surface estate became subservient to the mineral estate because of an "implied easement" to the mineral rights owner.[202]

With horizontal drilling, a horizontal well often is drilled more than a mile away from a horizontal drain hole, meaning that a single well can "produce from multiple different production points including *off-tract* production points."[203] Horizontal drilling compels drilling from a "remote location." Thus, restrictions on a mineral rights owner's ability to use the surface do not mean that the owner is denied the ability to produce oil and gas.[204] Oil and gas can be produced from surrounding tracts through the use of a single well on a single tract. Bret Wells identifies several issues with traditional property principles that arise with horizontal drilling.[205] For example, a mineral rights owner has an exclusive right to drill a vertical well on a tract; but, in horizontal drilling, when the well is placed on a nonproducing tract, the mineral rights owner does not receive an implied easement and cannot drill a horizontal well without the surface owner's consent.[206]

D. Consequences of Retaining / Withholding Mineral Interests

A landowner may choose not to sell or lease rights to minerals. Landowners are entitled to traditional property causes of action like trespass, ejectment, compulsory partition, and compensation for damages. Nevertheless, states have prioritized access to minerals to such an extent that owners may no longer have those total property rights.[207] Courts commonly express this public policy priority by demonstrating distaste for "waste" of minerals, even expressing that "the public has a sufficient interest in the preservation of oil and gas from waste to justify legislation upon this subject."[208]

1. Concurrent ownership of unified estates issues to consider

When a landowner jointly owns a unified estate with another, one landowner may want to remove minerals, while the other does not want to allow any subsurface development. Where the owners

202. *Id*. at 199.
203. *Id*.
204. *Id*. at 213.
205. *Id*.
206. *Id*. at 219.
207. Keith B. Hall, *Hydraulic Fracturing: If Fractures Cross Property Lines, is There an Actionable Subsurface Trespass?*, 54 NAT. RESOURCES J. 361, 376 (2014).
208. Hague v. Wheeler, 157 Pa. 324, 340 (Pa. 1893).

are joint tenants or tenants in common, each of the co-owners has an "undivided right to possess the entire estate."[209]

This means in a majority of jurisdictions, "each co-owner could develop the minerals individually."[210] As co-owners, both are "owners of the substance of the estate" meaning that each has the right to "make such reasonable use of the common property as is necessary to enjoy the benefit and value of such ownership."[211] Each co-owner has the "right to develop and operate the common property for oil and gas" despite the non-consent of other co-owner(s).[212] The majority rule for development of minerals by concurrent owners follows from the possibility of mineral drainage by a third party if each co-owner needed to consent to development of oil.[213] The time spent getting consent might mean that the value of the hydrocarbons would be lost to all of the co-owners. Thus, the majority rule allows each co-owner to develop and to sell oil and gas without risk of a claim of "conversion" by any other co-owner.[214] However, this principle is limited in two ways: first, a developing co-owner cannot exclude or oust another co-owner from also developing on the land; and, second, "the developing co-owner must account to other co-owners and bears the financial risk" of development.[215] While co-owners are equally entitled to share in the property, when one develops without the consent or participation of another, the risk and costs of developing the property must be allocated accordingly.

Non-consenting co-owners are not held liable for financial risks (costs) of developing, or failing to develop, minerals unless they benefit from a mining partnership in which there is a "community of losses as well as profits."[216] Non-consenting co-owners are entitled to "the basis of the value of the minerals taken less the necessary and reasonable cost of producing and marketing the same."[217] Non-consenting co-owners may seek an accounting to determine their "proportionate shares of proceeds."[218] When there is no partnership, a non-consenting co-owner is not required to contribute to expenses. The two general exceptions to this rule are

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209. Marla Mansfield, *A Tale of Two Owners: Real Property Co-Ownership and Mineral Developments*, 43 ROCKY MTN. MIN. L. INST. 20-1, 16 (1997), http://digitalcommons.law.utulsa.edu/cgi/viewcontent.cgi?article=1224&context=fac_pub.

210. *Id*. at 20-19.

211. *Id*. (citing Prairie Oil & Gas Co. v. Allen, 2 F.2d 566 (8th Cir. 1924)).

212. *Id*.

213. *Id*. at 20-20.

214. *Id*.

215. *Id*. at 20-20.

216. *Id*.

217. Mansfield, *supra* note 209.

218. *Id*. Accounting means "an act or a system of making up or settling accounts, consisting of a statement of account with debits and credits arising from relationship of parties." BLACK'S LAW DICTIONARY 19 (6th ed. 1991); *see, e.g.*, State ex reI. King v. Harvey, 214 So. 2d 817, 819 (Miss. 1968).

for: (1) costs of improvements "which were necessary and enhanced the value of the common property" and (2) when property development, like fracturing, results in a profit from which expenses are deducted before the non-consenting co-owner receives what his allotted amount.[219]

2. Impact of the Rule of Capture on choice not to develop

In addition, sometimes, landowners who have not chosen to develop their mineral rights or to transfer those rights to others may be barred from causes of action for subsurface trespass because of the "rule of capture." The "deceptively simple" rule of capture, as Bruce Kramer puts it, comes from the idea that "the owner of a tract of land acquires title to the oil and gas which he produces from wells drilled thereon, though it may be proved that part of such oil or gas migrated from adjoining lands."[220] In *Coastal Oil & Gas Corp. v. Garza Energy Trust*, the Supreme Court of Texas held that a landowner could not claim subsurface trespass unless he proved actual injury because the "rule of capture gives a mineral rights owner title to the oil and gas produced from a lawful well bottomed on the property, *even if* the oil and gas flowed to the well from beneath another owner's tract."[221] The court further added that the "maxim -- *cujus est solum ejus est usque ad coelum et ad inferos* – 'has no place in the modern world.'"[222] The court clarified that "actionable trespass requires injury, and [Plaintiff's] only claim of injury – that [Defendant's] fracing [sic] operation made it possible for gas to flow from beneath Share 13 to the Share 12 wells -- is precluded by the rule of capture."[223]

Nevertheless, the rule of capture does not give unlimited authority to drain minerals from another's land. Some of the regulations in place to preserve landowner rights include "well spacing, proration or allowable regulation, and pooling and unitization."[224] The rule of capture will not absolve liability for trespass in situations where: "(1) a person commits a subsurface trespass by engaging in slant drilling that results in the well bottoming beneath his neighbor's property; (2) a person negligently or intentionally wastes oil or gas or he intentionally interferes with the ability of someone else to produce oil or gas from a formation,

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219. Knight v. Mitchell, 97 Ill. App. 2d 178, 182 (5th Dist. 1968).

220. Bruce Kramer & Owen Anderson, *The Rule of Capture – An Oil and Gas Perspective*, 35 ENVTL. L. 899, 900, n.2 (2005) (citing Robert E. Hardwicke, *The Rule of Capture and its Implications as Applied to Oil and Gas*, 13 TEX. L. REV. 391, 393 (1935)).

221. Coastal Oil & Gas Corp. v. Garza Energy Trust, 268 S.W.3d 1, 12–13 (Tex. 2008) (emphasis added).

222. *Id*. (citing United States v. Causby, 328 U.S. 256, 260–61 (1946)).

223. *Id*. at 13.

224. Bruce Kramer & Owen Anderson, *The Rule of Capture – An Oil and Gas Perspective*, 35 ENVTL. L. 899, 904 (2005).

without benefit to himself; or (3) the rule has been superseded by conservation statutes and regulations."[225] Inapplicability of the rule of capture for these situations is explained by the Texas Supreme Court in *Elliff v. Texon Drilling Co.*, stating that "negligent waste and destruction of petitioners' gas… was neither a legitimate drainage of the minerals from beneath their lands nor a lawful or reasonable appropriation of them."[226] In Texas, the rule of capture bars recovery on a trespass claim when the defendant "simply drained gas from neighboring property" but damages may be available where there is "substantial drainage" and where "subsurface trespass results in 'actual injury' to neighboring property."[227]

3. Correlative Rights Doctrine

Additionally, the "correlative rights" doctrine may reduce a landowner's ability to bring a cause of action against another. The concept of "correlative rights" refers to the doctrine that landowners have rights to use "their land with respect to rights of adjoining… landowners in water or oil."[228] In the mineral context, correlative rights mean "when multiple tracts of land overlie a common reservoir of oil or gas, the owners of those separate tracts each have a right to produce oil or gas from the reservoir through operations on their own properties, but that *each* owner's exercise of his rights can affect the common reservoir and thereby affect the ability of the other owners' to produce oil or gas from the reservoir."[229] Owners are granted equal opportunities to develop land. "Accordingly, each owner has certain duties that relate to the reservoir, and the other owners have rights that arise from that duty."[230]

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225. Keith B. Hall, *Hydraulic Fracturing: If Fractures Cross Property Lines, is There an Actionable Subsurface Trespass?*, 54 NAT. RESOURCES J. 361, 367 (2014).

