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An historical political economy analysis and review of Texas oil and gas well flaring laws and policy

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ABSTRACT

Flaring (i.e., burning natural gas extracted at an oil or gas well) is an economically wasteful and environmental harmful industrial practice. Although initially banned in Texas, Texas Statewide Rule 32 currently allows oil wells to obtain a permit to legally flare gas. Through a thick description based on archival research, this paper explains: (1) how Texas flaring regulations emerged and weakened over time, (2) why Texas flaring regulations weakened, and (3) the implications of formal policy changes. This paper argues historical political-legal developments created new opportunities for companies to legitimately flare extracted natural gas. As new shale oil and gas development occurs in previously unreachable areas, incentives for immediate profits often outweigh the benefits of investing in the infrastructure and technology necessary to use extracted natural gas for productive purposes. This paper concludes that waste and pollution by oil and gas industry flaring practices can be minimized if state law and administrative code is changed to eliminate legal opportunities for companies to routinely flare natural gas and provide incentives for companies to immediately invest in the technology and infrastructure necessary to collect, store, and/or transport extracted natural gas to be used for energy production.

1. Introduction

Climate change, which is caused by increased greenhouse gasses in the atmosphere, is a critical problem facing humanity. According to a recent Intergovernmental Panel of Climate Change report (2018), if temperatures rise 2 degrees versus 1.5 degrees, there will an estimated 150 million more deaths due to climate induced food insecurity and water scarcity. With the energy sector being the primary contributor to greenhouse gas emissions, energy law, particularly *ex-ante* regulations to minimize environmental damages before they occur, is key to combatting climate change (Heffron et al., 2018).

While much research focuses on changes in energy law at the global, national, and local level (Heffron and Talus, 2016b), in the United States energy law and policy has historically developed at the level of the subnational state. In the United States, state energy law developed decades before national policies and state agencies remain key regulators of a dominant energy source– oil and gas. To better understand critical historical developments of oil and gas law in the United States, this paper explores the creation and evolution of Texas state law pertaining to a particularly wasteful practice by the oil and gas industry– the flaring of natural gas.

Although natural gas extracted along with oil and other petrochemicals at extraction sites has economic value, companies may decide to flare (i.e., burn extracted natural gas). There are three primary reasons for this decision. First, to test the pressure and composition of extracted natural resources, operators commonly flare gas the first few days after drilling is completed. However, some companies choose to forgo this unnecessary waste and instead use portable green completion equipment. Second, since wells must go through a costly process to be shut-in,[1] operators may flare gas to maintain a safe pressure during emergencies and repairs. Third, out of perceived economic interests and administrative costs, some companies choose to immediately flare extracted natural gas, rather than wait to invest in and build adequate infrastructure and technology necessary to effectively capture, store, and transport the gas to be sold or used.

As fracking technologies have opened oil and gas development in previously unreachable shale areas, flaring has become a growing economic concern. Prior to the start of the fracking boom in 2005, the United States Energy Information Administration (2017) estimated 96,408 million cubic feet of natural gas worth nearly $836 million was

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[1] Shutting in a well is a process by which a well is plugged at a specified level and filled with concrete to prevent natural gas from escaping. Depending on the depth of the well, shut in costs can be anywhere from $569 to $527,829 (Joyce, 2015).

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flared or vented (i.e., released raw natural gas)[2] at extraction sites across the United States; by 2015, the amount tripled to 289,545 million cubic feet worth over $1233 million. A large amount of that gas has been increasingly flared in Texas, which is the largest producer of oil and gas in the United States. As described in Fig. 1 below, while prior to the shale oil boom in 2005, the Texas Railroad Commission (TRC) estimated 7743 million cubic feet of natural gas worth nearly $57 million was wasted by flaring or venting at extraction sites in Texas; by 2015 the amount grew over tenfold to 100,388 million cubic feet worth over $427 million (TRC, 2016).

Flaring is problematic, as it wastes energy resources, creates health hazards and contributes to climate change. While urban air pollution in the United States has steadily declined since the 1970s, flaring has dramatically increased the number of toxic air pollutants in rural areas affected by the fracking boom (Schade, 2017). In 2012, flaring conducted in the Eagle Ford Shale, which is just one of Texas' many oil and gas shale plays, led to over 15,000 t of pollutants being released into the atmosphere, which is more than high-polluting Texas oil refineries (Hiller and Tedesco, 2014). Flaring releases a large amount of air pollutants into the atmosphere including carbon dioxide, methane, and other volatile organic compounds such as benzene, ethylbenzene and n-hexane. The magnitude of methane emissions from flaring is particularly problematic because global climate change is a growing concern. According to the Environmental Protection Agency (EPA, 2015), over the course of 100 years, methane contributes to climate change over 25 times as much as carbon dioxide.

While it is a growing modern environmental problem, flaring is not new to Texas. Texas residents and officials have expressed complaints of air pollution, light pollution, and economic waste from flaring since the first oil and gas boom in the early 1900s. As a result, the state legislature gave the Texas Railroad Commission (TRC) the responsibility to regulate flaring. In the 1940s, TRC shut down the production of flaring wells, forcing companies to invest in the necessary infrastructure and technology to collect extracted natural gas (Prindle, 1981). Despite a 400% increase in flaring from 2009 to 2012, TRC does not disseminate shut down orders. Instead, TRC has issued a few hundred fines, the average being less than $9000, a fraction of the immediate profit made by flaring gas rather than investing in green technologies (Morris et al., 2014). So why and how did this regulatory framework change?

