Preliminary Comments on 2014 Draft New York State Energy Plan
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The 2014 Draft New York State Energy Plan (NYSEP) should be revised and expanded in a number of ways to better reflect the realities of various energy sources and their impacts on New York State. I expect that many other commenters will address environmental and public health concerns likely to result from the energy path outlined in the NYSEP, so my comments below focus on economic issues. I am a Ph.D. economist who has been writing, lecturing and testifying extensively on the economic impacts of various energy sources for a number of years. An example of my writing is a peer-reviewed article in the journal, New Solutions, on the impacts of shale gas development on state and local economies [1]. I am also a coauthor of the Jacobson et al paper in Energy Policy that shows how New York State can transition to a 100% renewable energy infrastructure for all purposes using just wind, water and sunlight (WWS) [2].

Based on each of the following economic considerations, I recommend that the plan be reconfigured to immediately begin to reduce reliance on fossil fuels and move more quickly to renewable energy sources, rather than encourage increased use of fossil fuels.

1. Relative prices of fuel sources and the price volatility of natural gas are serious concerns that are rarely mentioned, and they should be more carefully analyzed in NYSEP.

NYSEP encourages increased reliance on natural gas, but the impact of price volatility has not been satisfactorily assessed. NYSEP points out (vol. 2, "Sources", p. 22) "concerns regarding reliance on natural gas-fired generation including price volatility and the availability of pipeline capacity," but highlights the "lower operating costs associated with the relatively low cost of natural gas."

The gas industry and its supporters often claim that the low price of natural gas makes the commodity attractive to end users, both residential and business consumers of all sizes. An important fact is that natural gas has a long history of price volatility. The President of American Electric Power commented on the volatility in the price of natural gas. He said, "Whether that volatility has changed permanently remains to be seen." He said that natural gas prices could spike if major environmental issues emerge with fracking, and that natural gas prices are vulnerable to volatile weather conditions. He also said they could increase as export facilities for LNG are constructed [3].

It is highly likely that the price of natural gas will increase as domestic gas is exported, thus exposing it to the global market where natural gas price in some countries is as much as five times greater than the US domestic price.

There will be additional upward pressure on the price of natural gas if demand increases domestically, which appears to be happening as there are major efforts to increase demand. For example, many large buildings are converting to natural gas for heating and there are efforts to increase the use of natural gas in transportation, including conversion of large vehicle fleets. There are efforts to encourage energy producers to use natural gas instead of coal or nuclear in power plants. Some manufacturing industries have been expanding in the US in order to take advantage of the recent low price of natural gas. Each of these efforts is likely to impose significant upward pressure on demand and thus on the price of natural gas.

After many residents and businesses in New York State become newly reliant on natural gas for heating, transportation and industrial feedstock, a substantial increase in the price of natural gas would harm all of us.

It should be noted that the supply side is highly uncertain. There have been vastly different estimates of recoverable shale gas in the US shale plays, and in particular in the New York portion of the Marcellus Shale. If the low estimates are correct, then there will be even further upward pressure on price due to supply constraints.

And NYSEP points out several reasons why dual fuel capability in newer power plants is becoming less and less common. This tendency will remove the ability of a natural gas-fired power plant to move to a second fuel if the price of natural gas increases substantially, another way that everybody will feel the pain of high natural gas prices.

The uncertainty resulting from volatility in fuel prices makes for very difficult long-term planning. The price of natural gas as an input to a fossil fuel based energy system will always be volatile and can be expected to increase, perhaps substantially, in the long-term. This sharply contrasts with the price of alternative fuels. The price of wind, water and sunlight as inputs to an energy system based on renewable energy, will always be zero.

It is highly risky for NYSEP to encourage such a widespread conversion and increased use of natural gas in light of the volatile nature of price and the likelihood of substantial price increases.

