

Shale Oil Development: Analyzing the Impact of the Shale Oil Revolution on the Global Energy Market

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Overview

The research work apply relatively new data on the oil sector to construct and measure the structure of the oil industry embedded in a general equilibrium model of the global energy market. In the model, crude oil, production championed by OPEC; is pitched against shale oil production, championed by the U.S. Using the model, we analyse the economic impact of shale oil on the global energy market. The analysis indicates that: (i) the shale oil revolution is weakening the global dominance of OPEC. (ii) production of shale oil has led to drop in oil price

Introduction

One of the biggest oil price declines in modern history took place in mid-2014 - a staggering 70% drop from \$107.95 per barrel to \$44.08 per barrel. Booming U.S. shale oil production played a significant role in this oil price plunge. Positive gains in the energy sector pushed down significantly, break-even prices, making U.S. shale oil the de facto marginal cost producer on the international oil market. The International Energy Agency in 2014 estimated the U.S. to had produced 3.5 mb/d of shale oil in 2013 - three times more than it produced three years before in 2010.

This article is about shale oil, specifically the state of development of shale oil - the contribution it has made so far and the contribution that is expected to be provided towards the global energy supplies in the future. This work is timely because the world needs energy more so, at an affordable rate - utilizing the energy potentials from shale oil exploration could in no small measure help to achieve this.

Method

Assessing the impact of shale oil revolution using a reduced economic model may undermine the true contribution of shale oil to the global oil market. A true understanding of the impact of shale oil on the global oil market requires a framework that can explain the changing behavior of participants in the global oil market and account for the impact of shale oil on the market. This is evident because, In particular, if the emergence and expansion of shale oil production affects the global oil market by not only adding another source of volatility, but also changes the way

the world market, and especially the OPEC, reacts to demand and supply, then the shale oil revolution can be said to be impactful. For the purpose of this work, a dynamic model of the oil market was constructed and analyzed so as to explain how the introduction of shale oil production affects the price of oil and its production, and to predict how the shale oil revolution will affect the oil market in the future.

Results

In order to assert that shale oil production can affect the price of oil and its production, the research model the energy supply decisions of the competing producers, OPEC/other conventional oil producers against shale oil production. Our organizational model shows that the OPEC plans and takes into account how its production decisions affect both market prices and how the choice of utilization and the ability of competition affect market prices.

The research model the transition from the pre-shale revolution oil market to the post-shale revolution oil market as a gradual decline, but in sustainable and cost-effective shale oil production. This cost-effective shale oil production increases the shale oil market share of the global oil market from just 1% of to about 20% today. We take this variable into account when we set up and evaluate the model.

Conclusion

Despite efforts from OPEC to keep oil price high by cutting production, the oil price have remained under \$80 per barrel. These cuts are less significant unlike they use to be. This is because, thanks to the U.S. shale oil production and other non OPEC producers, the oil market maintains enough supplies. Progress in drilling technology saw US oil exceed 20 mb/d in September, contrary to warnings of an imminent slowdown in growth. The US shale oil production, in 2023 reached between 12.3 mb/d and 12.9 mb/d accounting for two-thirds of the 2.2 mb/d non-OPEC expansion. On the other hand, OPEC market share is down to 51%

Acknowledgement

The authors acknowledge the Nigeria Association for Energy Economics, the Energy Society of Northern Nigeria and the Environmental Society of Northern Nigeria for providing the platform for this research work.. This research was supported by a grant from AA Rano Big. Ltd.

