

## **Environmental Consequences of Past and Future Energy Production in the United States**

Avner Vengosh, Nicholas School of Environment, Duke University  
(vengosh@duke.edu)

For decades, coal has been the primary source of fuel for electricity production in the United States. Yet, over a century of coal mining and combustion has created a legacy of water pollution: numerous cases of seepage of acid mine drainage into watersheds in the Appalachian basin, contamination of streams by effluents from surface mountaintop mining in West Virginia, and effluents flowing from hundreds of coal ash ponds into water resources across the nation. Our research in North Carolina has shown that most water resources located downstream from coal ash ponds are contaminated with toxic contaminants, such as arsenic and selenium, derived from unregulated coal ash stored in ponds. Our research has further developed a diagnostic “tool-box” that enables scientists to delineate and monitor contaminants’ sources and pathways in the environment. Over the last decade, shale gas exploration has offered an alternative new energy source. Advances in drilling technologies and production strategies such as horizontal drilling and hydraulic fracturing have significantly improved the production of natural gas by stimulating fluid flow, and since the late 2000s these developments have spurred exponential growth of shale gas well drilling across the United States. Yet recent scientific findings have raised important questions regarding the environmental effects of shale gas drilling. The primary environmental issues are: possible methane contamination of shallow drinking water wells located near shale gas wells; possible pathways of saline water and connection between deep shale gas formation and shallow drinking water aquifers; lack of water availability in some regions; and the safe disposal of waste water generated during shale gas production, which is often highly saline, toxic and radioactive.

While low-cost coal and new shale gas reserves are vital for enhancing US energy security, the direct and indirect effects on the environment might have significant long-term implications for the ecological systems and human health.