NYSEP itself projects (Vol. 2, "Sources," Page 66) that "prices for natural gas remain below $5 per thousand cubic feet through 2025." The reality is that the price has exceeded this level since NYSEP was released. The spot price at Henry Hub was $4.58 per million BTU on January 7, 2014 and $7.09 per million BTU on March 3, 2014.

If the price of natural gas drops again and miraculously remains low as projected by NYSEP, then it would lead to less investment in renewable energy, in contrast to the path that New York should be on regardless of natural gas price changes.

2. Job creation that is likely to result from NYSEP should be analyzed in detail.

New York State should view its energy plan in the context of economic development along with the need to supply future energy. NYSEP states (Vol. 2, "End Use Energy," page 107), "Solar photovoltaic, biofuels and wind power grew at an annual rate of more than 30 percent between 2010 and 2011. The number of jobs in smart grid, wind, biofuels, solar, energy storage and energy efficiency could double or triple by 2020. "

NYSEP should compare future job creation that would result from renewables to job creation associated with fossil fuels. Research shows that job creation from the installation and deployment of renewable energy far exceeds job creation from fossil fuels. For example, research from Berkeley concluded, "all non- fossil fuel technologies (renewable energy, energy efficiency, low carbon) create more jobs per unit energy than coal and natural gas [4]."

And research from University of Massachusetts shows that for every million dollars spent on energy production in the United States, oil & gas creates 3.7 direct and indirect jobs, whereas wind and solar produce 9.5 and 9.8 jobs, respectively [5].

And Jacobson et al concluded that transitioning to the 2030 WWS plan in New York State would create 4.5 million jobs during construction and approximately 58,000 permanent annual jobs thereafter for energy facilities alone. These numbers do not include the additional jobs "associated with the enhancement of the transmission system and with the conversion to electric and hydrogen fuel cell vehicles electricity-based appliances for home heating and cooling, and electricity and hydrogen use for some heating and high-temperature industrial processes." And these estimates do not include the jobs that would be created by retrofits to homes and buildings in order to increase efficiency and conservation. In fact, "the number of permanent jobs created by the electric power sector alone is expected to exceed significantly the number of lost jobs in current fossil-fuel industries [2]."

Independent economists, including myself, have been pointing out for years that the industry claims of job creation associated with shale gas development are highly exaggerated. The most recent report on this subject concluded that Marcellus Shale drilling has had "little overall impact on the state economy in any state studied,"; "employment estimates have been overstated, and the industry and its boosters have used inappropriate employment numbers, including equating new hires with new jobs and using ancillary job figures that largely have nothing to do with drilling,"; and "industry-funded studies…have substantially overstated the total jobs impact of the shale industry [6]."

It is clear that New York State would benefit more from job creation in the production and deployment of renewable energy than in the development of shale gas.

3. NYSEP, as written, would benefit other states more than it would benefit New York State, and this fact should be considered in the selection of energy sources going forward.

NYSEP (Volume 2, "End-Use Energy," page 12) states, "A significant proportion of NYS's energy expenditures flow outside the State's economy to other states and countries." And "sixty percent of expenditures leaves NYS."

This would be particularly true of shale gas development with the industry's typical hiring of a transient workforce and the fact that gas company headquarters are not generally located in New York State.

> An important fact to bear in mind when viewing the shale gas experience in Texas and trying to extrapolate it to other states, such as New York, is that Texas is likely to experience greater economic benefits from shale gas development than is New York. Texas has had a well-established oil and gas industry for many years and a labor force with the requisite skill sets. Oil and gas headquarters and main offices are more often in Texas than in New York. Many of the industries that are ancillary to gas exploration and development are also located in Texas, not in New York. New York will have to import skilled labor as well as materials and equipment, much of which is manufactured, managed, contracted for, and maintained in Texas. Economists at the Federal Reserve Bank of Dallas (Dallas Fed) have pointed out that due to the extensive oilfield machinery and energy services located in Texas, the state greatly benefits from oil and gas production throughout the world. In addition, the Barnett Shale is in the Dallas–Fort Worth metroplex, a region that is much more urban than the Marcellus Shale region. The literature indicates that the impact of extractive industries in nonmetropolitan areas may be much different than in metropolitan areas. Economic multipliers tend to be larger in metropolitan areas, such as the Dallas-Fort Worth metroplex, where there are larger populations and greater industrial diversity than in nonmetropolitan areas, such as the Marcellus Shale region of upstate New York [1].

