



Horizontal drilling, changing patterns of extraction, and piecemeal participation: Urban hydrocarbon governance in Colorado

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ABSTRACT

Research on unconventional oil and gas (UOG) development has focused so intently on hydraulic fracturing that it has overlooked “frackings” partner technology, horizontal drilling (HZD), which now enables operators to drill more than 2.5 miles. This innovation merits examination because it generates opportunities and challenges – in tension – for regions experiencing UOG development. HZD allows operators to condense their surface impacts by drilling multiple wells per pad. This consolidation benefits the many in a given extractive area, but at the expense of the few who live near intensified sites. HZD also allows operators to more flexibly position these large well pads. Combined, these drilling innovations are further splintering an already fragmented UOG governance space and creating novel procedural fairness challenges, especially in cities. This study offers the concept of “piecemeal participation” to describe these challenges, drawing from a case study in Colorado. Piecemeal participation occurs when governments structure public input on a site-by-site basis, while operators, leveraging HZD’s reach and flexibility, plan drilling and weigh alternative drilling locations at the scale of the city. The analysis evaluates piecemeal participation using standard procedural fairness criteria, generating findings of broader relevance as urban areas anticipate UOG development and HZD worldwide.

1. Introduction

The unconventional oil and gas (UOG) development boom of the last decade has been unique, and controversial, for bringing drilling activities into more densely populated environs than before (Lave and Lutz, 2014; Willow, 2014). Today, more than 17.6 million Americans live within a mile of an active oil or gas well, 49% of which have been drilled since 2000 (Czolowski et al. 2017), and UOG development is being considered near population centers in China, India, Poland, Turkey, and the United Kingdom (USEIA, 2011). The oil and gas industry credits two technologies – hydraulic fracturing and horizontal drilling – with enabling this surge and shift in energy production, but only the former has received close scholarly scrutiny. Indeed, the UOG literature has focused so intently on hydraulic fracturing (or “fracking”) that it has largely overlooked the implications of *horizontal drilling* for UOG governance.

Horizontal drilling merits closer attention because of the significant opportunities and challenges it generates – in tension – for cities experiencing UOG development. To explain, advances in drilling technology have enabled oil and gas operators¹ to advance from drilling vertical wells, to directional wells, to horizontal wells of growing length (now over 2.5 miles in the Denver-Julesburg Basin, where this research

is based) (Figs. 1 and 2) (USEIA, 1993). The adoption of horizontal drilling (HZD) has brought with it four changes of importance to energy policymakers (see Fig. 2 for a visual schematic). First, HZD enables operators to condense their surface footprints by co-locating many wells per pad. In the days of vertical drilling, by contrast, operators would sink a single vertical well every few acres, spreading out their impacts. Second, HZD increases an operator’s well pad siting flexibility by making it possible to drain the hydrocarbons under a given area from a variety of locations. Third, HZD has made urban drilling more lucrative because it allows operators to reach under cities to tap previously inaccessible hydrocarbons, drawing drilling activities farther into urban areas. And fourth, HZD has increased the odds of operators intersecting each other’s leaseholds, which has motivated a new level of comprehensive planning within the industry.

Combined, these new capabilities have enabled operators to develop hydrocarbons under cities while simultaneously allowing them to condense, more flexibly position, and collectively plan their extractive activities. These HZD dynamics present upsides and downsides for cities and their residents that have yet to be explored in the energy policy scholarship: namely, operators’ more condensed footprints have the potential to benefit the many by reducing the impacts of extraction for the total number of acres and people affected by extraction, but they do

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¹ Hereafter just “operators.” An operator is the company that owns and manages an oil/gas well – holding mineral leases, financing operations, contracting with service companies, etc.

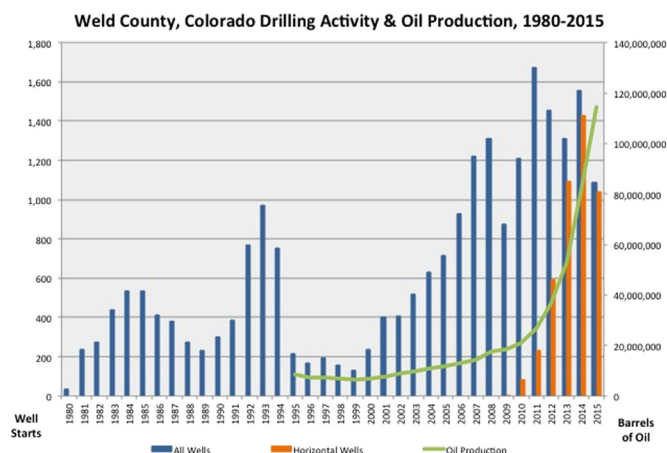


Fig. 1. In 2009, a total of five horizontal wells were drilled in Weld County (of which Greeley is county seat). Between 2010 and 2015, the number of horizontal wells drilled in Weld County grew to 4559 (COGCC, 2016). Production and drilling data gathered from the Colorado Oil and Gas Conservation Commission. (Oil production data available only to 1995.).

so at the expense of the few who live near intensified sites with greater potential hazards from higher truck traffic, more flammable fluids on site, and other risks (Adgate et al., 2014; Allshouse et al. 2017). In Greeley, Colorado, where this research is based, multi-well pads are now commonly about 4 acres in size, holding 24 horizontal wells with associated equipment. According to industry estimates, well pads of this size have estimated development times (24–7 drilling, completion, and flowback operations) of approximately 20 months total with associated truck traffic of 55–108 round trips per day in that timeframe, plus ongoing 23 truck trips daily during the wells' production lifetime (Matthews, 2015).² The tensions generated by this intensification of extractive activities are amplified by the increased siting flexibility that HZD enables, as city residents neighboring proposed multi-well pads ask why drilling has been located next to them instead of a few miles in another direction.

