



## Musings of a Seasoned Petroleum Reserves Evaluator about Improving the Reliability of Our Reserves Estimates from Unconventional Reservoirs

### Introduction:

Oil and gas reservoir engineers and geoscientists have made huge strides since Colonel Drake drilled the first well in the US more than 150 years ago in understanding, modelling and reliably predicting reservoir fluid flow rates from “conventional” reservoirs. On the contrary, some of these same individuals continue to be challenged by our inability to adequately describe the “reservoir rocks” that, over the past eight or 10 years have permitted the US to virtually double its oil and gas production during this brief time period.

In general, the industry, including lenders and regulators, continues to rely upon production rate versus time correlations (decline curves) for projections of future rates of oil and gas production – and for future cash flow estimates.

How can we accelerate our understanding of these unconventional “source rocks”?

**This writer believes the best hope today relies upon several factors briefly described below:**

1. The growing emphasis of academia and industry’s focus on “Big Data” as generally described in Mark P. Mills “Shale 2.0 – Technology and the Coming Big-Data Revolution in America’s Shale Oil Fields”, published by the Center of Energy Policy and the Environment at the Manhattan Institute.
2. During the past two years or so of declining and unstable well-head oil and gas prices, many – perhaps most – successful shale operators have huddled almost daily focusing on upgrading their talents in delving deeper into their data files to extract “hidden data” through various forms of data mining and analytics, including sustainable reductions of both capital and operating costs. As a friend once told this writer, “They torture the data until it confesses!”.
3. The significant re-entry of several major oil companies into the North American onshore marketplace as evidenced by large leasehold purchases, corporate acquisitions and partnerships. Several of

these companies had moved out of this universe several years ago, apparently recognizing their corporate structure could not effectively compete with some of the much more-nimble and intensely focused independent producers.

4. These “giants” may never become restructured to replicate their smaller competitor’s streamlined operating model, but they bring their enormous computing and research talents to the table as described in a March 7, 2017 news release as follows:

“ExxonMobil, working with the National Center for Supercomputing Applications (NCSA), has achieved a major breakthrough with proprietary software using more than four times the previous number of processors used on complex oil and gas reservoir simulation models to improve exploration and production results.

The breakthrough in parallel simulation used 716,800 processors, the equivalent of harnessing the power of 22,400 computers with 32 processors per computer. ExxonMobil geoscientists and engineers can now make better investment decisions by more efficiently predicting reservoir performance under geological uncertainty to assess a higher volume of alternative development plans in less time.

The record run resulted in data output thousands of times faster than typical oil and gas industry reservoir simulation. It was the largest number of processor counts reported by the oil and gas industry, and one of the largest simulations reported by industry in engineering disciplines such as aerospace and manufacturing.”

5. Clearly the quoted information above is not limited to Exxon’s plans for exploiting their conventional or unconventional resources but is, in this writer’s opinion, a powerful indicator of their long term commitment to commercially extract oil and gas from every resource available to them. Their conclusions will remain proprietary as long as possible from their perspective but knowledge somehow gets broadly

disseminated over time through many avenues – including the many numerous upstream oil and gas service providers. It is reasonable to assume, other majors are taking similar approaches.

6. Many of the US universities that offer undergraduate and graduate degrees in petroleum engineering and petroleum geosciences are increasingly becoming deeply involved in rigorous research studies of all phases of drilling, completing and producing hydrocarbons from today’s recognized unconventional reservoirs. Included in these studies are methodologies to improve reserves evaluation methods and techniques. Funding is coming from industry and government and dissemination of these research projects will be quickly and widely made.

### In conclusion:

This writer cannot fully comprehend and appreciate the significant impact resulting from the acceleration of intellectual and physical capital being invested today by virtually all of the participants in the upstream oil and gas industry, especially in North America, in improving our understanding of both conventional and unconventional reservoir rocks and fluid flow.

He does believe, however, that these learnings will – in a matter of only a few years – greatly improve (a) enhanced well logging and core analysis equipment and techniques (b) the efficiency in defining “sweet spots” for wellbore location (c) further, and continuing, optimization of completion methods (d) continuing reduction in well drilling, completion and operating expenses, and (e) significant reduction in the uncertainties of estimating and evaluation processes and procedures, through (f) improved correlations of reservoir rock information along with production performance trend analysis.

Respectfully submitted,  
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