The Houston Business Journal recently confirmed the dominance of Texas firms in the Marcellus Shale play by reporting, "A majority of the most active energy companies in Pennsylvania are actually based out of Texas [7]."

An energy plan for New York State should capitalize on the opportunity to maximize benefits to New York State, not to Texas. A renewable energy plan, as opposed to increased reliance on fossil fuels, would create income and jobs for

New Yorkers. The energy plan should also provide guidelines to incentivize manufacturers of renewable energy equipment, such as solar panels and wind turbines, to locate in New York State, as this would create many ongoing job opportunities for New Yorkers.

4. The economic impacts of natural gas exploration, development, and transmission are not properly considered or reflected in NYSEP.

NYSEP (Vol.2, "End-Use Energy," page 21) states that from 2012 to 2030, total primary energy use is projected to increase at an average annual rate of 0.3% and natural gas by 1.1% average annual rate. NYSEP is clearly predicated on the assumption of widespread and increased use of natural gas.

NYSEP (vol.1, page 12) also states, "unless we change our approach to provide greater emphasis on EE and clean, localized power sources, it is estimated that over the next 10 years more than $30 billion will need to be invested in New York's electric system to replace aging infrastructure and central generation resources just to meet currently projected energy demand."

While the plan confirms that greater emphasis is absolutely required on EE and clean, localized power sources, why does the plan then go on to support dramatically increased use of natural gas?

Increased reliance on natural gas would be a serious mistake for the state. Many other individuals and organizations will be submitting comments on the detrimental environmental and public health impacts of natural gas, so again, this comment focuses exclusively on economic impacts. A very recent paper on this subject, "Economic Realities of Hydrofracking," was written as a support document for testimony at a public forum in Albany several weeks ago [8]. This paper points out in greater detail economic concerns regarding shale gas development in New York State. It is available in PDF form upon request.

NYSEP (vol. 1, page 55) states, "economic efficiency potential includes all cost-effective efficiency potential, based on a simple comparison of the present value of costs and benefits over the expected life of the equipment." Why has such a simple cost-benefit analysis not been conducted for each type of fuel, and especially for natural gas? A start to such an analysis is provided in the attached, "A Balance Sheet for NYS: What is New York State's Net Equity from Shale Gas Development?" This "Balance Sheet" details the very long list of costs (as liabilities in the column on the right) and the much shorter list of benefits (as assets in the column on the left side). As more research and reports are published, the values of many of the items on the left side of the balance sheet are shown declining while the costs on the right hand side are clearly increasing.

NYSEP has omitted discussion of many costs attributed to shale gas development. There are costs to communities due to increased demand for police, fire, first responders and hospitals. There are costs to states, counties and local communities associated with road damage due to heavy truck traffic. There are costs associated with water and air contamination, and pubic health costs. For accurate conclusions to be drawn, all costs must be aggregated and accounted for across all of the affected communities.

Shifting of labor between and among industries should be considered. In the actual regions of shale gas development, small businesses will be crowded out and industries that are not compatible with an industrial landscape will decline or disappear entirely. The threat of water, air or land contamination will depress industries dependent on the existence and perception of clean water, air and land. And NYSEP should further consider the negative economic consequences of a regional long-term economic bust that frequently characterizes gas development and other extractive industries.

Exports of natural gas are often mentioned as a benefit. Such exports may benefit the US Balance of Payments and the gas industry as well as the nations receiving our natural gas, but it will be at the expense of states, regions and communities in the United States.

