

Review of PennEast Pipeline Project Economic Impact Analysis

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Delaware Riverkeeper Network retained Pepacton Institute LLC (PI) to review the analysis presented in the report titled, “PennEast Pipeline Project Economic Impact Analysis,” prepared by Econsult Solutions and Drexel University (ES&D), dated February 9, 2015. The ES&D report states on the title page, “Report Submitted To: PennEast Pipeline Company LLC,” so presumably, ES&D were retained by PennEast to conduct the analysis and prepare the report.

Based on a review of the ES&D analytical methodology, assumptions, economic impact estimates, and comparison to additional relevant data and research, we conclude that the ES&D analysis and conclusions are incomplete, inaccurate, and unreliable.

The ES&D report states, “The purpose of the report is to quantify the economic benefits resulting from the Project.” The report is organized into four sections: Description of the PennEast project, one-time economic and fiscal impact from construction, annual impact of the project, and summary of overall economic impact for the six-county region and the two impacted states.

While the title of the ES&D report implies that it is analyzing economic impacts, it clearly states that its purpose is to quantify only economic benefits. A comprehensive economic impact analysis would attempt to quantify both benefits and costs.

As is typical of most economic impact assessments conducted or funded by the oil and gas industry, the ES&D report exaggerates the economic benefits and ignores the costs.

This review shows how the benefits are exaggerated and then discusses the many significant costs that have been ignored by ES&D.

ES&D reached the following two conclusions, each of which will be reviewed below in discussions of methodology, assumptions and results.

- In Pennsylvania and New Jersey combined, the design and construction is estimated to generate an approximate \$1.62 billion in one-time total economic impact, supporting about 12,160 jobs with \$740 million in wages.
- In Pennsylvania and New Jersey combined, the ongoing operations of the project is estimated to generate annually an approximate \$23

million in total economic impact, supporting 98 jobs with \$8.3 million in wages.

ES&D further claims, “The primary ongoing impact of PennEast Pipeline will be to expand and stabilize the supply of natural gas in both states, thus leading to a reduced price of natural gas to final customers.” This claim will be discussed as well.

Employment and Income Impacts: Methodology

ES&D uses IMPLAN, an input-output model that is commonly used to show positive economic impacts caused by a proposed new development entering a region. Any new economic activity in a region will bring in additional expenditure, which, through multiplier impacts, usually results in some economic benefit in the form of jobs and income.

PI has reviewed many economic impact studies conducted or funded by the oil & gas industry [1]. Input-output modeling is used frequently by the oil & gas industry to show that oil & gas production, transmission and delivery will benefit the economy. The studies funded by the oil & gas industry tend to greatly exaggerate economic benefits and minimize or more commonly, entirely ignore significant economic costs. The results of these studies are used to try to convince the public and elected officials that shale gas development and its infrastructure will bring great economic benefits to communities.

ES&D included a short paragraph in an appendix that states a few of the shortcomings of input-output models, but instead of attempting to adjust their results to correct potential inaccuracies due to shortcomings, they simply state, “regardless, I-O models still serve as the standard in the estimation of local and regional impacts.”

Economists and other researchers who are attempting to reach accurate, unbiased conclusions would make adjustments in order to at least partially correct for known shortcomings in models being used. No such adjustments were discussed in the ES&D report.

In addition to the shortcomings pointed out by ES&D, limitations of input-output models have been pointed out elsewhere. The following is a discussion of input-output models as applied to the shale gas industry generally, and is thus of relevance to the PennEast Pipeline Project [2].

An additional weakness is the fact that environmental impacts are ignored. Wassily Leontief, who received the Nobel Prize in Economic Science for his model of input-output economics, had himself stressed

as early as the 1970s that environmental repercussions and externalities should be incorporated into input-output analysis [3-5]. Leontief recommended that a pollution abatement industry be entered into the input-output matrix, and that the abatement industry be in the business of eliminating pollutants generated by the productive sectors, consumers, and the abatement industry itself. And Wiedmann, Lenzen, Turner, and Barrett stated, “in the last few years 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” [6]. The industry-sponsored studies have not addressed environmental repercussions, such as water and air contamination, or externalities such as damage to roads and costs to communities. Unless appropriate adjustments are made, input-output analysis tends to use unrealistic assumptions. Bess and Ambargis [7] and Lazarus, Platas, and Morse [8] discuss some of the limitations of input-output analysis. For example, Bess and Ambargis state, “Regional input-output models can be useful tools for estimating the total effects that an initial change in economic activity will have on a local economy. However, these models are not appropriate for all applications and care should be given to their use. . . . Key assumptions of these models typically include fixed production patterns and no supply constraints. Assumptions about the amount of inputs that are supplied from the local region are also important in these models. Ignoring these assumptions can lead to inaccurate estimates” [7]. There are several additional problems of particular relevance to the application of input-output analysis to the study of shale gas development. For example, while spending patterns in communities with an established drilling industry [or extensive pipeline development] would probably be different than spending patterns in communities without an established drilling industry [or extensive pipeline development], this difference is not reflected. Input-output analysis implicitly assumes that all populations have identical spending patterns. This assumption exaggerates the estimated economic impact if new workers are transient. The gas industry frequently brings in transient workers and houses them in man-camps or rental housing on a short-term basis. Such workers often send their wages to their families living elsewhere, improving the economies in those distant locations . . . and thereby exaggerating the estimated economic impact. In addition, input-output analysis assumes “constant returns to scale.” This means that the gas industry

would get no volume discounts on supplies. This is an unrealistic assumption, and it inflates estimates of industry spending and thus estimates of economic impacts from the industry's activity in the community. Input-output models used in the industry-sponsored studies tend to be static in time, implying that there are no changes in coefficients over time and no allowance for price changes in factors of production such as supplies and labor. The production function is also assumed to be constant. This does not allow for input substitution or changes in the proportions of inputs as technology and/or prices change over time. Input-output models tend to be aspatial, implying that transportation costs are not fully reflected.

