Is the Open Fuel Standard Good for Advanced Biofuels or for the USA? Don't Think So!

By Robert Kozak (Advanced Biofuels USA) A proposal called the Open Fuel Standard (OFS) has recently been included in a number of bills (HR 1687 is one example) submitted for consideration by the US Congress. These OFS provisions go beyond the current voluntary Flex-Fuel vehicle (FFV) programs to mandate that specific percentages of vehicles be built to operate on "alternative" fuels. While on the surface the OFS may seem to benefit the biofuel industry, there is a very significant part of the "alternative fuels" definition that should give all biofuel, and especially advanced biofuel producers pause.

In addition, the significant increase in GHG emissions that would be produced by a new fuel added to the "alternative fuel" definition should concern all Americans interested in preserving the environment.

In the OFS provisions of HR 1687 and other bills, methanol produced from non-renewable natural gas is included on equal grounds with renewable biofuels in the definition of "alternative fuels."

For the biofuels market, implementation of the OFS would immediately mean that gasoline blenders could use a 10% natural gas (NG) methanol to meet EPA oxygenate requirements. Depending on the price charged by a large methanol producer such as Methanex for the initial sale of NG-methanol, existing ethanol sales could plummet.

Selling Points of a NG-Methanol OFS

The two selling points that the natural gas and NG-methanol industries have been using to promote NG-methanol for inclusion in the OFS are:

1. Natural gas is a low GHG producing fuel that would serve as an excellent "bridge fuel" to a renewable future.

2. There is sufficient low-cost, low GHG natural gas in the US to meet NG-methanol as well as projected non-transportation fuel demand.

Unfortunately, neither of these assumptions are supported by available data and analysis. Shale natural gases, which are projected to comprise 47% of the US natural gas supply by 2035 are very high in GHG emissions. In addition, the US natural gas supply does not appear to be sufficient to address added NG-methanol demand along with existing heating, electrical production, and industrial needs. These conclusions are based on recent research on shale gas GHG emissions and DOE/EIA analysis of US natural gas production that will be summarized below.

Shale Natural Gas GHG Emissions

In a recent paper in ***Climate Change Letters***, *("Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations,"* Robert W. Howarth, Renee Santoro, and Anthony Ingraffea), Robert Howarth and his associates analyzed the emission of GHGs from the extraction of shale natural gas. While most people focus on only CO_2 as a GHG gas, other gases, including methane (CH_4) the primary component of natural gas, are as important. Their research found that the emissions of methane from fracking, collecting, and processing greatly exceeded those of "conventional" natural gas and are actually similar to GHG emissions from coal.

> *"Natural gas is composed largely of methane, and 3.6% to 7.9% of the methane from shale-gas production escapes to the atmosphere in venting and leaks over the life-time of a well. These methane emissions are at least 30% more than and perhaps more than twice as great as those from conventional gas. The higher emissions from shale gas occur at the time wells are hydraulically fractured -- as methane escapes from flow-back return fluids -- and during drill out following the fracturing."*

> *"Compared to coal, the footprint of shale gas is at least 20% greater and perhaps more than twice as great on the 20-year horizon and is comparable when compared over 100 years."*

High levels of methane venting into the atmosphere from shale gas occur primarily during well drilling and the building of a well-field infrastructure. Therefore, high methane GHG emissions will occur at a critical time in the world's GHG reduction efforts, i.e. the next twenty or so years.

> *"Methane dominates the GHG footprint for shale gas on the 20-year time horizon, contributing 1.4- to 3-times more than does direct CO_2 emission. At this time scale, the GHG footprint for shale gas is 22% to 43% greater than that for conventional gas.* ***The large GHG footprint of shale gas undercuts the logic of its use as a bridging fuel over coming decades****,[emphasis added] if the goal is to reduce global warming."*

So while shale natural gas from Marcellus and other formations is high in GHG emissions during the very time their reduction is crucial, isn't there so much other natural gas produced in the US that shale natural gas is there for the future and won't be needed for NG-methanol and other uses in the next twenty years?

No, there isn't.

US Natural Gas Supplies and Future Costs

According to the US Dept. of Energy/Energy Information Administration (DOE/EIA Annual Energy Outlook 2011 April 26, 2011, DOE/EIA-0383(2011):

> *"While total domestic natural gas production grows from 21.0 trillion cubic feet in 2009 to 26.3 trillion cubic feet in 2035, shale gas production grows to 12.2 trillion cubic feet* ***in 2035, when it makes up 47 percent of total U.S. production—up considerably from the 16-percent share in 2009*** *[emphasis added]."*

The disturbing conclusion of this shift to shale natural gas, caused by the depletion of "conventional" natural gas supplies in the US, is that it will actually increase GHG emissions. The passage of OFS legislation that includes NG-methanol, would therefore actually cause results that were opposite of the purposes expressed by its supporters - improvements in the environment.

As for the availability of non-imported natural gas that would be available for approximately $.40/gallon as feedstock for NG-methanol? That assumption also appears somewhat shaky.

In their analysis of future shale gas availability and pricing EIA tried to account for the varying estimates of future reserves.