The many negative economic impacts of shale gas development should influence NYSEP to move away from natural gas and to quickly move toward renewable energy.

5. The plan pays lip service to societal costs, but does not consider them in the selection of fuels.

It is curious that the plan states (vol. 2, "Sources," page 45), "It is likely that electricity prices do not currently reflect the full cost to society of related carbon emissions. The state still has a role to assure that societal goals are addressed in electricity and other energy markets." In actuality, the plan itself would contribute to climate change due to the increased use of natural gas.

Again, many others will comment on the fact that shale gas is not in fact a clean fuel and also the specifics on why methane is a more potent greenhouse gas than carbon dioxide and that substantial amounts of methane are released into the atmosphere during the entire life-cycle of shale gas.

The economic costs associated with climate change and pollution from fossil fuels is staggering. Jacobson et al tie fossil fuel driven air pollution to widespread illness, lost time from work and school, and 4000 annual premature deaths in New York State, which together cost the state approximately $33 billion per year. And, "fossil fuels emitted in the state will also result in approximately $1.7 billion in global

warming costs to the United States by 2025. Converting to WWS in the state will eliminate these externalities and their costs [2]".

6. Environmental and economic justice are not sufficiently addressed in NYSEP.

NYSEP (vol. 1, page14) points out that environmental justice communities "bear the burdens of higher rates of asthma, diabetes, cardiovascular disease and childhood lead poisoning." NYSEP does not seem to be concerned with the fact that these same communities bear the burdens of natural gas health impacts. It is possible that some of those Americans who rely solely on wage income (as they do not hold a stock portfolio with oil & gas investments) are the same Americans whose families may experience the negative health impacts associated with natural gas development. They may even be the same Americans who lose jobs in industries in shale regions that are not compatible with shale gas development, such as tourism, agriculture, organic farming, wine making, hunting, fishing and other outdoor recreation.

The increased production and use of natural gas, which in fact will be primarily fracked shale gas, will cause additional, inequitable harm to environmental justice communities, whether the shale gas comes from New York, Pennsylvania, or any other state or shale gas formation.

It is irresponsible for NYSEP to be pushing an energy source that further harms these communities. Why is this issue not addressed in NYSEP?

7. NYSEP states that several metrics will be used to evaluate the plan. The analyses of at least two of the metrics, "Energy Affordability" and "Cleaner Environment," are incomplete. And a third metric, "Robust Economic Activity," is unlikely to be accomplished if natural gas is increasingly used in New York State.

NYSEP (vol.2, End-Use Energy, pages 28-29) discuss four metrics used to evaluate the plan. One is "Improved Energy Affordability." The plan states, "NY residential customer electric bills will be kept at or below the national average as a percentage of median household income." Keeping energy at a low price will be very unlikely in light of the history of price volatility and likely substantial increases in the price of natural gas. The Henry Hub spot price of natural gas on Monday, March 3, 2014, was $7.09, which is more than $2 higher than the maximum price projected by NYSEP through 2025. It is time to immediately move away from expensive fossil fuels and toward zero cost fuel sources in the form of wind, water and sunlight.

Another metric stated in NYSEP is "Cleaner Environment," but its analysis is also incomplete. Other commenters will be addressing environmental concerns, ranging from methane emissions, leaks and their impact on climate change to impacts on

public health associated with shale gas development. There are high economic costs associated with these environmental impacts.

There are varying aggregate estimates of the costs of climate change, but they are all high. For example, one estimate referenced in the Jacobson et al paper is that in the US alone, by 2050, global warming will cost $271 billion per year [2]. This includes severe storm and hurricane damage, real estate loss, energy sector costs, and water costs. This does not include the costs associated with increased morbidity and mortality.

Another metric, "Robust Economic Activity", is unlikely to be accomplished if natural gas is used increasingly in NYS, for reasons explained in comments 1 through 4, above.