Employment and Income Impacts: Assumptions

As ES&D correctly points out, "The workforce for the Project is likely to be comprised of personnel from across the country due to the specialized nature of pipeline construction." (Page 10)

It is likely that the workforce will come from parts of the country that have more miles of pipelines already installed. According to data from PHMSA Pipeline Safety Program, the three states with the greatest number of natural gas transmission pipelines as of 2010 are Texas with 54,933 miles, Louisiana with 30,093 miles, and Oklahoma with 13,124 miles. These are likely to be the states from which many of the temporary workers will come to build the PennEast and other pipelines in the Northeast and other parts of the country. And these are the same states from which many of the temporary workers came to work in the early shale gas boom in Pennsylvania. This is the industry pattern.

When a temporary workforce comes from out of state for a short term project (such as six months of installing a pipeline), most of the wages earned are likely to be sent to the workers' families in their home states, helping the economies there rather than the economies of New Jersey or Pennsylvania.

The assumption made by ES&D is that "25 percent of the disposable income of the construction workforce will be spent outside of Pennsylvania and New Jersey." No justification is provided for this assumption. Reports from Pennsylvania indicated that at the beginning of the short-lived shale gas boom, possibly up to 97% of the workers came from out of state, so the 25% assumption made by ES&D is probably far too low.

It is curious that ES&D state that they used "detailed budget projections provided by PennEast," but they do not provide detailed expenditure inputs in the report. For the construction phase, they show only the six broad categories of Land Acquisition, Materials, Construction Labor, Project Management, All over head construction

services, and Other (in Table 3.1 on Page 10). The modeling effort is presented as a black box, jumping from Table 3.1 with the broad expenditure categories, to Table 3.2, with the impact estimates. A detailed input-output analysis should separate Construction Labor and Materials, the two largest categories, into more detail. For the Ongoing Operations Economic Impact section, the expenditure categories are even fewer, having been separated into only the three very broad categories of Labor, Maintenance and Operations (in Table 4.1 on Page 14). If a high proportion of labor or particular materials must be imported to the local region, as opposed to sourced locally, then the economic impact on the immediate region will be relatively weak. Research presented in the Oil & Gas Journal shows the unsurprising result that pipeline construction costs are different for different regions. Material cost includes the cost of line pipe, pipeline coating and cathodic protection. Labor costs include construction labor as well as surveying, engineering, supervision and administrative labor, each with specific cost levels. And there are miscellaneous costs such as telecommunications equipment, freight, cost of ROW and allowance for damages. The region in which each of the costs and benefits occur should be considered and reflected in an economic impact study [9].

Employment and Income Impacts: Results

It appears that ES&D did not make an effort to check the reasonableness of their results. Normally, a researcher will compare their conclusions to those of other studies to check for veracity and accuracy.

The employment estimate of 12,160 jobs for the design and construction phase of the Project is very optimistic in light of job creation from other similar projects.

The Goodman Group, Ltd. (TGG) provided a detailed critique of the job estimates that were presented in the PennEast study [10]. As pointed out on page 21 of the TGG critique, based on the estimates provided, the overall multiplier for the potential economic impact from design and construction of the project is 10.7 jobs per \$1 million project cost. TGG compared job creation from other pipeline projects and found that “the multipliers for other similar gas pipelines are only 8 – 36% of the PennEast Analysis multiplier” (Page 30 of the TGG report). TGG compared job estimates for the following four Northeast US Gas Pipeline Projects: Atlantic Sunrise, Northeast Supply Link, Northeast Energy Direct (NED), and Constitution. Their findings are summarized in Figure 2 of the TGG report and are repeated in the following table.

Multipliers
(Jobs per \$1 million project cost)

Pipeline Project	All Workers	In-State Workers
PennEast	10.2	NA
PennEast(FERC project cost)	10.7	NA
Atlantic Sunrise	NA	3.8
Northeast Supply Link	3.9	NA
Northeast Energy Direct	2.0	1.4
Constitution	1.5	0.9

(Source: The Goodman Group report)

PI reviewed additional information in order to make independent comparisons. Our findings, described below, provide further support for the conclusions reached by TGG, that the job estimates reported by ES&D are highly exaggerated.

As stated above, PI has reviewed many economic impact studies of shale gas development. The industry regularly exaggerates job creation, often on the order of ten-fold.