226. Elliff v. Texon Drilling Co., 210 S.W.2d 558, 563 (1948).

227. Jean L. Bertrand & Lindsey N. Berg, *MCLE Self-Study Article: Fracking: Expected Lawsuits*, Schiff Hardin (2013), www.schiffhardin.com/Templates/media/files/publications/PDF/Fracking-Expected-Lawsuits---California-Real-Property-and-Environmental-Law-News---J--Bertrand-and-L--Berg---Fall-2013.pdf.

228. BLACK'S LAW DICTIONARY 344 (6th ed. 1991), citing Alameda County Water District v. Niles Sand & Gravel Co. Inc., 37 Cal. App. 3d 924 (1st Dist. 1974).

229. Keith B. Hall, *Hydraulic Fracturing: If Fractures Cross Property Lines, is There an Actionable Subsurface Trespass?*, 54 NAT. RESOURCES J. 361, 369 (2014).

230. *Id.*; *see also* Bruce Kramer and Owen Anderson, *The Rule of Capture – An Oil and Gas Perspective*, 35 ENVTL. L. 899, 930 (2005) (suggesting that a landowner must look to state case law to understand what rights are available if another captures oil and gas from the landowner's property).

4. Forced pooling

In thirty-nine states landowners are also restricted in their ability to avoid gas or oil extraction beneath their property by state "forced pooling" regulations.[231] Forced pooling, also called unitization, modifies rules relating to trespass because landowners who refuse to permit drilling on their property may be required to comply with unitization orders.[232] Forced pooling "compel[s] holdout landowners to join gas-leasing agreements when enough of their neighbors have already signed on."[233] One example of the law in action: in Pennsylvania, the forced pooling law allowed Hilcorp, a drilling company, to drill even when landowners refused to sign drilling leases.[234] "The specific provisions of the laws vary from state to state, but drillers are generally allowed to extract minerals from a large area or 'pool'--in most states a minimum of 640 acres--if leases have been negotiated for a certain percentage of that land."[235]

While some view forced pooling as harmful to a landowner's rights from the perspective of the rule of capture, others see forced pooling as a remedy for a landowner whose minerals are being "drain[ed] away" by a neighboring well.[236] Tim Carr, a geologist and professor at West Virginia University, added that "By not signing a lease, 'you're not going to stop a well being drilled. You're going to stop yourself from getting money for it."[237] Additionally, Michigan follows the rule that even if neighbors receive royalties, a non-consenting landowner (one who has not granted a lease for mineral production), will only receive "fair compensation" for minerals.[238] Thus, a landowner presented with an oil or gas lease should consider whether surrounding neighbors received the same lease. If yes, there is a possibility that the landowner's minerals will be

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231. *See generally* Benjamin Holliday, *New Oil and Old Laws: Problems in Allocation of Production to Owners of Non-Participating Royalty Interests in the Era of Horizontal Drilling*, 44 ST. MARY'S L. J. 771 (2013) (providing a comprehensive history of the Texas case and predictions of future with fracking).

232. Keith B. Hall, *Hydraulic Fracturing: If Fractures Cross Property Lines, is There an Actionable Subsurface Trespass?*, 54 NAT. RESOURCES J. 361, 383 (2014).

233. *Your Lawn Need Fracking?*, NEWSWEEK GLOBAL Vol. 162, Issue 24 (June 20, 2014).

234. *Id*.

235. Marie C. Baca, *Forced Pooling: When Landowners Can't Say No to Drilling*, PROPUBLICA (May 18, 2011). State survey available: Marie C. Baca, *State Laws Can Compel Landowners to Accept Gas and Oil Drilling*, PROPUBLICA (May 19, 2011).

236. *Id*. at 395 (discussing *Coastal Oil and Gas Corp. v. Garza Energy Trust*, 268 S.W.3d 1, 4 (Tex. 2008)).

237. *Your Lawn Need Fracking?*, NEWSWEEK GLOBAL Vol. 162, Issue 24.

238. Curtis Talley, Jr., *Compulsory Pooling and the Landowner That Has Not Signed an Oil and Gas Lease*, MICHIGAN STATE UNIVERSITY EXTENSION (March 15, 2013).

taken under forced pooling law, but the landowner will receive only a fraction of the profits. Forced pooling regulations have been upheld for two reasons: (1) they are valid exercises of state police power because there is a public interest in efficient development of resources, preventing waste, and equitable sharing of profits,[239] and (2) there is no taking because nonparticipating owners still have mineral interests and a right to royalties.[240]

E. Private Restrictions and Government Regulations Impact Mineral Rights Ownership

Private and public restrictions may also impede a mineral rights owner's ability to develop their minerals. Private regulations and public regulations are distinguishable. Private regulations come from private third parties and independent associations, while public regulations originate from "federal, state, regional and local government entities."[241]

1. Private restrictions

Private regulations tend to come in different forms, for example: mortgage restrictions as mentioned before, homeowner's insurance policy provisions, lease stipulations, and restrictive covenants benefitting adjacent property. Private insurance companies can, in effect, impose regulations that government regulatory agencies are unable to impose often because of political obstacles.[242] "Standard, non-negotiated, gas leases fail to mention insurance or indemnification."[243] This means that risk allocation remains with the landowner, often a homeowner.

For example, homeowner's insurance "excludes from coverage the types of hazards associated with unconventional drilling."[244] Thus, property loss or damage is not covered by common

239. *Continental Resources v. Farrar Oil Co.*, 559 N.W.2d 841, 846 (N.D. 1997); Eugene E. Dice, *Oil and Gas Forced Pooling Update*, PENNSYLVANIA BAR ASSOCIATION ENVIRONMENTAL AND ENERGY LAW SECTION NEWSLETTER (Mar. 2014), http://ssrn.com/abstract=2406901.

240. Marla Mansfield, *A Tale of Two Owners: Real Property Co-Ownership and Mineral Developments*, 43 ROCKY MTN. MIN. L. INST. 20-1, 20-52 (1997), http://digitalcommons.law.utulsa.edu/cgi/viewcontent.cgi?article=1224&context=fac_pub.

241. Amanda C. Leiter, *Fracking, Federalism, and Private Governance*, 39 HARV. ENVTL. L. REV. 107, 126 (2015).

242. Dana & Wiseman, *supra* note 87 at 1529.

243. Elisabeth N. Radow, *At the Intersection of Wall Street and Main: Impacts of Hydraulic Fracturing on Residential Property Interests, Risk Allocation, and Implications for the Secondary Mortgage Market*, 77 ALB. L. REV. 673, 682 (2013).

244. *Id*. (discussing Nationwide Mut. Ins. Co., *Press Release: Nationwide Statement Regarding Concerns About Hydraulic Fracturing* (July 13, 2012), www.nationwide.com/newsroom/071312-FrackingStatement.jsp).

homeowner's insurance and homeowners are left to defend the claim on their own.[245] Elisabeth Radow advised homeowners with gas lease prospects to consult counsel and impose the following requirements on the gas company:

> (i) [N]ame the homeowner as an additional named insured on its general liability policy and self-insure beyond the policy limits; (ii) pay for homeowner's insurance, regardless of cost, should the homeowner be denied coverage on his or her own homeowner's policy as a result of the drilling activity; and (iii) provide for indemnification, which survives termination of gas drilling operations, for related loss or property damage.[246]

In effect, private insurance companies can act as market-regulators of fracking operations by imposing mandatory insurance.[247] Mandatory insurance has been imposed on nuclear plants and offshore oil companies.[248] Implementing mandatory insurance in fracking would require affirmative action from private companies, and some may be unwilling to take that action.

Lease stipulations are negotiated between the lessors and the lessees, and may be used to limit drilling on the leased property.[249] During negotiations, landowners can seek terms like location of wells or drilling activity, requirement for lessee to return surface to original condition, insurance, and even liquidated damages in the case of surface harm. Landowners may also want to regulate the time for drilling and provide for restoration of the surface at the end of the lease term. In *Warren Petroleum Corp. v. Monzingo*, the Texas Supreme Court held that lessees have no obligation to restore the surface of property unless it is imposed by "some provision in the lease or by necessary implication."[250] Although some jurisdictions recognize an implied duty of surface restoration, not all do. Lessors should add express clauses creating a duty to restore.[251]

Adjacent property landowners often have protectable rights, as mentioned before, when the rule of capture doesn't absolve liability.[252] Those situations include: when a person drills on a slant such that well bottoms beneath the neighbor's property, when a person wastes minerals or interferes, intentionally, with another's ability to produce oil or gas, and when the rule of capture has been superseded by conservation statutes and regulations.[253] Adjacent

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245. *Id*.

