



Economic Costs of the Eastern System Upgrade:

EFFECTS ON
PROPERTY VALUE, THE SOCIAL COST OF
CARBON, AND PUBLIC HEALTH

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EXECUTIVE SUMMARY

The Eastern System Upgrade project (“ESU”) is a multi-part project intended to expand the capacity of the Millennium Pipeline in New York State. The project includes construction of approximately 7.8 miles of 30- and 36-inch pipeline loop in Orange County, construction and operation of a new compressor station (“the Highland Compressor Station” or “Highland CS”) in Sullivan County, an additional compressor at the existing Hancock Compressor Station (“Hancock CS”) in Delaware County, modifications to the existing Ramapo Meter and Regulator station in Rockland County, and additional pipeline appurtenant facilities at the existing Huguenot Meter Station and Westtown Meter Station in Orange County.

Millennium Pipeline Company, L.L.C (“Millennium LLC”) would be in charge of the construction and operation of the project.

Millennium LLC is seeking authorization from the Federal Energy Regulatory Commission (“FERC”), which is responsible for reviewing, and either approving or rejecting the proposal. Under FERC’s own policy and the more comprehensive requirements of the National Environmental Policy Act (“NEPA”), FERC’s review must look at the economic benefits and costs, as well as the full range of environmental effects of the proposed project. The costs include, but are not limited to, the different ways in which the environmental effects of the pipeline would result in changes in human well-being—including economic benefits and costs.

Under FERC’s policy, the applicant of the project provides estimates of economic benefits for review. Millennium LLC’s estimates include jobs and income associated with the construction and operation of the pipeline, and additional jobs and income that could occur if the pipeline’s operation results in lower net energy costs for industrial, commercial, and individual customers. Due to flaws in methods,

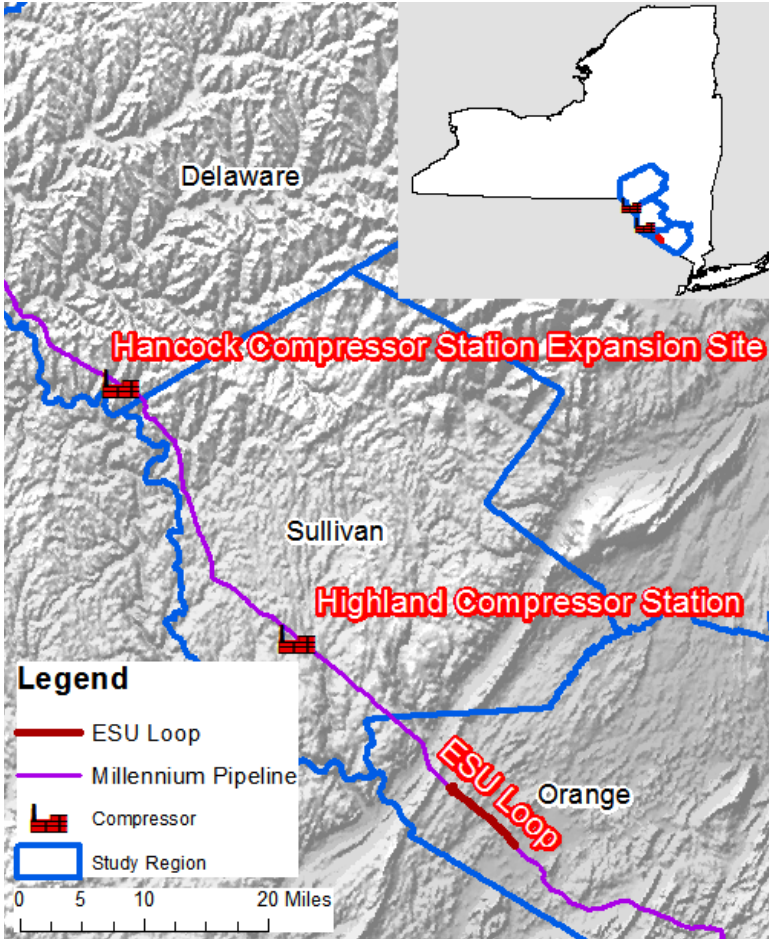


FIGURE 1: Eastern System Upgrade Project (Proposed)

Sources: Eastern System Upgrade loop obtained from Stephen Metts of the New School; Millennium Pipeline Route obtained from OpenStreetMap; Study region (counties), federal lands, and hill shade from USGS (U.S. Department of Interior & U.S. Geological Survey, 2015).

assumptions, and execution of its study, we conclude that the benefit estimates Millennium has provided are overstated.

On the cost side, the situation is worse. Millennium LLC and FERC have thus far discounted or ignored important environmental effects (and the economic consequences of those effects) of the proposed expansion project that would harm the human environment. In other words, Millennium LLC has not yet given serious or adequate consideration to potential negative economic effects—that is, costs—of the ESU.

Delaware Riverkeeper Network commissioned this report to fill that information gap and provide independent research into some of the ESU's principal external costs. In light of data limitations, we provide quantitative estimates of just two types of costs in this report.

First, the construction, operation, and presence of the project would reduce property values along the pipeline and around the compressor stations. Affected properties, those touched by the right-of-way ("ROW"), the 0.9-mile-wide evacuation zone, and within half a mile of the Highland and Hancock compressor stations, could lose a total of \$2.0 million in property value. (See "At a Glance" for details.) This one-time reduction in property asset value will spawn a recurring loss of local property tax revenue of \$36,000 per year forever.

Second, there is also the social cost of carbon ("SCC"), the additional economic cost of harm associated with the emission of carbon from the project encompassing the cost of methane transport, with the annual cost varying with the year in which the emissions would occur and the assumed rate at which future costs are discounted. Using a 5% discount rate, the social cost of carbon ranges from \$50.1 to \$115.0 million per year between 2019 and 2048. With a 2.5% discount rate, the annual social cost of carbon ranges from \$256.5 to \$420.1 million.

Putting the stream of costs into present value terms and adding the one-time costs (the initial loss of property value), the total estimated economic cost of the ESU project in the study region is \$4.7 and 18.8 billion.¹ To put this in perspective, and using the (inflated) estimates of benefit provided by the applicant, the Eastern System Upgrade would impose between \$2.31 and \$9.24 in costs for every dollar of benefit promised.

For reasons explained fully in the body of this report, these are conservative estimates of the external costs for the proposed ESU. One reason is simply that categories of impacts exist that, due to lack of sufficient data, we could not quantify. These include public health costs to residents that would

¹ The present value of a perpetual stream of costs is the one-year cost divided by the real discount rate recommended by the Office of Management and Budget for cost-benefit and cost-effectiveness analysis of public projects and decisions (Office of Management and Budget, 2015). For our analysis, we calculated the appropriate real discount rate for each year the project is in operation for up to 50 years (until 2068), the minimum physical life of the project facilities given by Millennium (Millennium Pipeline Company, L.L.C., 2016). These discount rates were applied to the estimated annual loss in tax revenue and ecosystem service value in each of those years. The social cost of carbon calculations have discounting built in. The total present discounted value for all costs is then the one-time costs, plus the social cost of carbon for 30 years, plus the separately discounted costs due to lost property taxes and ecosystem services.

experience negative health impacts from compressor stations, the potential impact on the economic development, or other costs that may accompany construction.

Another important category of cost not counted here is “passive use value.” Passive use value includes the value to people of simply knowing an unspoiled natural area exists and the value of keeping those places unspoiled for the sake of some future direct or active use. In light of this, it is important to consider the estimates of economic costs provided here as a fraction of the total economic value put at risk by the proposed ESU project.

Finally, while this report covers some of the costs that will occur if the ESU is approved, it does not include an assessment of natural resource damage and other effects that might happen during construction and operation. For example, there is a probability that erosion and resulting sedimentation of streams and rivers will occur during construction. There is also the likelihood that a leak or explosion could occur somewhere along the length of the pipeline or at the compressor station. If, when, and where these events occur, there will be clean-up and remediation costs, costs of fighting fires and reconstructing homes, businesses, and infrastructure, the cost of lost timber, wildlife habitat, and other ecosystem services, and most tragically, the cost of lost human life and health.²

The magnitude of these damages, multiplied by the probability of occurrence, yields additional “expected costs” which add to the certain costs estimated in this study. To be clear, the costs estimated here—the impact on land values resulting from buyers’ concerns about the pipeline and compressor station, the social cost of carbon, and public health impacts associated with the compressor station—will occur with or without any discrete events like stream damage or explosions ever happening. These impacts and their monetary equivalents are simply part of what will happen in New York if the ESU is approved, built, and operates without incident.

FERC could and should thoroughly investigate all of these costs before determining whether or not the Millennium ESU project meets what the Commission describes as an “economic test”—whether the public benefits outweigh the costs—of the merits of natural gas transmission projects and before rendering its decision on the project.

² While no one was killed in the incident, the recent explosion of Spectra Energy’s Texas Eastern gas transmission line in Pennsylvania is an example of these impacts. See, for example, “PA Pipeline Explosion: Evidence of Corrosion Found” (Phillips [Susan], 2016).

At a Glance:

The Eastern System Upgrade in New York Delaware, Orange, and Sullivan Counties

- **Miles of pipeline loop:** 7.8
- **Additional aboveground facilities:** Highland CS, new compressor at the Hancock CS; new pig launcher/receiver, alternate interconnect, and modifications to 3 metering stations
- **Impacted acres:**
 - In the permanent right-of-way (ROW): 26.0
 - In the construction zone: 156.9
 - At the existing Hancock Compressor Station in Delaware County during construction and operation: 9.05, 5.5
 - At the new Highland Compressor Station in Sullivan County during construction and operation: 14.31, 5.4
- **Parcels in the portion of the loop not co-located with the existing Millennium Pipeline:**
 - In the ROW: 5
 - In the 1.2-mile-wide evacuation zone: 196
 - Within half a mile of the compressor stations: 32 for the Hancock CS and 11 for the Highland CS
- **Residents and housing units in the pipeline evacuation zone:** 1,092 people, 470 homes
- **Property value:**
 - Baseline—that is, in a “no ESU” scenario—property value at risk (with the expected one-time cost due to the ESU in parentheses):
 - In the ROW: \$186,050 (\$7,814 to \$24,187)
 - In the 0.9-mile-wide evacuation zone: \$19.8 million (\$753,700)
 - Within half a mile of the compressor stations: \$2.1 million (\$519,900) for the Hancock CS and \$2.9 million (\$715,500) for the Highland CS
 - Total property value lost (a one-time cost): \$2.0 million
 - Resulting loss in property tax revenue (annual): \$36,005 to \$36,298
- **The social cost of carbon (equivalent):**
 - An annual cost that varies year to year, the project would contribute to an equivalent of 3.9 million metric tons of carbon dioxide a year. Using a 5% discount rate, the social cost of carbon ranges from \$50.1 to \$115.0 million per year between 2019 and 2048. Using a 2.5% discount rate for the same time period, the social cost of carbon ranges between \$256.5 and \$420.1 million per year.
- **Other impacts for consideration:**

Economic activity that depends on the region’s scenic, recreational, and quality of life: We consider a conservative scenario in which visitor spending declines by 5% from current levels, and the rate of growth in retirement and proprietor’s income slows by 5%)

 - Annual loss of recreation tourism expenditures of \$47.2 million that would otherwise support 745 jobs and generate \$3.1 million in local taxes and \$2.6 million in state taxes
 - Annual loss of personal income of \$6.3 million due to slower growth in the number of retirees
 - Annual loss of personal income of \$1.2 million due to slower growth in sole proprietorships
 - The total of these losses is \$82.5 million per year
- **Total estimated costs:**
 - One-time costs (property value lost during construction) would be \$2.0 million
 - Annual costs (costs that recur year after year) would range from \$36,005 to \$36,298 PLUS the social cost of carbon, which also varies year by year, and ranges between \$50.1 and \$420.1 million
 - One-time costs plus the discounted value of all future annual costs: \$4.7 to \$18.8 billion

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ABBREVIATIONS AND TERMS

BTM: Benefit Transfer Method, a method for estimating the value of ecosystem services in a study region based on values estimated for similar resources in other places

Construction Zone: Refers to the temporary construction right-of-way, temporary work spaces (TWS), additional temporary workspace (ATWS), access roads from public roadways to the construction work areas, pipe/contractor yards, and staging areas.

EA: Environmental Assessment, a document prepared under the National Environmental Policy Act used to determine whether a proposed agency action would require an environmental impact statement of a finding of no significant impact.

EIS: Environmental Impact Statement, a document prepared under the National Environmental Policy Act analyzing the full range of environmental effects, including on the economy, of proposed federal actions.

ESU: The Eastern System Upgrade Project, generally referring to the proposed loop in Orange County and the Hancock and Highland Compressor Stations.

FERC or The Commission: Federal Energy Regulatory Commission, the agency responsible for preparing the EA or EIS and deciding whether to grant a certificate of public convenience and necessity (i.e., whether to permit the pipeline)

HCA: High Consequence Area, the area within which both the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure

Millennium LLC: Millennium Pipeline Company, L.L.C., the company responsible for construction and operation of the Eastern System Upgrade; also “the applicant”

NEPA: National Environmental Policy Act of 1970, which requires the environmental review of proposed federal actions, preparation of an EIS, and, for actions taken, appropriate mitigation measures

ROW: Right-of-Way, the permanent easement in which the pipeline is buried

AUTHOR'S NOTE

Delaware Riverkeeper Network commissioned this report to help ensure that the likely costs of the Eastern System Upgrade are not left out of the public debate. Delaware Riverkeeper Network has been working throughout the Delaware River Watershed for over 25 years. Using independent advocacy, and backed by facts, science, and law, Delaware Riverkeeper Network champions the rights of communities to a Delaware River and tributary streams that are free flowing, clean, healthy, and abundant with a diversity of life. Please visit www.delawareriverkeeper.org to learn more about their work.

Key-Log Economics is an independent consultancy that brings more than 50 years of combined experience analyzing the economic features of land and resource use and related policy. We are grateful for the assistance of Delaware Riverkeeper Network in identifying local information sources and making contacts in the study region.

Key-Log Economics remains solely responsible for the content of this report, the underlying research methods, and the conclusions drawn. We used the best available data and employed appropriate and feasible estimation methods but nevertheless make no claim regarding the extent to which these estimates will match the actual magnitude of economic effects that will be realized if the Eastern System Upgrade is approved.

