



## FOSSIL ENERGY RESEARCH BENEFITS

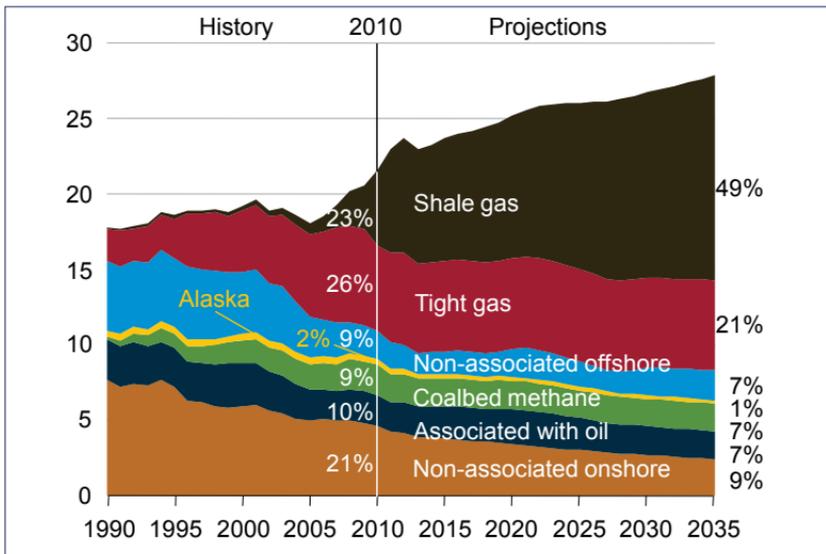
### Coalbed Methane

**Coalbed Methane (CBM)** is natural gas found in coal deposits. It was once considered a nuisance and mine safety hazard, but today has become a valuable part of the U.S. energy portfolio. A major reason for this is resource characterization and the establishment of efficient recovery methods pioneered by **Office of Fossil Energy (FE)** research and development.

*According to the President's Council of Advisor's on Science and Technology, FE's CBM research combined with other efforts to help raise production "from essentially nothing to 2 trillion cubic feet of gas per year ...a very large return on a relatively small R&D investment."*

CBM proved reserves and production have grown nearly every year since 1989. Today it accounts for **9 percent** of total domestic natural gas production and nearly 8 percent of U.S. proved reserves. The U.S. Energy Information Administration believes CBM will continue to provide an important share of domestic energy between now and 2035.

**U.S. Natural Gas Production, 1990-2035**  
(trillion cubic feet per year)



Source: Energy Information Association, "Annual Energy Outlook 2012 Early Release Overview," page 1.

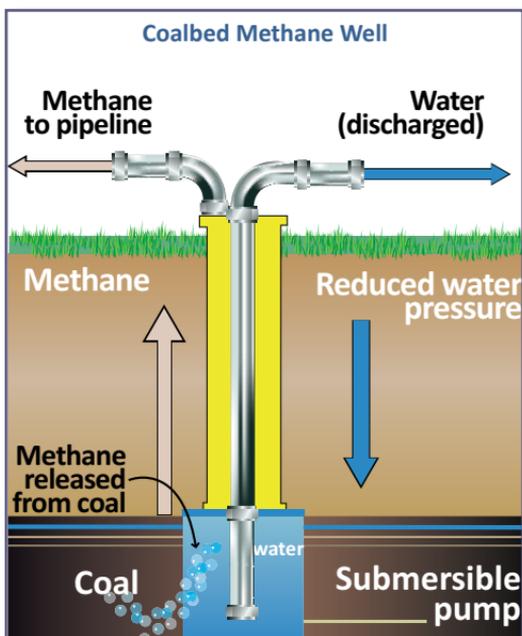
The U.S. Geological Survey (USGS) reports more than **700 trillion cubic feet** (tcf) of CBM in place resources, over 100 tcf of which is economically recoverable.

CBM can be recovered from underground coal **before, during or after mining operations**. Significant quantities of CBM can also be extracted from “unminable” coal seams that are relatively deep, thin, or of poor or inconsistent quality. Vertical and horizontal wells are used to develop CBM resources.



*Coal bed methane well boring.*

DOE has been a long-time supporter of CBM R&D. As early as **1984**, FE’s Unconventional Gas Recovery Program encouraged CBM development, resulting in the first commercial sale from dedicated wells.



Through R&D, FE has been instrumental in providing a fundamental CBM knowledge base to industry that includes: **assessing** the resource; **identifying** favorable geologic production areas; **establishing** efficient recovery schemes; **demonstrating** advanced drilling technologies; and **supporting** capture and use of diluted gas streams. FE R&D is currently focused on the potential for enhanced gas recovery integrating **underground storage of carbon dioxide**.

*CBM production involves using water or other fluids to create a “crack” through which methane can flow easily into a well.*