An early industry-funded study that was often quoted toward the beginning of shale gas development in Pennsylvania claimed that 88,000 jobs would be created in Pennsylvania in 2010 due solely to shale gas development. The reality is that only 65,000 jobs were created statewide in ALL industries in Pennsylvania in 2010, and half of those were in education and health and in leisure and hospitality. Later, industry claimed that 48,000 jobs were created in Pennsylvania from the fourth quarter of 2009 to the first quarter of 2011, about a year. The Keystone Research Center debunked this claim by pointing out that the 48,000 jobs referred to “new hires,” and does not reflect separations in the form of layoffs or quits. Using appropriate data, the Keystone Research Center found that Marcellus core and ancillary industries created less than 6,000 net new jobs between the fourth quarter of 2007 and the fourth quarter of 2010 [11]. Governor Corbett of Pennsylvania, based on shale gas industry claims, stated that 200,000 jobs had been created in his state due to shale gas development. Not only did the Keystone Research Center (not industry-funded) find that less than 6,000 net new jobs were created in three years in Pennsylvania in Marcellus core and ancillary industries, but other Pennsylvania-based economists have pointed out that the Governor’s claim is highly exaggerated and implies a multiplier of about seven, which would be extraordinarily and unrealistically high for any industry.

[\(https://stateimpact.npr.org/pennsylvania/2013/11/06/economists-question-corbetts-marcellus-shale-jobs-claims/\)](https://stateimpact.npr.org/pennsylvania/2013/11/06/economists-question-corbetts-marcellus-shale-jobs-claims/)

As Ohio began to be exploited for shale gas, an industry-funded study again claimed that 200,000 jobs would be created there. An independent study (not industry-

funded) estimated that there would be only 20,000 jobs created, only one-tenth of industry's estimate.

The Multi-State Shale Research Collaborative has confirmed our early predictions and now established findings that job creation from shale gas development is greatly exaggerated. For example, among other conclusions, the Collaborative found 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" [12]. Specifically, they found an estimated 3.7 jobs created for every well drilled in the Marcellus region, as compared to industry's claim that 31 jobs are created per well drilled. So, as above, independent research finds approximately one-tenth of the amount of job creation claimed by the shale gas industry.

Such exaggeration appears to apply to studies of the economic impacts of infrastructure as well, such as power plants and pipelines. Take, for example, the CPV Woodbridge Energy Center (WEC) that broke ground in October of 2013. It is a 700 megawatt (MW) natural gas fueled power plant located in Woodbridge Township, NJ, which is in Middlesex County. According to the website, "WEC will employ as many as 500 to 600 skilled workers during construction and 25 permanent employees." (<http://www.cpvwoodbridge.com/about.php>), accessed January 18, 2016). Construction was expected to take two years. As county level data for 2015 is not yet available, we took a look at the Quarterly Census of Employment and Wages, on the Bureau of Labor Statistics website, and found that during the first year of construction, from the end of 2013 to the end of 2014, only 27 jobs were added to the NAICS code 2371 Utility System Construction in Middlesex County. Note that Utility System Construction includes more than power plants. Even if all 27 jobs were generated by construction of WEC in the first year of construction, it is difficult to believe that another 473 to 573 jobs would be added in the second and final year of construction.

As another example, consider the Algonquin Incremental Market Project (AIM), a pipeline being expanded by Spectra Energy and impacting five states, Pennsylvania, New York, Connecticut, Massachusetts and Rhode Island. According to Spectra's website, the AIM project includes over 20 miles of 42-inch diameter new pipeline in New York and Connecticut, over 9 miles of 16-inch diameter pipeline in Connecticut, another 1.3 miles of 12-inch diameter loop pipeline in Connecticut and 2 miles of 36-inch extension pipeline also in Connecticut, and 5.1 miles of new 16-inch and 24-inch diameter lateral pipeline in Massachusetts. The AIM project also includes six new compressor units at five existing compressor stations in New York, Connecticut and Rhode Island, modification to an existing compressor station in Connecticut, a new metering station in Connecticut and two in Massachusetts and modifications to existing metering stations in New York, Connecticut and Massachusetts. (See

<http://www.spectraenergy.com/Operations/US-Natural-Gas-Operations/New-Projects-US/Algonquin-Incremental-Market-AIM-Project/>). FERC's Draft EIS confirms that few jobs would be created by the AIM project. It is stated that after construction, Algonquin would add only three full-time permanent workers for operation of the proposed and modified facilities. This is far fewer than the 98 operations jobs estimated by ES&D for PennEast. Will there really be 32 times more jobs ongoing at the PennEast Pipeline which is to be about 114 miles long and 36-inch diameter, through four counties in NJ and six counties in PA, compared to the AIM expansion which includes new 42" diameter high-pressure pipeline crossing under Hudson River and continuing through New York State and into Connecticut, Rhode Island, and Massachusetts, a total of 37.6 miles of new pipeline? And bear in mind that the AIM project (and jobs estimate) also includes 6 new or expanded compressor stations, 24 existing metering and regulating stations, and construction of 3 new metering and regulating stations.

Another example is the well-publicized Keystone XL pipeline project, a pipeline proposal far more extensive than PennEast. (<http://www.transcanada.com/keystone.html>) The Perryman Group, a consulting firm hired by TransCanada, concluded that 119,000 jobs would be created by the 1,179 mile 36-inch diameter Keystone XL Pipeline. Cornell University's Global Labor Institute found the Perryman Group study on the Keystone XL Pipeline to be flawed and the employment numbers highly exaggerated. The Cornell report concluded that, "Employment potential from the Keystone XL Pipeline is little to none" [13].