Cover Photo from Mark Egan.

BACKGROUND

The Eastern System Upgrade Project proposed by Millennium Pipeline Company, L.L.C. (“Millennium LLC”) is seeking a federal permit to expand capacity on parts of the Millennium Pipeline (See Table 1 for a timeline of the Millennium Pipeline and associated infrastructure). The project would transport an additional 200,000 dekatherms per day of natural gas from the Corning Compressor Station to an interconnect with Algonquin Gas Transmission, L.L.C. in Ramapo, New York (Millennium Pipeline Company, L.L.C., 2016a). The ESU includes the construction of about 0.1 miles of 30-inch and 7.7 miles of 36-inch pipeline loop in Orange County, New York, construction of a new 22,400 horsepower (hp) compressor station in Sullivan County, New York (Highland CS), adding an additional 22,400 hp to the existing 15,900 hp Hancock Compressor Station in Delaware County, New York (Hancock CS) for a total of 38,300 hp, modifications to the existing Ramapo Meter and Regulator Station in Rockland County, New York, and additional pipeline facilities at the Huguenot Meter Station and Westtown Meter Station in Orange County, New York (Millennium Pipeline Company, L.L.C., 2016).

Table 1. Brief timeline of Millennium LLC’s work with Millennium Pipeline and the ESU project work.

Milestone(s)	
Date	Description
December 1997	Millennium LLC files an application for a certificate of public convenience and necessity authorizing the construction and operation of the Millennium Project
June 2007	FERC authorizes Millennium LLC to commence construction
December 2008	Millennium Pipeline went into service
October 2012	Construction of the Minisink Compressor Station begins
June 2013	Minisink Compressor station went into service
October 2013	Construction of the Hancock Compressor Station begins
April 2014	Hancock Compressor Station went into service
January 2016	Millennium LLC files a request for a pre-filing review with FERC for the ESU project
May 2016	FERC announces that they will prepare an environmental assessment for the ESU project
July 2016	Millennium LLC files an application requesting a certificate of public convenience and necessity authorizing the ESU project

For this report, “ESU” refers to those portions of the entire Eastern System Upgrade project that entail (a) the addition of pipeline or an increase in the amount of land consumed by pipeline right-of-way (i.e., the new pipeline and loop in Orange County), and (b) construction of the new (Highland) compressor station and addition of compression capacity at the existing (Hancock) station. We did not analyze the other components of the project because the changes would occur in areas already modified from their previous natural land cover and/or would not represent a major change from the status quo in terms of land consumption, air, noise or other direct impacts. We are not, in other words, rolling back the clock to estimate the external costs of the existing Millennium pipeline facilities in the study area: we are instead focused only on the new costs that the ESU project would impose.

According to Millennium LLC, the ESU project is necessary for meeting natural gas market demand in the region. The applicant also argues that the ESU will stimulate the local economy during the construction phase and produce long-run economic benefits due to energy cost savings for New York electric utility customers in the long run. These claims are detailed in a report prepared for Millennium LLC by Concentric Energy Advisors (“Concentric”). Concentric estimates that construction will have a total impact of \$314 million and that the first ten years of operation will result in \$703 million in additional economic output. These estimates include predicted consumer energy cost savings, spending on labor and materials during construction and operation, re-spending of consumer cost savings, workers’ wages and firm revenues in the local economy, and property tax payments from project facilities associated with the proposed project (Concentric Energy Advisors, 2016; Millennium Pipeline Company, L.L.C., 2016b).

However, there needs to be a more thorough examination into how the permanent right-of-way, the temporary construction corridor of the pipeline, and the proposed compressor stations would impose additional external costs on local residents and businesses, including costs that accrue due to safety concerns. All natural gas pipelines present some danger of leaks and explosions that can cause substantial physical damage. Noise and air pollution from the compressor stations present risks to health and quality of life for nearby residents and businesses (Table 2) (Pipeline Safety Trust, 2015). According to the Pipeline Safety Trust (2015), these dangers are greater with pipelines installed after 2010 than with older facilities. Besides the physical dangers, pipeline incidents may require evacuation of a wide area (up to 0.9 miles across in the case of the ESU loop), a potential constant concern for the thousands of people who live or work in that zone. The economic consequences of these impacts can include diminished property value, lost natural benefits, higher healthcare costs, and dampened economic development, if the physical effects and safety concerns reduce the attractiveness of the region as a place to live, visit, retire, or do business.

TABLE 2. Pipeline Incidents, Impacts, and Costs, 1996 to 2015. Includes gas distribution, gas gathering, gas transmission, hazardous liquid, and LNG lines.

Source: Pipeline and Hazardous Materials Safety Administration (2016)

Place	Incidents	Fatalities	Injuries	Total Cost
U.S.	11,208	360	1,376	\$6.9 Billion
New York	201	23	124	\$ 78.2Million

To date, the negative effects mentioned above and estimates of their attendant economic costs have not received much attention in the debate surrounding the proposed ESU project. This report, commissioned by the Delaware Riverkeeper Network, is both an attempt to understand the nature and potential magnitude of the economic costs of the project in New York, as well as to provide an example for FERC as it proceeds with its process of analyzing and weighing the full effects of the proposed project.

Policy Context

Before construction can begin, the project must be approved, or “certified,” by the Federal Energy Regulatory Commission (FERC). That approval, while historically granted to pipeline projects, depends on FERC’s judgment that the project would meet a public “purpose and need” and that the public benefits of the project are balanced against the “potential adverse consequences” of natural gas transmission projects. Because the approval would be a federal action, FERC must also comply with the procedural and analytical requirements of the National Environmental Policy Act (NEPA). These include requirements for arranging public participation, conducting environmental impact analysis, and writing an Environmental Assessment (“EA”) or Environmental Impact Statement (“EIS”) that evaluates all of the relevant effects. Of particular interest here, such relevant effects include those direct, indirect, and cumulative effects on or mediated through the economy. As the NEPA regulations state,

“Effects” includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (emphasis added, 36 CFR 1508.8; Council on Environmental Quality, 1978).

To begin its review, FERC issued a Notice of Intent to prepare an EA in May of 2016 (Federal Energy Regulatory Commission, 2016). In The Notice of Intent, FERC anticipated issues of concern regarding geology and soils, land use, water resources, fisheries, and wetlands, cultural resources, vegetation and wildlife, migratory birds, air quality and noise, endangered and threatened species, public safety, and cumulative impacts (Federal Energy Regulatory Commission, 2016). Each of these can translate into economic costs external to Millennium LLC that would be borne by individuals, businesses, and communities throughout the landscape the project would traverse and beyond.

Market Failure: External Costs and the Need for Countervailing Public Action

All market transactions involve two sets of costs and benefits. The first set includes private costs, such as the costs of constructing and operating a pipeline, and private benefits, such as the value to consumers of natural gas delivered through the pipeline. Under the certain highly restrictive preconditions that currently exist, it is possible to say that the price of gas, the amount consumed, and therefore the number of pipelines built and operated functions as the “right” number. “Right” in an economic context translates to “efficient,” as in there are no other combinations of gas use/pipeline capacity that could

produce greater net societal benefits. However, the reality is that these pre-conditions do not hold and the market does not give us the right answer to the question of how many pipelines (and how much gas use) should exist. Economists call these situations “market failures.” Market failures justify extra-market processes to get us to solutions that are more like the theoretical ideal.

The markets for natural gas and natural gas transmission pipelines fail in many ways. The most important, from the perspective of NEPA and FERC’s certification policy, is the presence of “externalities.” Externalities are costs generated by market transactions not borne by the parties to those transactions. In this case, externalities include the costs of building and operating the pipeline imposed on people other than the pipeline company and its customers (natural gas shippers and wholesale purchasers, including local distribution companies).

External costs include effects mediated through market transactions (a good example is the reduction in property value when people know a pipeline is nearby) as effects on human well-being that exceed the number of dollars that actually change hands. This “nonmarket value” includes the total value to people (reflected in their full willingness to pay for a good) over and above what they actually pay for a market good (such as a safe place to live, or clean water to drink). Nonmarket benefits and costs also include changes in human welfare from environmental effects for which there is no out of pocket payment at all. Enjoying the aesthetic quality of a view may cost nothing to experience, but the observer still values it. Whether or not there is a market component to the resulting change in value, damage to environmental goods and services caused by the construction and operation of natural gas transmission infrastructure represents a reduction in human welfare and, therefore, an economic cost.

Because these reductions are external costs, neither the pipeline company nor its customers see or consider these costs when making decisions about how much pipeline capacity or natural gas they require. The result is too much pipeline capacity and too much gas delivered at too low a price. The pure economic problem with this over-investment in pipeline capacity and over-consumption of gas stems from resources spent on excess pipeline capacity and gas that could have been more wisely invested in other infrastructure, other services, or other activities that produce higher net benefits.

From an economic point of view, compliance with the National Environmental Policy Act is one way to ensure that costs not considered by the market are nevertheless considered in resource allocation decisions. The NEPA review adds, or should add, the necessary breadth to FERC’s analysis of the economics costs of proposed natural gas infrastructure. NEPA requires an evaluation of all relevant effects, but of particular interest here are the direct, indirect, and cumulative economics effects of changes in human welfare that might or might not be reflected in the market economy—i.e. the external costs.

Policy Failure: The Review and Certification of Natural Gas Transmission Projects Discounts External Costs and Inflates Social Benefits

To help address the market failure inherent in the construction and operation of natural gas transmission pipelines, additional analyses and decision making processes are required. FERC’s policy on the Certification of New Interstate Natural Gas Pipeline Facilities (88 FERC, para. 61,227) is one example of an attempt to ensure consideration of at least some external costs. The policy requires that adverse

effects of new pipelines on “economic interests of landowners and communities affected by the route of the new pipeline” be weighed against “evidence of public benefits to be achieved [by the pipeline]” (88 FERC, para. 61,227, pp. 18–19). Further, “...construction projects that would have residual adverse effects would be approved only where the public benefits to be achieved from the project can be found to outweigh the adverse effects” (p. 23).

In principle, this policy—what FERC calls an “economic test”—is in line with the argument, on economic efficiency grounds, that the benefits of a project or decision should be at least equal to its cost, including external costs. However, the policy’s guidance regarding what adverse effects must be considered and how they are measured is deeply flawed. The policy states, for example, “if project sponsors...are able to acquire all or substantially all, of the necessary right-of-way by negotiation prior to filing the application...it would not adversely affect any of the three interests,” which are pipeline customers, competing pipelines, and “landowners and communities affected by the route of the new pipeline” (88 FERC, para. 61,227, pp. 18, 26). The Commission’s policy contends that the only adverse effects that matter are those affecting owners of properties in the right-of-way. Even for a policy adopted in 1999, this contention is completely out of step with long-established understanding that development that alters the natural environment has negative economic effects at an individual, community, and broader population level.

The policy’s confusion over what counts as an environmental effect (again, most of which will have economic effects) is further expressed by the following statement:

Traditionally, the interests of the landowners and the surrounding community have been considered synonymous with the environmental impacts of a project; However, these interests can be distinct. Landowner property rights issues are different in character from other environmental issues considered under the National Environmental Policy Act of 1969 (NEPA) (88 FERC, para. 61,227, p. 24).

By the Commission’s reasoning, environmental effects are a matter of the Commission’s “traditions,” not science, and environmental effects are deemed to be both synonymous with, and distinct from, interests of landowners and the surrounding community. This statement seems to contradict the statement one page earlier in the policy that “[there] are other interests [besides those of customers, competitors, and landowners and surrounding communities] that may need to be separately considered in a certificate proceeding, such as environmental interests (p. 23).” While it is true that separate/additional consideration of environmental “interests” must indeed be part of the Commission’s review, the policy embodies such a muddle of contradictions on the question of what impacts to examine and why (tradition versus science), that it seems unlikely that any pipeline certification granted under the policy would be scientifically or economically sound.

FERC’s own policies and track record, including an over-reliance on the applicants’ own estimates of project benefits, make it extremely unlikely that the ESU project certification process would meet NEPA’s requirement to consider all project costs and benefits, let alone produce a decision that could be

construed as generating or supporting net economic benefits.³ The policy’s stated objective “is for the applicant to develop whatever record is necessary, and for the Commission to impose whatever conditions are necessary, for the Commission to be able to find that the benefits to the public from the project outweigh the adverse impact on the relevant interests” (88 FERC, para. 61,227, p. 26). The applicant therefore has an incentive to be generous in counting the benefits and parsimonious in counting the costs of its proposal.⁴

Given the weaknesses of the policy, and as evidenced by the track record, FERC’s “economic test” does not provide a robust evaluation of the public merits of natural gas transmission projects. It is a “test” in which difficult questions (such as about external costs borne by all stakeholders) are not asked, and where those taking the test (the applicants) provide the answer key. It is therefore not surprising that FERC’s environmental reviews typically have not provided estimates of the magnitude of the full external costs associated with natural gas transmission pipelines. Also not surprising, pipeline applicants typically employ methods, assumptions, and a selective review of effects that result in a rosy and grossly distorted picture of the net benefits of their proposed projects.⁵

Current Economic Conditions

Our geographic focus is the three county region of Delaware, Orange, and Sullivan, containing the ESU loop, the Highland CS, and the Hancock CS. This 3,300-square-mile county region supports diverse land uses, including the headwaters of the Delaware River, thriving agri-tourism businesses, and various other attractions. These natural, cultural, and economic assets are among the reasons more than 1.8 million people call this three county region home and an even larger number visit each year for hiking, fishing, skiing, festivals, kayaking, horseback riding, weddings, and other events.

Statistics from the Center for the Study of Rural America, part of the Federal Reserve Bank of Kansas City, highlight the extent to which the region possesses the right conditions for resilience and economic success in the long run (Low, 2004). These data show that the study region has a higher human amenity index (based on scenic amenities, recreational resources, and access to health care), strong entrepreneurship, and higher agricultural land value, relative to the average for New York counties.⁶

³ It is important to note that NEPA does not require that federal actions—which in this case would be approving or denying the ESU certification—necessarily balance or even compare benefits and costs. NEPA is not a decision-making law, but rather a law requiring decisions be supported by an as full as possible accounting of the reasonably foreseeable effects of federal actions on the natural and human environment. It also requires that citizens have opportunities to engage in the process of analyzing and weighing those effects.

