

# **Shale gas and oil development: A review of the local environmental, fiscal, and social impacts**

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## **Executive summary**

### **1. Motivations underlying the research**

Hydraulic fracturing and horizontal drilling technology became commercially viable in the early 2000s, leading to a veritable boom in the development of natural gas and oil from shale plays. In 2018, about 63 percent of natural gas and 61 percent of crude oil production in the US was from shale resources. The effects of this rapid expansion of shale oil and natural gas extraction may include lease and royalty payments to land and mineral rights owners; increased demand for labor, land, housing, and infrastructure; increased truck traffic, air pollution, surface-level ecological disturbances; and the risk of soil or water contamination. Development is also associated with new sources of tax revenue for States and local governments, as well as strains on government resources to improve and maintain public infrastructure and services.

In this article, we review the literature on the environmental, social, and fiscal implications of shale development for residents and the environment in shale areas. To our knowledge, this is the first article that combines a review of the social, environmental, and government finance impacts of shale development with a discussion of the local, state, and federal regulatory framework in which this development is occurring.

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## 2. A short account of the topics reviewed

**Regulatory context.** The shale gas and oil boom is occurring within a framework of local, state, and federal regulations. While local governance can influence the effect of this energy transition on local communities, local policies and fiscal choices are often bounded by state and federal regulations. Impacts at the local level will be shaped concurrently by the local, state, and federal regulatory framework.

**Environmental impacts.** Direct environmental effects encompass the potential for groundwater contamination as well as surface-level ecological disturbances, both terrestrial and riparian. In addition, fugitive methane from operations, as well as the accumulation of volatile organic compounds (VOCs) and ozone, can affect air quality. Induced seismicity and methane leakages are the two main pathways that shale gas and oil production in one location affects larger regions.

**Effects on income and employment.** Landowners with mineral rights can receive lease and royalty payments. Severance taxes paid on extracted natural gas can contribute to higher revenues for state and local governments. Spending on goods and services by local residents and governments from these additional sources of income, as well as by workers involved in construction or operations activities, can further affect local economies. Some studies have found positive benefits to total local employment, wages, and population growth, while others found much more modest impacts on local employment and wages.

**Local resident participation in energy-development benefits.** Unconventional methods of gas extraction may have dissimilar impacts on community residents, with some residents receiving significant benefits while others experience mostly the inconveniences or costs of development. We review studies that find that local ownership of mineral rights varies substantially across shale plays, from an average low of 12 percent in the Permian in Texas to a high of 55 percent in the Marcellus in Ohio and Pennsylvania, while a study of farmer ownership of mineral rights found that in oil- and gas-producing counties 11 percent of farm operators own oil and gas rights.

**Zoning and other local regulation.** Setback provisions regulate how far away oil and gas wells must be from a person's residence or any other commercial structure. While these laws are passed at the State level, the local city or county government often handles zoning and other land-use issues. As a result, there is considerable variation in the types of laws and degrees of regulation placed on oil and gas development across the United States. How much control local governments should have to regulate gas or oil development activities has been a source of major contention in some States, with States providing varying local authority (and experiencing court cases).

**Local fiscal issues.** The impact of energy development on state and local governments depends upon the structure of taxation and expenditures in affected jurisdictions, in addition to the level, pace, and duration of the development activity. In most States, State governments set and modify the fiscal codes. Consequently, local governments typically are only able to choose from the tax options granted to them by their State government. Thus, policy decisions at the State level have a significant effect on both state-level and local fiscal outcomes.

## 3. Main conclusions and policy implications of the work

In this review article, we discuss the local, state, and federal regulatory context in which shale gas and oil production occurs and review how it affects local communities, the environment, and government income and spending. As production of oil and gas from shale plays is projected to increase, shale development will occur in more areas and increase in existing ones. As such, this review can serve both as an interim assessment of how shale development has affected local communities and the environment and as a compilation of various lessons learned and different regulatory approaches for regions where shale development is only beginning.