8. While the plan promotes energy efficiency, a key element that would lead to increased energy efficiency is ignored.

One policy initiative (initiative number 1, Vol. 1, page 31) is to promote energy efficiency. This is a desirable policy, but there is no mention that a shift to 100% renewable energy in the form of wind, water and sunlight will reduce energy consumption by 37% in New York State [2]. And another initiative (number 9) conflicts with this goal. Initiative 9 is to "expand access to natural gas."

> A conversion to WWS will reduce world, U.S. and NYS end-use power demand and power required to meet that demand by 32%, 37%, and 37%, respectively. The reductions in NYS by sector are 21.0% in the residential, 12.3% in the commercial, 20.0% in the industrial, and 69.5% in the transportation sectors. Only 5-10 percentage points of each reduction are due to modest energy-conservation measures. Some of the remainder is due to the fact that conversion to WWS reduces the need for upstream coal, oil, and gas mining and processing of fuels, such as petroleum or uranium refining. The remaining reason is that the use of electricity for heating and electric motors is more efficient than is fuel combustion for the same applications [2].

9. NYSEP should address in detail the future of NYS utilities and their business model in light of grid defection.

Much recent research indicates that major changes in the electric power production and distribution industry are beginning to take place, and New York State should recognize this and address it in NYSEP. The electric utility industry is concerned about a so-called "death spiral," and Edison Electric released a report that outlines the industry's concerns [9].

The Jacobson et al study shows that it is feasible for New York State to transition to 100% renewable energy by 2050, if we start now [2]. Another recent study by GE Energy Consulting of PJM renewable integration concludes that obtaining 30 percent of PJM's electricity from wind energy significantly reduces the cost of producing electricity and that there is no harm to reliability from increasing wind energy use by a significant factor [10]. And a recent IEA Report found that "integration of large amounts of renewable energy can be achieved by any country at only a small increase on whole-system costs, compared with the current fossil-fuel heavy electricity systems [11]."

The future of utilities in New York State needs careful review and planning. Much recent research indicates that New York State should move quickly to a renewable energy infrastructure, but in doing so, the power utilities may suffer. A new business model is required and NYSEP should be at the forefront of addressing this. Recent reports about RWE, a major German utility that is taking a massive loss, show that the utility had made a big mistake by taking the wrong path. Instead of choosing to embrace renewable and distributed energy, it tried to continue to focus on fossil fuels [12,13].

The utility industry here in the United States has indicated serious concerns about customers producing more and more of their own power and the impact on ratepayers who neither leave the grid nor produce their own power. These remaining ratepayers may end up paying substantially higher rates to cover the costs of maintaining the grid. These are issues that NYSEP should address in detail.

10. The costs of energy infrastructure must be analyzed in greater detail and considered more carefully in NYSEP.

There will be major costs to New Yorkers as a result of the build out of natural gas infrastructure, whether or not shale gas drilling is allowed in New York State. There are significant costs associated with pipelines, compressor stations and storage facilities. Examples of just some of the costs include the costs that result from environmental and health impacts, costs associated with declines in property values and property tax revenue, and costs due to future economic development limitations.

Significant costs have been identified and discussed in the many comments submitted in New York State in response to proposals for expanded pipelines, gas fired power plants, storage facilities and compressor stations. Just a few examples of relevant comments are included in the references below [14,15,16,17].

Costs associated with pipelines frequently seem to be dismissed entirely. The vast network of pipelines that will be required, ranging from smaller gathering lines, to larger transmission lines and major pipelines, create large opportunity costs to communities and the state. In addition to new pipelines, there are plans to expand and extend existing pipelines substantially. In every mile of a pipeline's location,

future economic development potential is diminished as one cannot build on or close to natural gas pipelines. Another cost that is often disregarded with respect to pipelines is associated with the dangerous and tragic explosions that seem to be occurring regularly across the nation. One report stated, "Thousands of miles of 'gathering lines' are now operating at high pressure to serve fracking operations, but regulators don't even know where they are [18]."