⁴ Millennium LLC and Concentric published estimates of economic benefits in the form of employment and income stemming from the construction and operation of the ESU project (Concentric Energy Advisors, 2016; Millennium Pipeline Company, L.L.C., 2016b). These studies suffer from errors in the choice and application of methods and in assumptions made regarding the long-run economic stimulus represented by the project. Most significantly, the studies make no mention of likely economic costs. See Phillips & Wang (2016), and Appendix A for details on these shortcomings.

⁵ See, for example, FERC’s Environmental Impact Statements (Draft or Final) for the Constitution Pipeline (CP13-499), Mountain Valley Pipeline (CP16-10), Atlantic Coast Pipeline (CP15-554), PennEast Pipeline (CP-15-558), and the Atlantic Sunrise Pipeline (CP15-138).

⁶ Note that the Kansas City Fed’s statistics have not been updated since 2004-2006, and conditions in and outside the study region have undoubtedly changed. Some of these relative rankings may no longer hold.

More traditional measures of economic performance suggest the counties are strong and resilient, though there are some differences among the counties.⁷ From 2000 through 2014, for example:⁸

- Population
 - Population in Orange County grew by 9.7%, which is more than twice the average growth rate of 4.4% increase for all of New York's metropolitan counties.
 - Population in Delaware and Sullivan Counties increased by 0.4%, compared to an average 1.7% decrease for New York's non-metro counties.
- Employment
 - Orange County employment increased by 18.0%, compared to a 14.1% increase for New York's metropolitan counties.
 - In Delaware and Sullivan Counties, job growth was 2.1%, compared to an average 0.1% decline for non-metro New York.
- Personal income
 - Personal income, which includes wages and salaries as well as income from investments and transfer payments, like Social Security, grew by 26.2% in Orange County, compared to 19.2% average growth in New York metropolitan counties.
 - Delaware and Sullivan Counties saw personal income grow by 15.0%, outpacing the New York non-metro average of 14.3%.
- Earnings per job
 - Average earnings per job increased 7.7% in Orange County, compared to a 1.6% increase for metro New York.
 - Earnings per job in Delaware and Sullivan Counties increased by just 5.8%, compared to the 9.5% increase seen in all of non-metro New York.
- Per capita personal income⁹
 - Per capita income is lower in Orange County, by about \$24,700, than the average for New York's metro counties.
 - For Delaware and Sullivan Counties, per capita personal income was about \$1,100 higher than the average for non-metro New York counties.
- Unemployment rate
 - The 2014 unemployment rate was 5.5% in Orange County, compared to 6.3% unemployment rate for New York's metropolitan counties.
 - The unemployment rate in Delaware and Sullivan Counties was 6.6%, the same as the unemployment rate for non-metro New York overall.

⁷ Orange County is included in the NY-NJ-PA Metropolitan Statistical Area but Delaware and Sullivan are not (Office of Management and Budget, 2015). Therefore, statistics from Orange County will be compared to the New York metro benchmark and statistics from Delaware and Sullivan Counties will be compared to New York non-metro areas.

⁸ These data are from the U.S. Department of Commerce (2015a,b) as reported in Headwaters Economics' Economic Profile System.

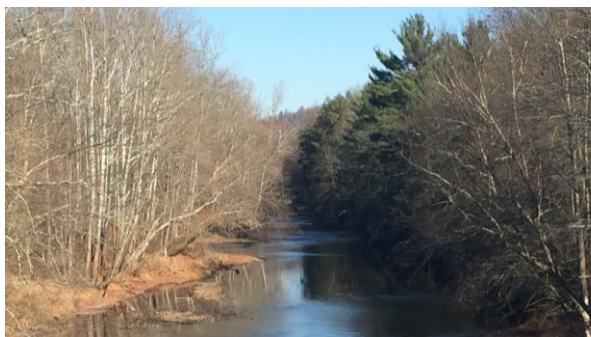
⁹ Per capita income reflects non-labor income, such as from investments and social security, in addition to the wages and salaries included in earnings per job.

In addition, several trends suggest entrepreneurs and retirees are moving to (or staying in) this region, bringing their income, expertise, and job-creating energy with them. Namely,

- In-migration contributed to 24% of population growth in Orange and 100% of population growth in Delaware and Sullivan.
- The proportion of the population 65 years and older increased from 10.3% to 11.8% in Orange and from 16.0% to 17.5% in Delaware and Sullivan.
- Proprietors' employment is up by 44.3% in Orange and 16.2% in Delaware and Sullivan.
- Non-labor income (primarily investment returns and age-related transfer payments like Social Security) is up by 37.1% in Orange and 27.5% in Delaware and Sullivan.

Temporary residents—tourists and recreationists attracted to the natural amenities of the region—and the businesses that serve them are also important parts of the region's economy. Tourists spent about \$944.3 million in the study region in 2015 and the companies that directly served those tourists employed 14,907 people (Tourism Economics, 2016a & Tourism Economics, 2016b).

It is in this context that potential economic impacts of the ESU project should be weighed and the apprehension of the region's residents understood. Many believe the construction and operation of the pipeline will kill, or at least dampen, the productivity of the proverbial goose that lays its golden eggs in the region. This could result in a slower rate of growth in the region and worse economic outcomes. More dire is the prospect that businesses will not be able to maintain their current levels of employment. Just as retirees and many businesses can choose where to locate, visitors and potential visitors have practically unlimited choices for places to spend their vacation time and expendable income. If the study region loses its amenity edge, other things being equal, people will go elsewhere, and this region could contract.



The Neversink River where Millennium LLC proposes to cross.

Photo credit: Stephen Metts

Instead of a “virtuous circle” with amenities and quality of life attracting/retaining residents and visitors, who improve the quality of life, which then attracts more residents and visitors, the ESU could tip the region into a downward spiral. In that scenario, loss of amenity and risk to physical safety would translate into a diminution or outright loss of the use and enjoyment of homes, farms, and recreational and cultural experiences. Some potential in-migrants would choose other locations and some long-time residents would move away, draining the region of some of its most productive citizens. Homeowners would

lose equity as housing prices follow a stagnating economy. With fewer people to create economic opportunity, fewer jobs and less income will be generated. Communities could become hollowed out, triggering a second wave of amenity loss, out-migration, and further economic stagnation.

STUDY OBJECTIVES

Given the policy setting and the potential for the project to impact the people and communities in the study region, Key-Log Economics has undertaken this study to provide information of three types:

1. An additional critique positive economic impacts that Millennium, LLC and their consultant, Concentric, has promoted as potential results of the project.
2. An example of the scope and type of analyses that FERC could, and should, complete as part of its assessment of the environmental (including economic) effects of the ESU project.
3. An estimate of the magnitude of key economic effects of the ESU.

The estimates presented below, however, represent less than the total of all potential costs that would attend the construction, operation, and presence of the pipeline and associated infrastructure. The reason is that there are several categories of cost for which the scope of the project or the availability of data preclude direct quantification of those costs. These categories are:

- “Passive-use value,” including the value of preserving the landscape without a pipeline for future direct use.
- Probabilistic damages to natural resources, property, and human health and lives in the event of mishaps during construction and leaks/explosions during operation.

Our overall estimates, therefore, should be understood to be conservative, lower-bound estimates of the true total cost of the ESU in the region.

PASSIVE USE VALUE

Passive-use values include *option* value, or the value of preserving a resource unimpaired for one’s potential future use; *bequest* value, which is the value to oneself of preserving the resource for the use of others, particularly future generations; and *existence* value, which is the value to individuals of simply knowing that the resource exists, absent any expectation of future use by oneself or anyone else. In the case of the ESU project, people who have not visited the Catskills, for example, or otherwise spent vacation time and dollars in the region are better off knowing that the setting for their planned activities is a beautiful, aesthetically pleasing landscape. The value that future visitors would be willing to pay to maintain that possibility would be part of the “option value” of a landscape without the ESU.

MILLENNIUM LLC OVERESTIMATES ECONOMIC BENEFITS AND DISCOUNTS OR IGNORES ECONOMIC COSTS ASSOCIATED WITH THE PROJECT

Economic *efficiency* requires that the total societal benefits of a proposed public action (like approval of a pipeline) balance or exceed the total societal costs of the action. That efficient outcome does not require that the costs be zero, but it does require that it be at least conceptually possible to re-allocate benefits in such a way that those who bear the costs *could be* compensated for their losses. If, in other words, the gainers *could* compensate the losers, then we can declare the project to be a good idea from an economic efficiency standpoint.¹⁰

As noted under “Policy Failure: The Review and Certification of Natural Gas Transmission Projects Discounts External Costs and Inflates Social Benefits” (p. 4) FERC’s pipeline policy states an intention that pipeline projects “would be approved only where the public benefits to be achieved from the project can be found to outweigh the adverse effects” (88 FERC, para. 61,227, p. 23). It is therefore incumbent upon FERC to ensure that estimates of both public benefits and the public costs (i.e., adverse effects) are vigorously and completely investigated. Given that FERC relies almost exclusively on information about costs and benefits provided by private companies seeking pipeline approval, it is up to FERC to ensure that the information it receives is complete and credible as the basis for a comparison of public benefits and costs.

In the case of the ESU project, an initial review of economic information presented to FERC by Millennium Pipeline LLC¹¹ does not meet this test. We found that the studies overestimated positive impacts (benefits) associated with construction, ongoing operation, and consumer spending of assumed savings elsewhere in local economies, while discounting or ignoring adverse effects (costs). It would therefore be impossible for FERC to conclude, given the information put forth by the applicant, that the Millennium ESU would have benefits that outweigh the costs and, therefore, that granting a certificate would be economically efficient and “good” for society.

The review was included in comments on the project filed by Delaware Riverkeeper Network.¹² Millennium LLC and Concentric Energy Advisors provided an initial and supplemental response to the review of our original critique suggesting FERC not allow our comments “to affect the normal processing of Millennium’s Application” (Millennium Pipeline Company, L.L.C., 2016d, p.1; Millennium Pipeline Company, L.L.C., 2017a). We disagree with this recommendation for the simple reason that consideration of input from interested parties, such as Delaware Riverkeeper Network or Millennium

¹⁰ Economic *justice* would require the further step of gainers actually compensating the losers.

¹¹ See *Estimated Savings For New York Consumers From The Millennium Pipeline Eastern System Upgrade Project* (Concentric Energy Advisors, 2016), and *Draft Resource Report 5: Socioeconomics* (Millennium Pipeline Company, LLC, 2016b).

¹² Available as submittal 20161207-5162 at <https://elibrary.ferc.gov/>. The review is Phillips, S., & Wang, S. Z. (2016). *Economics of the Eastern System Upgrade: Credible and Complete Estimates of Benefits and Costs are Needed* (p. 16). Charlottesville, VA: Key-Log Economics, LLC for Delaware Riverkeeper Network.

Pipeline Company, LLC is an essential—and legally mandated—part of the normal processing of a pipeline certification application. Moreover, and in light of the substance of the Millennium/Concentric responses, it remains clear that the FERC has yet to receive sufficient and reliable information from the applicant regarding the potential economic benefits and costs of the proposed ESU project. Please see Appendix A for details regarding the Millennium/Concentric responses to our earlier review.

In general, and to summarize from that initial review, Millennium LLC has still not defended its misuse of a short-term economic base model to predict long-term project impacts; it continues to cite fundamentally flawed studies to support the dubious contention that natural gas infrastructure does not affect property values; and it has not shown that the social cost of carbon and public health impacts have been considered and/or will be offset by project benefits. The reasons for caution regarding the benefit estimates are summarized below, and further details regarding the potential costs of the project comprise the remainder of this report.

Millennium LLC relies on an input-output model (specifically, IMPLAN), to estimate long-term impacts though it is well known that such models are unsuitable for estimating such impacts. Due to the underlying assumptions and structure of such models, economic actors (firms and households), at least as represented in the models, cannot respond to changing economic conditions, including new technology, changes in relative prices for goods and services, and changing consumer preferences. Input-output modeling is therefore only appropriate for estimating impacts over the short-term, during which technology, prices, and preferences might be reasonably stable.

Indeed, empirical tests have shown that input-output models have very little value as predictors of economic impacts occurring more than a year or so into the future.¹³ The consequence of misapplying input-output techniques to the long-term impacts of the proposed ESU is that the estimates of economic impact presented are too high. FERC needs to understand and acknowledge these limitations, given that part of the rationale for the project is its promised regional economic benefits.

Potential overestimation of impacts occurs because Millennium LLC assumes that the entire state of New York is the proper region for analysis. Because input-output models are built to track the flow of dollars among actors in the defined study region, the bigger the region, the more times those dollars will change hands within the region before “leaking” into some other region. Thus, the bigger the region, the larger the estimated impact. We would suggest defining a more compact study region to obtain more plausible estimates of the short-term economic impact of the project’s construction. Such a region would include the counties where the construction would occur, to be sure, and possibly additional counties where significant construction-related planning, engineering, etc. would occur.

Further potential benefits of the project are assumed to result from energy savings for utility customers. Concentric Energy Advisors (2016) estimated these savings for New York consumers using a partial equilibrium model that assumes a competitive energy market. Accordingly, Key-Log recommends FERC also consider the many factors affecting energy prices—and potential savings—over time that are not considered in such a model. These include additional planned natural gas pipelines, natural gas storage, the increasing rate of growth in renewable energy sources for electricity generation, electricity imports

¹³ See Robertson (2003), Haynes et al. (1997), Hoffmann and Fortmann (1996), and Krikelas (1992).

into the NYISO from other regional transmission organizations, weather variations, and state demand management programs.

Overestimates in the benefit to New York electric utility customers of increased natural gas supply could result from a failure to consider costs of the pipeline construction, including a rate of return (Phillips & Wang, 2016, pp. 8-9). Millennium states New York ratepayers will not bear the costs of the Project because none of the ESU Project shippers directly provide service to New York customers (Millennium Pipeline Company, L.L.C., 2017a, p. 4). By estimating the benefits to New York consumers as a result of increased natural gas supply without considering corresponding costs—because they are not borne by New York consumers—Millennium has provided incomplete and unbalanced information regarding the potential consequences of the ESU Project.

With regard to potential negative economic impacts of the proposed project, Millennium LLC relies on flawed analyses that purport to demonstrate that natural gas infrastructure does not affect nearby property values. The studies in question fail in two ways. First, they do not consider whether or not buyers have full information about the purchased properties' proximity to natural gas pipelines. When buyers do not know a pipeline is nearby, it is impossible to conclude from a lack of property price differences, that pipelines do not affect willingness to pay for properties near pipelines.

