December 14, 2011

The Honorable Andrew M. Cuomo
Governor of the State of New York
NYS State Capitol Building
Albany, NY 12224

Dear Governor Cuomo,

We are economists concerned about the economic impact on New York State of shale gas exploration, drilling, production, and transmission. Unfortunately, there are no credible, thorough economic studies that have been conducted on the many aspects of the exploitation of the Marcellus shale.

Most of the economic studies cited by partisans in this matter have been produced to sustain some biased view. The economic analyses produced or funded by the gas industry exaggerate benefits and ignore many significant costs. And most importantly, independent research often reaches conclusions that are at odds with industry claims and raise the prospect that net economic benefits to the state may be modest or even negative.

We particularly note that the economic assessment conducted by Ecology & Environment, Inc. (E&E) for the revised draft SGEIS is also seriously deficient.

The State's economic focus should be the realistic identification and estimation of the present value of all costs and benefits to the State and its citizens. The State should be concerned with maximizing the present value of the benefits to the State and minimizing the present value of all costs to the State and its citizens. The gas industry will strive to maximize the present value of the benefits to themselves and postpone costs, or more likely, make others pay the costs.

Note that these costs and benefits are different for the different players in this matter; these include gas producers, gas drillers, gas pipelines, labor, local property owners, residents who are not property owners, farmers, the tourist industry, other impacted industries, local towns and counties, communities, conurbations, water sheds, other local governments, state government, tax payers, etc. Any competent analysis will address each of these economic actors in appropriate ways.

And any competent analysis should address the costs and benefits of the full panoply of the activities associated with exploitation of this asset. By this we mean the activities of the landmen, gas drillers, fracking fluid injection, well completers, gas producers, water extractors, water haulers, flow back fluid disposal activities, pipeline builders, pipeline operators, compressor station construction and operation, and ultimately, well closure operations.

Concerns that we have with the economic assessment conducted by E&E include the absence of considering the cumulative effects of gas development, the absence of common oil and gas industry discounted cash flow analysis, the blatant ignoring of opportunity costs and other significant costs, the lack of any environmental considerations, many heroic assumptions, the use of inappropriate models, a sole reliance on Input-Output analysis, and a mechanical calculation of details giving rise to endless tables that may impress the unsuspecting reader.

We find the following additional and specific problems with the E&E study:

1. Many of the numbers in the tables are simply the result of multiplying assumptions and projecting them year by year; in a phrase, mechanical rather than thoughtful.

2. The report does not seriously address the environmental costs and the firm was probably not asked to do so.

3. While the report's conclusions are being touted as showing the creation of 54,000 jobs in NY, one should be aware of the way this number is generated.
    a. First, the authors divided the portions of the state in the Marcellus shale region into three types; high gas production potential, average production potential, and low production potential, and they chose two or three counties in each of the portions as representative and made their calculations based on that sample. Accordingly, statewide numbers derived by E&E are often projections from eight counties. This may not be a bad way to do this sort of estimation, but it should be understood that this is the method and is not a careful evaluation of all counties in the region.
    b. Next, the report acknowledges a number of uncertainties exist but tries to accommodate these in providing a range of estimates called low, medium and high development. Unfortunately, the degree of uncertainty is quite complex, yet the report offers an extremely

large range of high development for the counties with high potential. The range is from 600 billion to 3.6 trillion cubic feet of gas produced in the 23rd year of production, a variation on the order of 600%. Clearly, E&E has not addressed the uncertainties to an acceptable degree.

c. E&E made arbitrary assumptions about how the use of local labor will grow over time displacing transient labor. The report states that under the low development scenario, 15,200 local employees would be hired; under the average scenario, 60,800; and under the high potential scenario, 91,000. The latter figure represents a one half of one percent increase in the state employment. But the report may mislead policy makers and the public when it compares the new jobs with a depressed local employment number to report a quite high percentage increase.

4. The report is based on a vast number of other questionable assumptions including:

   a. Wells will produce gas for thirty years; independent analysts have reported that shale gas wells in other plays produce for far fewer years.
   b. Production will decline in each well following a hyperbolic curve; this should be supported with evidence.
   c. There will be no crowding out in local labor markets as people with the needed skills, training and education, not to mention mobility, will be available. Economists call this a perfectly elastic labor supply. It is not a realistic assumption and certainly not one on which to base policy decisions.
   d. Whatever is calculated to be the case for a region can be scaled up to the state as a whole. Economists call this the fallacy of composition.