And as a final example, Shell Oil plans to build an ethylene cracker plant in Beaver County, Pennsylvania. (<http://stateimpact.npr.org/pennsylvania/topic/ethane-cracker/>) A cracker plant separates wet gas and produces ethylene that is in turn used in plastics and other chemical industries. There was competition among West Virginia, Ohio and Pennsylvania, each state hoping that Shell would decide to locate there. There are concerns about the quality of air emissions near the cracker plant, but beyond the air emissions issue, consider the estimated economic impact. Each state offered tax incentives to entice Shell. Pennsylvania created a Keystone Opportunity Zone whereby the plant will pay virtually no taxes to the state for 15 years. There were reports that this plant would create 10,000 construction jobs (note that construction jobs are just during the short-term construction phase) and then the plant would create another 10,000 permanent jobs. The question becomes, were the incentives to have the plant located in PA worth the tax losses and were the assertions of job creation accurate or earnest? The Shell Oil cracker plant would be built on 300 acres. For comparison, another ethylene cracker plant owned by Shell is located in Norco, Louisiana. The Shell website states that this plant is on 1,000 acres and has only about 600 full-time employees. In other words, the Norco cracker plant is on more than three times the acreage, but has only 6% the number of jobs as promised to PA for the corporate tax write off that was given to Shell. It appears that the industry has exaggerated job creation claims in order to secure both tax incentives and other necessary approvals to be located in PA.

The ES&D report created for PennEast is another example of an industry funded study that has obviously overstated job creation many times over. If any jobs will be created by the PennEast Pipeline Project, they will be during construction and such jobs are not sustainable. The oil & gas industry is known for its transient workforce, so it is unlikely that even the few short-term construction jobs would go to local residents. Obviously, pipeline companies are motivated to make grandiose job creation and economic impact claims in order to encourage approval of a project. It is incumbent on state and local decision makers to see through these false claims.

A small amount of job creation by shale gas development and its infrastructure has never been in question. But, the number is so tiny relative to that of all other jobs in the region that aggregate statistical analysis shows that the overall impact is insignificant. TGG has pointed this out as well. They state, “Even if the PennEast Analysis’ employment impact estimates were realistic, the employment impact from design and construction of the Project are (a) tiny in the context of the New Jersey and Pennsylvania state economies (less than 0.1% of total NJ jobs); and (b) very short-term.” They point out that jobs from actual construction are temporary with an average duration of only 5.2 months (Page 40 of the TGG report).

It should be pointed out that the natural gas industry, including its infrastructure such as pipelines, is highly capital intensive, about ten times more capital intensive than the average American industry. This means that relatively few jobs are created per dollar invested.

Of course, if the number of jobs created is overstated, then the resulting income estimates will also be overstated. So, based on our review of ES&D’s methodology, assumptions, and results, we conclude that the employment and income estimates presented in their report are highly exaggerated.

Impacts on Tax Revenue

ES&D present estimates of income tax benefits to Pennsylvania and New Jersey. If the employment and income estimates are exaggerated, as shown above, then income tax benefits will also be exaggerated.

There is a further concern regarding the ES&D approach to estimating income tax impacts. In a footnote, it is stated, “the tax estimates were calculated using each state’s published personal income tax collection effective rates, which are currently 2.043% and 3.185% in Pennsylvania and New Jersey, respectively.” However, while out of state workers are a significant share of total workers, ES&D included no discussion of adjusting income tax estimates to reflect Pennsylvania and New Jersey laws for handling income tax collection from out of state workers. While Pennsylvania residents are the only out-of-state residents exempt from New Jersey withholdings (Department of Treasury, State of New Jersey), the Commonwealth of Pennsylvania has reciprocal tax agreements with Indiana, Maryland, New Jersey,

Ohio, Virginia and West Virginia (www.revenue.pa.gov). As a result, an accurate economic assessment would reflect the loss of income tax benefits for Pennsylvania and New Jersey for out-of-state resident workers hired by PennEast.

ES&D should have clarified if and how they handled the distribution of workers from different states. Evidence-based assumptions regarding the distribution of out of state workers from different states should have been made. Based on observations in the oil & gas industry generally, many of the workers are from states other than New Jersey or Pennsylvania.

A glaring omission in the ES&D report is discussion of potential property tax payments by PennEast. There have been reports indicating concern by impacted Pennsylvania communities that they will lose out on tax revenue while New Jersey communities will collect additional revenue. (See for example, <https://stateimpact.npr.org/pennsylvania/2015/06/11/new-pipeline-could-mean-tax-bonanza-for-nj-towns-but-for-pa-not-so-much/>). This obvious omission may be intended to avoid the discussion of whether PennEast intends to request tax abatements, a frequent strategy of pipeline companies. Or the obvious omission may be to avoid a discussion of the potential impacts on property values that can result from pipeline infrastructure projects. It is possible that any increased property tax revenue from PennEast will be offset by declines in property tax revenue due to declines in land values, a topic further discussed later in this analysis.

Impact on the Price of Natural Gas

ES&D claims that, “the primary ongoing impact of PennEast Pipeline will be to expand and stabilize the supply of natural gas in both states, thus leading to a reduced price of natural gas to final customers. Lower natural gas prices will also lead to lower electricity prices as power generation throughout the region becomes more heavily dependent on natural gas as a fuel.”