Second, the studies fail to compare the prices of properties that are meaningfully different with respect to their proximity to natural gas infrastructure. With few exceptions, nearly all of the properties included in the studies can be said to be “near” the pipelines in that they are within the evacuation zone, or at least within its high consequence area. There is therefore no meaningful difference in pipeline proximity between what the studies define as properties that are “near” (or on) the pipeline and “far” (or off) the pipeline. With no difference in the key feature of the subject properties, one would not expect to find any difference in price between those types of properties. To put it more simply, if one wants to know whether there is a price difference between apples and oranges, one has to consider the price of apples and the price of oranges. The studies cited by Millennium however, only consider the price of apples, which makes it impossible to say anything about the relative price of oranges. (See “Effects on Property Value” on p. 17 for more details.)

With regard to the social cost of carbon, we recognize that there is precedent in previous FERC proceedings to ignore this important external cost of natural gas infrastructure. (See “The Social Cost of Carbon: An Additional Cost of Methane Transport” on p. 28.) We make a distinction, however, between what is done by habit and by precedent, and what should be done, if we as a society are to arrive at an economically efficient level of natural gas extraction, transportation, and use. To that end, we agree with the advice of former FERC Commissioner Norman Bay where he states that “the Commission should also be open to analyzing the downstream impacts of the use of natural gas and to performing a life-cycle greenhouse gas emissions study” (Federal Energy Regulatory Commission, 2017).¹⁴

¹⁴ The Trump Administration has recently rescinded guidance that requires federal agencies to use the social cost of carbon in their environmental reviews. However, this executive action does not make the cost go away; it merely increases the likelihood that agencies will make economically sound decisions.

The possible health effects of the proposed ESU project present a challenge that can only be addressed with further research beyond the scope of this study. On one hand, Millennium LLC has recently released a study that concludes that the *modeled* emissions of hazardous air pollutants associated with the Compressor Stations are “below a level of health concern” (Millennium Pipeline Company, L.L.C., 2017b, p. 2). Specifically, the model predicts an excess lifetime cancer risk for a “reasonably maximally exposed adult” living near either of the proposed compressor stations to be well below the benchmark level of one-in-a-million deemed acceptable under Clean Air Act rules. In addition, the model predicts that the risk of acute health effects is also well below legally acceptable levels.

On the other hand, evidence from other studies suggest that *actual* emissions from compressor stations may exceed allowable levels and that people living near those stations may experience higher incidence of acute health effects, such as nosebleeds, loss of sleep, and severe headaches, compared to people living farther away. A five-state study examining air pollutants around compressor stations found high concentrations of benzene and formaldehyde that exceeded federal guidelines (Macey et al., 2014). In a survey and testing study focused on Pennsylvania, Steinzor, Subra, and Sumi (2013) compared the rate of various health effects experienced by people living closer to (within 1,500 feet) and farther from natural gas facilities, including compressor stations. They found that people living closer to the facilities were more likely to experience 18 of 20 possible symptoms, with several symptoms, like throat irritation and severe headaches affecting more than half of the respondents living within 1,500 feet of the facilities.

It is important to note that further epidemiological research would be required to determine the extent to which such effects are the result of exposure to emissions from compressor stations, as opposed to wells and other facilities, and to control for other relevant factors (e.g., smoking or other behavioral factors, and exposure to other environmental hazards, such as vehicle emissions for people living in congested areas). Such research would shed light on the seeming disconnect between the results of predictive models and the experience of people living near compressor stations.

For this report, we do not include the cost of potential health effects in our estimates of the likely costs of the ESU project. Instead, we discuss those effects and associated treatment costs under the separate heading of “Public Health Effects” (p. 29) along with other possible effects where further investigation is needed.

ENVIRONMENTAL-ECONOMIC EFFECTS AND WHERE THEY WOULD OCCUR

In the remainder of this report, we follow this potential cycle and consider three distinct types of economic consequences. For the first two of these, there are sufficient data on which to base numerical estimates of economic costs. The latter two are described qualitatively.

1. **Effects on Property Value:** Estimating the loss of private property value as owners and would-be owners choose properties farther from the pipeline’s right-of-way, evacuation zone, and compressor stations.
2. **The Social Cost of Carbon:** The economic cost of harm associated with the emission of carbon.

3. **Effects on Economic Development:** More general economic effects caused by a dampening of future growth prospects or even a reversal of fortune for some industries.
4. **Public Health:** The potential for diminished human health due to the operation of compressor stations.

We begin with an exploration of the geographic area over which these various effects will most likely be felt.

Impact Zones within the Study Region

Right-of-Way and Construction Corridor

Construction of the pipeline would require clearing an area of on average about 125 feet (38.1 m or 0.02 miles) wide.¹⁵ After construction, the permanent right-of-way (“ROW”) would be an average of 50 feet (15.2 m or 0.01 miles) wide along the entire length of the pipeline.¹⁶

High Consequence Area

Operated at its intended pressure and due to the inherent risk of leaks and explosions, the pipeline would present the possibility of having significant human and ecological consequences within a large “High Consequence Area” and an even larger evacuation zone. A High Consequence Area (“HCA”) is “the area within which both the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure” (Stephens, 2000, p. 3). Using Stephens’ formula, the HCA for the 30” portion of the pipeline would have a radius of 711.87 feet (216.98 m or 0.13 miles) and for the 36” portion of the pipeline, a radius of 854.25 feet (260.38 m or 0.16 miles).¹⁷

Evacuation Zone

The evacuation zone is defined by the distance beyond which an unprotected human could escape burn injury in the event of the ignition or explosion of leaking gas (Pipeline Association for Public Awareness, 2007, p. 29). There would be a potential evacuation zone with a radius of at least 2,369 feet (722.07 m or 0.45 miles) for the 30” portion of the pipeline and 2,843 feet (866.55 m or 0.54 miles) for the 36” portion (Figure 2).

It is reasonable to consider land value impacts within the evacuation zone. As Kielisch (2015) stresses, the value of land is determined by human perception, and property owners and would-be owners have ample reason to perceive risk to property near high-pressure natural gas transmission pipelines. Traditional and new media reports attest to the occurrence and consequences of pipeline leaks and explosions, which are even more prevalent for newer pipelines than for those installed decades ago (Smith, 2015). Information about pipeline risks translates instantly into buyers’ perceptions and their

¹⁵ Table 1A-1 in *Draft Resource Report 1: General Project Description (2016a)* gives the approximate width of the construction corridor by milepost. For our analysis, we took into account the different widths.

¹⁶ In *Draft Resource Report 1: General Project Description (2016a)*, Millennium LLC notes that they will increase the existing 50-foot wide permanent easement of the Millennium Pipeline by 25 feet to accommodate the ESU loop in areas where the loop and existing easement co-locate. For the areas where the ESU loop and existing pipeline easement do not co-locate, a new 50-foot permanent easement will be created for the loop.

¹⁷ The HCA calculations used the maximum allowable operating pressure of 1,200 PSIG, as noted in *Draft Resource Report 1: General Project Description (2016a)*.

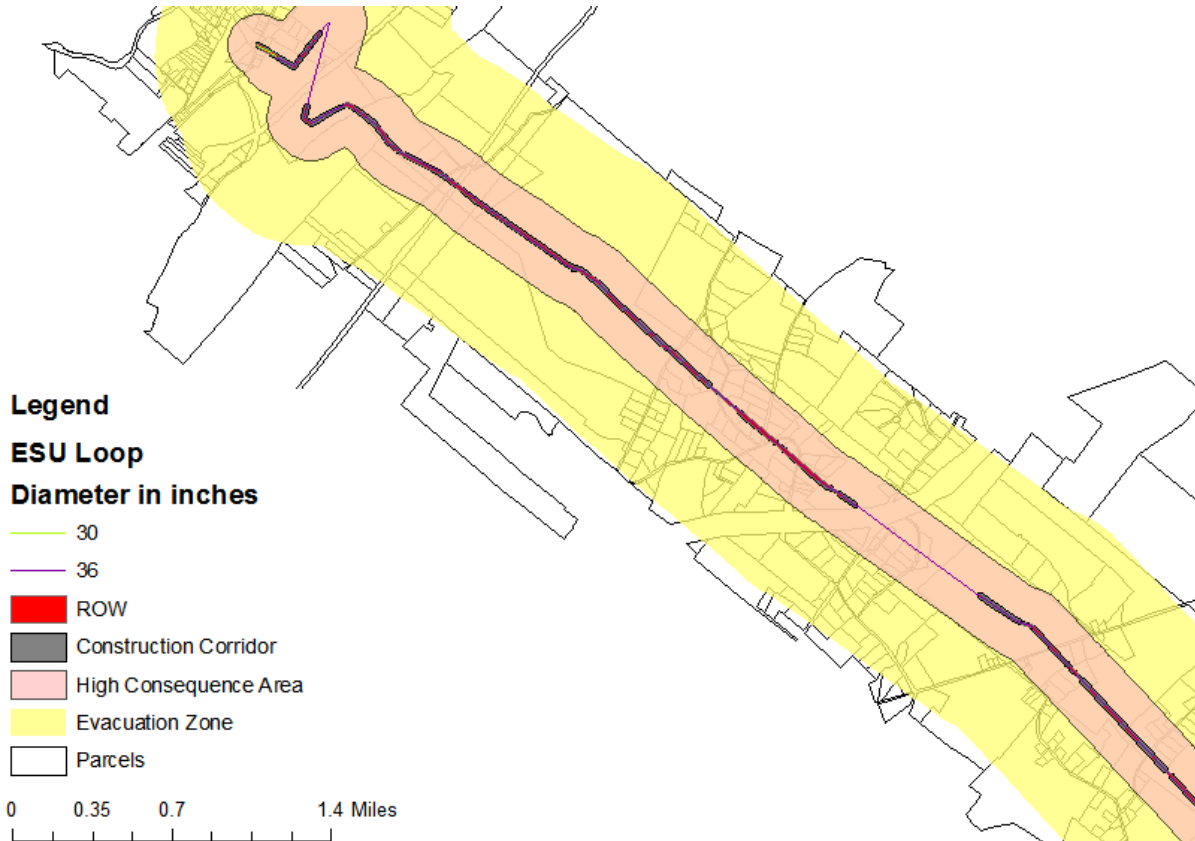


FIGURE 2: Right-of-Way, Construction Corridor, High Consequence, and Evacuation Areas

Note that the overlay of the HCA (in pink) and the evacuation zone (in yellow) shows up as the salmon band in the map. The ROW covers much of the construction corridor, leaving a thin band of red/grey visible (besides for the area where a permanent ROW will not exist). The size of the ROW and construction corridor vary throughout the entire loop.

Sources: ESU loop obtained from Stephen Metts of the New School and parcels from Orange County obtained from New York State's GIS Clearinghouse.

willingness to pay for properties exposed to those risks. For would-be sellers, this dynamic reduces the price they could expect to receive for their homes and makes it harder to find a buyer in the first place. Property owners who do not wish to move would experience a loss of economic value due to diminished enjoyment of their homes (Freybote & Fruits, 2015).

Compressor Stations

The proposed compressor stations are likely to have separate effects on property value and on human health. Based on the experience of homeowners near the compressor station in Hancock, New York, the same one for which the ESU would increase horsepower, we consider the possibility of a property value effect within one half mile of both compressor stations (Catskill Citizens for Safe Energy, 2015). This zone overlaps the ROW and the evacuation zone. Because we assume that the more acute and ever present effect of proximity to the compressor station would dominate all other effects, we ignore the ROW and evacuation zone effects for the properties affected by the compressor stations.

Compressor stations have also been associated with various human health effects at distances up to two miles away from compressor stations (Subra, 2009, 2015). Further epidemiological research would allow

estimation of the costs of those effects for the two proposed stations, however, without such research, we do not include the potential public health costs in the present study.

Municipalities and Counties

If the ESU is built, there will likely be increases in the costs of community services, such as for traffic control and extra law enforcement capacity needed during construction and for emergency preparedness/emergency services during operation. As municipality and county governments, as well as volunteer fire companies meet these needs, costs for services could increase.

Millennium states that they expect the construction and operation of the project to have minor to no short-term impacts or long-term increases to public services (Millennium Pipeline Company, L.L.C., 2016b). Millennium LLC did not confirm in Resource Reports that they interviewed officials responsible for such services, therefore, FERC should not base the claim that the project will not impact public services entirely on Millennium's assurance. Rather, FERC needs to confirm and base their decision on real data, which should be collected before the final decision regarding the pipeline.

Region-Wide Effects

Beyond the loss of property value resulting from the chance of biophysical impacts (leaks and explosions), or the certainty of impacts on aesthetics, the proposed ESU would also diminish scenic amenity and passive-use value that are realized or enjoyed beyond the evacuation zone and out of sight of the pipeline corridor. The people affected include residents, businesses, and landowners throughout the study region, as well as past, current, and future visitors to the region. The impacts on human well-being would be reflected in economic decisions such as whether to stay in or migrate to the study region, whether to choose the region as a place to do business, and whether to spend scarce vacation time and dollars near the ESU project instead of in some other place.

To the extent the ESU causes such decisions to favor other areas, less spending and slower economic growth in the study region would be the result. A secondary effect of slower growth would be further reductions in land value, but in this study we consider the primary effects in terms of slower population, employment, and income growth in key sectors. Table 3 summarizes the types of economic values considered in this study and the zones in which they are estimated.



Proposed compressor station site.
(Photo credit: George Billard)

TABLE 3. Geographic Scope of Effects

A check mark indicates the zones/effects for which estimates are included in this study. The "?s" indicate cost categories for future study, but not quantified in this report.

Values/ Effects	ROW & Construction Zone	High Consequence Area & Evacuation Zone	Near Compressor Station	Entire Study Region	Beyond the Study Region
Human Health and Safety	?	?	✓	?	?
Land/ Property Value	✓ ^a	✓ ^b	✓ ^b	?	?
Economic Development	c	c	c	c	?