Researchers have described the different elements of change in energy law at global, national, and local levels including international treaties, international policy organizations, government aims, availability of finance, advances in technology, and societal preferences (Heffron and Talus, 2016a). However, research has yet to deeply explore how structural power relates to the different elements of energy policy change. The purpose of this paper is to relate changes in Texas oil and gas policies to historically contingent power structures and to use these findings to develop justice driven policy recommendations, meaning energy policy that pushes for equality in energy development decisions. I start by briefly discussing my data and methods. Then I present my historical, archival findings and examine them from a political economy of the environment perspective. The political economy of the environment perspective focuses on how the governance and management of industrial production practices relate to the natural environment, while accounting for the historical development of political, economic, and social movement structures (Rudel et al., 2011). Upon presenting historical evidence, I evaluate the idea that rising volumes of flared natural gas are related to historically contingent power structures that create increased opportunities and incentives for companies to waste natural gas through flaring, rather than investing in the infrastructure and technology necessary to use extracted natural gas for productive purposes. I conclude by discussing state-level policy suggestions to decrease unnecessary energy waste.

[2] Federal and state records do not differentiate between venting and flaring estimates.

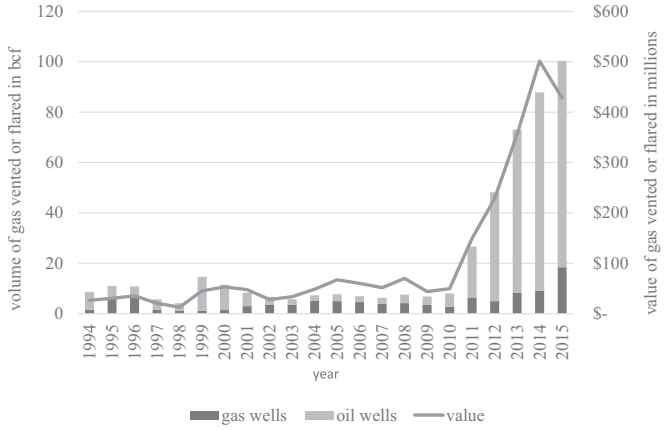

Fig. 1. Estimated waste from flaring and venting at extraction sites in Texas, 1994–2015.

2. Historical data and method

In order to trace the development and changes of Texas flaring laws and policies, I employ evenemential historical analysis (Sewell, 1996). From this perspective, history is path dependent; previous events impact the possible outcome of future events. Therefore, in order to understand what causes state policy outcomes, sequences of events are traced over time. Data include archival documents related to the politics behind flaring regulations in Texas from 1889 to 2017. I collected data from a variety of resources including industry reports, newspaper articles, law reviews, court records, and TRC archival documents obtained through Public Information Act requests for documents related to flaring laws and policies.

3. Historical findings

3.1. Texas oil and gas industry regulatory origins (1880s)

The "tragedy of the commons" is an economic theory of how unregulated free-market systems are destined for ecological collapse (Hardin, 1968). The commodification of oil results in a type of "tragedy of the commons." Numerous different producers with competing interests are each drawing from a shared field with a finite number of petrochemicals. Furthermore, as the field goes dry, it becomes more costly for producers to extract oil and gas. As such, a rational producer will attempt to extract more oil and gas faster than their competition. However, if everyone pursues their rational self-interest, the market would become flooded, the extracted resource would lose value, and the field would quickly run dry.

Due to the tragedy of the commons facing the industry, many landowning industrial and citizen groups supported early efforts by the state to ensure individuals and companies conserve oil and gas. In order to protect natural gas and oil reserves, in 1889 the Texas state legislature passed House Bill No. 167 as "An act to provide for the inspection of refined oils which are the product of petroleum and which may be used for illuminating purposes within this State, and to regulate the sale and use thereof; and to provide penalties for the violation of the same" (Texas Congress, 1889). This legislation gave the governor the legal authority to appoint an inspector to regulate the use and misuse of oil and gas. However, a state regulatory agency was not appointed to this task until conservation legislation was passed in 1919.

In 1919 TRC was appointed with the task to regulate the use and misuse of oil and gas. However, TRC has much earlier regulatory origins. Upon campaigning to better regulate railroad monopolies, Governor Jim Hogg worked with the state legislature to establish TRC

in 1881. By creating TRC as an appointive agency, Governor Hogg aimed to avoid situations where railroad barons could buy elections. However, a few years after the agency was established, railroad industry leaders, seeking greater industry influence upon elections, led the state legislature to amend the Texas Constitution such that TRC is run by three elected commissioners. Each commissioner holds a six-year term and there are elections every two years. If a commissioner steps down, the governor has the power to appoint a commissioner to serve until the next election. As I later discuss, the institutional foundations of TRC as an elected agency regulating the railroad industry had long-term consequences on the regulation of the oil and gas industry, especially in modern political campaigns which rely upon financing from wealthy donors.

3.2. Political conflict during the gusher age (1900s-1930s)

Upon the establishment of the oil and gas industry in Texas, many capitalists supported state regulation to enforce legal contracts and coordinate a fragmented market to prevent over production. As I will explain below, during the first Texas oil boom both Texas courts and TRC served the function of mediating conflict among different capitalist segments of the oil and gas industry. In an attempt to resolve competing capitalist interests, early flaring policies continuously changed.