First, according to expert analysis there is no shortage of natural gas currently in the State of New Jersey, and construction of PennEast will in fact result in a 53% surplus of gas in the state. According to noted expert, petroleum engineer, Arthur Berman:

Natural gas consumption for New Jersey has been relatively flat for the past four years at average rate of 1.8 billion cubic feet of gas per day (Bcf/d), somewhat below the higher levels of the late 1990s. Although consumption increased slightly in 2013 compared to the three previous years, New Jersey cannot be called a growth market...

And Pennsylvania has been a net exporter of natural gas since 2003...

The proposed PennEast Pipeline would deliver an additional 1 Bcf/d of natural gas to New Jersey potentially creating a 53% supply surplus above the current level of consumption.

(Professional Opinion of Proposed PennEast Pipeline Project, Arthur E. Berman, Petroleum Geologist, Labyrinth Consulting Services, Inc., February 26, 2015)

As a result, ES&D's asserted scenario is unlikely to come to pass. If there was going to be an evolution towards greater dependence on natural gas in the state that evolution would already be in the works.

That being said, there are likely to be enormous negative long term economic impacts associated with encouraging any region to become more heavily dependent on natural gas as a fuel, impacts that were not considered by ES&D. These impacts are discussed further below.

The industry often claims that the low price of natural gas makes the commodity attractive to end users, both residential consumers and businesses of all sizes. But the industry never points out that natural gas has a long history of price volatility and that the price may very well increase substantially due to increased demand through LNG exports, the conversion of buildings and vehicles to natural gas, and the new manufacturing plants that are currently taking advantage of low natural gas prices. When the price of natural gas increases dramatically after increased exports and widespread conversion to the fuel for heating, transportation and industrial feedstock, all of the end users will suffer financially. As a result, dependent communities will be locked into a high priced energy source. Bear in mind that the prices of wind, water and sunlight as inputs into an energy system based on renewable energy will always be zero.

The uncertainty resulting from volatility in fossil fuel prices makes for very difficult long-term planning. A report by National Economic Research Associates (NERA), an oil & gas industry-friendly consulting firm, that tries to make the case that increased exports of LNG from the United States will have minimal impact on natural gas price, has been harshly criticized by other industries and environmentalists [14]. The Department of Energy website provides officially submitted comments, some written by industry friendly sources and some by sources independent of the industry (http://www.fossil.energy.gov/programs/gasregulation/authorizations/export_study/export_study_initial_comments.html)

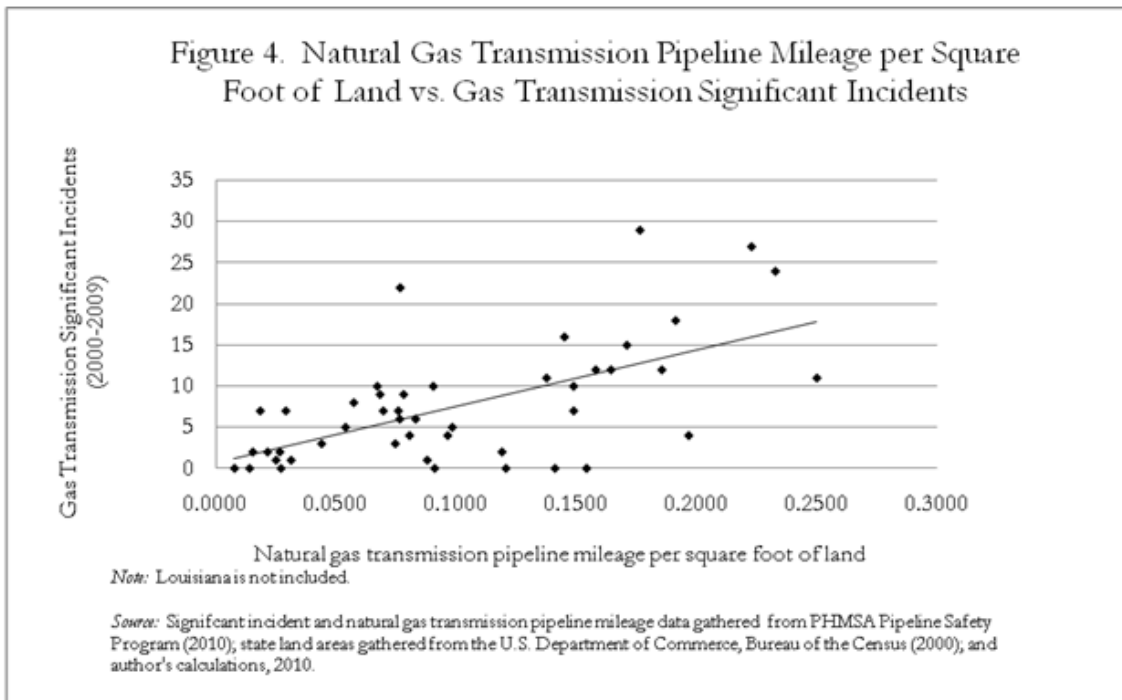
A study by Charles River Associates (CRA) reached vastly different conclusions than NERA (http://www.crai.com/sites/default/files/publications/CRA_LNG_Study.pdf). CRA estimated several alternative LNG export scenarios and found that their most likely export level scenario would result in a doubling of domestic natural gas prices

and their high export scenario would result in a tripling of natural gas prices [15].