Notes:

- a. We estimate land value effects for the ROW but not for the construction zone.
- b. Properties in the HCA are treated as though there is no additional impact on property value relative to the impact of being in the evacuation zone. Also, we exclude properties in the compressor station zone from estimates of impacts related to the ROW and the evacuation zone: while the compressor station’s effects on land value may be similar (driven by health and safety concerns and possible loss of use), they are both more acute and certain. (Noise and air emissions from the compressor stations will be routine, while the probability of a major leak occurring at a given time from the pipeline is rare.) We assume that the ongoing effects of the compressor station on the use and enjoyment of properties nearby would overshadow or dominate the possibility of a high-consequence event or the need to evacuate.
- c. Economic development effects related to these subsets of the study region are scenarios that are not included in the total cost estimates for the study region.

EFFECTS ON PROPERTY VALUE

To say the impacts and potential impacts of the ESU loop and the compressor stations on private property value are important to people along its proposed route would likely be an extreme understatement. Key-Log Economics and Delaware Riverkeeper Network are conducting an analysis of comments FERC received in regards to the report. While results from that analysis are not yet available, one can look to the nearby example of the proposed PennEast pipeline. Landowners and Realtors in the region affected by that proposal, along the proposed route of the PennEast Pipeline, a 36” high-pressure natural gas pipeline designated to transport gas through Pennsylvania and New Jersey, are already reporting lower than expected appraisals (Kohler, 2015).

While it is impossible to know precisely how large an effect the ESU project has already had on land prices, there is strong evidence from other regions that the effect would be negative. In an independent and systematic review, Kielisch (2015) presents evidence from surveys of Realtors, home buyers, and appraisers demonstrating natural gas pipelines negatively affect property values for a number of reasons.

Among his key findings relevant to the ESU project:

- 68% of Realtors believe the presence of a pipeline would decrease residential property value.
- Of these Realtors, 56% believe the decrease in value would be between 5% and 10%. (Kielisch does not report the magnitude of the price decrease expected by the other 44%.)
- 70% of Realtors believe a pipeline would cause an increase in the time it takes to sell a home. This is not merely an inconvenience, but a true economic and financial cost to the seller.
- More than three quarters of the Realtors view pipelines as a safety risk.
- In a survey of buyers presented with the prospect of buying an otherwise desirable home with a 36-inch diameter gas transmission line on the property, 62.2% stated that they would no longer buy the property at any price. Of the remainder, half (18.9%) stated that they would still buy the property, but only at a price 21%, on average, below what would otherwise be the market price. The other 18.9% said the pipeline would have no effect on the price they would offer.

Not incidentally, the survey participants were informed that the risks of “accidental explosions, terrorist threats, tampering, and the inability to detect leaks” were “extremely rare” (2015, p. 7), which shows that home buyers (and home prices) are sensitive even to low-probability threats to the safety of their families.

Considering only those buyers who are still willing to purchase the property, the expected loss in market value would be 10.5%.¹⁸ This loss in value provides the mid-level impact in our estimates. A much greater loss (and higher estimates) would occur if one were to consider the fact that 62% of buyers are effectively reducing their offer prices by 100%, making the average reduction in offer price for all potential buyers 66.2%.¹⁹ In our estimates, however, we have used the smaller effect (-10.5%) based on the assumption that sellers will eventually find one of the buyers still willing to buy the pipeline-easement-encumbered property.

- Based on five “impact studies” in which appraisals of smaller properties with and without pipelines were compared, “the average impact [on value] due to the presence of a gas transmission pipeline is -11.6%” (Kielisch, 2015, p. 11). The average rises to a range of -12% to -14% if larger parcels are considered, possibly due to the loss of subdivision capability.

These findings are consistent with economic theory about the behavior of generally risk-averse people. While would-be landowners who are informed about pipeline risks and nevertheless decide to buy property near the proposed ESU project could be said to be “coming to the nuisance,” one would expect them to offer less for the pipeline-impacted property than they would offer for a property with no known risks.

Kielisch’s findings demonstrate that properties on natural gas pipeline rights-of-way suffer a loss in property value. Boxall, Chan, and McMillan (2005), meanwhile, show that pipelines also decrease the value of properties lying at greater distances. In their study of property values near oil and gas wells, pipelines, and related infrastructure, the authors found that properties within the “emergency plan

¹⁸ Half of the buyers would offer 21% less, and the other half would offer 0% less; therefore the expected loss is $0.5(-21\%) + 0.5(0\%) = -10.5\%$.

¹⁹ This is the expected value calculated as $0.622*(-100\%) + 0.189*(-21\%) + 0.189*(0\%)$.

response zone” (EPZs) of sour gas²⁰ wells and natural gas pipelines faced an average loss in value of 3.8%, other things being equal.

The risks posed by the ESU project would be different—it would not be carrying sour gas, for example—but there are similarities between the ESU scenario and the situation in the study that makes their finding particularly relevant. The emergency plan response zones, for example, are defined by the health and safety risks posed by the gas operations and infrastructure. Also, in contrast to Millennium-cited studies showing no price effects (see “Claims that pipelines do not harm property value are invalid,” below), the Boxall study examines prices of properties for which landowners must inform prospective buyers when one or more EPZs intersect the property.

The ESU has both a high consequence area and an evacuation zone radiating from both sides of the pipeline defined by health and safety risks. Whether disclosed or not by sellers, prospective buyers are likely to become informed regarding location of the property relative to the ESU’s HCA and evacuation zones or, at a minimum, regarding the presence of the ESU in the study region.

The two compressor stations would likely cause their own more severe reduction in the value of nearby properties. Around the existing Hancock compressor station, properties within half a mile of the proposed compressor station saw property devalued 25% (“Proximity of Compressor Station Devalues Homes by as much as 50%,” 2015). We use the 25% devaluation to estimate the amount of property value lost within half a mile of the Highland CS and Hancock CS.²¹

The stations can also be noisy, with low-frequency noise cited as a constant nuisance (“Proximity of Compressor Station Devalues Homes by as much as 50%,” 2015). These issues led some homeowners to pull-up stakes and move away and to reduced property value assessments for others (Cohen, 2015a; “Proximity of Compressor Station Devalues Homes by as much as 50%,” 2015).

Existing studies suggest negative impacts on land value from various types of nuisances that impose noise, light, air, and water pollution, life safety risks, and lesser human health risks on nearby residents (Sun, 2013; Bolton & Sick, 1999; Boxall et al., 2005). In addition to the emerging body of evidence demonstrating a negative relationship between natural gas infrastructure and property value, well established analyses strongly reveal the opposite analog. Namely, amenities such as scenic vistas, access to recreational resources, proximity to protected areas, cleaner water, and others convey positive value to property.²² The bottom line is that people derive greater value from, and are willing to pay more for, properties that are closer to positive amenities and farther from negative influences, including health and safety risks.

²⁰ “Sour” gas contains high concentrations of hydrogen sulfide and poses an acute risk to human health.

²¹ We re-evaluate the property value lost around the Hancock CS to reflect more up to date parcel information. We believe these estimates may be conservative due to the fact that under the update, the Hancock CS would receive additional horsepower.

²² Phillips (2004) is an example of a study that includes an extensive review of the literature on the topic.

Claims That Pipelines Do Not Harm Property Value Are Invalid

In *Draft Resource Report 5: Socioeconomics* (2016b), Millennium, LLC cites studies purporting to show that natural gas pipelines have at most an ambiguous and non-permanent effect on property values (Diskin et al. 2011; Integra Realty Resources, 2016). Millennium LLC also cites the authors of Wilde, Loos, & Williamson (2012) and their statement that there is “no credible evidence based on actual sales data that proximity to pipelines reduces property values” (p. 16). While the studies referenced differ in methods, they are similar in that they fail to take into account two factors that void entirely their conclusions that natural gas pipelines have no effect on property values.

First, the studies fail to consider that the property price data employed in the studies do not reflect buyers’ true willingness to pay for properties closer to or farther from natural gas infrastructure. For prices to reflect willingness to pay (and therefore true economic value), buyers would need full information about the subject properties, including whether the properties are near a pipeline. Second, the studies finding no difference in prices for properties closer to or farther away from pipelines are not actually comparing prices for properties that are “nearer” or “farther” by any meaningful measure.²³ The studies compare similar properties and, not surprisingly, find that they have similar prices. Their conclusions are neither interesting nor relevant to the important question of how large an economic effect the proposed pipeline would have.

When the Preconditions for a Functioning Market Are Not Met, Observed Property Prices Do Not (And Cannot) Indicate the True Economic Value of the Property

Economic theory holds that for an observed market price to be considered an accurate gauge of the economic value of a good, all parties to the transaction must possess full information about the good. If, on the other hand, buyers lack important information about a good, in this case whether a property is near a potential hazard, they cannot bring their health and safety concerns to bear on their decision about how much to offer for the property. As a result, buyers’ offering prices will be higher than both what they would offer if they had full information and, most importantly, the true economic value of the property to the buyer.

As Albright (2011) notes in response to the article by Disken, Friedman, Peppas, & Peppas (2011):

“The use of the paired-sales analysis makes the assumption of a knowing purchaser, but I believe this analysis is not meaningful unless it can be determined that the purchaser had true, accurate and appropriate information concerning the nature and impact of the gas pipeline on, near or across their property... I believe that the authors’ failure to confirm that the purchasers in any of the paired sales transactions had full and complete knowledge of the details concerning the gas transmission line totally undercut the authors’ work product and the conclusions set forth in the article” (p.5).

²³ The Kinnard studies mentioned in Wilde, Loos, & Williamson (2012).

In some cases, however, the location and hazards of petroleum pipelines become starkly and tragically known. For example, a 1999 liquid petroleum pipeline exploded in Bellingham, Washington, killing three, injuring eight, and causing damage to property and the environment. In that case and as Hansen, Benson, and Hagen (2006) found, property values fell after the explosion, thus demonstrating that once would-be buyers become aware of the presence of a pipeline and its hazards, they can “vote with their feet” and their wallets and buy elsewhere. The authors also found that the negative effect on prices diminished over time. This makes perfect sense if, as is likely, information about the explosion dissipated once the explosion and its aftermath left the evening news and the physical damage from the explosion had been repaired.

Today’s market is quite different. In contrast to Bellingham homebuyers in the months and years after the 1999 explosion, today’s homebuyers can query Zillow to see the history of land prices near the pipeline and explore online maps to see what locally undesirable land uses exist near homes they might consider buying. They also have YouTube and repeated opportunities to find and view news reports, citizen’s own videos, and other media describing and depicting such explosions and their aftermath. Whether or not the pre- and (in the long term) post-explosion prices in that Bellingham neighborhood reflected the presence of the pipeline, it is hard to imagine that the evident dangers of living near a fossil fuel pipeline would be so easily missed or so quickly forgotten by today’s would-be homebuyers.

What Zillow and other sites do accomplish is a lowering of the effort/cost of acquiring information about properties. Potential homebuyers can easily visualize the location of properties relative to other land uses, including pipeline rights-of-way. Combined with other information, such as maps of pipeline routes and other searchable online information, real estate marketing tools do make it more likely that prospective buyers will gain and act on information about the hazard they could be buying into.

With more vocal/visible opposition to large, high-pressure natural gas pipelines and associated natural gas infrastructure it also seems likely that prospective home buyers will not have to wait for an incident involving the ESU project to learn of it and, therefore, for the project to affect willingness to pay for properties nearby. Anyone with an eye toward buying property near the proposed path of the project could quickly learn that the property is in fact near the corridor, that there is a danger the property could be adversely affected by the still pending project approval, and that fossil fuel pipelines and related infrastructure have an alarming history of negative health, safety, and environmental effects.

When people possess more complete information about a property, they are able to express their willingness to pay when it comes time to make an offer. Accordingly, the prices buyers offer for homes near the ESU upgrade will be lower than the prices offered for otherwise similar homes farther away or in another community or region.

Studies Concluding That Proximity to Pipelines Do Not Result in Different Property Values Are Not Actually Comparing Prices for Properties That Are Different

While the studies cited in *Draft Resource Report 5: Socioeconomics* purport to compare the price of properties near a pipeline to properties not near a pipeline, many or in some cases all, of the properties

counted as “not near” the pipelines are, in fact, near enough to have health and safety concerns that could influence prices. In the Interstate Natural Gas Association of America (INGAA) study, the authors compare prices for properties directly on a pipeline right-of-way to prices of properties off the right-of-way (Integra Realty Resources, 2016). However, in almost all of the case studies the geographic scope of the analysis was small enough where most or all of the properties not on the right-of-way were still within the pipelines’ respective evacuation zones (Integra Realty Resources, 2016).²⁴

INGAA analyzed six case studies in the 2016 study. In four of the case studies where an exact distance between the property and the pipeline was given, an average of 72.5% of the “off” properties were actually within the evacuation zone and, like the “on” properties, are therefore likely to suffer a loss in property value relative to properties farther away.²⁵

For the other two case studies analyzed in the 2016 INGAA study, the study reported a simple “yes” or “no” to indicate whether the property abutted the pipeline in question. For these two case studies, we assume the author’s methods, while flawed, are at least consistent from one case study to the next meaning it is likely at least 50% or more of the comparison properties (the “off” properties) are in fact within the evacuation zone.

To adequately compare the price of properties with and without a particular feature, there needs to be certainty that properties either

FINANCIAL DAMAGE ALREADY OCCURRING

Mark and Alycia Egan live 0.59 miles, directly across the street, from the proposed Highland compressor station. Upon learning about the plans for the Highland CS, the Egan’s put their home on the market for fear their property value would be significantly diminished. A year later, with their home still on the market, the Egan’s have had to lower the cost of their home and learned a recent buyer loved the home but declined entering an offer once they knew about the potential of the compressor station.

The Egan’s contacted Millennium regarding their worries that their property may be unsellable but their only response was that buyers were “clearly misinformed.” Millennium LLC and FERC continue to put industry supported studies falsely claiming property values are not impacted by pipelines and related infrastructure over the actualized harms suffered by homeowners.



