



Office of Oil and Natural Gas: Unconventional Oil and Gas Resources

Over the past decade, the domestic oil and natural gas industry has been transformed by the successful development of unconventional shale resources. The commercial success of shale is in part the result of a research effort by the U.S. Department of Energy (DOE), the Gas Research Institute, and later, industry. The mission of the Office of Oil and Natural Gas is to maximize the public benefits of oil and natural gas resources and ensure their environmentally responsible development and delivery through research, policy, innovation, and outreach.

Role of DOE's Office of Oil and Natural Gas

The increase in unconventional shale gas production in the United States follows many years of investment and research carried out by the federal government. Between 1978 and 1992, DOE invested about \$137 million in the Eastern Gas Shale Program, which helped demonstrate and commercialize many technologies in use today. As early as 1975, a DOE-industry joint venture drilled the first Appalachian Basin directional wells to tap shale gas. From the 1970s to the 1990s, multiple National Energy Technology Laboratory (NETL)-funded research and development (R&D) technologies would optimize production of shale gas across the United States: directional drilling, microseismic monitoring of multi-stage hydraulic fracturing treatments, and modeling. These investments—combined with industry collaboration—made the American shale gas revolution possible. Since then, DOE has continued to carry out R&D to reduce the potential environmental impact of shale gas development, as well as to develop reporting and data collection tools for industry professionals, regulatory agencies, and the public to easily access information on oil and natural gas activities.

DOE has a successful track record of promoting innovation in the natural gas sector

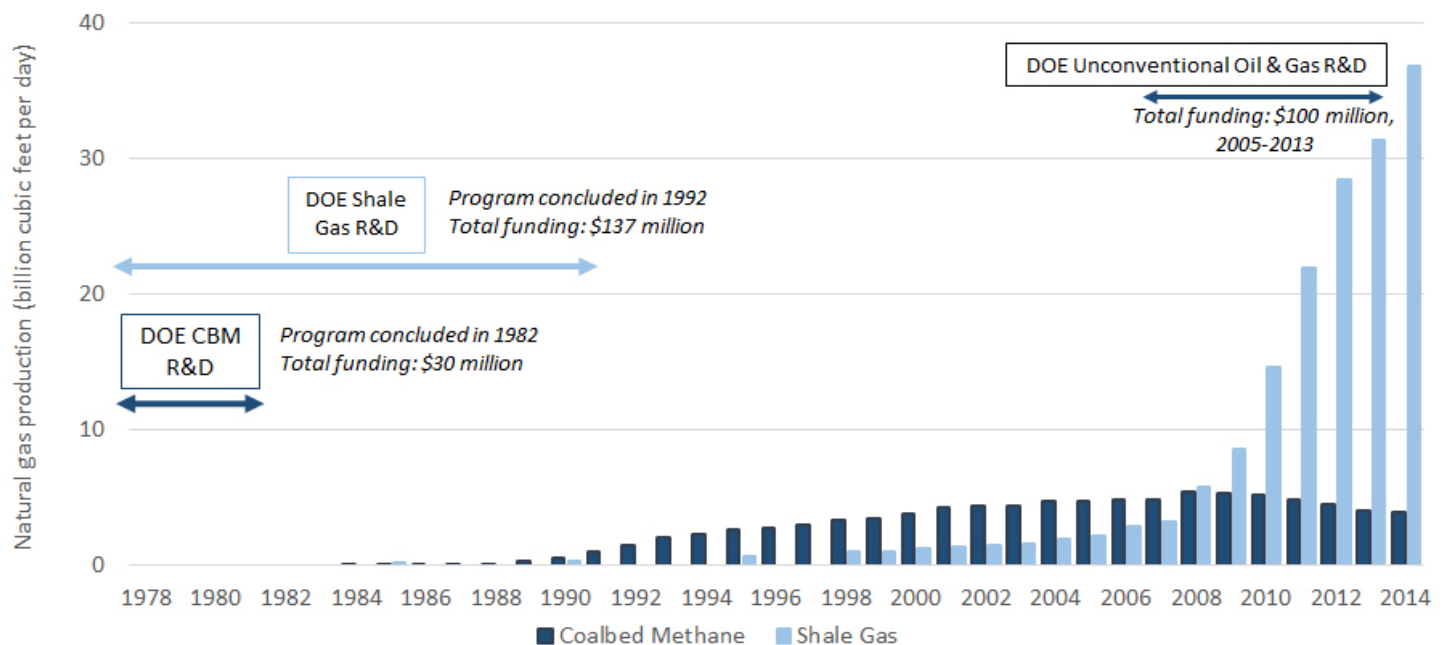


Figure 1. Federal funding of shale gas investment. Sources: DOE and EIA

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Research Results

The Office of Oil and Natural Gas is now focusing on environmentally prudent and efficient development, as well as responsible stewardship of the resource. Research is ongoing to continually narrow the bounds of uncertainty and risk. DOE-sponsored results include:

- **Water Quality and Availability:**

Developed new technologies that treat produced water so it can be reused rather than disposed of, and improved how wells are designed and engineered.