Early flaring policy advanced as the state served the function of mitigating conflict between competing class segments within the oil and gas industry. For instance, the first regulations developed as an attempt to ease conflict between raw natural gas producers and royalty owners (i.e., those who own the rights to drill on Texas land). Conflict between these two groups emerged due to differences over what should be considered necessary waste. While producers profit from leasing land to quickly (and not always carefully) drill, extract, and collect the more valuable oil and associated gas and then moving on once the well goes dry, royalties owners, who own the rights to drill on Texas land and lease rights out to operators for a portion of the profit, only profit from selling the finite number of natural resources on their land. While it is in the royalty owner's interest to achieve maximum economic value from all natural resources extracted from the field over the long term, producers, who often rely upon short term land leases, do not always have the long term interests of the field at heart. In short, since raw natural gas had little economic value and is costly to store and transport, some production companies saw flaring gas as acceptable waste. On the other hand, royalty owners and conservationists saw flaring raw natural gas as unacceptable waste because it is the primary commodity of a natural gas well and requires little to no refinement to be used for energy production. Because some production companies failed to voluntarily eliminate routine flaring of raw natural gas, royalty owners and local communities urged state leaders to ban the practice so that the natural resource would not be physically wasted. State managers supported the royalty owners because flared gas also resulted in lost state revenue. Flared gas is not subject to state tax. For this reason, in 1899 Robert Prince of Corsicana led the state legislature to ban the flaring of raw natural gas 10 days after a gas well's[3] completion (Texas Congress, 1899).

When gas flares continued to be a problem throughout 1918 and 1919, industrial support for conservationist regulation and policing expanded. Royalty owners, federal regulators, gas refineries (who would profit from processing associated gas that was currently being flared), and some conservationist producers began to demand state-level environmental governance. For example, the Wichita County Producers and Refiners' Association announced producers would work with local police departments to enforce conservation laws since state-level enforcement was inadequate (Dallas Morning News, 1919). Additionally, due to complaints by conservationists and industry stakeholders, the United States Fuel Administration appointed federal inspectors to investigate the waste of natural gas in Texas (Dallas Morning News, 1918). As industrial and federal leaders began to question the adequacy of state-level conservationist regulation, the legislature responded by enacting stronger state-level conservationist laws to eliminate the physical waste of natural gas.

Rather than creating a new regulatory body to conserve natural gas, because TRC was authorized to regulate the transportation of natural gas through pipelines, elected Texas officials reacted to external threats to state governance by enhancing TRC's authority to regulate the use and misuse of oil and natural gas. In 1919, Senator Carlock of Fort Worth introduced Senate Bill 350, which gave TRC the authority to regulate Texas oil and gas production practices (Texas Congress, 1919). This law mandated each company provide TRC with thorough records of oil and gas operation, production, and disposal activities.[4] Furthermore, the bill forced organizations to obtain a certificate of compliance to TRC regulation to lawfully operate in the state. In short, the conservationist law allowed TRC to regulate oil and gas production and limit production to minimize waste, such as the burning of natural gas. Since, until the Organization of the Petroleum Exporting Countries (OPEC) was established in the 1960s, Texas controlled a major portion of the world's discovered oil and gas reserves, this law empowered TRC to significantly influence world gas prices (Prindle, 1981). In 1931, TRC's first legal order limiting production to eliminate waste went into effect. Although oil and gas production company leaders defied state regulatory efforts, Governor Sterling (1931) declared martial law, forcing corporate compliance.

Despite state efforts to better conserve gas, throughout the 1920s the oil industry successfully resisted the efforts of state managers, royalty owners, pipeline companies, and refinery companies to regulate flaring at oil wells using legal prowess in state courts. For example, in 1925 after a royalty owner filed suit against an oil production company, the resulting legal rulings reinforced the idea that producers should pay royalties for sold casinghead gas but not for gas flared at oil wells (Livingston Oil Corp. v. Waggoner, 1925). In short, due to the oil industry's successful argument that casinghead gas is not the primary product of oil wells, it was ruled that producers were not held liable for economic losses to royalty owners from wasted gas from flaring.

Differences between the legality of flaring at oil and gas wells created burdens for administrators in TRC. Because of state laws which explicitly prohibited flaring at gas wells but not oil wells, state managers were met with the difficult task of differentiating between oil and gas wells and then only enforcing flaring bans at designated gas wells.

Due to oil industry lobbyist efforts, the state legislature continued to develop and support state laws which excluded oil wells from flaring regulations. For example, in 1931 TRC Commissioner Parker and Texas Governor Pat Neff testified to the state legislature in support of more stringent conservation laws at both oil and gas wells. However, oil producers opposed regulatory efforts; they argued that regulating flaring at oil wells would stop the economic boom occurring within the state (Dallas Morning News, 1931). Despite the resistance of TRC, Texas legislature passed House Bill 25, which emphasized TRC's authority to regulate flaring at gas wells, but not oil wells (Texas Congress, 1931).

In sum, during the first oil boom, the oil and gas industry was split into various capitalist factions, such as royalties owners, pipeline companies, producers, and refineries. Oil and gas conservation policy regularly changed as competing industrial groups conflicted over regulation. TRC played the role of managing conflict within the oil and industry. Early conflicts between competing factions resulted in laws

[3] A gas or oil well is a surface area drilled for the purpose of extracting petroleum crude oil and natural gas. The difference between a gas and oil well is the amount of raw gas produced in comparison to crude oil. Texas Natural Resources Code Sec. 86.002 sets the ratio at 100,000 or more cubic feet of natural gas per every barrel of crude oil (Wilson, 1977).

[4] Flaring is considered an oil and gas disposal activity.

that provided TRC with the power to curtail production to minimize waste at oil and gas wells, yet excluded oil wells from flaring regulations.

3.3. The advancement of conservationist state leadership, 1930s-1950s

As the Texas oil boom peaked, capitalists continued to be split over regulation. Since the capitalist class failed to unify, yet TRC's authority and goal to minimize waste remained constant, TRC held increased regulatory power over capitalist resistance to environmental regulation. As a result, through scientific and legal means described in this section, TRC enhanced and exercised their power to force companies to invest in the technologies and infrastructures necessary to minimize flaring.