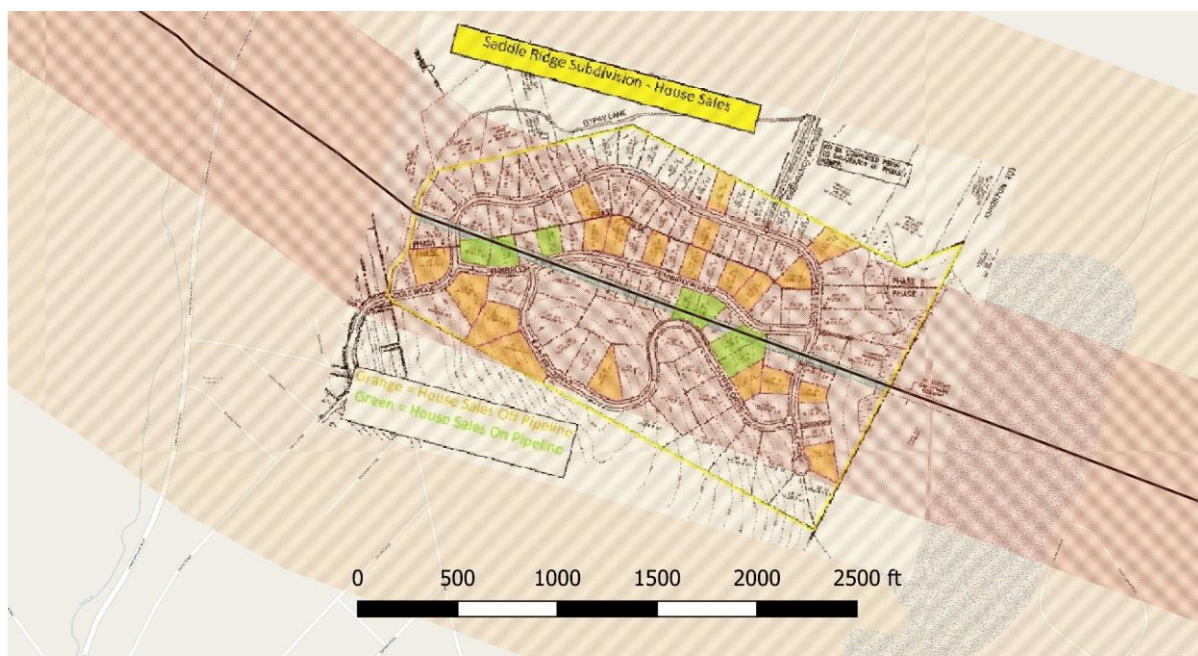
Mark and Alycia walking along old route 55. (Photo credit: Mark Egan)

²⁴ Proximity of properties to pipelines is based on best estimate of the location of the pipelines derived from descriptions of the pipelines’ locations provided in the studies and an approximation of the evacuation zone based on pipeline diameter and operating pressure (Pipeline Association for Public Awareness, 2007).

²⁵ We estimated the evacuation zone based on available information about the pipeline diameter and operating pressure (Pipeline Association for Public Awareness, 2007).

have or do not have said feature. The feature of interest in this case is the presence of a nearby risk to health and safety. INGAA instead relied upon case studies with little to no variation in the feature of interest (i.e., the majority of properties are within the evacuation zone), and found, unsurprisingly, that there was no systematic variation in the subsequent price of properties. By comparing apples to apples rather than comparing apples to oranges, the INGAA studies reach the obvious and not very interesting conclusion that properties that are similar in size, condition, and other features including their location within the evacuation zone of a natural gas pipeline, have similar prices.

A prime example of this problem is embodied in the 2014 study by Allen, Williford, and Seale, which is summarized in the latter INGAA study (Integra Realty Resources, 2016). The authors compare the prices of homes and lots “on” and “off” a Transco-operated pipeline in Luzerne County, Pennsylvania. In the map below (Figure 3), the green-shaded properties are those identified by the authors as “on the pipeline,” because they are crossed by the 50-foot right-of-way. The orange properties are what the authors call “off the pipeline.”



Legend

— Transco Pipeline High Consequence Area Evacuation Zone

FIGURE 3. Transco Pipeline evacuation zone covers all, and the high-consequence area covers most, of properties in the Saddle Ridge case study area.

Sources: Saddle Ridge subdivision image from Allen, Williford, and Seale (2014) as reproduced in Integra Realty Resources (2016, p. 69); Transco Centerline digitized from approximated ROW shown in blue and, beyond the subdivision, from Google satellite imagery (2017).

Figure 3 also shows, in pink shading, the 1,139-foot-wide high-consequence area and, in tan, the 3,796-foot-wide evacuation zone. All of the properties that Allen, Williford, and Seale consider as either “on” or “off” the pipeline are well within the evacuation zone, and all of the properties are at least touched by the high-consequence area. Because perceptions of the risk to life and property in the event of an explosion or, at minimum, worry and inconvenience homeowners, living within the evacuation zone

should likely affect offer prices for all of the properties in the study area, making the authors' definitions of "on" and "off" the pipeline substantially irrelevant. As in the other cases included in INGAA's review (Integra Realty Resources, 2016), Allen, Williford, and Seale simply document the unsurprising result that similar properties have similar prices.

As economic research, their exercise is a perhaps harmless but wasted effort. As the basis for FERC's and others' contention that natural gas pipelines do not affect property values, the exercise is one of costly, and possibly dangerous, misdirection.

In short, the conclusion that pipelines do not negatively affect property values cannot be drawn from these flawed studies. To evaluate the effects of the proposed ESU project on property value, FERC and others must look to studies (e.g., Boxall et al. (2005), Kielisch (2015)) in which the buyers' willingness to pay are fully informed about the presence of nearby pipelines and in which the properties examined are truly different in terms of their exposure to pipeline-related risks.

Land Value Effects of Compressor Stations

Compressor stations can cause decreases in home values and have even forced some homeowners to move away from the noise, smells, and illnesses associated with living near the compressor stations. In one documented case from Minisink, New York, a smaller (12,600 hp) compressor station just southeast of the proposed Highland compressor station, a family of six moved to escape the effects of the compressor station operated by Millennium LLC. After two years of headaches, eye irritation, and lethargy among the children and even lost vigor in their fruit trees, the couple, unable to find a buyer for their home, moved away, leaving their \$250,000 investment in the property on the table with their bank holding the balance of the mortgage (Cohen, 2015a).

Around the existing Hancock CS, three homeowners living around 15,900 hp compressor station, which would get an additional 22,400 hp upgrade under the ESU project, have had their property assessments reduced, two by 25% and one by 50%, due to the impact of truck traffic, noise, odors, and poor air quality associated with the compressor station ("Proximity of Compressor Station Devalues Homes by as Much as 50%", 2015). The larger of these reductions was for a home very close to the station and reflected physical damage that led to an increase in radon concentrations above safe levels. The two properties devalued by 25% were approximately one half mile away (Ferguson, 2015).

As of this writing, there have not been statistical studies conducted demonstrating the relationship between a property's value and its proximity to a compressor station. However, the mounting anecdotal information suggests there is a negative relationship, and depending on the particular circumstances, the effect can be large—up to the 100% loss sustained by a family in Minisink (less than whatever the bank can recover at auction). FERC must therefore count the potential loss of property value associated with the compressor stations proposed for Sullivan County and further losses associated with the existing station in Delaware County.

For our estimates, we follow the existing example of the Hancock, New York case and assume that properties within one half mile of the Highland CS would lose 25% of their value if the station is built.²⁶ For the analysis, we re-analyzed the potential property value loss around the Hancock CS in order to reflect up to date parcel value information. We believe our estimates are conservative in part because the horsepower proposed for the Highland CS (22,400 hp) and the upgrade for the Hancock CS (38,300 total hp) are both larger than the horsepower of the existing Hancock Station (15,900 hp), about 1.5x and 2.4x respectively. It is therefore likely that noise, odor events, and other physical effects would be experienced at a greater distance and/or with greater intensity than the existing property devaluation example.

Parcel Values

We obtained parcel data in electronic form from the New York state GIS clearinghouse as well as from county level GIS departments. The data included Geographic Information System (“GIS”) layers with the valuation/assessment data for the counties. Because publicly owned conservation lands (parks, etc.²⁷) are unlikely to be sold, they do not have any market value. To avoid overestimating property value effects, we set the value of any publicly owned parcels equal to zero.

Using the GIS data, we identified the five different types of parcels for which the pipeline would have an effect. In order of increasing distance from the pipeline itself, these are:

1. Parcels crossed by the right-of-way
(5 parcels, with total baseline value (without the ESU project) of \$186,050)
2. Parcels crossed by the construction corridor
(18 parcels, with total baseline value (without the ESU project) of \$6.1 million)
3. Parcels at least partially within the high consequence area (HCA)
(20 parcels, with total baseline value (without the ESU project) of \$5.9 million)
4. Parcels at least partially within the evacuation zone
(196 parcels, with total baseline value (without the ESU project) of \$19.8 million)
5. Parcels with their geographic center (centroid) within one-half mile of the parcel containing the compressor station
(43 parcels, with total baseline value (without PE) of \$4.9 million)

Note there is overlap among the zones. All ROW parcels are within the construction corridor, the HCA, and the evacuation zone. All construction corridor parcels are within the HCA and the evacuation zone. And HCA parcels are within the evacuation zone. To avoid double counting parcel values, only one land value effect is applied to a given parcel.

²⁶ For land value analysis of the compressor stations, we buffered a half mile radius around the workspace of the station.

²⁷ We used the “Protected Areas Database” from the National Gap Analysis Program to identify fee-owned conservation properties (Conservation Biology Institute, 2012).

For estimates of the ROW, we assume that the health and safety concerns associated with the compressor station dominate the effects within the ROW and the evacuation zone. Estimates of the impact of the ROW and evacuation zone exclude the compressor zone parcels, and we estimate a separate effect of the compressor station. ROW parcels are also assumed to suffer no further reduction in value due to their location within the evacuation zone.

We do not consider the construction corridor separately for the land value analysis. Even though the additional 18 parcels and \$6.1 million in value (relative to parcels in the ROW) are not trivial, we do not have a basis for estimating a change in value that is separate from, or in addition to, the change due to these parcels' proximity to the ROW or their location within the evacuation zone.

TABLE 4: Summary of Marginal Property Value Effects

Values/ Effects	Right-of-Way (Low, Medium, & High Effects)	High Consequence Area & Evacuation Zone	Compressor Station Zone
Land/ Property Value	-4.2% ^a -10.5% ^b -13.0% ^c	-3.8% ^d	-25% ^e

Notes:

- Kielisch, Realtor survey in which 56% of respondents expected an effect of between -5% and -10% (0.56*-7.5% = -4.2%).
- Kielisch, buyer survey in which half of buyers still in the market would reduce their offer on a property with a pipeline by 21% (0.50*-0.21 = -10.5%).
- Kielisch, appraisal/impact studies showing an average loss of between -12% and -14% (-13% is the midpoint).
- Boxall, study in which overlap with an emergency planning zone drives, on average, a 3.8% reduction in price. We apply this reduction ONLY to those parcels in the evacuation zone that are not also in the ROW or within one half mile of the compressor station.
- Based on examples from the town of Hancock, New York.

Furthermore, we treat parcels in the HCA and in the evacuation zone the same by applying a single land value change to all parcels in the evacuation zone. Arguably, there should be a larger effect on parcels in the HCA than those only in the evacuation zone. Living with the possibility of having to evacuate at any time day or night should have a smaller effect on property value than living with the possibility of not surviving a “high consequence” event and, therefore, not having the chance to evacuate at all. We do not have data or other study results that allow us to draw this distinction. We therefore apply the lower evacuation zone effect to all HCA and evacuation zone parcels (beyond the ROW).

To summarize, Table 4 repeats a portion of Table 3, but with the property value effects in place of check marks.

Estimated Land Value Effects

Following the procedures outlined in the previous section, our conservative estimate for costs of the proposed ESU would include \$2.0 million in diminished property value with the most intense effects felt by the owners of 5 parcels in the path of the right-of-way, who collectively would lose between \$7,814 and \$24,187 in property value. Some 196 additional parcels lie outside the ROW but are within or

touching the evacuation zone. These parcels' owners would lose an estimated \$753,692 (Table 5). Finally, the compressor stations would reduce the value of 43 properties by a total of \$4.9 million.

Table 5: Summary of Land Value Effects, by Zone and County

	Delaware County	Sullivan County	Orange County	Total
Effects on ROW Properties (2015\$)				
<i>Realtor Survey (4.25%)</i>	n/a	n/a	-7,814	-7,814
<i>Buyer Survey (10.5%)</i>	n/a	n/a	-19,535	-19,535
<i>Impact Studies (13%)</i>	n/a	n/a	-24,187	-24,187
Effects on Evacuation Zone Properties (2015\$)				
<i>Boxall Study (3.8%)</i>	n/a	n/a	-753,692	-753,692
Effects Near Compressor Stations (2015\$)				
Hancock, NY Finding (25%)	-519,888	-715,474	n/a	-1,235,361
All Effects (2015\$)				
<i>Low</i>	-519,888	-715,474	-761,506	-1,996,868
<i>Medium</i>	-519,888	-715,474	-773,227	-2,008,589
<i>High</i>	-519,888	-715,474	-777,879	-2,013,240

Based on median property tax rates in each county, these one-time reductions in property value would result in reductions in property tax revenue of between \$36,005 and \$36,298 per year (Table 6). The present value of this stream of lost revenue over the 2018-2068 operating period would be \$1.6 million. To keep their budgets balanced in the face of this decline in revenue, counties would need to increase tax rates, cut back on services, or both. The loss in revenue would be compounded by the likelihood that the need for local public services, such as road maintenance, water quality monitoring, law enforcement, and emergency preparedness/emergency response could increase. Thus, the ESU could drive up expenses while driving down the counties' most reliable revenue stream.

TABLE 6. Effects on Local Property Tax Revenue

Source: Property Taxes by State (propertytax101.org, 2016)

	Delaware County	Sullivan County	Orange County	Total
Median Tax Rate (% of Home Value)				
	1.62%	1.95%	1.79%	
Lost Property Tax Revenue (2015\$)				
<i>Low</i>	-8,422	-13,952	-13,631	-36,005
<i>Medium</i>	-8,422	-13,952	-13,841	-36,215
<i>High</i>	-8,422	-13,952	-13,924	-36,298

THE SOCIAL COST OF CARBON: AN ADDITIONAL COST OF METHANE TRANSPORT

The social cost of carbon (“SCC”) is a comprehensive estimate of the economic cost of harm associated with the emission of carbon. The SCC helps better inform regulation because it allows agencies to more accurately weigh the environmental costs and benefits of a new rule or regulation. After challenges questioning the accuracy of SCC, in April 2016, a federal court upheld the legitimacy of using the social cost of carbon as a viable statistic in climate change regulations (Brooks, 2016). Even more recently, in August 2016, The Council on Environmental Quality (“CEQ”) issued its final guidance for federal agencies to consider climate change when evaluating proposed Federal actions (Council on Environmental Quality, 2016). The CEQ states “agencies should consider applying this guidance to projects in the EIS or EA preparation stage if this would inform the consideration of differences between alternatives or address comments raised through the public comment process with sufficient scientific basis that suggest the environmental analysis would be incomplete without application of the guidance, and the additional time and resources needed would be proportionate to the value of the information included” (2016, p.34).