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

Ignored Costs

The economic impact analysis conducted by ES&D ignored significant costs that may be passed on to individuals, businesses and communities. As additional natural gas transmission pipelines are built in an area, the risk of significant damaging incidents and/or accidents increases. The following chart, prepared by The National Conference of State Legislatures using PHMSA data, shows the relationship between natural gas transmission pipeline mileage per square foot of land vs. gas transmission significant incidents.



The risks associated with pipelines are so high that the pipeline companies themselves cannot afford to carry sufficient insurance to cover the risks of property damage and loss of human life in the event of an incident.

The ES&D report lists and briefly describes the corporate partners in the PennEast Project. ES&D points out that each partner has experience in the natural gas industry and in particular, midstream operations. It gives statements for example, on years of operation, numbers of customers and annual revenue. It does not point out the high risk nature of the industry and especially pipelines and the fact that these partners do not carry sufficient insurance in the event of a disaster and the high costs that would be incurred by residents, businesses and communities near the pipeline.

A look at 10-K forms submitted to the SEC by the PennEast corporate partners reveals the high cost risk that falls on communities near pipeline projects. For example, UGI Corporation SEC filing for fiscal year ended September 30, 2012, states:

We are subject to operating and litigation risks that may not be covered by our insurance.

Our business operations in the U.S. and other countries are subject to all of the operating hazards and risks normally incidental to the handling, storage and distribution of combustible products, such as LPG, propane and natural gas, and the generation of electricity. These risks could result in substantial losses due to personal injury and/or loss of life, and severe damage to and destruction of property and equipment arising from explosions and other catastrophic events, including acts of terrorism. As a result, we are sometimes a defendant in legal proceedings and litigation arising in the ordinary course of business. There can be no assurance that our insurance will be adequate to protect us from all material expenses related to pending and future claims or that such levels of insurance will be available in the future at economical prices.

Another example from the AGL Resources Inc. filing with the SEC for fiscal year ended December 31, 2013, states:
(Form 10-K, page 7)

Transporting and storing natural gas involves numerous risks that may result in accidents and other operating risks and costs.

Our gas distribution and storage activities involve a variety of inherent hazards and operating risks, such as leaks, accidents, including third party damages, and mechanical problems, which could cause substantial financial losses. These risks could result in serious

injury to employees and non-employees, loss of human life, significant damage to property, environmental pollution and impairment of our operations, which in turn could lead to substantial losses to us. In accordance with customary industry practice, we maintain insurance against some, but not all, of these risks and losses. The location of pipelines and storage facilities near populated areas, including residential areas, commercial business centers and industrial sites, could increase the level of damages resulting from these risks. The occurrence of any of these events not fully covered by insurance could adversely affect our financial position and results of operations.

And Spectra Energy, states in its SEC filings,

There are a variety of hazards and operating risks inherent in natural gas gathering and processing, transmission and storage activities, and crude oil transportation and storage, such as leaks, explosions, mechanical problems, activities of third parties, and damage to pipelines, facilities and equipment caused by hurricanes, tornadoes, floods, fires and other natural disasters, that could cause substantial financial losses. For pipeline and storage assets located near populated areas, including residential areas, commercial business centers, industrial sites and other public gathering areas, the level of damage resulting from these risks could be greater. **We do not maintain insurance coverage against all of these risks and losses.**

In addition to the damage and costs to residents and businesses should an incident or accident inflict life, health and/or property damage, Delaware River Basin (DRB) communities may be additionally harmed. The proposed pipeline will pass through the following six counties: Luzerne, Carbon, Northampton and Bucks Counties in Pennsylvania, and Hunterdon and Mercer Counties in New Jersey. Over 85% of the pipeline right of way will be located in the DRB, a fact not considered by ES&D. The DRB is a highly valuable region as it is a primary source of drinking water for millions of people and it supports a strong tourism industry that is dependent on a safe and clean environment. A major pipeline incident or accident could inflict additional unaccounted for harms on drinking water and water dependent economies.

Costs to Ecosystems

Potential damage both to wetlands and to economic activity that is generated by nature and ecosystems is substantial. The ES&D PennEast “economic impact study” did not attempt to identify the potential economic losses due to such activity.

The value of natural capital and ecosystem services impacted by the PennEast pipeline was not only underestimated, it was totally overlooked. Economic losses

due to impacts on wetlands, forests, farms, air and open water must be considered for an economic impact analysis to be deemed accurate or defensible, especially for an industrial project being proposed in a natural habitat and water resource region such as the DRB.

The University of Delaware issued a study that estimated the value of natural goods and services from the ecosystems in the DRB at \$683 billion (net present value using a discount rate of 3% over 100 years) [16]. The net present value contribution of the DRB ecosystems by state are estimated as follows:

New Jersey: \$213.4 billion
New York: \$113.6 billion
Pennsylvania: \$279.6 billion

Waterway and environmental harms are routinely documented for interstate transmission pipeline projects like PennEast. ES&D should have conducted a risk assessment and assigned values to the potential loss of value to ecosystems that may be caused by the PennEast Pipeline.