Figures

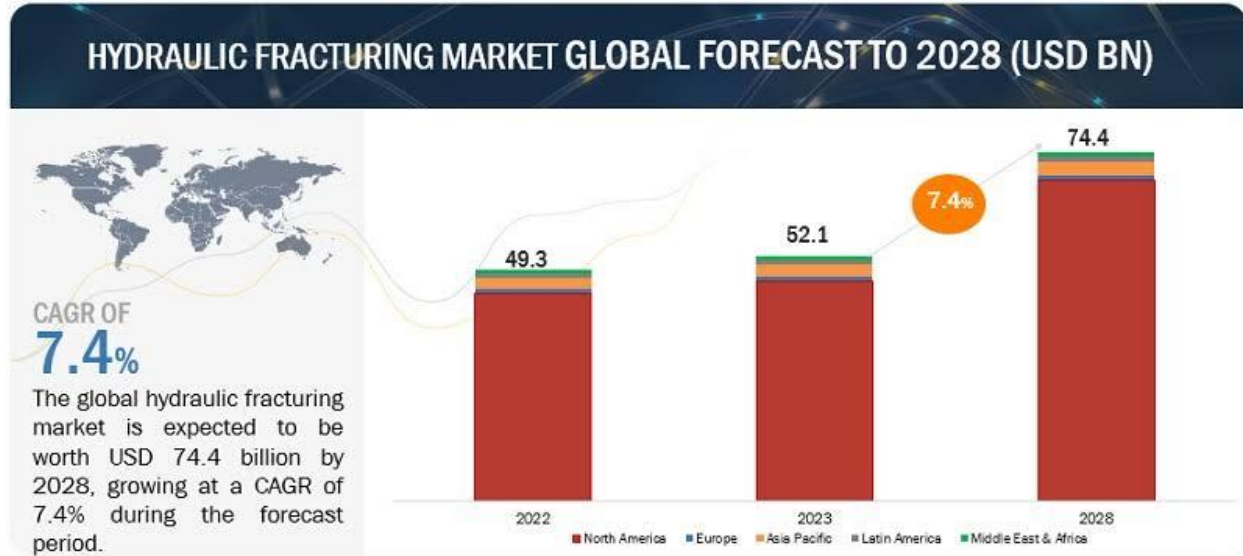


Figure 1: Shale Oil market forecast

Reference

Douglas B. R., & Maduabuchi P. U, 2019, Shale-Oil Development Prospects: The Role of Shale-Gas in Developing Shale-Oil. School of Management, University of Alaska Fairbanks, Fairbanks, AK 99775-6080, USA, Published: 29 August. [Google Scholar]

Smil, V. 1991, General Energetics: Energy in the Biosphere and Civilization; John Wiley: Hoboken, NJ, USA. [Google Scholar]

Welte, D. H., and D. Leythaeuser, 1984, Geological and physicochemical conditions for primary migration of hydrocarbons: *Naturwissenschaften*, v. 70, p. 133–137, doi:10.1007/BF00401597.

Petroleum (BP). 2017, Statistical Review of World Energy 2016—Data Workbook; British Petroleum: London, UK, 2016; Available online: <http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>.

Price, L. C., C. E. Dewitt, and G. Desborough, 1998, Implications of hydrocarbons in carbonaceous metamorphic and hydrothermal ore-deposit rocks as related to hydrolytic disproportionation of OM: U.S. Geological Survey Open-File Report 98-758, 127 p.

Robert R., 2017. How The Shale Boom Turned The World Upside Down. Forbes Media LLC.

Simmons, M.R. Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy; Wiley: Hoboken, NJ, USA, 2006. [Google Scholar]

Lei, Q., Weng, D., Xiong, S., Liu, H., and Guan, B. 2021. Progress and Development Directions of Shale Oil Reservoir Stimulation Technology of China National Petroleum Corporation. *Petroleum Explor. Dev.* 48 (05), 1035–1042. doi:10.1016/s1876-3804(21)60102-7

Rullkotter, J., et al., 1988, Organic matter maturation under the influence of a deep intrusive heat source: A natural experiment for quantitation of hydrocarbon generation and expulsion from a petroleum source rock (Toarcian Shale, northern Germany), *Advances in Organic Geochemistry 1987: Organic Geochemistry*, v. 13, no. 1–3, p. 847–856, doi:10.1016/0146-6380(88)90237-9.

Energy Information Administration, United States (EIA). 2017. How Much Shale-Gas is produced in the United States; Energy Information Administration, United States (EIA): Washington, DC, USA, 2016. Available online: <https://www.eia.gov/tools/faqs/faq.php?id=907&t=8>.

Ryan, R. C., Fowler, T. D., Beer, G. L., and Nair, V. 2010. Shell's In Situ Conversion Process—From Laboratory to Field Pilots. *Oil Shale: A Solution To the Liquid Fuel Dilemma*. ACS Publications, 161–183. doi:10.1021/bk-2010-1032.ch009.

Francis, D., 2007, Reservoir analysis of Whangai Formation and Waipawa Black Shale: GNS New Zealand Government report, 11 p.

Wang, Z., Gao, D., Diao, B., and Zhang, W. (2019). The Influence of Casing Properties on Performance of Radio Frequency Heating for Oil Sands Recovery. *Appl. Energy* 216, 114453. doi:10.1016/j.apenergy.2019.114453