Regional Economic Studies Institute

TOWSON UNIVERSITY

MEMORANDUM

DATE: October 4, 2013
TO: Marcellus Shale Safe Drilling Initiative Advisory Commission and Members of the Public
FROM: Regional Economic Studies Institute of Towson University
RE: Scenarios Feedback

Introduction

As was discussed at the August 26 and September 25 meetings of the Advisory Commission, the Regional Economic Studies Institute (RESI) of Towson University is developing scenarios for use in its economic analysis of Marcellus Shale gas development. Your feedback on the following *Marcellus Shale Impacts Scenarios* would be appreciated and will assist us in ensuring that the scenarios provide a sound, rational basis for the development of economic, fiscal, and community impact analyses. **We need to receive any comments or suggestions by October 14, 2013.** We realize this is only 10 days from today, but we need to finalize the scenarios quickly to remain on schedule with the development of the model and completion of the work.

Purpose/Background

The scenarios are being developed by RESI as part of the Maryland Marcellus Shale Safe Drilling Initiative on behalf of the Maryland Department of the Environment (MDE). RESI is currently studying the potential positive and negative effects of natural gas drilling in Western Maryland.

The primary purpose of the scenarios is to provide a framework for measuring the impacts. The scenarios also represent points of reference that can demonstrate the variation in impacts relevant to the study. Variation in impacts across the scenarios may be used by state agencies to inform decision-making in regard to evaluating potential strategies and policies.

Feedback Format

RESI is seeking constructive feedback regarding the following elements:

- Assumptions (e.g., the amount of recoverable reserves, the mean EUR, the number of wells per pad, etc.),
- Data sources (RESI is proposing to use public data such as the USGS and EIA to develop its estimates), and
- Number of scenarios (RESI has presented three scenarios involving no drilling, 25% extraction, and 75% extraction).

Although every comment will be considered, comments may not be individually addressed.

Please provide feedback in the comments column of the Scenario Table beginning on page 4. Feedback should be brief and focused on the elements described above. Please email your feedback to Brigid Kenney, Senior Policy Advisor at MDE, at brigid.kenney@maryland.gov.

The deadline for feedback to be considered is Monday, October 14.

Assumptions Common to All Scenarios

Reserves

- Total estimated undiscovered shale gas reserves in the Interior Marcellus Assessment Unit (AU), with a 95% probability of finding at least that amount: 41,607 billion cubic feet[1]
- Total estimated undiscovered shale gas reserves in the Marcellus Shale (mean): 84.198 billion cubic feet (bcf)[2]
- Estimated Ultimate Recovery for an Interior Marcellus AU well: 1.158 billion cubic feet[3]
- Total estimated portion of Marcellus Shale reserves in Maryland: 1.69%[4]

Production Curve (Well Lifespan)

- Each scenario considers a 20-year time frame, with the first Marcellus wells drilled in 2016.
- The wells become operational and produce gas in the same year they are drilled.
- Each well produces for 20 years, which means that wells drilled after the first year will continue to produce beyond the 20-year timeframe of the study.
- Well decline will be assumed to match curves developed by David Hughes from Post Carbon Institute.
- Under Hughes' analysis for unconventional fuels and their potential (with reference to Marcellus Shale), wells will produce the greatest amounts in the first 24 months, and level off to a static production around 36 months.[5]

Rate and Pace of Drilling

- All wells are drilled between 2016 and 2026, with the same number of wells drilled each year.
- All wells to be drilled on a pad will be drilled before another well pad is established in the area.

Number of Wells and Wells per Well Pad

- The total number of wells drilled per scenario will be based on the percentage of reserves to be extracted.
- RESI assumes that there will be a total of 8 wells per pad.[6].

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[1] Assessment of Undiscovered Oil and Gas Resources of the Devonian Marcellus Shale of the Appalachian Basin Province" (USGS, 2011). Accessed 18 September 2013. http://pubs.usgs.gov/fs/2011/3092/pdf/fs2011-3092.pdf.
[2] USGS, "Assessment of Undiscovered Oil and Gas Resources of the Devonian Marcellus Shale of the Appalachian Basin Province, 2011," Accessed 18 September 2013. http://pubs.usgs.gov/fs/2011/3092/pdf/fs2011-3092.pdf.
[3] "Variability of Distributions of Well-Scale Estimated Ultimate Recovery for Continuous (Unconventional) Oil and Gas Resources in the United States (USGS, 2012). Accessed 18 September 2013. http://pubs.usgs.gov/of/2012/1118/OF12-1118.pdf.
[4] Presentation by James Coleman (USGS) to MDE on Variability of Distributions of Well-Scale Estimated Ultimate Recovery for Continuous (Unconventional) Oil and Gas Resources in the United States, October 21, 2011.
[5] Hughes, David, "Drill, Baby, Drill: Can Unconventional Fuels Usher in a New Era of Energy Abundance," 65.
[6] EIA estimates 4 wells per pad for Maryland, although regions such as Mulehbach's have cited 6 to 8 wells per pad. Pennsylvania has reported well pads with nearly 12 wells on a single pad (majority of wells in PA report 8 to10, 12