5. The E&E study is seriously deficient when they chose to use to evaluate drilling and fracking via Input-Output (IO) analysis, an older and insufficiently nuanced method that is misapplied here. The US Bureau of Economic Analysis (BEA) has developed labor force and wage multipliers that are used by E&E, but these multipliers assume that the substitutability among inputs is zero. In English, that means that is it analogous to the assembly of a screwdriver; you need one blade and one handle and you cannot substitute either for the other. In the IO analysis of gas drilling, it

means that there is no substitution of one kind of labor for another, capital for labor, energy for labor, etc. This is a significant and quite likely unwarranted assumption. Further, an IO analysis assumes that the parameters used are spatially and time invariant as well as not varying over the business cycle. These are also unrealistic assumptions. Finally, the BEA has found these multipliers useful for studying the labor impact of a single new plant, or for a plant closure; not for an industry stretched out over an entire state, and certainly not for all of the ancillary environmental and infrastructure costs and benefits that would occur.

In an evaluation of IO analysis for environmental impacts, Thomas Wiedmann, Manfred Lenzen, Karen Turner, and John Barrett wrote[1]

"…only in the last few years environment-economic models have emerged that use a more sophisticated multi-region, multi-sector input–output framework...in order to calculate environmental impacts ... Results … demonstrate that it is important to explicitly consider the production recipe, land and energy use as well as emissions in a multi-region, multi-sector and multi-directional trade model …with detailed sector disaggregation. Only then reliable figures for indicators of impacts … can be derived."

In other words, most of the gas industry IO analysis is not fine grained enough to give reliable estimates; they miss sectors such as tourism, environment, etc., and concentrate only on jobs and income.

A noted Input-Output economist has told us that " *a more customized input-output model and analysis than those used in the E&E report …[could]… reveal and quantify both money costs and environmental challenges associated with shale gas exploration and extraction in this geography using hydraulic fracturing technology. "*

They went on to write, *"What some call an 'environmentally-extended input-output analysis' could track amounts and kinds of chemicals introduced by this technology and estimate their impacts on specific water sources. The state of the art today would involve the collaboration of input-output economists and water scientists, and probably health experts as well. Such a study would naturally be a lot more ambitious and costly*

[1] **Ecological Economics**
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than the multiplier analysis in the E&E study, but the time has probably come for such an in-depth evaluation of shale gas exploitation. "

The upshot is the current E&E study is seriously deficient even in the economic method they chose to use to evaluate drilling and fracking.

6. The report of E&E is vague. For example when discussing the impact on property values they write:
"In conclusion, the above literature review suggests that being in proximity to a well ***could reduce*** *the value of a property, but that proximity to a gas pipeline* ***might not reduce*** *the value of a property. The proposed natural gas development* ***would have an overall regional effect*** *of increasing property values due to the expected in-migration of construction and production workers and the increased economic activity that would occur in the area. Likewise, properties that still included unexploited sub-surface mineral rights would increase in value due to the potential of receiving royalty payments.* ***However, not all properties in the region would increase in value****, as residential properties located in close proximity to the new gas wells would likely see some downward pressure on price. This downward pressure would be particularly acute for residential properties that do not own the subsurface mineral rights."*
While sufficiently vague to be meaningless, we note further that none of this addresses the willingness of lenders to issue mortgages in an uncertain market; thus the properties in question have a de facto zero value, a fact not taken into account by E&E.

7. Overly optimistic tax revenue projections based on economic activity associated with gas drilling are a particular problem for New York State if the budget process relies on them. The employment, income and tax revenue projections of E&E are based on overstated gas production estimates. Recent estimates of Marcellus Shale gas reserves by the U.S. Geological Survey confirm that E&E used highly exaggerated production assumptions, and independent analysts confirm that the assumption regarding productive life of an average well is far shorter than assumed by E&E.