Despite oil industry resistance, state managers expanded their authority to regulate flaring at wells by supporting the development of scientific knowledge in the newly emerging industry and transforming legal context through litigation. For example, TRC hired chemists from the University of Texas to test water-white oil and determine if the substance should continue to be classified as oil (Prindle, 1981). Upon raising the temperature and pressure, the chemists found the white-water oil turned into natural gas. This new scientific discovery resulted in hundreds of oil wells being reclassified as gas wells. Since at this point of time, flaring was banned at gas wells, but not oil wells, by reclassifying facilities as gas wells, these facilities were no longer legally allowed to flare gas. As a result, TRC issued “no flare orders” which forced companies to shut down well production until the company built adequate infrastructure to capture the gas. In 1932 (Henderson Inc. v. Railroad Commission, 1932), upon being sued by a producer for shutting down the wells, TRC argued, regardless of the well's classification as an oil or gas well, flaring is an economic waste and within TRC's regulatory jurisdiction. The court agreed, providing legal precedent for TRC to enforce policies to minimize flaring at both oil and gas wells.

Although state courts held legal precedent for TRC to enforce polices to minimize waste at both oil and gas wells, without strong conservationist leadership from TRC, conflict within the industry continued to result in inconsistent state legislation. For instance, although policy instituted in 1931 banned flaring gas at gas wells, after pressure from gas stripping companies in East Texas, the state legislature passed Senate Bill 92 (1933). The bill permitted operators to flare gas at gas wells when there is “no reasonable market available” (Texas Congress, 1933:222). However, the industry did not cohesively support the bill. Pipeline companies, who economically benefitted from the state forcing companies to transport gas, resisted through an anti-waste lobbying campaign (Prindle, 1981). In response, the state legislature held hearings from April 9–12, 1934. Land owners, pipeline companies, refineries, royalty owners, producers, and other industry representatives attended the hearings regarding wasteful flaring practices (Texas Congress, 1934). During the hearing TRC began to develop a coalition with industry segments sympathetic to TRC's goals to minimize all forms of flaring.

In 1935, TRC teamed up with pipeline companies, land owners, refineries, and royalty owners to implement a consistent policy that explicitly banned flaring. With the support of land owners, royalty owners, refineries, and gas pipeline companies established at earlier hearings, in 1935 the Texas Congress overturned Senate Bill 92 by passing House Bills 266 and 782. The policies enhanced TRC's authority to prevent waste by shutting down gas wells that flare gas after 10 days of completion. But still, the state legislature avoided conflict with the industry by excluding discussion regarding flaring at oil wells. When TRC exercised its power by shutting down flaring gas wells, producers responded by filing suit. However, the courts maintained the legality of the shutdown orders (Clymore Production Co. v. Thompson, 1936).

After the conservationist bills of 1935, state law regarding oil and gas flaring regulation remained unchanged until the 1970s. In short, by 1935, state policy was institutionalized through three mechanisms: (1) the state legislature explicitly banned flaring gas as gas wells without mention of flaring at oil wells, (2) TRC held the authority to regulate production and waste in the oil and gas industry, and (3) state courts provided legal precedence for TRC to shut down wells that fail to cease wasteful practices (such as routine flaring), regardless of the well's classification as an oil or gas well.

In the mid to late 1940s, anti-waste activists used prevailing state policy to institute a strong anti-flaring campaign within TRC. The campaign gained steam in 1944 during a hearing, when anti-flaring activist and former TRC employee, William Murray, vigorously argued TRC official figures on waste were grossly underestimated; tax payers and royalty owners only knew of a fraction of the total amount of natural gas wasted from routine flaring practices. Forced to respond to his public, scientifically informed critique, TRC appointed Murray to chair a committee to investigate waste from industry production practices. Once completed, the Murray Committee report revealed the large amount of gas wasted through flaring.

Although some industry representatives resented the Murray Committee report, the industry was not unified in opposition to strong state-level anti-flaring efforts. For example, Dan Moran, the president of Conoco, provided public support for the Murray Committee and argued that for the sake of the long-term interests of the industry, flaring had to stop (Prindle, 1981). Public support by industry leaders legitimized TRC anti-flaring efforts.

The Murray Committee report increased national concern with the waste of natural gas, prompting fear of federal government involvement. In 1946, the Federal Power Commission held hearings regarding gas waste in Texas. Out of fear of federal intervention, industry opposition began to support strong state-level anti-flaring regulation. Supported by industry leaders, governors around the United States formed a coalition to support state-level regulatory control, the Interstate Oil Compact Commission. The Interstate Oil Compact Commission directly lobbied for states to support strong state-level anti-flaring efforts. In response to increased pressure from both within the state and across the nation, on his first day in office, the newly elected Texas Governor (and former TRC Commissioner) appointed William Murray to serve the TRC Commissioner seat he just vacated, an action lobbied by the Interstate Oil Compact Commission (Morehead, 1947).

Shortly after Murray was appointed, TRC began to implement strong conservationist policies, curtailing production until producers ceased wasteful flaring practices. TRC issued an order to shut down 615 oil wells in South Texas until corporations built the infrastructure to prevent flaring casinghead gas (Wells, 2014; Prindle, 1981). Corporations filed suit. The Texas Supreme Court held TRC could shut down flaring oil and gas wells since state legislation and legal precedent authorized TRC to implement policy to minimize waste in the oil and gas industry (Railroad Commission v. Shell Oil, 1947).

