Chapter 23
Shale Gas as an Alternative Energy Source

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ABSTRACT

Shale gas has been considered as an unconventional resource to date due to economics and technical challenges encountered. Under current circumstances, shale gas has and is receiving increasing attention as it is being quickly known as a viable energy resource. Countries who have been out of the energy game so far have an opportunity to be key players in the same industry. Current enhancement in technology and improved methods for fracking have proven that recovering shale gas is a viable and economically sound option in this century.

INTRODUCTION

The recent shale gas developments in the United States shows that the trend in the fossil fuel industry is moving steadily towards unconventional resources. Natural gas continues making significant contribution to the world energy economy. Natural gas is however, clean, plentiful and flexible. It is commonly used in the most efficient power generation technologies, such as, Combined Cycle Gas Turbine (CCGT) with conversion efficiencies of about 60%. It is well known that the reserves of conventional natural gas have grown by 36% over the past two decades and its production by 61%. Compared to early surveys such as that done in 2010, proved natural gas reserves have been reported to have grown by 3% and production by 15%. Exploration, development and transport of gas usually requires significant upfront investment and therefore, close coordination between investment in the gas and power infrastructure is necessary.

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It is said that the U.S. shale gas boom has created a lot of jobs in the domestic scene and greatly assisted the economic growth. In addition to this, the advent of shale gas has recast the role of the U.S. in the global energy landscape. This rapid shift in energy supply and resource development has exposed an important weakness in several countries, namely the lack of a strategic plan backed up by economically, socially, and environmentally viable policies. These factors will propel the role of shale gas by leveraging the gas as, both a fuel and as a feedstock for a variety of other uses. Implementation of proper management strategies is a prerequisite to complement the availability of low-cost shale gas that has the potential to create a renaissance in the manufacturing scene, revitalizing the chemical industry and enhancing the global competitiveness of energy-intensive manufacturing sectors.

Gas and oil production from shales is of global interest. Countries that once felt that they were limited to only conventional hydrocarbon reservoirs are now increasing their efforts to find black shales. Countries such as Britain, Canada, Ukraine, South Africa, several North African countries, and Argentina. Mexico, Belarus, Poland, Germany, Brazil, Australia and China are also interested in shale gas development and are actively engaged or planning to actively engage in drilling projects in these plays.

Despite exploration and production successes such as over 39,500 shale gas wells in the United States of America (USA), production of 600 bcf/year (EIA, 2014), 60% of assessed shale gas resources in the Asian-Pacific regions, the recoverable reserves of 862 trillion cubic feet (Tcf) in North America (Boyer et al., 2011), and the 7795 (Tcf) throughout the world (Guo and Zhao, 2012) due to the recent technological advancements in hydraulic fracturing and horizontal drilling (Soltanzadeh et al., 2015; Sun et al., 2015; Sun and Schechter, 2015), recovery rates have remained extremely low (estimated to be about 10% to 30% of gas in place (GIP) (Wu et al., 2014). The U.S. government’s Energy Information Administration (EIA) predicts that, about 46% of the United States’ natural gas supply may come from gas shales by 2035 but many other studies indicate a possible decline in some shale gas wells (Jarvie et al., 2007; Baihly et al., 2010a; Baihly et al., 2010b). These could possibly be indicative of a lower gas production than that which has been projected by the EIA (Boulis et al., 2012; Dong et al., 2012; Conti et al., 2013). Alternatively, it can also be indicative of the limitations imposed upon by our current technology to recover most if not all the original gas in place.

In the continuous search for secure, sustainable and affordable supplies of energy, the world is turning its attention to unconventional energy resources. The emergence of shale gas as a potentially major energy source can have strategic implications for the energy industry.

Over the last twenty years, the growth in unconventional oils and gas has accounted for a large proportion of the renewal and increase seen in global reserves. The exploitation of Canadian tar sands (169 Gb of reserves) and heavy and extra-heavy crudes in Venezuela (220 Gb) have contributed very significantly to available reserves in these two countries increasing by a factor of four since the start of the 1990s. At 296 Gb, Venezuela now leads the world in terms of oil reserves, ahead of Saudi Arabia (265 Gb). The volumes available in Canada (total reserves of 175 Gb) are more than those of both Iraq (143 Gb) and Iran (151 Gb). Development of light tight oils in the USA marks another step change. The growth in source rock oils and the liquid hydrocarbons associated with shale gas are changing the status quo for liquid hydrocarbons by reversing the downward trend that began in the mid-1980s: having fallen from 11 Mbd in 1985 to around 7 Mbd in 2005, volumes have now recovered to approximately 9 Mbd.

It is evident that the increase in production levels of heavy oils from Canada and Venezuela recently have had a significant effect on trends in the oil price since 2005. In the 1990s, they accounted for only 1% of total supply (0.4 Mbd). They now contribute 7% of the total (3.6 Mbd), half of which are Canadian heavy oils. Usually, the cost of these non-conventional oils would be higher than conventional ones. The
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