Groundbreaking Shale Gas Research: The cover image illustrates a typical shale gas well consisting of vertical and perforated horizontal sections for hydraulic fracturing. As described in the Full Paper by Adisa Azapagic and colleagues at the University of Manchester on page 1012, a life cycle analysis of the environmental impacts of UK shale gas used for electricity generation (in comparison with other fossil, nuclear and renewable options) shows that shale gas has higher environmental impacts than the other options, except for coal, per kWh of electricity generated. Thus, if it were to replace coal, most impacts would be reduced, including the global warming potential (GWP; by 2.3 times). However, if it were to compete with nuclear or some renewables most impacts would rise, with the GWP increasing by 5-123 times. Within a future UK electricity mix up to 2030, shale gas would make little difference to the environmental impacts of electricity generation, including the GWP, even for the most optimistic assumptions for its domestic production. This suggests that, in the medium term, shale gas cannot help towards meeting UK climate change targets and that certain renewables and nuclear power should be prioritized instead. This work is a part of a Special Issue of Energy Technology, which brings together experts to highlight some of the key technological, environmental, economic, and political issues surrounding shale gas developments around the world and shed light on this complex topic.
Expanding gas: Over the past six years, U.S. shale gas innovations have resulted in a transformation of the U.S. energy marketplace. This Review looks ahead to the coming decade, which will afford greater insights on shale gas resource base estimates and marginal production costs and ultimately lead to better knowledge of where the longer-term U.S. natural gas supply/price/demand equilibrium point may reside.

Energy going down the drain: A review of treatment system concepts that would be suitable for combined treatment of produced water and abandoned mine drainage (AMD) is presented here. The conventional treatment system includes a rapid mix reactor followed by coagulation/flocculation and sedimentation processes. Solids recirculation back to the rapid mix reactor would be required to enhance the kinetics of chemical precipitation in the reactor and ensure better quality of the finished water.

Policing the policies: The public, scientists, regulators, and legislators need information on the health and environmental impact of unconventional shale gas development in order to understand its risks and to develop risk-mitigation strategies. Improvements are needed in the monitoring of health and environmental parameters in the pre- and postdrilling periods and in the public disclosure of information.

Emission accomplished: Advances in horizontal drilling and hydraulic fracturing for shale gas recovery are energy-intensive processes that have typically been powered by diesel fuel. The current trend from producers and operators is to convert the equipment to operate as dual fuel or dedicated natural gas to achieve economic savings; however, these technologies result in new sources of methane emissions, as described here in detail.
Wireless Communication in Oil and Gas Wells

The low-down on downhole communication: The techniques of below-ground wireless communication in the oil and gas industry are reviewed. Critical challenges are associated with powering the devices, which must perform for months to years and must be able to generate sufficiently powerful signals to overcome the signal attenuation associated with electromagnetic-wave propagation through geological media.

FULL PAPERS

T. C. Kinnaman*
1006–1011
A Natural Gas Severance Tax—An Economic Analysis

Taxing results: This study estimates the economic effects of a severance tax on the market for natural gas produced from shale sources using non-conventional extraction methods, such as horizontal drilling and fracking. The burden of this tax falls on both producers and consumers and depends upon the underlying assumptions made regarding the price responsiveness of consumers and producers.

J. Cooper, L. Stamford, A. Azapagic*
1012–1026
Environmental Impacts of Shale Gas in the UK: Current Situation and Future Scenarios

Not all it's fracked up to be? Shale gas would make little difference to life cycle environmental impacts of future electricity generation in the UK even for the most optimistic levels of penetration up to 2030. The greatest effect would be on the depletion of elements. The global warming potential would be unaffected, which suggests that shale gas cannot help the UK to reduce its greenhouse emissions even if it were to replace coal and liquefied natural gas.

D. Johnson, A. Covington, N. Clark
1027–1032
Environmental and Economic Assessment of Leak and Loss Audits at Natural Gas Compressor and Storage Facilities

Cutting your losses: Natural gas is currently being touted as a bridge fuel between conventional liquid fuels and the fuels of the future. Its production and use is growing both domestically and internationally, but so is the scrutiny of methane emissions across their supply chain. These emissions add to the overall greenhouse gas (GHG) footprint of this bridge fuel, and an environmental and economic assessment of this impact is presented here.
Between a rock and a tight place: The combined application of multilateral horizontal drilling and multistage hydraulic fracturing has successfully unlocked unconventional tight hydrocarbon reservoirs. This paper aims to understand the relationship between water loss and rock petrophysical properties. A simple methodology is used to scale up the lab data for predicting water imbibition volume during the shut-in period after hydraulic fracturing operations.

Q. Lan, E. Ghanbari, H. Dehghanpour,* R. Hawkes
1033–1039
Water Loss Versus Soaking Time: Spontaneous Imbibition in Tight Rocks

Fulfilling China's potential: The exploitation of shale gas in China is at a very early stage. The related patents are analyzed by using data mining and patent maps. The findings show that shale gas exploitation involves complex technologies and technological accumulation is a long term process. Significant technology gaps exist for Chinese firms and technology could be the bottleneck of the exploitation.

M. E. Zhang,* W. Guo, Z. Lei
1040–1045
Patent Analysis of Shale Gas Technology in China and Implications for its Exploitation