> *"Uncertainties associated with shale gas formations include, but are not limited to, the following:*
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> *• Most shale gas wells are only a few years old, and their long-term productivity is untested. Consequently, reliable data on long-term production profiles and ultimate gas recovery rates for shale gas wells are lacking.*
>
> *• In emerging shale formations, gas production has been confined largely to "sweet spots" that have the highest known production rates for the formation. When the production rates for the sweet spot are used to infer the productive potential of an entire formation, its resource potential may be overestimated.*
>
> *• Technical advances can lead to more productive and less costly well drilling and completion."*

Using historical data from previous natural gas discoveries, EIA produced a range of four scenarios (two high and two low) around the reference number of 12.2 trillion $ft.^3$ of shale gas to represent a reasonable range of expected shale gas production in 2035. These results are displayed in EIA Table 8. For our purposes, two numbers standout; natural gas imports and spot natural gas prices.

<u>Impact of NG-Methanol on Future Gas Imports</u>: Under the reference value scenario, a need for a slight import of natural gas is shown (row labeled 2). In fact, even the most optimistic scenario, High Shale EUR (Estimated Ultimate Recovery) shows only the possibility of a very small excess supply: (.5 of 30.1, or 1.7%). How would NG-methanol contribute to these scenarios? If 10 billion gallons of NG methanol were produced annually (less than the approximate 12 billion gallons/year of current corn ethanol production), **about 1.2 trillion $ft.^3$ of natural gas** would be required. (122 $ft.^3$ of natural gas is required for one gallon of methanol, including energy for conversion.) This quantity would require imports under all the scenarios with the reference scenario requiring about 1.4 trillion $ft.^3$ or about 5% of the total of US natural gas produced. At the reference price of $7.07/1 million BTUs (975 BTUs=1 $ft.^3$), **the imported natural gas would cost about $7 billion dollars/year.**

<u>NG-Methanol Feedstock Prices</u>: The natural gas feedstock prices being quoted by OFS supporters are around $.40/gallon of NG-methanol. To meet this price, natural gas would have to be priced at about $3.20/million BTUs (current spot price is about $4.00/BTU). At the 2035 reference price of $7.07/million BTUs, the feedstock (125,000 BTUs) price of one gallon of NG-methanol would be about $.88/gallon and the Low Shale Recovery price of $8.17/million BTUs would result in a feedstock price of about **$1.20/gallon NG-methanol**. For comparison, at a non-food biofuel sugar feedstock price of $.10/lb, the **feedstock price for a gallon** of advanced biofuel **ethanol would be about $1.20-1.30/gallon.**

Table 8. Natural gas prices, production, imports, and consumption in five cases, 2035

Projection	Low Shale EUR	Low Shale Recovery	Reference	High Shale Recovery	High Shale EUR
1. Henry Hub spot natural gas (2009 dollars per million Btu)	**9.26**	**8.17**	**7.07**	**6.0**	**5.35**
Total U.S. natural gas production (trillion cubic feet)	22.4	24.6	26.3	28.5	30.1
Onshore lower 48	17.2	19.6	23.1	25.5	27.2
Shale gas	5.5	8.2	12.2	15.1	17.1
Other gas	11.7	11.4	10.8	10.4	10.1
Offshore lower 48	3.5	3.2	3.1	2.8	2.7
Alaska	1.8	1.8	0.2	0.2	0.2
2. **Total net U.S. natural gas imports (trillion cubic feet)**	**1.7**	**0.7**	**0.2**	**-0.3**	**-0.5**
Total U.S. natural gas consumption (trillion cubic feet)	**24.1**	**25.4**	**26.6**	**28.3**	**29.6**
Electric power	6.4	7.1	7.9	8.9	9.6
Residential	4.6	4.7	4.8	4.9	4.9
Commercial	3.6	3.7	3.8	3.9	4.1
Industrial	7.5	7.8	8.0	8.4	8.7
Other	2.0	2.1	2.1	2.2	2.3

Conclusions

While supporters of the Open Fuel Standard may have had the best intentions, analyses of GHG emissions as well as US natural gas availability (from public data) have shown that the inclusion of NG-methanol in any OFS program would produce results opposite of those intended – petroleum imports, production costs similar to that of advanced biofuels, and increases in GHG emissions.

Therefore, for supporters of OFS who are committed to supporting a future of energy independence and reduced environmental damage, it would seem logical that any Federal policy on transportation fuels should be focused on increasing the use of renewable, low GHG biofuels and bringing vehicles to market that can optimize the use of these fuels.

References:

Climate Change Letters, (*"Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations,"* Robert W. Howarth, Renee Santoro, and Anthony Ingraffea) http://www.eeb.cornell.edu/howarth/Marcellus.htm

US Dept. of Energy/Energy Information Administration (DOE/EIA Annual Energy Outlook 2011 April 26, 2011, DOE/EIA-0383(2011)
http://www.eia.gov/forecasts/aeo/index.cfm

Advanced Biofuels USA*, a nonprofit educational organization advocates for the adoption of advanced biofuels as an energy security, military flexibility, economic development and climate change mitigation/pollution control solution. Our key tool for accomplishing this is our web site, www.AdvancedBiofuelsUSA.org, a one-stop-shop library for everyone from opinion-leaders, decision-makers and legislators to industry professionals, investors, feedstock growers and researchers; as well as teachers and students.*

Advanced Biofuels USA
507 North Bentz Street
Frederick, MD 21701
301-644-1395
info@AdvancedBiofuelsUSA.org