246. *Id*.

247. Dana & Wiseman, *supra* note 87, at 1531.

248. *Id*.

249. *See, e.g.,* Gulf Oil Corporation v. Marathon Oil Co., 152 S.W.2d 711, 724 (Tex. 1941).

250. Warren Petroleum Corp. v. Monzingo, 304 S.W.2d 362, 363 (Tex. 1957).

251. *See, e.g.,* Chevron U.S.A., Inc. v. Murphy Expl. & Prod. Co., 151 S.W. 3d 306, 310-12 (Ark. 2004).

252. Bruce Kramer & Owen Anderson, *The Rule of Capture – An Oil and Gas Perspective*, 35 ENVTL. L. 899 (2005).

253. Keith B. Hall, *Hydraulic Fracturing: If Fractures Cross Property Lines,*

property owners may sue the drilling permit holder for tort liability when actions arising out of the use of the permit are tortious.[254] A landowner's activities may interfere with the rights of another landowner if they intrude on an adjacent owner's ability to access the minerals below his own surface. Contracts and agreements between the landowner and the property owner are from where "private regulations" derive. Hence, agreements between the landowner with mineral rights and an adjacent landowner function as private regulation.

2. Government regulation

Public regulation of mineral drilling and the land used for it arises from the Tenth Amendment of the U.S. Constitution, which provides that states can exercise police powers to protect "public health, safety, and welfare."[255] Oil and gas estates are subject to reasonable regulations pursuant to state police power.[256] The police power, government land use regulatory authority, and community rights are generally enough to give authority for local bans, moratoria, and regulations on fracking.[257] Communities affected by the fracking boom tend to have "rapid population increase… widespread housing shortages and skyrocketing inflation… [H]eavy truck traffic… has taken a great toll on the roads…. Increased traffic also led to numerous accidents and deaths… and other public safety concerns."[258] Obviously, not all of the impacts of fracking are positive, so both frackers and landowners must be aware of government regulation. Local and state government regulations that limit fracking operations include zoning laws, moratoriums and bans on drilling, drilling permit requirements, disclosure laws, community restrictions against nuisance and for enjoyment, and regulations tailored for flood-prone regions, water ways, and fire-prone regions.[259] State laws on oil and gas development vary "among formations and by the type of resource being extracted.

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is There an Actionable Subsurface Trespass?, 54 NAT. RESOURCES J. 361, 367 (2014).

254. Dr. Robert H. Freilich & Neil M. Popowitz, *Oil and Gas Fracking: State and Federal Regulation Does Not Preempt Needed Local Government Regulation: Examining the Santa Fe County Oil and Gas Plan and Ordinance as a Model*, 44 URB. LAW. 533, 8 (2012) (citing to Bruce M. Kramer, *A Renaissance Year for Oil and Gas Jurisprudence: the Texas Supreme Court*, 18 TEX. WESLEYAN L. REV. 627, 628 (2012)).

255. Uma Outka, *Intrastate Preemption in the Shifting Energy Sector*, 86 U. COLO. L. REV. 927, 958 (2015).

256. Tysco Oil Co. v. R.R. Comm'n, 12 F. Supp. 202 (S.D. Tex. 1935).

257. Outka, *supra* note 255 at 958.

258. Joshua P. Fershee, *The Oil and Gas Evolution: Learning from the Hydraulic Fracturing Experiences in North Dakota and West Virginia*, 12 TEX. WESLEYAN L. REV. 23, 26 (2014).

259. *Id*. at 32.

Lessons from one state therefore may not fully transfer to other states."[260]

Even with the existence of local and state regulation of fracking, in many states those regulations do not create separate rights for neighbors, adjacent property owners, or other third parties related to the land because generally "operators have no obligation to consult with residential tenants, neighbors, agricultural lessees or any other non-owner who could be affected by the proposed operation."[261] Neighbors may be able to enforce rights through civil actions, under the common law of torts or contracts.[262] Requiring advance notice to those close to a proposed well may become more common as a protection of adjacent property owners and neighbors.[263]

Public regulations have also been imposed to deal with the common problem of abandonment of wells, which typically results when wells dry up or oil and gas prices drop up, or the fracking company becomes unable to afford the cost of the leased land and files for bankruptcy. When a well is abandoned, the landowner might desire that the well be plugged and that the surface of land be cleaned up, both of which can be costly to achieve.[264] If wells are not plugged, there is a strong chance of groundwater contamination.[265] When wells are abandoned, states are usually left with bearing the cost of abandonment.[266] States are regulating well abandonment more, but there are limitations on regulation-

260. Hannah Wiseman & Francis Gradijan, *Regulation of Shale Gas Development, Including Hydraulic Fracturing* (Jan. 2012), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1953547 (research funded by the University of Texas Energy Institute).

261. Katherine Toan, *Not Under My Backyard: The Battle Between Colorado and Local Governments Over Hydraulic Fracturing*, 26 COLO. NAT. RES. ENERGY & ENVTL. L. REV. 1, 66 (2015) (citing to Colo. Code Regs. 404-1:306(g)).

262. Benjamin E. Apple, *Mapping Fracking: An Analysis of Law, Power, and Regional Distribution in the United States*, 38 HARV. ENVTL. L. REV. 217, 233 (2014).

263. Lauren Sommer, *What California's New Fracking Rules Would Do (And Not Do),* KQED SCI. (Nov. 15, 2013) (reviewing proposed fracking rules in California that required that oil well operators give at least 30 days advance written notice before fracking to landowners and neighbors within 500 feet of the well), ww2.kqed.org/science/2013/11/15/what-californias-new-fracking-rules-would-do-and-not-do/.

264. Dan Frosch, *Wyoming May Act to Plug Abandoned Wells as Natural Gas Boom Ends*, N.Y. TIMES (Dec. 24, 2013), www.nytimes.com/2013/12/25/us/state-may-act-to-plug-abandoned-wyoming-wells-as-natural-gas-boom-ends.html?_r=0; *see also,* Dimiter Kenarov, *Lost: Hunting for Pennsylvania's Orphaned and Abandoned Wells*, Pulitzer Center (Jan. 31, 2013), http://pulitzercenter.org/reporting/pennsylvania-abandoned-wells-shale-gas-oil-horizontal-drilling-hydraulic-fracturing-climate-change .

265. Dan Frosch & Russell Gold, *How 'Orphan' Wells Leave States Holding the Cleanup Bag*, WALL ST. J. (Feb. 25, 2015 10:30 PM), www.wsj.com/articles/how-orphan-wells-leave-states-holding-the-cleanup-bag-1424921403.

266. *Id*.

enforcement, especially as new wells continue to be built.[267] Wyoming is setting aside money collected from gas companies as a part of the permit process to begin plugging wells, "but bonding often sets aside too little."[268] Assurance bonds may be used to pay for contamination clean up even in the absence of liability.[269] Wyoming bonds require companies to pay a $75,000 blanket bond to cover *all* of the wells they operate – and once a well stops producing, the operator must pay up to $10/linear foot in bonding to offset cost of reclamation.[270] Not only are bonds generally inadequate to cover the cost of plugging, but also some companies find ways to avoid financial assurance requirements entirely. Then, landowners may be left with inadequate remedies if a financially bust company abandons the well and land.[271]

3. Current System: The Absence of Comprehensive Regulation

Comprehensive regulation of fracking is virtually nonexistent. There is some federal regulation, some state regulation, and some local regulation, but some contend that there is a "dearth of a proper regulatory mechanism."[272] The specific requirements of drilling activity vary based on where the activity takes place: federal, state, Native American, or private land.[273] From state to state, there is significant variation in the reception and treatment of fracking activity.[274] Some local governments have implemented regulation to limit fracking operations and fill regulatory vacuums, even as "some states have taken steps to preempt local authority."[275] In 2011, Pennsylvania state legislature passed legislation that required local land-use ordinances "shall allow for the reasonable development" of the Marcellus Shale, which preempted certain local ordinances that

267. Dana & Wiseman, *supra* note 87 at 1526.

268. Frosch & Gold, *How 'Orphan' Wells Leave States Holding the Cleanup Bag*, WALL ST. J. (Feb. 25, 2015 10:30PM), www.wsj.com/articles/how-orphan-wells-leave-states-holding-the-cleanup-bag-1424921403.

269. Dana & Wiseman, *supra* note 87, at 1529.

270. Dan Frosch, *Wyoming May Act to Plug Abandoned Wells as Natural Gas Boom Ends*, N.Y. TIMES (Dec. 24, 2013), www.nytimes.com/2013/12/25/us/state-may-act-to-plug-abandoned-wyoming-wells-as-natural-gas-boom-ends.html?_r=0.