EPA has also challenged FERC’s failure to consider climate change implications in a similar application process (Westlake, 2016). Citing the CEQ guidance, EPA notes that the Final EIS for the Leach Xpress, Columbia Gulf Transmission LLC-Rayne Xpress Expansion project “perpetuates the significant omission...with respect to a proper climate change analysis to inform the decision making process” and recommends that GHG emissions from end product combustion be counted among the environmental effects of each alternative” (p. 2).

Millennium LLC estimates the ESU loop would transport 73,000,000 dekatherms annually, contributing to an equivalent of 3.9 million metric tons of CO2 emitted per year (U.S. EPA, 2016). Because the SCC assumes a ton of carbon emitted in the future will have more dire impacts than a ton emitted in the

present, we estimate the cost of carbon annually until 2068.²⁸ Using U.S. EPA estimates based on the average of impacts from three assessment models and discount rates of 5% and 2.5% (U.S. EPA, Climate Change Division, 2016), the cost to society of the carbon transmitted through the ESU project would total between \$4.8 and \$18.8 billion over 50 years. FERC must count this significant cost among the effects of the proposed pipeline.

OTHER IMPACTS FOR CONSIDERATION

Public Health Effects

Natural gas transmission releases toxins, smog forming pollutants, and greenhouse gases that have a negative impact on public health (Fleischman, McCabe, & Graham, 2016). Emissions from the natural gas industry have been tied to a malady of health concerns. More concrete epidemiological studies are needed to determine the extent to which natural gas transmission causes public health concerns.

More recent emerging literature is beginning to quantify just how large of an effect the industry can have on public health. For example, a study by the Clean Air Task Force estimated that in 2025, increases in ozone levels due to pollution from the oil and gas industry will cause 750,000 additional asthma attacks in children under the age of 18, add an additional 2,000 asthma-related emergency room visits and 600 respiratory related hospital admissions, cause children to miss 500,000 days of school annually, and cause adults to deal with 1.5 million days of forced rest or reduced activity due to ozone smog (Fleischman, McCabe, & Graham, 2016).

Air Pollution from the Proposed Compressor Stations

The ESU project impacts air quality by converting forests, which remove normal levels of impurities from the air, to other land uses. While there is a chance leaks could occur at any place along the proposed route, leaks and major releases of gas and other substances (lubricants, etc.) will certainly occur at the two proposed compressor stations. Leaks in seals on the moving parts of natural gas compressors produce a significant amount of VOC emissions (Fleischman, McCabe, & Graham, 2016). Also, after the compressor station in Hancock began operation, there was a 5x increase in the amount of ambient methane for roughly a one mile radius (Cohen, 2015).

The negative effects of the compressor station include noise and air pollution from everyday operations plus periodic “blowdowns,” or venting of gas in the system to reduce pressure. David Carpenter, the director of the Institute for Health and the Environment at the University at Albany, notes that compressor stations are among the worst of fracking related infrastructure (Lucas, 2015). A five-state study examining air quality near compressor stations found that levels of several volatile chemicals, including benzene and formaldehyde, exceeded federal guidelines (Macey et al., 2014). As more

²⁸ Based on information provided by Millennium LLC in *Draft Resource Report 1: General Project Description* (2016a), construction on the project would begin in 2017 and the first year of operation, or the first year the project would produce associated emissions, would be 2018. Millennium LLC also states that the ESU facilities “are projected to have a 50-year minimum physical life” (Millennium Pipeline Company, L.L.C., 2016, p. 1-42). Given a 50-year minimum physical life, we use 2068 as the final year of operation for the project.

“I have worked on the Town of Highland's Comprehensive Management Plan and its zoning that expressly, clearly and specifically bans any and all compressor stations - as have a number of surrounding towns concerned with protecting the quiet enjoyment of our homes and rural, tourism-friendly environment.”

-Debra R. Conway, Resident
Barryville, New York

negative documented health impacts arise from other existing compressor stations, this has led the Highland Town Board to draft a unanimous resolution opposing the compressor station, citing potential health impacts as a cause of great concern (Times Herald-Record, 2016).

The documented negative health impacts from other existing compressor stations led the Highland Town Board to draft a unanimous resolution opposing the compressor station, citing potential health impacts as a cause of great concern (Times Herald-Record, 2016).

While more definitive epidemiological studies are needed to determine the extent to which natural gas

compressor stations add to background rates of various illnesses, these stations are implicated as contributing to a long list of maladies. According to Subra (2015), individuals living within 2 miles of compressor stations and metering stations experience respiratory impacts (71% of residents), sinus problems (58%), throat irritation (55%), eye irritation (52%), nasal irritation (48%), breathing difficulties (42%), vision impairment (42%), sleep disturbances (39%), and severe headaches (39%). In addition, some 90% of individuals living within 2 miles of these facilities also reported experiencing odor events (Southwest Pennsylvania Environmental Health Project, 2015). Odors associated with compressor stations include sulfur smell, odorized natural gas, ozone, and burnt butter (Subra, 2009). Furthermore, compressors emit constant low-frequency noise, which can cause negative physical and mental health effects (Lockett, Buppert, & Margolis, 2015).

In Sullivan County, 115 people live within 2 miles of the proposed Highland CS (U.S. Census Bureau, 2015). Applying the results of Subra (2015) to the population in Sullivan living within 2 miles, 104 people would experience odor events, 82 people would experience respiratory impacts, 67 people would experience sinus problems, and 45 people would experience sleep disturbances and/or severe headaches.

In Delaware County, 256 people live within 2 miles of the existing compressor station in Hancock (U.S. Census Bureau, 2015). Applying the results of Subra (2015) to the population in Delaware living within 2 miles, 230 people would experience odor events, 182 people would experience respiratory impacts, 148 people would experience sinus problems, and 100 people would experience sleep disturbances and/or severe headaches.

In addition to the health impacts discussed above, this pollution can cause damage to agriculture and infrastructure. One study found that shale gas air pollution damages in Pennsylvania already amount to between \$7.2 and \$30 million, with compressor stations responsible for 60-75% of this total (Walker & Koplinka-Loehr, 2014). Using the low estimate of 60%, that is between \$4.32 and \$18 million in damages associated with compressor stations.

Effects on Economic Development

In each county analyzed, county-level economic development plans recognize the importance of a high quality of life, a clean environment, and scenic and recreational amenities to the economic future of people and communities. According to the Orange County Comprehensive Plan, one of the priority goals is to “strengthen the economy in Orange County by attracting and supporting businesses that will enhance the County’s economic base and provide jobs, tax revenues, and an orderly and sustainable land use pattern that accommodates the best of the County’s old economy while providing the attributes necessary to build the new economy” (Orange County Planning Board, 2010). Sullivan County’s Comprehensive Plan dedicates an entire section to alternative energy sources and the importance that the county supports environmentally conscious initiatives that generate economic benefits and simultaneously preserve significant natural resources (Sullivan County Planning and Environmental Management, 2005). Along similar lines, Delaware County recognizes that preserving water quality and supporting their growing agri-tourism sector go hand in hand (Delaware County Planning Department, 2008).

These intentions mirror common trends in other amenity-rich locales around the country. For example, Niemi and Whitelaw state “as in the rest of the Nation, natural-resource amenities exert an influence on the location, structure, and rate of economic growth... This influence occurs through the so-called people-first-then-jobs mechanism, in which households move to (or stay in) an area because they want to live there, thereby triggering the development of businesses seeking to take advantage of the households’ labor supply and consumptive demand” (1999, p. 54). They note that decisions affecting the supply of amenities “have ripple effects throughout local and regional economies” (p. 54). Similarly, Johnson and Rasker (1995) found that quality of life is important to business owners deciding where to locate a new facility or enterprise and whether to stay in a location already chosen. This is not surprising. Business owners value safety, scenery, recreational opportunities, and quality of life factors as much as residents, vacationers, and retirees.

“This area is known for its unspoiled natural beauty, clean water and fresh air. The local economy is entirely dependent on nature tourism and vacation homes, including ours. The area is heavily forested, with a number of endangered and threatened species. There is no municipal water supply and all homeowners are dependent on the purity of the aquifer, which is replenished by our myriad of lakes and streams. Industrial use is specifically banned in The Town of Highland in order to preserve the unique natural habitat.”

- John Caplan, Landowner
Highland, New York

Part of what makes tourism an important part of the study region’s economy is the high aesthetic quality and environmental amenities available in the study region. In 2015 alone, tourism in the study region is a \$944.3 million industry, up \$61.7 million from 2010. The industry provides 14,907 jobs across the study region, contributing to \$441.3 in payroll, \$63.0 million in local taxes, and \$52.4 in state taxes (Tourism Economics, 2016a, 2016b).

The ESU could dampen these economic activities and undermine the progress toward economic development goals. A loss of scenic and recreational amenities, the perception and the reality of physical danger, and

environmental and property damage resulting from the ESU could discourage people from visiting, relocating to, or staying in the region. Workers, businesses, and retirees who might otherwise choose to locate along the ESU's proposed route or near the compressor stations will instead pick locations that have retained their character, their productive and healthy landscapes, and their promise for a higher quality of life.

This is already occurring in the region. With the possibility of the ESU looming, business plans are stalling and the real estate market is slowing. In nearby Minisink, community members impacted by Minisink compressor station have had signs in opposition of the construction stolen from their property by other neighbors fearing if too much press highlights the negativity of the station for the town that it will harm the agricultural industry that the town depends on (Rugh, 2014).

Many of the region's residents believe the ESU will also harm the travel and tourism industry. For example, Juliette Hermant, a small business owner in Narrowsburg, an area heavily dependent on nature tourism and vacation homes has heard from clientele expressing heavy concern over the proposed project (Carazo, 2015).

It is difficult to predict just how large an effect the ESU would have on decisions about visiting, locating to, or staying in the study region. Even so, based on information provided by business owners to FERC and as part of this research, we can consider scenarios for how the ESU might affect key portions of the region's overall economy, such as tourism and recreation, retirement, and entrepreneurship.

"This whole Upper Delaware River Valley is a sacred national asset. The economy here, and the livelihood of the people who live here, are as fragile as the river valley itself. Thus, the number one economic engine here has always been, quite appropriately, the sanctity of our natural habitat. We should never, ever, ever, ever take a risk of damaging or diminishing that asset, our only real economic engine."

-Mark Righter, Community Member
Glen Spey, New York

If, for example, the ESU were to cause a 5% drop in recreation and tourism spending from 2015 baselines, the project could mean \$47.2 million less in travel expenditures each year (Tourism Economics, 2016a, 2016b). Those missing revenues would otherwise support roughly \$3.1 million in local tax receipts, \$2.6 million in state tax revenue, 745 jobs, and \$22.1 million in payroll in the three-county region. In the short run, these changes multiply through the broader economy as recreation and tourism businesses buy less from local suppliers and fewer employees spend their paychecks in the local economy. As with the reduction in local property

taxes, lost tax revenue from a reduction in visitation and visitor spending would squeeze local governments trying to meet existing public service needs as well as additional demands created by the ESU.

Along similar lines, retirement income is an important economic engine that could be adversely affected by the ESU. In county-level statistics from the U.S. Department of Commerce, retirement income shows up in investment income and as age-related transfer payments, including Social Security and Medicare payments. In the study region, investment income grew by 0.6% per year from 2000 through 2014, and age-related transfer payments grew by 4.5% per year. During roughly the same time period (through

2013), the number of residents age 65 and older grew by 20.3% (1.6% per year), and this age cohort now represents 13.2% of the total population (U.S. Department of Commerce, 2015a; U.S. Department of Commerce, 2015b).

It is difficult to precisely quantify the effect of the ESU on retirement income, but given the expression of concern from residents about changes in quality of life, safety, and other factors influencing retirees' location decisions, it is important to consider that some change is likely. Here, again, we consider what a *5% reduction of the growth rate* might entail. A 5% growth reduction scenario would mean an annual decrease in investment income and age-related transfer payments of approximately \$6.3 million. That loss would ripple through the economy as the missing income is not spent on groceries, health care, and other services such as restaurant meals, home and auto repairs, etc.

The same phenomenon also applies to people starting new businesses or moving existing businesses to communities in the study region. This may be particularly true of sole proprietorships and other small businesses who are most able to choose where to locate. As noted, sole proprietors account for a large and growing share of jobs in the region. If proprietors' enthusiasm for starting businesses in the study region were dampened to the same degree as retirees' enthusiasm for moving there, the 5% reduction scenario in the rate of growth would mean 74 fewer jobs and \$1.2 million less in proprietor's income.

For "bottom line" reasons (e.g., cost of insurance) or due to owners' own personal concerns, businesses in addition to sole proprietorships might choose locations where living near the pipeline or a compressor station is not an issue. If so, further opportunities for local job and income growth will be missed.

These are simple, but plausible scenarios regarding the potential economic development impacts of the ESU. Other methods and assumptions would lead to different estimates, of course, and it is incumbent on FERC to complete its own evaluation of the merits of the proposal. Especially because the project is promoted by its supporters for its jobs and potential other economic benefits to the region, it is important to consider the potential for loss, as well as to take a hard look at the project applicant's claims regarding possible gains.

CONCLUSIONS

The full costs of the proposed Eastern System Upgrade to people and communities in the three-county study region and beyond are wide-ranging. The costs include one-time costs like reductions in property value during pipeline construction, which we estimate to be about \$2.0 million. There are also ongoing costs like lost property tax revenue and the cost of increased carbon emissions that recur year after year for the life of the pipeline. Diminished property tax revenues would total between \$36,005 and \$36,298 per year. The majority of these costs would be borne by the residents, businesses, and institutions in Orange, Delaware, and Sullivan Counties.

Beyond the immediate region, the Eastern System Upgrade would also impose a cost on people worldwide due to the addition and combustion of natural gas transported through the pipeline. The social cost of carbon is an annual cost that varies by year and with the rate at which future costs are

discounted. It would total between \$50.1 and \$420.1 million, raising the total annual external costs to between \$50.2 and \$420.2 million.