Locations of Well Pads and Infrastructure

- The approximate locations of the well pads will be based on data collected by Garrett County on recorded gas leases.
- Potential well locations for Allegany County will be derived using spatial analysis of property characteristics shared with Garrett County.

Natural Gas Prices

- Natural gas prices will be based on Energy Information Administration (EIA) Annual Energy Outlook 2013 report, which is based on the Henry Hub spot price analysis, which is $3.25 to date (2011 constant dollars).[7]

Fiscal Impacts

- Taxes are reported as a total for state and local government entities.
- A severance tax of 5.5% on the value of the gas at the well head is collected by the county.
- The royalty payment will be assumed to be 12.5% of the value of the gas at the well head
- Fiscal impacts will report the following items:
    - Property;
    - Sales;
    - Income;
    - Payroll; and,
    - Other taxes,
- Other taxes will include a myriad of items from motor vehicle taxes to motor fuel taxes.

is considered relatively high). RESI chose eight based on the low (4 wells per EIA) and the high (12 wells per PA studies) and calculated the average (eight) to use for the assessment.

[7]The Henry Hub prices forecast annually using historical data and industry trends through 2040. Prices will be used from the latest Annual Energy Outlook report by the EIA (2013).http://www.eia.gov/forecasts/aeo/source_natural_gas_all.cfm#natgas_prices

Scenarios

This table contains the three scenarios being considered by RESI: a baseline scenario under which no drilling will occur, along with two additional scenarios. Elements common to Scenarios 2 and 3 are listed in the first row of the table. The other scenarios will be benchmarked against the baseline scenario in order to measure the magnitude of the impact under varying conditions.

Scenario	Background	Elements/Assumptions	Comments
Elements Common to Scenarios	Scenarios #2 and #3 will rely on the following elements/assumptions.	• RESI will use the F5 estimate of 41,607 bcf of shale from USGS and apply the 1.69 percent that Maryland holds to determine the potential number of reserves held in Maryland. • The total shale reserves held by Maryland for the analysis will be **703.16 bcf**. • There will be 8 wells per pad in each scenario (if applicable) and no more than 10 wells per year will be drilled (due to limited resources shared across states). • RESI will use the USGS report associated with current production mean EURs for wells in the interior Marcellus region as the potential EUR for Maryland based wells (1.158 EUR) per well.	
#1 – No Drilling/ Baseline	The baseline scenario will reflect the current economic activity of the region over the next 20 years.	• No wells are drilled.	
#2 – 25%	Under Scenario 2, RESI will assume that 25% of the total estimated undiscovered gas will be extracted.	• RESI will use the 703.16 bcf estimate and multiply it by 0.25 as this is the potential reserves to be extracted by 2036. • In this scenario, the estimate reserves to be extracted by 2036 would be **175.8 bcf**. • If the wells have an EUR on average of 1.158, then to recover the total amount by 2036 the number of wells needed would be **152 wells**. • Using the assumptions stated above, 152 wells will be able to extract about 25% of the total estimated undiscovered gas.	

Scenario	Background	Elements/Assumptions	Comments
#3 – 75%	Under Scenario 3, RESI will assume that 75% of the total estimated undiscovered gas will be extracted.	• RESI will use the 703.16 bcf estimate and multiply it by 0.75 as this is the potential reserves to be extracted by 2036. • In this scenario, the estimate reserves to be extracted by 2036 would be **527.4 bcf**. • If the wells have an EUR on average of 1.158, then to recover the total amount by 2036 the number of wells needed would be: **456 wells**. • Using the assumptions stated above, 456 wells will be able to extract about 75% of the total estimated undiscovered gas.	

Findings

Findings will be reported for each of the three scenarios. Findings will include the following:

- Direct, indirect, and induced impacts for wages, employment, and tax revenues changes from the increased industry production.
- Fiscal impacts will be reported for property, sales, income, payroll, and other tax revenues by year.
- Fiscal impacts will be in a table within the report and are given in the total (state and local) tax revenues associated with economic changes.