271. Tony Dutzik, et al., *Who Pays the Costs of Fracking?,* Environment America Research & Policy Center (2013), www.environmentamerica.org/sites/environment/files/reports/Who%20Pays%20the%20Cost%20of%20Fracking_vUS%20screen_0.pdf.

272. *See* Baker, *supra* note 25, at 255; *see also* David B. Spence, *Federalism, Regulatory Lags, and the Political Economy of Energy Production*, 161 U. PA. L. REV. 431, 434-35 (2013) (complaining about the impact of federalism on the goal to have comprehensive, uniform regulation of fracking).

273. *See* Baker, *supra* note 25, at 256.

274. *Id.* at 258–59, nn.159–65.

275. *Id.*

regulated gas well operations.[276] The Pennsylvania Supreme Court later overturned this provision in the state statute, recognizing that the intentions of the legislation were good, but the actual legislation had "structural difficulties," and was "malleable and unpredictable."[277] In contrast, a town in New York amended a local zoning ordinance to "expressly prohibit extraction of oil and gas or other associated processes," but the amendment was upheld, as "state law did not prohibit local zoning laws which prohibit oil and gas development."[278] The state regulation "could have preempted local regulation," but did not in light of the lack of "a clear expression of preemptive intent."[279] Local regulations generally address the "secondary" impacts of fracking and may be "much needed" for a community.[280] "The door is open to complementary local regulation" to state and federal regulations, as long as local regulation is not prohibited.[281] Alternatively, in Louisiana and Ohio, local governments are "largely preempted from regulating."[282] There is a great debate about state preemption, which has been addressed by several scholars and practitioners.[283]

Some regulations are so detailed that they appear to be *de facto* bans on fracking, according to David Spence. However, Hannah Wiseman argues that, "even these very detailed ordinances could allow a particularly ambitious operator to attempt to drill and frack for oil and gas."[284] Regulations are necessary in a world where bargaining is not costless. "The costs and benefits of fracking are

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276. *Id.*

277. Robinson Twp. v. Commonwealth, 623 Pa. 564, 698 (Pa. 2013).

278. Kevin J. Lynch, *Frackings/Takings*, 84 U. CINCINNATI L. REV. (forthcoming 2016), http://ssrn.com/abstract=2602516 (discussing *Wallach v. Town of Dryden*, 16 N.E.3d 1188, 1201 (N.Y. 2014)).

279. *Id.*

280. Dr. Robert H. Freilich & Neil M. Popowitz, *Oil and Gas Fracking: State and Federal Regulation Does Not Preempt Needed Local Government Regulation: Examining the Santa Fe County Oil and Gas Plan and Ordinance as a Model*, 44 URB. LAW. 533, 7 (2012).

281. *Id.*

282. *See* Hannah J. Wiseman, *Governing Fracking from the Ground Up*, 93 TEX. L. REV. *See also* 29, 36, nn.50–51 (2015) (offering the reason that local governments have very little voice on the proper allocation of entitlements).

283. For a greater discussion of state preemption, see *Id.* at 8. Compare David L. Callies, *Federal Laws, Regulations, and Programs Affecting Local Land Use Decision Making: Hydraulic Fracturing*, SV003 A.L.I.-C.L.E. 409 (2013) which indicates how state law usually, but not always, preempts "local land use controls." *See also* Hannah J. Wiseman, *Governing Fracking from the Ground Up*, 93 TEX. L. REV. 29 (2015), www.texaslrev.com/wp-content/uploads/Wiseman-93-SeeAlso.pdf (offering Wiseman's response to David Spence and his analysis that is consistent with the Calabresi-Melamed economic framework).

284. David B. Spence, *The Political Economy of Local Vetoes*, 93 TEXAS L. REV. 351, 352 (2014); Hannah J. Wiseman, *Governing Fracking from the Ground Up*, 93 TEX. L. REV. *See also* 29, 36 (2015), www.texaslrev.com/wp-content/uploads/Wiseman-93-SeeAlso.pdf.

spread widely . . . but local governments experience concentrated costs and benefits (particularly costs)."[285] Typically, the costs and benefits of fracking are not fully appreciated by the producers of the oil and gas.[286] This impacts how governments engage in decision-making to regulate or even to prohibit fracking activity.[287] Wiseman recognizes that more consideration is necessary before creating a system in which costs match benefits to a party.[288]

Finally, fracking regulations have been challenged as "takings" because owners of oil and gas interests maintain their absolute right to extract oil and gas without the impact of fracking regulations.[289] Regulation ranges from moratoriums and outright prohibitions to zoning regulations to regulations on the technical process.[290] Regulations have generally been upheld as "necessary" to protect the public, including a statewide prohibition of fracking in New York.[291] In Colorado, communities demanded government regulation after experiencing societal harms and decreasing quality of life from the encroaching oil and gas community.[292] Such regulations are intended to curb activity that is "'injurious to the health, morals, or safety of the community,' or when the uses around the property preclude its use in a certain manner, such as for a brickyard, or when new circumstances arise making the public interest be preferred over a private property interest, such as a disease spreading through trees."[293] Fracking is associated with several injurious activities having "nuisance-like impacts" such as "air pollution, water pollution, induced earthquakes, community impacts of boom town economics, and health impacts such as increased cancer risk and premature births."[294] For this reason, most fracking regulations do not rise to the level of takings.[295]

A wrinkle in takings law arises because owners of oil and gas interests are entitled to make "reasonable use" of the surface of the property above their oil and gas interest, for example in gaining access to install a well. This right to "reasonable use" may make the subsurface interests superior to the surface estate. The right may deprive the surface owner of some property value. Alternatively, if

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285. Spence, *supra* note 284, at 358-368, 379-383; *see also,* Wiseman, *supra* note 284, at 34-36.

286. Wiseman, *supra* note 284, at 34, n. 37-38 ("Fracking generates benefits not fully internalized by producers, such as tax revenues from the influx of well-paid employees, jobs created in supporting industries outside of the oil and gas sector, and, perhaps, increased national security. It additionally produces costs at the state, regional, and national levels also not borne by producers.")

287. *Id.* at 44.

288. *Id.* at 45.

289. Lynch, *supra* note 278.

290. *Id.* at 6.

291. *Id.* at 9.

292. *Id.*

293. *Id.* at 40. (citing Mugler v. Kansas, 123 U.S. 623, 668 (1887)).

294. *Id.* at 40-41.

295. *Id.*

the only way to access a subsurface interest is by unreasonable means, then the oil and gas owner is effectively deprived of the right to extract minerals.[296] The question of "reasonable use" is based on the factual circumstances, and is a "principle that might insulate fracking regulations and bans from takings claims."[297] Regulations, in their current state, make property rights less certain, but market-based regulation may offer stability by placing liability on the harm-causing parties.[298]

IV. IMPLICATIONS OF FRACKING FOR COMMERCIAL REAL ESTATE

A. Introduction

Fracking has the power to revolutionize commercial real estate markets. John M. Golden and Hannah J. Wiseman report "a vast range of straightforward economic benefits" resulting from the natural gas boom.[299] These include job creation and tax revenues as well as the reduced price of energy that makes meeting that demand achievable for more people.[300] Although they recite the "negative environmental effects," even those can be reduced especially if methane leakage from wells, gathering lines and pipelines are managed and controlled.[301]

Case studies, like those reported by Joshua Fershee, reveal similarities and differences between production of oil and gas through fracking in North Dakota (oil in Bakken Shale) and West Virginia (gas in Marcellus Shale).[302] Fershee discusses the oil play

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296. *Id.* at 42.

297. *Id.*

298. As discussed, market-based regulation may be an alternative to governmental regulation. Dana and Wiseman have proposed mandatory insurance and assurance bonds as substitutes for the "current patchwork state" of regulation. David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance, and the Certain and Uncertain Risks of Hydraulic Fracturing*, 99 IOWA L. REV. 1523, 1529 (2014). The insurance and assurance bonds would create a pool of financial resources for a community to pull from when dealing with clean up and repair of an area. *Id.* Right now, there is uncertainty in who bears the risk of contamination or damages resulting from fracking, so there are several insurance coverage issues. *Insurance Coverage Issues in Hydraulic Fracturing*, MATTHEW BENDER COMPANY, 2014 EMERGING ISSUES 7295 (2014).

299. John M. Golden & Hannah J. Wiseman, *The Fracking Revolution: Shale Gas as a Case Study in Innovation Policy,* 64 EMORY L.J. 955, 966 (2015).

300. *Id.* at 998, n. 267 (attributing the shale gas boom as a significant reason for North Dakota's rise to the top in Gallup-Healthways Well-Being Index, *Well Being in America: Shale Gas Buys You Happiness,* ECONOMIST (Feb. 21, 2014, 5:59 PM), www.economist.com'node/21597121.

301. *See infra* Part IV.B(1) (providing a look at the environmental risks of fracking).