Impact on Property Values

There is evidence that compressor stations and pipeline projects cause declines in property values of nearby homes. Whenever property values decline, property tax revenues also decline. Local governments rely heavily on property tax revenue. In addition to strains on their usual budget items, a reduction in property tax revenues will mean less income to allocate to increased needs for emergency services that will be called upon when explosions or major leaks occur.

Forensic Appraisal Group, Ltd., experts in condemnation appraisal, state on their website that the property valuation impact of a natural gas transmission pipeline depends on the size of the property, property use, etc, and the impact range could be nominal to substantial, and could be “up to 30% or more of the whole property value.” (See http://forensic-appraisal.com/gas_pipelines_q_a) In one of the few peer-reviewed articles about real estate valuation issues with unconventional shale gas development, the authors contend that the more permanent features of unconventional shale gas development are likely to affect property values. Such permanent features would of course include natural gas pipelines [17].

While the oil & gas industry has hired consultants to produce reports that show that pipelines have not impacted property values, such analysis is highly suspect and the conclusions are not at all in line with expectations.

A review of peer-reviewed literature (not industry funded), as well as facts concerning the impact of shale gas development on property values, suggests that

natural gas industry activities are likely to negatively impact property values, despite industry claims to the contrary [2].

In addition, there are multiple studies that show that environmental contamination has significant negative impacts on nearby property values. For example, Taylor, Phaneuf, and Liu [18] used an empirical model to identify the direct impact of environmental contamination on residential housing prices separate from land use externalities. They found the following:

Commercial properties with no known environmental contamination reduce neighboring residential home values by an average of 2.5 percent. Environmental contamination augments this negative external impact, so that the overall effect is approximately 8 percent. Thus, environmental contamination causes external effects that are more than twice as large as the land use spillovers associated with commercial land use – a substantial amount that is similar to what is found in many other studies

Most of the studies that have attempted to analyze whether proximity to natural gas pipelines has impacted property values are not peer reviewed and are funded by gas transmission companies. Further research is required, but it is clear that with the increased public awareness and concern about pipeline and other gas infrastructure explosions, leaks and accidents, as well as the loss of unfettered use of one's property, and the land transformation associated with pipelines such as tree cutting and other land and vegetation modification, properties near gas infrastructure will become increasingly less desirable and more difficult to sell.

Recent news coverage, including interviews with local realtors, indicates that this is already happening in Pennsylvania. For example, in Lebanon, PA, it was reported that realtors said, "the impact of a pipeline on sales prospects can depend on its proximity to the house, the pressure level of products traveling through the pipeline and whether the property is residential or agricultural" [19].

Recent legal decisions support the notion that landowners are insisting on greater compensation from pipeline companies due to diminution of values of real property with pipelines. And juries are awarding increasing easement values for pipelines [20].

We recognize that real estate appraisers use as comparables similar properties that have sold and they adjust their valuation for certain differences. It is impossible, however, to account for all differences due to the numerous factors that impact a property's selling price.

Many of the studies use the methodology of pairing past sales, but even an alternative methodology such as analyzing the real estate market before and after the construction of a pipeline, is subject to uncertainty, again due to the great

number of factors that can influence real estate purchase decisions. Comparing properties goes well beyond the number of bedrooms and square footage. There are far too many uncertain variables that impact the ability to determine accurate econometric estimate of the impact of pipelines on selling price. Examples of factors beyond bedrooms and square footage include the state of the overall market, an individual's personal reaction to the view, curb appeal, neighbors, schools, layout, condition, etc.

With greater public awareness of climate change, fracking, and all fossil fuel infrastructure impacts, the adverse affect on property values is likely to increase. And, as more and more pipelines are being proposed in the Northeast and Middle Atlantic states, relatively densely populated areas, the risks will multiply and the negative impact on property values will likely become more significant.

Real estate professionals sometimes use the term "stigma" to describe a factor that may reduce property values. Fear of family illness due to emissions from potential leaks or from explosions is certainly a "stigma" that will negatively impact property values near a natural gas pipeline. And PennEast would be no exception.

Health Costs

Numerous acute and chronic health impacts experienced by individuals living and working near compressor stations and pipelines have been documented. (See for example, <http://www.environmentalhealthproject.org/wp-content/uploads/2012/03/Compressor-station-emissions-and-health-impacts-02.24.2015.pdf>)

Whenever there are negative health impacts, including illnesses and deaths caused by pollutants, there are economic costs. Costs are incurred not only directly by the victims and their families, but costs are incurred by society due to lost time from work and school, declines in productivity, and the use of public resources necessary to provide emergency services and/or health care to impacted individuals.

Economic Costs of Climate Change

The ES&D report describes natural gas as "cleaner burning," and likely to "reduce the risk of price volatility in energy markets". This description is how the gas producers describe their product, but it does not paint an accurate picture of the impacts of increased use of natural gas.

While natural gas produces less carbon dioxide when burned, natural gas extraction and use results in both carbon dioxide and methane emissions (among others) and is far worse for climate change than are renewable energy sources such as wind, water and sunlight.

The gas industry always ignores the fact that natural gas is composed primarily of methane and methane is a far more potent greenhouse gas than carbon dioxide. Methane from natural gas leaks into the atmosphere throughout its production, transmission and delivery. There is a rapidly increasing amount of scientific literature available on this subject. (See for example, http://www.psehealthyenergy.org/data/SS_Methane_Nov2015Final.pdf)

Fracked gas from the Marcellus shale play will be the gas being transmitted in the pipeline. Fracked shale gas is especially harmful to the climate as its greenhouse gas footprint is even larger than that from conventional gas due to additional emissions resulting from flow-back fluids and well completions [21].

