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Efficient Environmental Regulation in the Unconventional Oil Industry

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US oil production has skyrocketed since 2007. Technological advances in oil and gas drilling (commonly referred to as ‘fracking’) have allowed producers to access vast petroleum reserves that were previously too costly to recover. The growth in oil and gas production from unconventional sources has been tremendous, so that unconventional sources now make up more than 50 percent of total US petroleum production (EIA 2015). While this represents a boost to job growth and the broader economy, growth in the oil industry comes with its fair share of problems. Academics and news agencies have documented a host of costs associated with new oil and gas production—groundwater pollution, oil spills, large “man camps” and increased crime, and even increases in traffic accidents and exploding train cars. Some of these costs were seen in Iowa with the contentious nature of right-of-way issues associated with building out the Dakota Access pipeline across the state. Farmers and environmentalists alike are bound together in their concern for right-of-way, human rights concerns, and environmental issues.

Efficient Pollution Regulation: A Case Study of the Bakken

Our recent work studies just this sort of problem. We study a new regulation aimed at reducing natural gas flaring (e.g., drilling, fracking, production, and transportation costs), but also the external costs borne by other members of society that may have no stake in oil production. A prominent external cost associated with oil production is air pollution. Air pollution comes from all stages of oil production, from drilling, to transportation, to processing, and eventually to burning the fuel in its final use. In the unconventional oil industry, significant pollution comes from the flaring of natural gas. When oil producers drill a well, the well produces both oil and lighter hydrocarbons like methane and butane. Up until very recently, there has been a lack of infrastructure in North Dakota to capture and transport these lighter products to natural gas processing plants. Thus, producers have resorted to flaring the gas (burning it at the well site). Absent environmental policy, oil producers do not consider the local pollution (e.g., black carbon or carbon monoxide) or global greenhouse gas impacts of flaring when they make their decision of whether to invest in onsite gas capture infrastructure; nor do they consider the lost royalty payments for landowners because the gas was burned off instead of captured and sold.
at wells in one of the most prolific oil producing regions in the country—the North Dakota Bakken Shale Formation. The Bakken has transformed North Dakota from a small oil state to among the most productive oil producing areas in the world. Figure 1(a) shows that oil produced from wells drilled since 2007 has risen to around one million barrels per day in under a decade. However, the figure shows that the oil wells in the Bakken also produce a lot of natural gas. In 2015 alone, the state produced just under 585 billion cubic feet of natural gas, enough to supply all Iowa residents for ten years. However, producers in the state flared over 30 percent of gases produced from 2007 to 2016 because of difficulties in building out gas pipelines and gas capturing and processing infrastructure. Flaring is so widespread in the state that the lights from the flares can be seen from space at night (Figure 2). These flared gases not only produce greenhouse gases and local pollutants harmful to human health, but they also represent significant royalty and tax revenue losses to landowners and local and state governments.

In 2014, regulators in North Dakota began discussing potential regulations to reduce gas flaring in the state. In 2015, the North Dakota Industrial Commission instituted an ambitious regulation requiring producers to meet stringent flaring limits across all of their wells. In a new working paper, we study the impacts of this regulation on flaring rates at new wells drilled in the state since 2015. Overall, we find that the regulation has done its job. Firms have begun connecting wells to gas capture infrastructure more quickly since 2015, resulting in less flaring. As shown in Figures 1(a) and 1(b), average flaring rates are declining, and the number of wells not connected to gas pipelines has decreased precipitously. We attribute a large part of these changes to the regulation.

Good economics judges regulations by the benefits they deliver as well as the costs they impose. Our research goes beyond quantifying the benefits from the regulation, but also considers the costs of achieving the flaring reductions. The regulation has a particular feature that may make it less cost-effective than the ideal regulation: it is firm-specific. Regardless of where in North Dakota a firm operates its wells or how many wells a firm owns, they must all meet the same flaring reduction targets. We show that this leads to inefficiencies in the policy. Some firms own a lot of wells that are close to gas pipelines. These firms are able to comply with the regulation at low cost, since building out pipelines is the expensive part of complying with the regulation. These firms may end up flaring at many of their new wells if they are already in compliance with the regulation. However, other firms may operate wells far from pipeline infrastructure and therefore may incur massive costs to comply with the policy (i.e., they must build out far longer pipelines than other firms). We show that if the regulation allowed firms with high compliance costs to pay firms with wells close to pipelines to connect their cheap wells and therefore over-comply with the policy, the same reductions in flaring could be achieved at a lower aggregate cost and both firms would be better off.

Does this mean the flaring regulation in the Bakken should be scrapped? Almost surely not. Some of the wells we see connecting to gas capture infrastructure do so at very low cost. Given the benefit to society...