In brief, Texas state policy regulating flaring at oil and gas wells emerged before the turn of twentieth century. Responding to threats of federal intervention during a period of economic growth, the governor appointed a conservationist anti-flaring activist engineer, William Murray, as a TRC Commissioner. With the support of key state and industry leaders, Murray emerged as a strong conservationist leader who used the power of the state to shut down wells until they built the infrastructure necessary to eliminate routine flaring. Because of Murray's TRC leadership, the industry was legally forced to minimize flaring practices by investing in the equipment necessary to capture natural gas and either save it for later use by utilizing technologies to reinject it into an underground reservoir or build the pipeline and road infrastructure necessary to transport natural gas to consumers.

3.4. State responses in the global era, 1960s-1990s

While prior to globalization, Texas controlled most of the known oil reserves, upon the rise of the global marketplace, TRC is no longer the regulatory powerhouse it once was. As the result of busts, increased regulatory completion, and industry cohesion since the 1960s, TRC

policy became increasingly influenced by capitalists by the 1990s. As a result, policy shifted to increase the legal opportunities for oil and gas companies to flare natural gas.

TRC lost regulatory control of the greatest portion of the world's known oil reserves when, in 1960, the Organization of the Petroleum Exporting Countries (OPEC) was established. While prior to the founding of OPEC, TRC held the power to set oil and gas prices by controlling the supply of the greatest portion of the world's oil reserves. However, once OPEC was established, it overtook TRC's power. In short, globalization and global regulatory competition decreased the power of TRC.

Globalization and global regulatory competition led to crises resulting in increased public scrutiny of TRC and the Texas oil and gas industry. For example, during the Iranian revolution, oil production decreased, culminating in the 1979 Energy Crisis, where the nation faced major oil and gas shortages. However, Texas oil and gas producers aimed to avoid federal regulation, specifically the 1938 Natural Gas Act, which gave the federal government authority to set prices and sales for all gas transported through interstate pipelines. As a result, although Texas faced an oversupply of gas, producers failed to sell gas to customers across state lines during a period of national shortage, creating surplus for the state. To manage oversupply, TRC ordered a prorationing of gas, limiting Texas gas production. This regulatory action acquired national attention in 1978, when, on the popular national news program "Face the Nation," Senator Henry Jackson directly accused TRC of price fixing and suggested federal control of Texas gas. Due to fear of federal intervention, the Texas legislature, TRC, and the industry were forced to do something in response.

In response to external political and economic pressures, the oil and gas industry politically unified to claim prevailing state regulation established organizational complexities which created legal and economic disincentives for the industry to meet national needs. Industry representatives argued that failures to supply natural gas were the result of inflexible and unclear regulations impeding the discovery of new gas wells and deterring sales of gas across state lines. In concession to industry arguments, the federal government amended the 1938 Natural Gas Act to end federal regulation of natural gas prices sold across state lines (Walden, 2008).

Under pressure to better regulate the industry and facilitate growth, TRC was also forced to respond. However, with the industry unified, corporate hegemony (i.e. corporate dominance over ways of thought) limited the viable options of state actors. While in the 1930s and 1940s some industry segments supported increased state intervention, in the 1990s, the industry was cohesively opposed. Furthermore, as elections became more expensive, TRC leaders became increasingly dependent upon industry financial support for political elections. For example, the 1976 TRC election of the Jon Newton over populist Jerry Sadler was strongly influenced by industry leaders. Over $285,012.78 came from contributions of $500 and over and 73% of those contributions were traced to just a few independent oil and gas producers (Prindle, 1981). Due to the increased power of the industry over state regulators, TRC leaders responded by regurgitating industry framing of the flaring problem. Rather than framing the development of Statewide Rule 32 as a conservationist policy, it was framed as necessary to reduce regulatory costs. Statewide Rule 32 was passed, "to provide needed flexibility in gas operations," (Texas Register, 1978: 1020). Like previous regulation, Statewide Rule 32 banned flaring of gas at gas wells after 10 days of a well's completion. Yet, the rules provided the opportunities for bureaucratic exemptions; gas well operators were required to file a request to flare gas due to cleaning and repair needs. TRC held the responsibility of implementing a permit system and fining gas wells that flared without obtaining a permit. However, TRC did not receive adequate funding to manage their increased administrative burdens.

While those writing and developing TRC administrative code came under increased industry control, throughout the 1980s TRC engineers used bureaucratic means to eliminate unnecessary waste from flaring by shutting down production at flaring wells. Without administrative code regulating flaring casinghead gas at oil wells, legal precedent provided state managers with the capacity to restrict the production of flaring oil wells. Due to increased flaring activity, TRC engineers recommended operators cease wasteful flaring practices (Singletary, 1982). Examiners found, despite adequate pipeline infrastructure, operators were flaring gas in the Giddens Field area (Singletary, 1982). In response, regulators issued no flare orders for Giddens Field, limiting the production of wells in the area until flaring ceased (RRC, 1982). In 1986, due to continued waste, TRC limited the production of oil wells throughout the entire state (RRC, 1986).

TRC was pressured to initiate strong anti-flaring actions out of fear for loss or dual regulatory control by other state and federal agencies. For instance, the Environmental Protection Agency (EPA), began to pressure the Texas Air Control Board (TACB) to meet federal ozone standards. As part of its response, TACB scrutinized emissions from oil and gas flaring practices and contacted TRC (Bradford, 1986). TRC feared external intervention into their affairs and took actions to protect its regulatory authority. TRC officials contacted the TACB against dual regulation by arguing TRC flaring policy focusing on minimizing oil and gas waste should not be interfered by the TACB (Hall, 1986:2). To maintain their authority and legitimacy as the sole regulator of Texas oil and gas well flares, TRC was again pressured to respond. "In order to prevent avoidable physical waste" (TRC 1987: 1), TRC issued shut down orders for flaring gas.