Investment in fossil fuel infrastructure, including natural gas pipelines, prolongs and expands the use of natural gas, which due to its highly harmful impact on the climate will exacerbate the economic costs of climate change. There are many different estimates of the economic costs of climate change. One estimate is in the US alone, by 2025, global warming will cost \$271 billion per year. 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. So it's a conservative estimate. The World Bank EACC report projected that the cost between 2010 and 2050 of adapting to an approximately 2degree C warmer world by 2050 is in the range of \$75 billion to \$100 billion per year. (<http://siteresources.worldbank.org/INTCC/Resources/EACCReport0928Final.pdf>)

It is widely recognized that estimates of economic costs of climate change are conservative because many impacts simply cannot be measured. For example, while the cost of increased fires can be estimated by what it would cost to put them out, one does not know the extent of damage to property and loss of human life that would be caused by the fires.

The Union of Concerned Scientists has prepared an assessment of how climate change would impact the state of Pennsylvania. (http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/Exec-Summary_Climate-Change-in-Pennsylvania.pdf)

Rutgers University has prepared an assessment of how climate change would impact the State of New Jersey. (<http://njadapt.rutgers.edu/climate-impacts-in-new-jersey>)

A comprehensive economic impact assessment for the PennEast Pipeline Project would take into account the costs to both Pennsylvania and New Jersey due to climate change that will be caused by the increased greenhouse gas emissions resulting from the Project.

Conclusion

The “economic impact analysis” conducted by ES&D for the PennEast Pipeline Company exaggerates economic benefits and ignores significant economic costs which, in most cases, are not mentioned at all. The economic impact analysis conducted by ES&D is incomplete, inaccurate and unreliable.

NOTES

[1] Studies of economic impact of shale gas development funded by the oil & gas industry or groups that represent the industry include the following:

Considine, et al. (2009), *An Emerging Giant: Prospects and Economic Impacts of Developing the Marcellus Shale Natural Gas Play*, Study commissioned by the Marcellus Shale Coalition. <http://allegHENYconference.org/PDFs/PELMisc/PSUStudyMarcellusShale072409.PDF>.

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Higginbotham, A. Pellillo, T. Gurley-Cavez, T.S. Witt, “The Economic Impact of the Natural Gas Industry and the Marcellus Shale Development in West Virginia in 2009,” December 2010. Study funded by the West Virginia Oil and Natural Gas Association. <http://ohshalecoalition.com/study/study.pdf> (accessed July 30, 2012).

Considine, et al. (2011), *The Pennsylvania Marcellus Natural Gas Industry: Status, Economic Impacts and Future Potential*, Study commissioned by the Marcellus Shale Coalition.

The Public Policy Institute of New York State, Inc., “Drilling for Jobs: What the Marcellus Shale could mean for New York,” July 2011.

Considine, et al. (2011), “The Economic Opportunities of Shale Energy Development,” Center for Energy Policy and the Environment, The Manhattan Institute, May 2011.

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[3] Wassily Leontief, *Input-Output Economics* (New York: Oxford University Press, 1986).

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[9] Z. Rui, P. Metz, D. Reynolds, G. Chen, X. Zhou, "Regression Models Estimate Pipeline Construction Costs," *Oil & Gas Journal*, July 4, 2011.

[10] I. Goodman, B. Rowan, The Goodman Group, Ltd., "Expert Report on the PennEast Pipeline Project Economic Impact Analysis for New Jersey and Pennsylvania," November 4, 2015.

[11] S. Herzenberg, "Drilling Deeper into Job Claims," Keystone Research Center, June 20, 2011.

[12] Multi-State Shale Research Collaborative, "Exaggerating the Employment Impacts of Shale Drilling: How and Why," November 2013.
<http://www.multistateshale.org/shale-employment-report>

[13] Cornell University Global Labor Institute, "Pipe Dreams? Jobs Gained, Jobs Lost By the Construction of Keystone XL," September 2011.

[14] NERA Economic Consulting, "Macroeconomic Impact of LNG Exports," 2012, Contracted for by U.S. Department of Energy. See also comments submitted to Department of Energy.

[15] Charles River Associates, "US Manufacturing and LNG Exports: Economic Contributions to the US Economy and Impacts on US Natural Gas Prices," February 2013.

[16] G.J. Kauffman, "Socioeconomic Value of the Delaware River Basin in Delaware, New Jersey, New York and Pennsylvania: The Delaware River Basin, an Economic Engine for Over 400 Years", University of Delaware, Water Resources Agency, May 25, 2011.

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[18] L.O. Taylor, D.J. Phaneuf, X. Liu, “Disentangling the Impacts of Environmental Contamination from Locally Undesirable Land Uses,” January 2012.
<http://www.ncsu.edu/cenrep/research/documents/Tayloretal.pdf>

[19] <http://www.ldnews.com/story/news/local/2016/01/02/pipelines-could-affect-property-values/77984160/>

[20] <http://www.law360.com/articles/522523/pipeline-giants-lose-ground-in-fight-over-easement-values>

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