**Harvesting the Marcellus Shale Deposits: Not a Paradigm Shift**

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Abstract:

The recent discoveries of potentially large yields of shale natural gas has changed our near term energy strategy in a direction away from sustainability and towards business as usual (BAU) and its associated strain on the environment. While domestic build out of wind energy saw significant gains from 2000 - 2008, that effort has lost momentum due to deteriorating economic conditions combined with the perceived economic advantage that natural gas (NG) power plants have over further development of wind and solar. In turn, if NG fired electricity is sufficiently cheap it will drive increased electrical demand such that, by the end of this century, NG will simply have substituted for coal as the main greenhouse gas contributor in the US. The fact that it emits about ½ as much carbon per Megawatt (MW) of generated power makes little difference as the electrical demand will rise by and equivalent factor of 2 by 2100. This situation is then equivalent to simply burning coal for the next 88 years, thus making the advantage of “retiring” (dirty) coal plants through NG quite moot.

In this article we examine, through modeling, the overall value of harvesting the Marcellus Shale deposits from the discovery to market timeline in comparison to what can be accomplished by continued investment in wind energy, and associated energy storage, which does not produce greenhouse gas emissions. We will show the NG solution to finding sources of new generation sources is self-defeating in the sense that we must both increase our generating efficiency while decreasing our carbon footprint. To explicitly demonstrate this we pick a target of 200 MW of new generation by the year 2020 and pose the question of whether that is best met by sole use of NG, continued investment in wind, or some combination thereof. Under that target we show that the sole NG pathway is neither physically nor environmentally wise, particularly in light of the great uncertainties in actual yields from these shale gas deposits.

We also discuss in some physical detail the operational mechanics of fracking and the subsequent unwanted release of methane to the atmosphere and/or the release of hydraulic fracking fluids, which contain high concentrations of dissolved solids from the rock formation itself, into the local ground water. These releases are critically dependent on the overall porosity and permeability of the rock formation which then suggests tight regulation on fracking locations. Eseme etal 2007 show porosity/permeability factors have considerable variations in any given shale gas deposit. Moreover, recent (but still controversial studies) suggest that a) livestock deaths can result in a few hours after exposure to hydraulic fracking fluid (Oswald etal 2012), b) significant amounts of methane can be released directly to the atmosphere (Howarth etal 2011) by the fracking process.

We also address the legal and regulatory aspects of hydraulic fracking in the Marcellus Shale formation, including local land use law, mineral rights, water rights, and applicable federal law including Environmental Protection Agency regulations and tax incentives.  As the Marcellus deposit is contained in 4 states (NY, PA, WV, OH) local variations in land use law exist. Furthermore, local and national levels of government may have conflicting interests:  protecting citizens’ rights to clean water and providing a new domestic source of energy.