Increased economic and political threats motivated the oil and gas industry to unify and cohesively respond in opposition to strong TRC anti-flaring policy. After increased production in response to the oil shortage of the 1970s, an oil glut created economic turmoil for oil and gas production companies in the 1980s. Strong anti-flaring state policy threatened corporate profits, as companies with few liquid assets preferred to expediently extract oil and burn excess gas, rather than invest in the infrastructure and technology necessary to bring extracted natural gas to the market. Accordingly, companies mobilized to erode prevailing state policy which permitted TRC to shut down flaring oil wells. During public hearings, the industry cohesively argued flaring regulations were too burdensome (Shook, 1985:16):

> Dan H. Montgomery, president of Houston-based Commet Resources, is concerned that producers' inability to sell gas is going to affect oil production. Montgomery explained that TRC regulations prohibit producers from flaring the casinghead gas produced by many oil wells and reinjecting the gas into the oil reservoir may not be possible. "Casinghead gas can't be sold, it can't be transported and it can't be flared," he said. "Producers are going to have only two choices: shut in an oil well or give the gas away."

By employing economic rationality throughout the hearing and failing to mention technologies available to store and transport gas that is otherwise flared, industry leaders argued, in order to meet national gas needs, immediate financial interests must supersede TRC anti-waste efforts. Even after the hearings, industry officials continued to publicly argue that state anti-flaring regulations threatened state revenues and national security (Shook, 1988).

The oil and gas industry used prevailing public policy as a tool to increase legitimate opportunities to waste gas through flaring. Industry efforts in opposition to strong anti-flaring state policy centered around amending Statewide Rule 32. Following industry recommendations, TRC announced plans to amend policy to include rules for flaring casinghead gas and extend the conditions under which flaring is considered necessary. The proposed amendment expanded the conditions to include the "unavailability of a pipeline or other marketing facility, or other legal uses" (Texas Register, 1990a:1680). Upon the passage of the amendment, a permit is approved not just for cleaning and repair (like previous policy), but if the producer claims, because technology and infrastructure is not currently available, not flaring would result in economic delay.

In addition to allowing flaring for immediate economic reasons, the proposed amendments minimized administrative burdens for routine flaring at low producing wells. The following section was added (Texas Register, 1990a: 1680):

> The Director of the Oil and Gas Division, or the director's delegate, may administratively grant exceptions in the manner authorized by subsections (a)(2), (b) and (c) of this section. Exceptions granted pursuant to this subsection may not exceed a period of ninety (90) days; provided that, the ninety-day limitation does not apply for volumes of casinghead gas less than or equal to 5 mcf per well per day.

This policy change minimized the administrative cost for wells flaring 5 mcf or less of gas *each day*. To put this number in context, in 1990, the average U.S. residential consumer used 95 mcf *each year* (United States Energy Information Administration, 2010).

TRC again regurgitated oil industry economic framing of the problem. For example, TRC emphasized the need to minimize administrative burdens and acquiesced to Exxon's request for a higher exemption threshold. In September 1990, corporate representatives wrote to TRC (Hutchingson, 1990:1):

> Exxon Corporation supports the Commission's proposed changes to Statewide Rule 32 with one exception. Exxon recommends that Section (d) be revised to allow the Director of the Oil and Gas Division or his delegate to administratively approve exceptions to subsections (a) (2), (b), and (c), without a ninety-day limitation for volumes of gas less than or equal to 25 Mcf/day. The volume limitation in the proposed rule will impose an undue administrative burden on both the Railroad Commission and industry.

Later in April 1990, responding to Exxon's request, TRC recommended the changes be approved since it would limit the administrative burden of the permit process (Winetroub, 1990:1):

> Only 23 leases per month (average) flare/vent volumes greater than 25 MCFD. On the other hand, the existing proposed rule with a cut-off of 5 MCFD would place a maximum of 80 cases before the Commission each month…. Exxon Company U.S.A. filed a comment in agreement with the staff recommendation.

Comments made by the industry in April resulted in TRC recommendations in September. Six months after Exxon's recommendation, TRC formally increased the limit from 5 mcf/day to 25 mcf/day (Texas Register, 1990b). In short, through direct lobbying, Exxon and other oil industry efforts used state administrative code to increase the legal opportunities for producers to flare gas.

Statewide Rule 32 amendments minimized the risk and cost of corporate non-compliance. Flaring regulations shifted from shutting down violators to issuing fees. Fines can be issued for up to $10,000 each day the well flares without a permit. However, fees are rarely issued (Hiller and Tedesco, 2014). Instead, TRC sends warnings to pressure violators to comply to state policy by filing for a flaring permit, which is rarely denied. Individual royalty owners and landowners surrounding a property can sue producers for negligent waste (Wells, 2014), but state structure fails to enforce a strong, comprehensive, anti-flaring policy. Instead, prevailing political-legal arrangements provide corporations with the capacity to legitimately flare gas, and wells continue to flare gas when economically beneficial (McFarland, 2014).

In conclusion, globalization decreased the power of state managers over the industry. By the 1970s, OPEC began to have greater control over oil and gas prices. Subsequently, economic downturns pressured state managers to comply to cohesive oil and gas industry efforts to change conservation policy to better meet the immediate economic interests of the industry. State managers supported industry efforts by employing economic framing to create new opportunities for companies to legally flare gas.

3.5. Modern flaring politics, 2000s-2010s

The change in policy in the 1990s had major consequences during the shale oil boom, when, due to the development of fracking technologies, there was a dramatic increase in production as it became economically feasible to extract oil and gas in previously unreachable tight geologic shale formations. With the legal opportunity to do so, some companies have chosen to immediately drill for oil and flare natural gas rather than wait to invest in and obtain the pipeline infrastructures or portable green technology equipment necessary to collect gas in remote fields. With legal opportunities and economic incentives supporting the practice, flaring has increased since the start of the shale oil boom in the early 2010s.