8. Examples of important considerations insufficiently covered by E&E include the following:

a. Adjustment costs are totally ignored. The oil and gas industry is an extractive industry and these are known for the boom/bust cycle. While all economic activity may be transitional, the negative effects of temporary or short term boom bust cycle impose severe and rapid adjustment costs on local communities as well as the state. The need for the DEC to staff up to handle such an industry is one example of an adjustment cost.
b. Infrastructure costs, especially roads, culverts, structures, bridges, etc. are ignored. These have been major costs to taxpayers in other regions with shale gas extraction, such as the Fayetteville Shale in Arkansas. New York's Department of Transportation has prepared an internal memo noting these costs and the lack of any existing mechanism to defray them.
c. The costs of water contamination and land, stream and air pollution may be substantial. Various contaminants in the fracking fluid and the flow back fluids are endocrine disruptors and carcinogens. All of these can affect not only human health, but also the health of domestic and game animals, and this important cost is ignored.
d. There will be costs to communities associated with the increased demand on hospitals, police, fire departments and emergency health services. All of these costs are either glibly mentioned and then ignored or never even mentioned in the revised draft SGEIS. There are recent reports of the increase in DWI, bar fights, and other disturbances which have occurred in Pennsylvania, so data exist.
e. Some insurance companies reportedly are refusing to issue policies on homes with gas wells. E&E, without valid rationale, adopts the assumption that property values will increase, thus ignoring this negative impact on property values.
f. Existing industries that are vital to the region, such as agriculture, organic farming, tourism, wine making, hunting, fishing, water recreation, etc., may be negatively impacted, and such losses were not taken into account.

9. Another negative impact of gas development is the foregone economic development of the next best use of the land. Economists characterize such foregone opportunities as opportunity costs. While these will vary of course area by area, the neglect of them in the E&E report simply assigns a value of zero to them, which is utter nonsense. One example of this is the network of pipelines that will be required. Potential future

development may be destroyed in many communities because building cannot take place on top of or too close to pipelines.

10. The variance in economic costs and benefits over small units such as towns are ignored and averages are seized upon to support the analysis. Yet decisions in these matters should be based on the worst outcomes as well as the average outcomes; one can drown in a river whose average depth is 3 inches. Small towns have more downside and more exposure to economic risk. Small towns have small budgets, a small taxpayer base, and little diversity. So treating all the same is unacceptable; there is no representative small town as there is no such thing as a representative worker. The use of such jargon or assumptions is simply sloppy reasoning in this age of fast computers and understanding of statistical variance. We should be able to at least describe what happens in each town over the shale play.

11. Communities adjacent to those with the actual well pads are not considered. Nearby communities without gas wells may have related industrial development such as water treatment facilities, staging areas, man camps, and pipelines. These communities will also have costs associated with heavy industrial development and a long-term bust, even if there is no drilling going on there.

12. There is no mystery as to what will happen to the affected communities when the gas is gone if they are left with contaminated drinking water, pollution, an industrial landscape, a population with failing health, and vanished employment opportunities. Yet E&E do not address such an event, assuming that after thirty years, we need not concern ourselves with that outcome. Policy makers in New York should be more far-sighted in their stewardship of the State.

13. The cumulative effects of the vast number of wells necessitated by this type of gas development are not addressed.

14. No mention of a discounted cash flow is made. Yet this type of economic analysis is common in the oil and gas industry, indeed they pioneered this in the 1950s or earlier. As stated above, from the State's point of view, we should be maximizing the present value of the benefits and minimizing the present value of the costs. From the viewpoint of the gas companies, they will strive to maximize the present value of the net private benefits to them

and find ways to be absolved from social, community health, environmental and other public costs.

The level of uncertainty in the E&E report, the number of poor assumptions made by its authors, the size of the positive effects they found relative to the state economy, the lacuna regarding worst cases, the absence of any attention to discounted cash flow analysis, the simplistic application of Input-Output analysis, the blatant ignoring of opportunity costs and other important costs, and the mechanical nature of their projections all mean that if one bases a decision on this work, they are doing so on statistical noise. That is, early data and initial incomplete analysis are widely imperfect, have a strong element of meaninglessness, and would be revised as more data and analysis came in. In the short term, these noisy data and analysis should not drive economic policy decisions.

The State's policy makers should have better data upon which to make decisions. A comprehensive, unbiased, and respectable economic assessment should be made prior to making any decisions regarding shale gas extraction by means of hydraulic fracturing in New York State.

The assessment conducted by Ecology & Environment, Inc. (E&E) does not meet this standard.

Sincerely yours,

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