302. *See* Joshua Fershee, *The Oil and Gas Evolution: Learning from the*

in North Dakota, which surpassed California in oil production at the end of 2011, and Alaska the following year, thus making it the second largest oil producing state after Texas.[303] While this has resulted in positive economic results, including increased employment and increased overall economic activity, which tripled between 2005 and 2009, there have been social costs. Fershee's list includes: pressure on schools due to rapid population increase, widespread housing shortages, infrastructure damage due especially to high truck traffic and other problems.[304] The "gas play" impact in West Virginia provides "a boost to the state's economy … thousands of job opportunities," but "not all of the impacts of hydraulic fracturing in West Virginia have been positive."[305] Fershee's narrative includes typical Boom results.[306]

Moreover, fracking production of oil and gas is capital intensive. This means that investments in the projects only persist when there is a profit.[307] It means that the impact can be volatile and enhance vulnerabilities, e.g., with the Boom and Bust scenario. Environmental concerns will be the host to political problems. And, as part of the overall energy industry, fracking will expand and contract, likely causing the real estate implicated to do the same. While some impacts of the fracking has been positive, the environmental concerns paralleled those in other fracking communities: impact of chemicals on the water supply, especially drinking water; traffic jams and infrastructure damage; migration of out-of-state contractors who take away jobs from local union construction workers among other problems.[308]

Hydraulic Fracturing Experiences in North Dakota and West Virginia, 19 TEXAS WESLEYAN L. REV. 23, 25–30 (2012) (providing detailed information about the significant impact of the oil and gas industries in the two states, respectively).

303. *Id.* at 25; *see also* Hannah J. Wiseman, *Governing Fracking from the Ground Up,* 93 TEXAS L. REV. *See also* 1, 6 (2015) (arguing that many benefits are not internalized by producers alone, including: "tax revenues from the influx of well-paid employees, jobs created in supporting industries outside of the oil and gas sector, and perhaps, increased national security").

304. Fershee, *supra* note 302, at 25–27.

305. *Id.* at 28.

306. *Id.*

307. David B. Spence, *Federalism, Regulatory Lags, and the Political Economy of Energy Production*, 161 U. PA. L. REV. 431, 495 (2013) (recognizing the profit perspective of the producers).

308. Fershee, *supra* note 302, 29-30.

B. Three Categories of Risk are Associated with Fracking that have Implications for those Owning, Developing, Financing, Leasing and Using Real Estate[309]

1. Environmental Risks

There is serious concern about fracking's harm to our water – both excessive usage and pollution of it at its source. Rhonda G. Jolley discusses the importance of water to humankind and its place in the oil and gas industry, including its current use in fracking.[310] She describes the reasons so much water is used in the fracking process. Water is pumped under pressure to force the rock to fracture and then "more water …is pumped into the lines to keep the fractured rock open while the oil or gas is pumped to the surface."[311] This has resulted in "[m]any landowners accumulating wealth through the sale of water" and, as long as the policy issues concerning usage of water are unresolved, she suggests that real estate and mineral attorneys "must be ready to negotiate water sale and lease agreements on behalf of clients whether they be landowners or oil companies."[312] The fact that "several of the states seeing the biggest increase in oil and gas drilling in recent years … have experienced prolonged periods of drought" makes water usage problems a critical concern.[313]

Pollution of drinking water has been alleged by anti-fracking activists who argue that the fracking is going on at much shallower depths than imagined, putting underground drinking water at risk.[314] Even the Obama Administration's early support of fracking

309. Shalanda Helen Baker, *Is Fracking the Next Financial Crisis? A Development Lens for Understanding Systemic Risk and Governance,* 87 TEMP. L. REV. 229, 263 (2015) (identifying the three primary categories of risk that may "overlap, bleed into and affect each other").

310. Rhonda G. Jolley, *Like Grandma Said, "Oil and Water Don't Mix,"* The ACREL Papers, ALI-ACREL (Fall 2013*); see also* TERRENCE S. WELSH, BEYOND THE FRACKING WARS - A GUIDE FOR LAWYERS, PUBLIC OFFICIALS, PLANNERS, AND CITIZENS 237-38 (2013).

311. *Id.* at 8.

312. *Id.* at 9 (providing a sample Water Purchase Agreement with comments at the end of the article).

313. BRENDA L. CLAYTON, KENNETH M. KLEMM, CHAD M. SMITH, & TYLER L. WEIDLICH, THE SHALE ENERGY REVOLUTION – A LAWYERS GUIDE 140-41 (2015) (citing Monika Freyman & Ryan Salmon, Hydraulic Fracturing & Water Stress: Growing Competitive Pressure for Water 3 (May 2013), www. ceres.org/resources/reports/hydraulic-fracturing-water-stress-growing-competitive -pressures-for-water/view).

314. David B. Spence, *Responsible Shale Gas Production: Moral Outrage vs. Cool Analysis,* 25 FORDHAM ENVTL L. REV. 141, 160 (2015) (providing a history of some of the research which he puts into the category of "disputed Effects of Fracking"); *see also* Neela Banerjee, *Oil Companies Fracking into Drinking Water Sources, New Research Shows,* L.A. TIMES (August 12, 2014 9:33 AM),

was modified after a long awaited study by the Environmental Protection Agency "confirmed 'specific instances' when fracking 'led to impacts on drinking water resources, including contamination of drinking water wells.'"[315] The underbalanced drilling (UBD) recommended by Jim Hughes would not cause water pollution or extraordinary water usage because no water is used and no chemicals are inserted into the soil.[316]

Whether and to what extent fracking has been responsible for an increase in earthquakes and other seismic activities depends, to some extent, on who you ask and when. Science-based studies and reports issued since 2014 increasingly indicate risks from fracking. The U.S. Geological Survey has indicated there is a connection between injecting fracking wastewater into underground disposal wells and earthquakes.[317]

An article entitled "On Shaky Ground: Fracking, Acidizing and Increased Earthquake Risk in California" refers to long documented inducement of earthquakes by underground injection of wastewater from fracking.[318] Austin Holland, then a research seismologist at the Oklahoma Geological Survey (now with the U.S. Geological Survey's Seismic Lab at Albuquerque), made headlines when it was reported that Oklahoma reported three times as many earthquakes as in the entire "seismically active state of California."[319]

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www.latimes.com/nation/la-na-fracking-groundwater-pavillion-2-140811-story.html# page=1 (referring to research released by Stanford University scientists about the shallower wells, though no direct evidence of water-supply contamination). *See also* Zahra Hirji, *Drillers Fracking at Much Shallower Depths than Widely Believed,* INSIDE CLIMATE NEWS (July 24, 2015), http://insideclimatenews.org/print/40614 (reporting that the danger is greatest when high pressure is used in the shallow wells).

315. Neela Banderjee, *Fracking has Contaminated Drinking Water, EPA Now Concludes,* INSIDE CLIMATE NEWS (June 5, 2015), http://insideclimatenews.org/news/05062015/fracking-has-contaminated-drinking-water-epa-now-concludes (noting that this report was released by the administration and EPA "after years of asserting that hydraulic fracturing has never tainted drinking water").

316. Richard J. Roddewig & W. James Hughes, *Underbalanced Drilling: Can It Solve the Economic, Environmental and Regulatory Taking Problems Associated with Fracking?,* 49 J. MARSHALL. LAW REV. at *31 (forthcoming 2016).

317. William Ellsworth, Jessica Robertson & Christopher Hook, *Man-Made Earthquakes Update,* UNITED STATES GEOLOGICAL SURVEY (Jan. 17, 2014, 1:00PM), www.usgs.gov/blogs/features/usgs_top_story/man-made-earthquakes (reporting an increase in earthquakes measuring 3.0 or higher in parts of the U.S.).

318. Jhon Arbelaez, Shaye Wolf & Andrew Grinberg, *On Shaky Ground: Fracking, Acidizing and Increased Earthquake Risk in California*, CENTER FOR BIOLOGICAL DIVERSITY (March 2014), www.biologicaldiversity.org/campaigns/california_fracking/pdfs/ShakyGroundReport-March2014.pdf.

319. Joe Wertz, *Oklahomans feel Way More Earthquakes than Californians; Now They Know Why,* NPR (April 23, 2015 5:25PM), www.npr.org/2015/04/23/401624166/oklahomans-feel-way-more-earthquakes-than-californians-now-they-know-why.