Since the 1990s, companies continue to develop technology to reduce flaring emissions (Montgomery, 1996). However, many companies fail to invest in new technologies and flaring continues to be a major problem facing local communities. As flaring became more prevalent during the shale oil boom, communities and corporate shareholders mobilized in opposition to wasteful practices. Scientists and environmentalist groups released reports about the impact of flaring on local community health (Morris, 1997). Increased citizen concern promoted private investors to call for corporate managers to address the issue (Hays, 2007). Furthermore, oil and gas lawyers have rallied for individuals to take companies to court to stop waste from corporate flaring practices (Wells, 2014).

While anti-flaring activists have targeted corporations to minimize flaring, corporate managers blame federal regulations, specifically the United States Environmental Protection Agency (EPA). Due to increased concern with global climate change, in 2011, the EPA set new greenhouse gas limits. Although, as a result of industry pressure, EPA policy exempted oil and gas wells and pipelines from reporting, the regulations still apply to other gas infrastructures, such as processing plants. While some companies overcome constraints by investing in new portable equipment, industry representatives publicly claim flaring is inevitable because EPA regulations prohibit companies from getting quick approval to build the infrastructure necessary to capture gas (Landers, 2012).

Aiming to maintain their authority over an industry they are highly dependent upon, state managers within TRC have aligned with corporate managers in opposition to federal regulation. In a testimony to Congress, TRC Chairman Barry Smitherman argued in support of industry and in opposition to federal environmental regulations (2013): “The key to keeping our nation's natural gas momentum going is to limit interference from EPA.” In addition to suing the EPA (Hiller and Tedesco, 2014), Texas officials have also resisted efforts by the United States Bureau of Land Management (BLM) to eliminate routine flaring on federal land through lawsuits (Staff, 2017). As a result of lawsuits put forward by state officials, like Texas Attorney General Ken Paxton, and industry representatives, such as the Independent Petroleum Association of America and the Western Energy Alliance, under the Trump Administration BLM suspended the implementation of Obama-era rules to eliminate routine flaring on federal land (Barlas, 2017).

Whereas corporate-state relations were more contentious in the early twentieth century when the industry was more divided over policy, the early twenty-first century corporate-state relations are more cooperative, as the industry is cohesively opposed to increased regulation. As opposed to strong anti-flaring regulation, TRC has shifted to support cooperative voluntary efforts (Dallas Morning News, 2013). These cooperative efforts between the state and corporations soothe environmentalist concerns without making significant structural chances. For example, in 2011, to address the problem of flaring, TRC initiated the Eagle Ford Shale Task Force in coordination with industry officials and headed by TRC Commissioner David Porter. The Task Force was praised by industry leaders (McEwen, 2012):

> Robison [chairman of the Permian Basin Petroleum Association

(PBPA)] praised Porter for taking the initiative on the issue, saying its important flaring is addressed within the state by state regulators before federal regulators step in and address the issue. Porter, he added, has done a good jo of keeping the PBPA and other associations in the loop as he studies what can be done and what needs to be done to minimize flaring and its impact on the population.

However, the Task Force did not result in structural changes to limit flaring. Instead, the Task Force argued the flaring problem would be reduced if regulations were clearer and permits were granted at a faster rate (Vaughan, 2013). Because of the Task Force's findings, the state legislature provided TRC with a $24.7 million supplemental appropriation to digitize oil and gas reporting requirements and permit applications (Vaughan, 2013). Although these administrative efforts speed the process of obtaining a flaring permit, changes due not limit routine flaring. Through membership on TRC special interest committees, corporate interests are achieved while placating environmentalist stakeholders.

In sum, regulations established in the 1990s created legitimate opportunities to flare gas. Many companies seized this opportunity during the shale oil boom. As a result, gas is frequently flared at well sites and the once banned activity of flaring is now an industry norm. However, rather than forcing companies to not routinely flare gas from an adversarial standpoint, TRC works with the industry to maintain legitimate opportunities for companies to flare gas.

4. Discussion

Historical analysis demonstrates how Texas oil and gas flaring regulations have changed over time. Although state legislatures implemented anti-waste flaring regulations before the 1900s, regulations remained unenforced until the state was pressured to negotiate terms to better conserve natural gas. By 1935, TRC held and exercised the regulatory power to shut down and fine flaring oil and gas wells. Since the industry was not unified during this historical period, when pressured by conservationists and federal agencies, Texas state managers, such as Commissioner Murray, successfully implemented strong anti-flaring state policies. However, globalization changed corporate-state relations and led to decreased power of TRC over the industry. Due to unified industry efforts responding to capital decline, by 1990 Texas oil and gas flaring regulation was eroded to emphasize enhancing economic expediency over minimizing waste.

While Texas responded to flaring in the mid twentieth century by shutting down wells, due to changed power dynamics from globalization, during the twenty first century Texas state officials have not employed a strong anti-flaring response. Prior to globalization, because it maintained regulatory control over the largest portion of the world's known gas reserves, state regulators held a great amount of autonomous power over the conflicted industry. During this historical period, state managers used their power to institute flaring bans and shut down production at flaring wells. However, as new oil fields were developed abroad, TRC no longer was the regulatory agency with control of most of the world's known gas reserves. Throughout this historical period, during periods of economic decline, the oil and gas industry politically unified to overpower established anti-waste regulation by modifying prevailing state-policy to increase opportunities for corporations to legitimately flare gas. Now, rather than increasing the cost for flaring, TRC works with industry representatives to maintain opportunities for companies to routinely flare gas with few possible legal or economic costs.