Following Hecht (2009), I use the term “technopolitics” to describe these HZD dynamics. Using French nuclear reactors as an example, Hecht argues that, because energy technologies are both a *product* of politics and *tools* used to achieve political goals, they are neither purely “political” nor purely “technological,” but “technopolitical” in nature (p15). In the case of urban oil and gas extraction, HZD is technopolitical because it is entwined with at least two political goals: boosting domestic energy production while also making an effort to improve community relations by condensing surface impacts. The central objective of this paper is to explore these previously unexamined HZD technopolitics in an urban environment. More specifically, the analysis investigates the understudied process of well pad siting in cities. I argue that this already consequential activity is growing increasingly fraught as HZD technopolitics heighten the size, intensity, proximity – and therefore the stakes – of urban drilling. Given the paired pros and cons of HZD for cities and their residents, the analysis focuses on the procedural fairness dynamics within HZD technopolitics. The following questions guide the analysis:

1. How is horizontal drilling changing spatial patterns and practices of UOG extraction?
2. What are the implications of these changes for procedural fairness in UOG governance?
3. Do existing well pad siting processes effectively respond to the evolving procedural fairness dynamics that have accompanied horizontal drilling?

² Traffic estimates assume that water is transported without trucks (e.g., using irrigation ditches).

These lines of inquiry have both theoretical and practical motivations. In theoretical terms, scholars cannot hope to understand contemporary UOG governance dynamics without attending to the ways that industry's ever-changing extractive technologies shape governance processes, and are shaped by them in return – in other words, how UOG technologies and politics co-produce particular “technopolitical” outcomes. On a practical level, UOG extraction is underway in or near numerous cities globally, presenting local and state governments with the challenge of balancing energy development and other community goals, protecting public health and safety, and making land use trade-offs that respond to residents' concerns and respect the rights of mineral owners. While these challenges span rural and urban UOG landscapes, this analysis focuses on the urban context, where the proximity of dense populations to well pads renders the opportunities and tensions associated with HZD most pronounced.

I explore the technopolitics of HZD via a case study of Greeley, Colorado – a city of 104,000 located in Colorado's Denver-Julesburg (DJ) Basin that, since 2011, has served as a crucible of contestation and compromise over urban HZD (Fig. 3a/b). Drawing from Greeley, I show that, while operators have been using HZD to respond to public concerns, the condensed extractive footprint enabled by HZD generates mixed results for residents. Moreover, I argue that contemporary HZD technopolitics are characterized by significant shortcomings in procedural fairness, which stem from the fact that state and local permitting processes structure public input on a site-by-site basis, while operators' HZD planning processes occur at the scale of the city (or larger). This scalar mismatch in decision-making between governments and industry serves to further fragment already fragmented public input on UOG development, generating what I call “piecemeal participation” dynamics for city residents and local officials. In short, HZD has granted operators more flexibility in where they drill, and has enabled them to collaboratively plan the siting of large multi-well pads in constellations that drain large sub-city areas, but local stakeholders are formally granted only small, single-site windows into these siting possibilities and choices. As a result, local participation in urban UOG extraction decisions is “piecemeal” in both definitions of the term: it occurs one piece at a time (gradually) and also with increasing fragmentation (discontinuity) as drilling sites are proposed and re-sited among different neighborhoods and jurisdictions. Greeley's recent history of well pad siting conflicts illustrates that this piecemeal participation is problematic for operators, residents, and local and state governments alike. These findings are relevant in Colorado and beyond, as municipalities facing UOG development work to keep pace with evolving extractive technologies such as HZD (USEIA, 2011; Fisk, 2016), and as extractive activities take up more space in these urban areas (Fry et al., 2017).

The paper is organized as follows: Section 2 reviews the literature to provide a conceptual framework for the analysis; Section 3 details the case study background and methods; Section 4 presents the recent history of HZD in Greeley and Section 5 analyzes its procedural fairness dynamics; Section 6 offers a discussion of policy implications and conclusions.

2. Urban hydrocarbon governance & procedural fairness

2.1. Understanding governance & procedural fairness in UOG communities

A governance approach to UOG begins from the premise that natural resources decisions are the product of ongoing negotiations and struggles among a triumvirate of state, market, and community actors (Fry and Branstrom, 2017). In the past decade in the U.S., the active contestation of UOG governance among such actors has generated a set of institutional dynamics that grant regulatory primacy to state governments while minimizing federal involvement and allowing local governments to steer only the aspects of UOG development that do not interfere with state rules. This framework has been characterized as a “decentralized regulatory approach” (Fisk, 2016), as “fragmented

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