Bloomberg's Business Week reported that a major donor (Harold Hamm) to the University and the "billionaire founder of Continental Resources, one of Oklahoma's largest oil and gas operators" met with Holland in November 2013.[320] "During this meeting, Hamm requested that Holland be careful when publicly discussing the possible connection between oil and gas operations and a big jump in the number of earthquakes, which geological researchers were increasingly tying to the underground disposal of oil and gas wastewater, a byproduct of the fracking boom that Continental has helped pioneer."[321]

The official report of the U.S. Geological Survey, released on April 23, 2015, was the "first comprehensive assessment of the link between thousands of earthquakes and oil and gas operations, identifying and mapping 17 regions where quakes have occurred."[322] It indicated particular concern because there is no scientific way to predict how powerful and potentially damaging the earthquakes can be. Without insertion of water under pressure in the underbalanced drilling technique (UBD) of Hughes, the risk of earthquakes from fracking would be eliminated.[323]

Air pollution, especially from the high methane released in fracking, is on many lists of the environmental risks from fracking and to climate change as well.[324] Beth Kinne provides a comprehensive review of the air pollution issues surrounding fracking.[325] She considers the matter one of "debate" as does David Spence who places air pollution in the category of "the Disputed Effects of Fracking."[326]

In addition to concerns about how to reduce the environmental risks of fracking, a question remains as to how these risks will be dealt with to protect producers, landowners, and communities from economic consequences.[327]

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320. Ben Elgin & Matthew Philip, *Fracking, Oklahoma Shakes: Big Oil's Link to Big Quakes*, BUSINESS WEEK, (April 6, 2015).

321. *Id.* at 20.

322. Richard Perez-Pena, *U.S. Maps Where Human Acts Lead to Thousands of Quakes,* N.Y. TIMES, A1 (April 24, 2015) (listing Oklahoma as "by far the hardest-hit state").

323. Richard J. Roddewig & W. James Hughes, *Underbalanced Drilling: Can It Solve the Economic, Environmental and Regulatory Taking Problems Associated with Fracking?,* 49 J. MARSHALL. LAW REV. (forthcoming 2016).

324. *See, e.g.,* Robert F. Kennedy, Jr, *A Review of Potential Community and Real Estate Impacts from the Rush to Frack,* 39 REAL ESTATE ISSUES 44 (2014) (mentioning the negative health risks reported by researchers).

325. BETH E. KINNE, BEYOND THE FRACKING WARS – A GUIDE FOR LAWYERS, PUBLIC OFFICIALS, PLANNERS AND CITIZENS, *Chapter 7 - Clearing the Air: Reducing Emissions from Unconventional Oil & Gas Development,* (Erica Levine Powers and Beth E. Kinne, ABA Section of State & Local Government) (2013).

326. David B. Spence, *Responsible Shale Gas Production: Moral Outrage vs. Cool Analysis,* 25 FORDHAM ENVTL L. REV. 141, 162 (2015).

327. *See* Tony Dutzik, Benjamin Davis & Tom Van Heeke, *Who Pays the*

2. Social and Community Harms

Shalanda Helen Baker describes what she sees as a significant but infrequently discussed social risk in the transformation of rural areas by the fracking Boom.[328] Besides being rural, the places where fracking makes sense, and occurs, are among the poorest communities in the U.S.[329] The dilemma is between a community taking advantage of the predicted economic opportunities while dealing with the environmental problems fracking threatens. The "social tensions" flow from the fact that there are winners and losers. Baker cites the increased costs of everything, including food, services, homes, and retail goods, as caused by the boomtown phenomenon. Especially because there is rapid change with fracking, the social strain often leads to increases in economic stress for citizens, crime, and drug abuse.[330] While Sorrell E. Negro agrees that oil and gas development traditionally have been in rural areas, she expresses her concern that fracking is occurring in more densely populated areas and in eastern states.[331] From her perspective as a real estate attorney, she notes the economic boom in places where fracking occurs: an increase in jobs, an increase in tax revenues, an increase in incomes, and an increase in value of housing.[332] Negro urges communities to consider opportunities carefully after they get information lest they miss opportunities. She provides examples of communities communicating and working successfully with

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Costs of Fracking? Weak Bonding Rules for Oil and Gas Drilling Leave the Public at Risk, ENVIRONMENT AMERICA RESEARCH & POLICY CENTER (2013) (recommending that oil and gas producers be required to supply financial assurances); *see also* David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance and the Certain and Uncertain Risks of Hydraulic Fracturing,* 99 IOWA L. REV. 1523 (2014) (arguing that because the industry has more knowledge than regulatory agencies about the risks, a market based approach of bonding requirements and mandatory environmental liability insurance is needed).

328. Shalanda Helen Baker, *Is Fracking the Next Financial Crisis? A Development Lens for Understanding Systemic Risk and Governance,* 87 TEMP. L. REV. 229, 266-267 (2015).

329. *Id.* (reporting that the largest shale plays are in the "hollows that already bear the scars of coal mining").

330. *Id.* at 266.

331. Sorell E. Negro, *Looking Below the Surface: Planning for Impacts on People, Places and Property from Natural Gas Development,* 27 PROBATE & PROPERTY 36 (2013) (writing from a real estate attorney's perspective about the impact on a community).

332. *Id.*; *But see* Zhongmin Wang & Alan Krupnick, *A Retrospective Review of Shale Gas Development in the United States: What Led to the Boom?*, RESOURCES FOR THE FUTURE (April 2013), www.rff.org/RFF/documents/RFF-DP-13-12.pdf (arguing that proximity to fracking sites reduces the fair market value of houses).

producers in Garfield County, Colorado and Arlington, Texas to achieve positive outcomes.[333]

Sorrell Negro's narrative in the ABA Section on Energy of Litigation book, *Shale Energy Revolution: A Lawyer's Guide,* provides the details of changes within several communities where fracking suddenly hit the scene.[334] While dealing with the community problems presented by the Boom, including the serious environmental and social ones described, Negro's insight that planning for the Boom must go hand in hand with planning for the inevitable Bust when the "Drilling Stops" is an important one.[335] Her practical advice provides help for communities and their attorneys dealing with the social and community harms that fracking may threaten.

Yet it is the impact that the fracking industry puts on individuals within the community that may deserve more attention than it usually receives in discussions of the impact on communities.[336] For example, does the average home owner realize that mortgages may not be available on houses located within the impact area of fracking or that their homeowner's insurance policy probably does not cover risks from fracking damage?[337] What about the possible impact on the broader community distant from the fracking place and national? Will the secondary mortgage market, and even the broader financial markets experience another collapse because of mortgages on leased land?[338] And Jared B. Fish analyzes the behavioral aspects of decision making by landowners who grant leases to fracking producers.[339] He points out that landowners are at an "informational disadvantage vis-à-vis industry experts" about whether this highly technical operation poses any threats. Without

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333. *Id.* at 40.

334. SORELL E. Negro, *Man Camps, Boomtowns, and the Boom –and-Bust Cycle – Learning from Rifle, Colorado and Williams County, North Dakota in* THE SHALE ENERGY REVOLUTION – A LAWYER'S GUIDE, (ABA Section of Litigation - The Energy Litigation Committee 2013).

335. *Id.* at 206-209.

336. Ted Gregory, *North Dakota Oil Bust Shatters, Shifts Dreams of Illinois Transplants,* CHI. TRIB. (Feb. 20, 2016 4:04 PM), www.chicagotribune.com /news/ct-oil-fracking-boom-bust-met-20160218-story.html (reveals how three Chicagoans who went off to the fracking fields in 2013 are faring today: one committed suicide after the Bust and demonstrated an inability to survive after leaving the Midwest).

337. *See infra* Part IV.B(3) (discussing the economic risks of fracking to individuals, businesses, and communities).

338. *Id.; see also* Shalanda Helen Baker, *Is Fracking the Next Financial Crisis? A Development Lens for Understanding Systemic Risk and Governance,* 87 TEMP. L. REV. 229, 267 (2015) (reporting that several industry insiders have termed the fracking boom as a "Ponzi scheme").

339. Jared B. Fish, *Note: The Rise of Hydraulic Fracturing: A Behavioral Analysis of Landowner Decision-Making,* 19 BUFF. ENVTL. L. J. 219 (2012)

all the relevant information, landowners are inclined "to take the money and run."[340]

Moreover, abandonment of wells is a big issue for the community. Fracking is driven by profit; when wells dry up or oil and gas prices drop, companies abandon wells, which means no more income and may mean leakage of contamination into water and air supplies. Some companies are unable to afford the cost of the leased land and file bankruptcy, and leave lands and wells abandoned. "Landowners would like to have their land to be brought back to a productive status and have orphaned wells cleaned up."[341] This affects both the individual landowner who may have been counting on the royalties (the income) as well as the lenders and investors in mortgage loans secured by such real estate.[342] Now, regulations in some jurisdictions try to reduce the likelihood of "abandoned" and "orphaned" wells, but may not be very effective.[343] Wyoming is setting aside money to begin plugging wells.[344]

The impact of fracking activity on fair market value of real estate for property tax purposes is mentioned in analyzing the different situations of the winners versus the losers. The Pennsylvania Supreme Court recently ruled that the presence of contamination and the stigma surrounding contamination are relevant to determining fair market value for property tax assessment purposes.[345] While in the past Pennsylvania courts looked at the cost-to-cure as the basis for determining fair market value for tax assessment purposes, the Supreme Court, in this case, held that a 5% stigma reduction in property value was appropriate.