The industry claims that they are now focusing on developing "smart" or "intelligent" pipelines with fiber-optic sensors [19], but such advances are likely to substantially drive up not only the cost of pipelines, but also the end user price of natural gas.

If the costs of infrastructure are fully taken into account, it is clear that natural gas would not in reality be the short-term bridge fuel claimed by gas industry supporters. An MIT study found that shale gas use suppresses the development of renewables [20]. Aspen Environmental Group has estimated that in the United States it would cost about $700 billion to convert all coal based power plant infrastructure to natural gas [21]. It is unlikely that financial institutions and other investors would be willing to make such large investments if they are viewing natural gas only as a short-term bridge fuel.

The time is now to reduce our reliance on all fossil fuels and move quickly to renewable energy.

Conclusion:

It is foolish for New York State to encourage a build out of a natural gas infrastructure that will last for 30 to 50 years when climate change is upon us, and increased production and use of shale gas are likely to detrimentally impact our environment, our health and our economy here in New York State. There is a much better fossil fuel-free alternative and NYSEP should focus on transitioning to this better fossil fuel-free energy system immediately.

Respectfully Submitted,

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References:

[1] Barth, JM, "The Economic Impact of Shale Gas Development on State and Local Economies: Benefits, Costs, and Uncertainties," New Solutions Vol.23 (1), 2013.

[2] Jacobson, M., et.al., "Examining the feasibility of converting New York State's all-purpose energy infrastructure to one using wind, water, and sunlight," Energy Policy 57 (2013) 585–601.

[3] The Hill.com E2 Wire, "Utility President Warns of Natural Gas Price Volatility," April 26, 2012.

[4] M. Wei, S. Padadia, D. Kammen, "Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?"Energy Policy 38 (2010) 919-931.

[5] Pollin, R, Heintz, J, Garrett-Peltier, H., "The Economic Benefits of Investing in Clean Energy," Political Economy Research Institute, University of Massachusetts, Amherst, 2009.

[6] Multi-State Shale Research Collaborative, "Exaggerating the Employment Impacts of Shale Drilling: How and Why," November 2013.

[7] Blum, Jordan, "See which Texas Energy Companies Dominate Pennsylvania Drilling," http://www.bizjournals.com/houston/blog/drilling-down/2014/03/see-which-texas-energy-companies-dominate.html

[8] "Economic Realities of Shale Gas Development in New York State," February 2014. Submitted to accompany verbal testimony presented at Feb 4th Public Forum Hosted by Senator Tony Avella, Albany, New York, titled "Economic Realities of Hydrofracking," Prepared by Jannette M. Barth, Ph.D., Economist, Pepacton Institute LLC. (PDF available on request.)

[9] Edison Electric Institute, "Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business," January 2013.

[10] "PJM Renewable Integration Study, Executive Summary Report, Prepared for PJM Interconnection, LLC, Prepared by General Electric International, Inc., February 28, 2014.

[11] "IEA Report: Wind and Solar can Carry Bulk of Energy Transformation," Jonathan Gifford, Renew Economy, March 3, 2014.

[12] Parkinson, Giles, "Germany: Decline of Fossil Fuel Generation is Irreversible," http://reneweconomy.com.au/2014/germany-decline-of-fossil-fuel-generation-is-irreversible-75224

[13] Steitz, Christoph, "RWE Posts Historic Net Loss as Writedowns Bite," http://uk.reuters.com/article/2014/03/04/uk-rwe-results-idUKBREA230EW20140304

[14] Barth, JM, "Comments on the Economic Impact of the proposed LPG Storage Facility in the Town of Reading, Schuyler County, New York," August 02, 2013 (PDF available on request).

[15] Barth, JM, "Comments on Repowering Cayuga Power Plant," Letter submitted to New York State Public Service Commission, August 13, 2013, Re: Case 12---E---0577, Proceeding to Examine Repowering Alternatives to Utility Transmission Reinforcements (PDF available on request).