Changes in state policy created new opportunities and incentives for companies to waste natural gas through flaring, rather than investing in the infrastructure and technology necessary to use or sell the less valuable natural gas extracted along with other more valuable petrochemicals, such as oil. Prior to the 1990s, there were possible significant legal and economic costs for flaring, as demonstrated by TRC issuance of shut down orders. However, due to changes in Statewide Rule 32, companies no longer face those threats from the TRC. Because, due to changes in state administrative code, there are few legal and economic repercussions but many immediate economic benefits, when deciding whether to rent or buy green technologies rather than flaring gas, many companies choose to immediately flare.

5. Conclusions and policy implications

This study demonstrates the powerful role that state legislatures, state agencies, state courts, and industry representatives play in determining the use of energy resources. As the industry developed and globalized, oil and gas companies accumulated power over state officials and used such power to increase the opportunities to legitimately pollute and waste natural resources by routine flaring. Although policies at one point banned flaring practices, since the 1990s flaring is allowed when it is in the immediate interest of corporate managers to not invest in the technology or build the infrastructure necessary to capture extracted natural gas. In short, changes in state law and administrative code decreased the costs for flaring.

While powerful state and industry actors dominate the energy policy formation process, residents are often left out. The power of industry over residents in determining modern Texas energy policy is demonstrated by the lack of resident involvement in flaring regulation, as well as industry involvement in overruling other local oil and gas regulations. For example, on November 4, 2014, with 59% voter support, residents approved the City of Denton Fracking Ban Initiative, which banned all hydraulic fracturing in city limits. However, the initiative was never enforced. The industry organized to override local decision making by working with state officials to pass House Bill 40, which preempts local regulation and gives the state exclusive jurisdiction to regulate oil and gas operations. By ensuring state and industry actors dominate energy policy decisions, Texas energy law provides little opportunities for local residents to have a say.

There is a growing need to hold energy companies accountable for the sustainable distribution of energy resources. While there is literature and legislation on restoring the environmental harms at nuclear facilities and offshore oil and gas extraction sites, questions remain about how the environmental costs of on-shore oil and gas extraction should be remedied (Heffron, 2018). This paper demonstrates how state legislation can be used to pressure oil and gas extraction companies to invest in sustainable green completion equipment and infrastructure as means to achieve just distribution of energy resources.

A key tenant of energy law is energy justice, which is the fair and equal treatment of all people in energy decision making (Heffron et al., 2018). One of the principles of energy justice is transparency and accountability to the public (Heffron and McCauley, 2017). However, Texas energy law has little transparency and accountability. Due to state law and procedures, residents surrounding energy extraction facilities have little power to hold industry accountable for wasteful and environmentally harmful actions. Yet, with a few, simple actions, state regulators could become closer to achieving energy justice.

Currently, TRC does not provide maps showing where flaring occurs, and the information is not cheaply available to researchers. In order to map flaring volume totals, researchers must purchase, process, and link several datasets on production and wellbore locations. While the information can be requested through the Texas Public Information Act, TRC charges hefty fees to turn over the information, and it has denied requests by academic researchers to waive or reduce charges for research that is in the public's interest. Without the ability to obtain systematic information on where and who is flaring natural gas, residents and stock holders remain unaware of the environmental hazards being produced. In order to empower communities with information on how energy is being wasted, TRC leaders should change internal procedures to waive or reduce fees for all researchers requesting the information for non-profit purposes that are in the public's interest.

In addition to achieving energy justice, energy law is also needed to obtain industry investment in critical infrastructure and green technologies necessary to combat climate change. In order to address the problem of climate change, energy law and policy must be linked to environmental and conservation law and policy (Heffron et al., 2018). Below, I describe several ways state regulators could better combat climate change by linking energy law to environmental and conservation policy.

First of all, energy policy should eliminate all legal opportunities to unnecessarily waste gas by routine flaring. To ensure companies do not have the legal opportunity to routinely flare, RRC should eliminate the flaring exception established in Statewide Rule 32(f)(2)(D), which allows flaring when pipeline is unavailable, even if available green technologies could eliminate the need to flare when pipeline has yet to be established. By instituting flare bans and forcing companies to invest in green technologies and infrastructure by shutting down production at wells engaged in flaring, in the 1940s under the leadership of Commissioner Murray, TRC was able to force companies to invest in green technologies and infrastructure necessary to eliminate unnecessary waste. Like in the 1940s, TRC should be given the legal and monetary resources necessary to heavily police and shut down wells engaged in routine flaring.

State agencies can also create fiscal incentives for companies to build the technology and infrastructure necessary to eliminate routine flaring. This could be done by providing tax breaks for companies that purchase or rent green equipment to minimize flaring. Also, the state could subject all flared gas to both royalties and state taxes, thus increasing the cost for routine flaring. By creating financial incentives for green investments, state energy policy could help reduce carbon and methane emissions and deter further environmental damage.

It is in everyone's long term interest to achieve the desirable goal to eliminate unnecessary waste and pollution from routine flaring. However, political will is necessary to change the incentive structures affecting company decisions to not waste gas through flaring by investing in portable green equipment. Under the Obama Administration, the Bureau of Land Management instituted the 2016 Waste Prevention Rule to reduce flaring on public and tribal land. After the Trump Administration took control of the Executive Branch, these federal rules linking energy to the environment have been rolled back. While states and environmental groups are fighting the Trump Administration in courts, it is up to state leaders to institute state-level laws to eliminate flaring. Due to the potential economic and environmental benefits, both the industry and the broader public must push state legislatures and administrators to establish state energy law that enhances the fiscal and political costs for unnecessary routine flaring. State energy law remains a critical component to address the problem of global climate change.

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