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340. *Id.* at 233-234.

341. Dan Frosch, *Wyoming May Act to Plug Abandoned Wells as Natural Gas Boom Ends*, N.Y. TIMES (Dec. 24, 2013), www.nytimes.com/2013/12/25/us/state-may-act-to-plug-abandoned-wyoming-wells-as-natural-gas-boom-ends.html?_r=0 (quoting Shawn Reese, Wyoming governor's policy director); Dimiter Kenarov, *Lost: Hunting for Pennsylvania's Orphaned and Abandoned Wells*, PULITZER CENTER (Jan. 31, 2013), http://pulitzercenter.org/reporting/pennsylvania-abandoned-wells-shale-gas-oil-horizontal-drilling-hydraulic-fracturing-climate-change.

342. Elisabeth N. Radow, *At the Intersection of Wall Street and Main: Impacts of Hydraulic Fracturing on Residential Property Interests, Risk Allocation, and Implications for the Secondary Mortgage Market,* 77 ALB. L. REV. 673, 681 (looking at the impact of fracking, particularly for residential real estate).

343. David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance and the Certain and Uncertain Risks of Hydraulic Fracturing,* 99 IOWA L. REV. 1523, 1527-1528 (2014).

344. *See* Dan Frosch, *State May Act to Plug Abandoned Wyoming Wells as Natural Gas Boom Ends,* N.Y. TIMES A16 (Dec. 25, 2012) (describing efforts at the state level to deal with over 1200 abandoned mines after the natural gas boom ended).

345. Harley-Davison Motor Co. v. Springettsbury Twp., 124 A.3d 270 (Pa. 2015).

Yet, fracking bans may undercut property taxes for the locality. Robert D. Cheren reports on the three overlapping shale formation plays (the Devonian, Marcellus and Utica) that cross New York, Pennsylvania, Ohio, West Virginia, Maryland, Kentucky and Virginia.[346] There is great variation in the ways fracking is taxed in the areas of his research. Predominately the activity is taxed using property taxes or income taxes or both.[347] He concludes that "local governments that draw little additional revenue from fracking are more likely to ban the practice because of environmental concerns."[348] Moreover, that tax revenues would fall after a Bust seems likely.

Finally, the impact of fracking on infrastructure is relevant from both a community and economic standpoint. Terrence Welch points out what he terms "intuitively obvious": fracking is a specialized industrial activity requiring use of heavy equipment for a variety of purposes.[349] He describes the movement of the drilling rigs, the traffic between the drilling sites and communities where workers live, and other aspects of a Boom economy as causing damage especially to roadways.[350] Welch shares a variety of approaches by local governments to deal with this damage including requiring performance bonds to get permits, letters of credit provided by developers, and upfront fees for maintenance of the infrastructure. Another high stakes infrastructure cost involves building and supporting housing for new workers.[351] Of course, with a possibility of decreased activity because of a Bust or, now, because it is not economical to frack due to reduced energy pricing, one can

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346. Robert D. Cheren, *Fracking Bans, Taxation and Environmental Policy,* 64 CASE WESTERN L. REV. 1483 (2014) (noting that bans were almost entirely confined within New York and a small portion of Pennsylvania in and around Pittsburgh).

347. *Id.* at 1491-1499 (providing great detail on how taxing works in those places).

348. *Id.* at 1483; *see also* Richard J. Roddewig & W. James Hughes, *Underbalanced Drilling: Can It Solve the Economic, Environmental and Regulatory Taking Problems Associated with Fracking?,* 49 J. MARSHALL. LAW REV. (forthcoming 2016) (discussing whether a ban or moratorium on fracking is a taking because of the interference with distinct "investment-backed expectations").

349. Terrence S. Welch, *Beyond the Fracking Wars – A Guide for Lawyers, Public Officials, Planners and Citizens* 238 (2013); *Backyard Drilling: Local Regulation of Gas Drilling in the Barnett Shale of North Central Texas, (*Erica Levine Powers & Beth E. Kinne, ABA Section of State & Local Government Law (2013)).

350. *See also* SORELL E. NEGRO, THE SHALE ENERGY REVOLUTION – A LAWYER'S GUIDE 203-204 (ABA Section of Litigation - The Energy Litigation Committee 2013) (describing the necessity to have large number of trucks and other vehicles to support the fracking operations).

351. *See, e.g.,* Hannah J. Wiseman, *Governing Fracking from the Ground Up,* 93 TEXAS L. REV. 1, 7 (2015) (describing a significant cost to local governments as fracking comes into a community).

only wonder whether such measures will cover the systemic risk of fracking.

3. Economic

The economic risks and burdens associated with the fracking industry affect individuals as well as both the local and broader communities.

a. Mortgages

Financing using real estate affected by fracking as security for debt has implications both for the individual landowner and for the secondary mortgage market. The individual landowner may learn that if the land it owns is subject to mineral rights for fracking, the landowner will not be able to get mortgage financing. In addition to restricting the market for the land, the lack of mortgageability likely will have a negative impact on fair market value.

Mortgagee permissions or refusals also impact the real estate industry. Some lenders will not provide mortgages for property that is adjacent to or the location of drilling. Fannie Mae and Freddie Mac require prior approval of a drilling lease. Thus, without permission of the lender, such fracking activity may trigger a breach of the loan. Having gas leases on the real estate or even the fact of gas drilling on adjacent land may also reduce the number of buyers willing and able to buy a piece of property.[352] In the typical mortgage loan documents there is a catchall provision that lender's consent is required for drilling ("mineral, oil and gas rights rider"). Also, owners agree to "not use ultrahazardous materials" and to "not generate waste," and doing so puts mortgages in "technical default" with lenders Fannie Mae and Freddie Mac.[353] Additionally, owners must disclose if there are easements, encroachments, environmental conditions or land uses when they are seeking a mortgage appraisal – which often arise as a result of mineral leases.[354] Another unknown aspect of such mortgages involves how many exist for land where leases for fracking have been made? It has been estimated that 90% of all residential mortgages in the U.S. are sold into the secondary mortgage market.[355] How many

352. Wayne L. Hunsperger and Jean C. Townsend, *Real Estate Valuation Services Phase 1-Fracking Impact Study; Report: Impact of Hydraulic Fracturing*, HUNSPERGER & WESTON, LTD. (Aug. 1, 2014).

353. Jason Notte, *Fracking Leaves Property Values Tapped Out*, MSN MONEY (Aug. 23, 2013).

354. Richard J. Roddewig and Rebel A. Cole, *Real Estate Value Impacts from Fracking: Industry Response and Proper Analytical Techniques,* REAL ESTATE ISSUES Vol. 39, Number 3 (2014), www.cre.org/memberdata /pdfs/RE_Value_Impacts_Fracking.pdf.

355. Elisabeth N. Radow, *At the Intersection of Wall Street and Main: Impacts of Hydraulic Fracturing on Residential Property Interests, Risk*

investors in that market may be affected by fracking Booms and Busts or liabilities? Is this a repeat of 2008?[356]

Indeed, the fair market value may decrease for land "affected" by fracking. This is especially significant for owners whose land is seen as contaminated by environmental damage or where land was acquired during the Boom, but is to be sold after the Bust. Ron Throupe, Robert Simons, and Xue Mao report the findings of a residential buyer survey given to prospective buyers in Texas regarding a fracking "heavy" scenario, where there were potential effects on groundwater and the house was close to the drilling site that the site itself was visible from the house, and in Florida regarding a fracking "light" scenario about a house a mile away from the drilling where the site was not visible from the house.[357] The results (oversimplified here): only 26% of the Texas respondents would even consider making a bid on the fracking "heavy" house; 74% would not consider living there. The impact of fracking on fair market value of residential land near a fracking site is very negative.[358]

Additionally, concerns about the impact of fracking on the secondary mortgage market result when landowners lease their land to a producer. The banks hold mortgages to such land, and bear the risk of the potential decline in fair market value due to environmental damage or the wide market swings due to Boom and Bust cycles.[359] The underwriting guidelines set up by lenders to protect their security interest predate the fracking revolution.[360] The appraisal process required by what may be obsolete underwriting will not capture what might happen to cause a decline in value, or to predict how likely such a decline in value is due to fracking.[361] Elisabeth Radow reports on policies of several local banks when approached by local borrowers. If the bank decides to make the loan even though the land would not meet underwriting standards of the secondary mortgage market, the bank as the

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Allocation, and Implications for the Secondary Mortgage Market, 77 ALB. L. REV. 673, 689 (2013).