[16] Barth, JM, Letter submitted to New York State Public Service Commission Re: Case 10-E-0501 CPV Valley, LLC, February 11, 2014 (PDF available on request).

[17] Barth, JM, Comments on Algonquin Incremental Market Project (Docket No. PF13---16---000), Submitted to Federal Energy Regulatory Commission,October 11, 2013 (PDF available on request).

[18] Sadasivam, Naveena, "Boom in Unregulated Natural Gas Pipelines Posing New Risks," Inside Climate News, September 26, 2013.

[19] Blum, Jordan, "Energy Sector Focused on 'Smart' Pipelines and Safety," Houston Business Journal, March 4, 2014.

[20] Eckstrom, Vicki, "A Shale Gas Revolution: MIT Report Shows Prosperous Shale Gas Market Could Hurt Future R&D, if we let it.," http://web.mit.edu/newsoffice/2012/shale-gas-revolution-report.html?tmpl=component&print=1

[21] Aspen Environmental Group, "Implications of Greater Reliance on Natural Gas for Electricity Generation," July 2010, page 94.

A Balance Sheet for New York State: What is New York State's Net Equity from Shale Gas Development?

Prepared by Jannette M. Barth, Ph.D., January 4, 2012

➤ Assets*

Tax Revenue:
- Direct from the gas industry based on future legislation
- Increased income tax based on
  - Royalty income to leaseholders
  - Lease income to landowners

Stimulation of industries based on byproducts of natural gas

Climate benefits from decreases in green house gases from burning shale gas

Indirect benefit to NYS from improved Balance of Payments assuming substantial shale gas exports

Short-term job gains in the gas industry and related industries

Increased spending by leaseholders in New York State

Lower cost of energy as long as it lasts

TOTAL ASSETS **???**

*These are not necessarily comprehensive lists of assets and liabilities. They serve only as examples. Note that where an asset or liability is a future stream of income or expense, discounted present value should be used.

➤ Liabilities*

Tax Revenue Loss:
- Income tax losses by leaseholders who vacate properties and relocate out-of-state
- Income tax losses caused by decreases in tourism and other industries negatively affected by drilling
- Property tax losses caused by negative impact of drilling on property values and financing

Decreased spending by leaseholders if they move out of state, or buy second homes out of state

Human health costs associated with:
- Water contamination from frack fluids and wastewater
- Air pollution from compressors, leaks, gas released at well-sites

Costs due to impacts on animals (domestic, agricultural and game) of water, land and air contamination

Climate costs associated with increases in greenhouse gases from methane leaks and venting

Costs associated with declining quality of life due to the creation of an industrial landscape

Costs associated with declines in tourism industry

Costs associated with declines in organic farming and other agriculture and food manufacturing

Costs associated with declines in outdoor recreation

Costs associated with increased air pollution from increased truck traffic

Costs associated with declines in fisheries and trout fishing industry

Infrastructure costs due to use of and damage to roads and bridges from increased truck traffic

Costs due to declines in numbers of retirees and retirement housing market

Costs due to declines in numbers of second home owners and second home market

Costs due to crowding out (loss of jobs to existing businesses and governments)

Costs to communities due to increased demand for police, fire and first responder services

Social costs associated with the gas drilling industry

Costs to the mortgage industry and housing market, and related declines in property values and property tax revenue

Costs associated with increased homelessness

Costs associated with the postponement of investment in renewables

Opportunity costs due to the prevention of future building and economic development

Costs associated with a long-term bust, characteristic of extractive industries

TOTAL LIABILITIES **???**

NET EQUITY **???**

Is the **Discounted Present Value of Total Assets** minus the **Discounted Present Value of Total Liabilities** a positive value?

This question cannot be answered until a comprehensive risk assessment and economic analysis has been conducted.