- **Induced Seismicity:**

Determined that the causes for induced seismicity are specific to regions and need to be studied individually. In the Barnett play, earthquakes occur near high-volume injection disposal wells, whereas in the Eagle Ford play, earthquakes follow increases in extraction of water/petroleum.

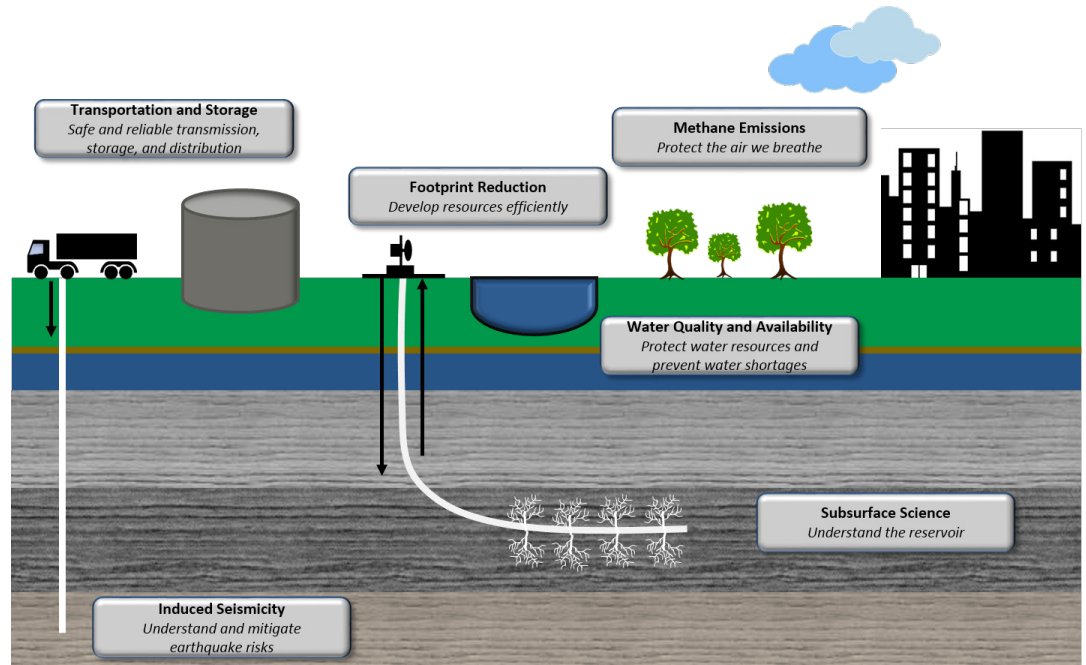


Figure 2. Oil and natural gas thematic areas

- **Methane Emissions:** Measurement and modeling efforts concluded that emissions from gas wells are intermittent and levels are determined by the stage of development. Specifically, methane emissions were quantified from pre-drilling to completion in the Marcellus, and methane emissions from regional sources in the Marcellus continue to be characterized.
- **Subsurface Science:** Improved the design, monitoring, and control of fractures and stimulations to optimize unconventional oil and gas (UOG) production; advanced understanding of properties and behavior of the reservoir rock, the well, and the fluids to enhance well productivity; and assessed the nature and scale of unconventional resource plays to reduce development intensity.
- **Footprint Reduction:** Developed tools and technologies to assist with well pad siting and density decisions, to identify location-specific subsurface geologic and wellbore (oil, gas, and underground injection) risks to the surface, and to minimize environmental impacts of well pad access roads.
- **Transportation and Storage:** Developing interactive, GIS-based tools that optimize management decisions related to pipe infrastructure, stationary, and mobile treatment systems, and reduce environmental and community impacts. By modernizing U.S. energy infrastructures in a changing global marketplace and supporting fuels diversity through research, demonstration, and analysis, DOE and its partners can develop a reliable infrastructure that provides energy security benefits, while reducing environmental footprints.

Coordination with Stakeholders

- **Multiagency Collaboration on Unconventional Oil and Gas Research:** Together with the Department of the Interior and the Environmental Protection Agency, DOE deployed a strategy to coordinate research on resource characterization, water quality and availability, air quality and greenhouse gas emissions, effects on human health, ecological effects, and induced seismicity.
- **FracFocus:** Developed in collaboration with the Groundwater Protection Council, this web-based tool is an example of a successful voluntary monitoring program; companies can record volumes of water used for hydraulic fracturing and disclose chemicals used in the fracturing fluid.
- **DOE-NARUC Natural Gas Infrastructure Modernization Partnership:** Collaborated with the National Association of Regulatory Utility Commissioners (NARUC) to support states in advancing technology and regulatory policies that enable investments in infrastructure modernization, mitigate methane emissions, and improve efficiency of natural gas utility distribution systems.
- **Environmental Council of States' Shale Gas Caucus:** Provided funding to develop analytical tools and technologies to assist states with their information exchange programs that provide approaches to mitigating methane emissions in the natural gas supply chain, including the ECOS Methane and Air Toxics Reductions Information Exchange (E-MATRIX).

For more information, please visit
energy.gov/fe/science-innovation/oil-gas-research