356. *See* Shalanda Helen Baker, *Is Fracking the Next Financial Crisis? A Development Lens for Understanding Systemic Risk and Governance,* 87 TEMP. L. REV. 229, 243 (2015) (comparing the 2008 economic Recession caused by unregulated housing markets and securitized mortgages with the current investment in fracking).

357. Ron Throupe, Robert Simons & Xue Mao, *A Review of Hydro "Fracking" and its Potential Effects on Real Estate*, 23(2), JOURNAL OF REAL ESTATE LITERATURE 205-232 (2013).

358. *Id.*

359. Ian Urbina, *U.S. May Restrict Mortgages on Properties Leased for Oil and Gas Drilling,* N.Y. TIMES A12 (Mar. 19, 2012).

360. Elisabeth N. Radow, *At the Intersection of Wall Street and Main: Impacts of Hydraulic Fracturing on Residential Property Interests, Risk Allocation, and Implications for the Secondary Mortgage Market,* 77 ALB. L. REV. 673, 689 (2013).

361. *Id.*

originating lender may have to keep that loan and not sell it into the secondary mortgage market.[362] However, she explains that the systemic risks are even more serious when the mortgage (likely sold to the secondary mortgage market) comes first and the mineral lease is made *after* the mortgage. There really is no monitoring of these situations. Although the mortgage terms prohibit the borrower from transferring the gas lease without the lender's permission, no one knows how many such mortgages there are in the secondary market. Reliance of investors in the secondary mortgage market, that their investments are not burdened by risks of fracking, may be misplaced.[363]

b. Insurance

Insurability for risks associated with fracking also reflects economic effects on individuals and the broader community. The standard, non-negotiated gas lease does not include any insurance for the lessor or any indemnification to protect the landowner. Unless the parties negotiate otherwise (very unlikely for leases from homeowners), the risks remain on the landowner.[364] Nor is fracking covered by the standard homeowner's insurance policy. Risks like natural gas and oil drilling are excluded routinely throughout the country.[365] "According to company spokesman Dave Phillips, State Farm [Insurance] does not have a fracking endorsement for private residences, but does have earthquake, earth-movement and sinkhole endorsements available in most areas."[366] This lack of coverage is important because mortgages for residential properties require such insurance; the absence of the insurance probably amounts to a breach of the mortgage.[367]

Moreover the "under-insured gas industry" discussed by Radow means that even where liability is clear, there may not be funds available to pay injured individuals or an injured community.[368] The insurance industry's awareness of coverage issues surrounding the fracking business is seen in a Matthew Bender publication issued in 2014, *Insurance Coverage Issues in Hydraulic Fracturing*.[369] The 10-K disclosure forms that must be

362. *Id.* at 695.

363. *Id.* at 696; *see also* Roger Droin, *Fracking Boom Could Lead to Housing Bust,* GRIST (Aug. 16, 2013, 7:57 AM), http://grist.org/climate-energy/fracking-boom-could-lead-to-housing-bust/.

364. Radow, *supr*a note 360, at 682.

365. *Id.*

366. *Id.*

367. *Id.* (although there is no requirement of insurance for land that does not have a mortgage on it). *Id.*

368. *Id.* at 685-686.

369. *Insurance Coverage Issues in Hydraulic Fracturing,* 2014 EMERGING ISSUES 7295, Matthew Bender & Company, Inc. (Dec. 21, 2014). *See also* John Mullen & Kim Hollaender, *Digging Deep: Fracking Litigation Trends-*

filed by publicly traded gas companies show that such companies maintain insurance against some risks. However, no disclosure must be made of whether the company has sufficient assets to cover uninsured and underinsured liabilities caused by fracking operations.[370] The ability of local government to cover adequately all potential loss is described and is challenging in light of the speed of the industry.[371]

Dana and Wiseman propose the use of assurance bonds and self-reporting to set the standard for regulating because the "industry" has more knowledge than government agencies. Plus, they argue that assurance bonds may be used to pay for contamination clean up even in the absence of liability.[372] In Wyoming, companies pay a $75,000 blanket bond to cover *all* of the wells they operate. Once a well stops producing, the operator must pay up to $10/linear foot in bonding to offset cost of reclamation.[373] However, bonds are generally inadequate to cover the cost of plugging. Some companies find ways to avoid financial assurance requirements altogether. Landowners may be left with insufficient remedies if a financially-busted company abandons both the well and the land.[374]

Even though fracking poses serious problems to the environment and climate change, to the community and social environment and for economic burdens on individuals and society, there is a call for "cool" analysis that is actually pro science.[375]

Insurance Coverage and Liability, CLAIMS MAGAZINE (Jan. 27, 2012), www.propertycasualty360.com/2012/01/27/digging-deep-fracking-litigation-trends.

370. Radow, *supra* note 360, at 685.

371. *See infra* Part IV.B(2) (describing the social and community harms caused by fracking).

372. David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance and the Certain and Uncertain Risks of Hydraulic Fracturing,* 99 IOWA L. REV. 1523 (2014); *see also* William E. Hefley and Shaun M. Seydor, et al., *The Economic Impact of the Value Chain of a Marcellus Shale Well*, PITTBUSINESS at *29 (Aug. 2011), http://ssrn.com/abstract=2181675 ("The bond is a financial incentive to ensure that the operator will perform the drilling operations, address any water supply problems the drilling activity may cause, reclaim the well site, and properly plug the well at the end of the wells useful life in accordance with their permit").

373. Dan Frosch, *Wyoming May Act to Plug Abandoned Wells as Natural Gas Boom Ends*, N.Y. TIMES (Dec. 24, 2013), www.nytimes.com/2013/12/25/us/state-may-act-to-plug-abandoned-wyoming-wells-as-natural-gas-boom-ends.html?_r=0.

374. Tony Dutzik, et al., *Who Pays the Costs of Fracking?*, ENVIRONMENT AMERICA RESEARCH & POLICY CENTER (2013), www.environmentamerica.org/sites/environment/files/reports/Who%20Pays%20the%20Cost%20of%20Fracking_vUS%20screen_0.pdf.

375. David B. Spence, *Responsible Shale Gas Production: Moral Outrage vs. Cool Analysis,* 25 FORDHAM ENVTL L. REV. 141, 172-181 (2015).

V. CONCLUSION

The science basis for the view that climate change is due to human activity is now accepted. The magnitude and scope of the impact that fracking will have on real estate and climate change is not yet clear. It is clear that if fracking continues, real estate as a complementary asset will continue to be affected and so will the industry. If fracking is reduced or eliminated, that too will affect real estate and the industry.[376] David Spence discusses what he calls the "undisputed facts" and the "disputed facts" which reflect confirmation bias depending upon whether one is a developer or an anti-fracking activist.[377] Spence points out how confirmation bias makes it difficult to evaluate fracking. This difficulty is significant particularly at a time when there is consideration of what the public policy and resulting legal rules should be.[378] Spence urges all to base conclusions and directions on "cool analysis" that reflect the science. This also has been the recent conclusion of Michael Levi.[379]

Both Spence and Levi are probably correctly identified as pro fracking. The policy debate continues as we wait for the science to provide comprehensive facts. Meanwhile, there are the innovators, like Jim Hughes, who is a developer after all, who is developing a new technique to avoid some of the clear risks of fracking while internalizing the benefits. Who can ask for more?

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376. *See* "North Dakota & Bakken Summit: What Impact Has Lower Oil Prices Had on the Bakken?," MINNESOTA REAL ESTATE JOURNAL (March 13, 2015) (indicating how important fracking is to the real estate industry in places where fracking is possible).

377. David B. Spence, *Responsible Shale Gas Production: Moral Outrage vs. Cool Analysis,* 25 FORDHAM ENVTL. LAW REV. 141 (2015).

378. *See* Joshua Fershee, *The Oil and Gas Evolution: Learning from the Hydraulic Fracturing Experiences in North Dakota and West Virginia,* 19 TEXAS WESLEYAN L. REV. 23 (2012) (concluding that it is important to avoid a revolution during the evolution of the fracking industry); *see also* Tony Dutzik, Benjamin Davis and Tom Van Heeke, *Who Pays the Costs of Fracking?—Weak Bonding Rules for Oil and Gas Drilling Leave the Public at Risk,* ENVIRONMENT AMERICA RESEARCH & POLICY CENTER (2013), www.frontiergroup.org/sites/default/files/reports/Who%20Pays%20the%20Cost%20of%20Fracking_vUS%20screen.pdf (reporting their recommendations to deal with "this dirty drilling").

379. Michael Levi, *Fracking and the Climate Debate*, DEMOCRACY (2015), http://democracyjournal.org/magazine/37/fracking-and-the-climate-debate/.