Adding up all one-time recurring costs, and discounting those future costs to 2017, we estimate the total external costs of the Eastern System Upgrade to be between \$4.7 and \$18.8 billion in 2015 dollars.

Construction and operation of the project would produce comparatively few economic benefits. Using Millennium LLC's estimates, the construction period would produce \$314 million (2015\$) in economic impact (additional spending by firms and households in Millennium's study region, which is the entire state of New York). Spending on operation and maintenance of the completed project, plus assumed cost savings for energy users would, in Millennium LLC's estimation, generate \$70.3 million (2015\$) in output annually for 10 years (Concentric, 2016).²⁹ Applying the same methods to calculate the present value of the positive effects,³⁰ the pipeline promises a total of \$2.0 billion in economic impact over 50 years of operation. This means for every dollar of benefit promised, the Eastern System Upgrade would impose between \$2.31 and \$9.24 in costs.

While the decision to approve or not approve the ESU does not hinge on a simple comparison of estimated benefits versus estimated costs, the difference between the external economic costs presented in this report and the potential payments to local governments and residents suggests that, from an economic perspective, the proposed project is inefficient. The scope and magnitude of the costs outlined here reflect a closer examination into important components of the full extent of the ESU's likely environmental effects that must be considered when FERC makes the certification decision. Impacts on human well-being, including but not limited to those that can be expressed in dollars-and-cents, must be taken into account by the Federal Energy Regulatory Commission and others weighing the societal value of the Eastern System Upgrade.

If these considerations and FERC's overall review result in selection of the "no-action" alternative and the ESU is never approved, most of the costs outlined in this report will be avoided. It is *most*, not *all*, costs because the cost of delayed business plans, houses languishing on the market, and the cost to individuals of the stress, time, and energy diverted to concern about the project rather than what would normally (and more productively) fill their lives has already occurred.

Another possible scenario is that FERC, considering the impacts of the ESU *as currently proposed* on property values, economic development, and climate impacts, conducts a thorough analysis of all possible alternatives. Those alternatives may include using alternative energy technologies for meeting the energy needs of the region, making better use of existing gas transmission infrastructure, and/or scaling down permitted new pipeline capacity to match regional gas transmission needs. In this case, estimates of these impacts should inform the choice of a preferred alternative that minimizes

²⁹ Concentric (2016) uses 2019-2028 as the operational phase, however, in Draft Resource Report 1 (2016), Millennium LLC states that the first year of operation will be in year 2018. For estimates in this report, we use 2018 as the first year of the ESU's operational period.

³⁰ Although Concentric (2016) only provides operational benefits for 10 years after the first year of operation, for our present discounted value calculations, we use their given average of \$70.3 million per year as the annual benefit.

environmental damage and, thereby, minimizes the economic costs to individuals, businesses, and the public at large.

Adequate environmental review by FERC and, subsequently, an economically efficient outcome cannot be achieved if FERC discounts or ignores important economic costs and turns a blind eye to energy supply and transmission options that could reduce the waste of land, natural resources, and financial wealth. The analysis presented here, therefore, should be seen and used as a first step to filling a major gap in the information on which to base public decisions about the Eastern System Upgrade.

WORKS CITED

- Adams, D. (2015, December 9). FERC chairman rejects overarching review of pipeline projects. *Roanoke Times*. Retrieved from http://www.roanoke.com/business/news/ferc-chairman-rejects-overarching-review-of-pipeline-projects/article_265b4fe9-610b-554b-9f36-136060d0da66.html
- Albright, H. K. (2011). A Question of Disclosure. *Right of Way*, (March/April), 5.
- Bixuan Sun. (2013). Land use conflict in an iron range community: an econometric analysis of the effect of mining on local real estate values and real estate tax collections (written). University of Minnesota-Morris.
- Bolton, D. R., & Sick, K. A. (1999). Power Lines and Property Values: The Good, the Bad and the Ugly. *The Urban Lawyer*, 31(2). Retrieved from <https://altered-states.net/barry/newsletter143/lawyer.htm>
- Boxall, P., Chan, W., & McMillan, M. (2005). The impact of oil and natural gas facilities on rural residential property values: a spatial hedonic analysis. *Resource and Energy Economics*, 27(2005), 248–269.
- Brooks, S. (2016, August 29). In Win for Environment, Court Recognizes Social Cost of Carbon. Retrieved August 30, 2016, from <http://blogs.edf.org/energyexchange/2016/08/29/in-win-for-environment-court-recognizes-social-cost-of-carbon/>
- Caplan, J. (2016, August 30). Caplan Comment, FERC DOCKET NO.: PF16-3, 20160830-5262(31654426).
- Carazo, J. S. (2015, October 22). Carbon County Tourism Comment, FERC DOCKET NO.: CP15-558-000, 20151023-5034(30974748). Federal Energy Regulatory Commission.
- Catskill Citizens for Safe Energy. (2015, July 7). Proximity of Compressor Station Devalues Homes by as much as 50%. Catskill Citizens for Safe Energy. Retrieved from <http://catskillcitizens.org/learnmore/DEVALUE.pdf>
- Cohen, J. (2015, July 15). Concerns over Milford compressor station. Retrieved December 1, 2016, from <http://www.riverreporter.com/news/4302/2015/07/15/concerns-over-milford-compressor-statio>
- Cohen, J. (2015). Home Sick from Toxic Emissions. Retrieved December 31, 2015, from <http://www.utne.com/environment/home-sick-from-toxic-emissions-zm0z15wzdeh.aspx>
- Concentric Energy Advisors. (2016). Estimated Savings for New York Consumers from the Millennium Pipeline Eastern System Upgrade Project (p. 25). Marlborough, MA: Concentric Energy Advisors for Millennium Pipeline Company, L.L.C. Retrieved from www.ceadvisors.com
- Conway, D. R. (2016, September 1). Debra R. Conway Comment, FERC DOCKET NO.: CP16-486, 20160901-0050(31661973).
- Council on Environmental Quality. (1978). Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. Washington, DC: Executive Office of the President.

- Council on Environmental Quality. (2016, August 1). Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews.
- Day, F. (2015). Principles of Impact Analysis & IMPLAN Applications. Retrieved from http://support.implan.com/index.php?view=download&alias=32-piaia-sample&category_slug=demo-1&option=com_docman&Itemid=1764
- Delaware County Planning Department. (2008). Planning in Delaware County: Agriculture, Agri-Tourism and Delaware County. Retrieved December 9, 2016, from <http://www.delawarecountypanningdept.com/PDFs/Issue3.pdf>
- Diskin, B. A., Friedman, J. P., Peppas, S. C., & Peppas, S. R. (2011). The Effect of Natural Gas Pipelines on Residential Value. *Right of Way*, (January/February), 24–27.
- Federal Energy Regulatory Commission. (2016). Millennium Pipeline Company, L.L.C.; Notice of Intent To Prepare an Environmental Assessment for the Planned Eastern System Upgrade Project, and Request for Comments on Environmental Issues [Docket No. PF16-3-000]. *Federal Register*, 81(98), 31922–24.
- Federal Energy Regulatory Commission. Order Granting Abandonment and Issuing Certificates for National Fuel Gas Supply Corporation and Empire Pipeline, Inc., 158FERC61,145 (2017).
- Ferguson, B. (2015, December 31). Personal Communication, Bruce Ferguson, Catskill Citizens for Safe Energy.
- Fleischman, L., McCabe, D., & Graham, J. (2016). Gasping for breath: an analysis of the health effects from ozone pollution from the oil and gas industry. Clean Air Task Force.
- Freybote, J., & Fruits, E. (2015). Perceived Environmental Risk, Media, and Residential Sales Prices. *Journal of Real Estate Research*, 37(2), 217–244.
- Haynes, R. W., Horne, A. L., & Reyna, N. E. (1997). Economic policy questions. In T. M. Quigley & S. J. Arbelbide (Eds.), *An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins, Volume IV* (Vol. PNW-GTR-405). Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Hibbard, P., Schatzki, T., Aubuchon, C., & Wu, C. (2015). NYISO Capacity Market: Evaluation of Options. Analysis Group. Retrieved from http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/nyiso_capacity_market_evaluation_of_options.pdf
- Hoecker, J. J., Breathitt, L. K., & He'bert Jr., C. L. Certification of New Interstate Natural Gas Pipeline Facilities, 88 FERC, para. 61,227 (1999).
- Hoffman, S. A., & Fortmann, L. (1996). Poverty in forested counties: an analysis based on aid to families with dependent children. In *Sierra Nevada Ecosystem Project: Final report to Congress, vol. II, Assessments and scientific basis for management options*. Davis, CA: University of California, Centers for Water and Wildland Resources.
- Integra Realty Resources. (2016). Pipeline Impact to Property Value and Property Insurability (No. 2016.01) (p. 144). Interstate Natural Gas Association of America (INGAA) Foundation, Inc. Retrieved from <http://www.ingaa.org/PropertyValues.aspx>
- Johnson, J. D., & Rasker, R. (1995). The role of economic and quality of life values in rural business location. *Journal of Rural Studies*, 11(4), 405–416. [https://doi.org/10.1016/0743-0167\(95\)00029-1](https://doi.org/10.1016/0743-0167(95)00029-1)

- Kennedy, K. (2016, January 11). In State of State Address, Gov. Cuomo Can Build on Strong Clean Energy & Climate Policies. Retrieved October 13, 2016, from <https://www.nrdc.org/experts/kit-kennedy/state-state-address-gov-cuomo-can-build-strong-clean-energy-climate-policies>
- Kielisch, K. (2015). Study on the Impact of Natural Gas Transmission Pipelines (p. 28). Forensic Appraisal Group, Ltd.
- Kohler, R. J. (2015, December 17). Cedar Land Farm, Inc. Comment, FERC DOCKET NO.: CP15-558-000, 20151217-5084(31089137). Federal Energy Regulatory Commission.
- Krikelas, A. C. (1992). Why regions grow: A review of research on the economic base model. *Economic Review*, 77(4).
- Low, S. (2004). Regional Asset Indicators: Entrepreneurship Breadth and Depth (The Main Street Economist) (p. 4). Kansas City, Missouri: Federal Reserve Bank of Kansas City. Retrieved from https://www.kansascityfed.org/publicat/mse/MSE_0904.pdf
- Lucas, D. (2015, July 6). Officials To NYS: Take A Second Look At Pipelines. Retrieved July 14, 2015, from <http://wamc.org/post/officials-nys-take-second-look-pipelines>
- Luckett, B., Buppert, G., & Margolis, J. M. (2015, April 28). SELC ACP Comment, FERC DOCKET NO.: PF15-6-000, 20150428-5504(30537222). Southern Environmental Law Center; Appalachian Mountain Advocates; Center for Biological Diversity.
- Macey, G. P., Breech, R., Chernaik, M., Cox, C., Larson, D., Thomas, D., & Carpenter, D. O. (2014). Air concentrations of volatile compounds near oil and gas production: a community-based exploratory study. *Environmental Health*, 13(1), 82. <https://doi.org/10.1186/1476-069X-13-82>
- Metts, S. (2016a, October 4). ESU Spatial Data.
- Metts, S. (2016b). *Neversink River Crossing* [Photo].
- Millennium Pipeline Company, L.L.C. (2016a). Eastern System Upgrade, Draft Resource Report 1: General Project Description (p. 32). Millennium Pipeline Company, L.L.C.
- Millennium Pipeline Company, L.L.C. (2016b). Eastern System Upgrade, Draft Resource Report 5: Socioeconomics (p. 32). Millennium Pipeline Company, L.L.C.
- Millennium Pipeline Company, LLC. (2016d, July 29). Abbreviated Application for a Certificate of Public Convenience and Necessity and Related Authorizations. Federal Energy Regulatory Commission.
- Millennium Pipeline Company, L.L.C. (2016d, December 22). ANSWER OF MILLENNIUM PIPELINE COMPANY, L.L.C. TO COMMENTS ON THE EASTERN SYSTEM UPGRADE PROJECT, FERC DOCKET NO.: CP16-486, 20161222-5549(31858964).
- Millennium Pipeline Company, L.L.C. (2017a, February 9). SUPPLEMENTAL ANSWER OF MILLENNIUM PIPELINE COMPANY, L.L.C. TO COMMENTS ON THE EASTERN SYSTEM UPGRADE PROJECT, FERC DOCKET NO.: CP16-486, 20170209-5083(31959000).
- Millennium Pipeline Company, L.L.C. (2017b, February 10). Supplemental Information – Human Health Risk Assessment Report, FERC DOCKET NO.: CP16-486, 20170210-5174(31962341).
- Millennium Pipeline Route*. Retrieved from <https://www.openstreetmap.org/>
- Morris, J. (2016, April 12). New Study Concludes Getting 50% of NY's Electricity from Renewable Sources by 2030 is a Net Win. Retrieved October 12, 2016, from <https://www.nrdc.org/experts/jackson-morris/new-study-concludes-getting-50-nys-electricity-renewable-sources-2030-net-win>
- Office of Management and Budget. (2015, July). Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas. Retrieved from <https://www.whitehouse.gov/sites/default/files/omb/bulletins/2015/15-01.pdf>

- Orange County Planning Board. (2010). Orange County New York Comprehensive Plan. Retrieved December 2, 2016, from http://www.orangecountygov.com/filestorage/124/1362/1460/10182/Orange_County_Comprehensive_Plan_2010_update.pdf
- Phillips, S., & Wang, S. Z. (2016). Economics of the Eastern System Upgrade: Credible and Complete Estimates of Benefits and Costs are Needed (p. 16). Charlottesville, VA: Key-Log Economics, LLC for Delaware Riverkeeper Network.
- Pipeline and Hazardous Materials Safety Administration. (2016, September). Pipeline Incidents. Retrieved September 13, 2016, from <https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages>
- Pipeline Association for Public Awareness. (2007). Pipeline Emergency Response Guidelines (p. 20). Pipeline Association for Public Awareness. Retrieved from www.pipelineawareness.org
- Pipeline Safety Trust. (2015). Are Old Pipelines Really More Dangerous? Retrieved October 10, 2016, from <http://pstrust.org/wp-content/uploads/2013/03/Incidents-by-age-of-pipes-PST-spring2015-newsletter-excerpt.pdf>
- propertytax101.org. (2016). Property Taxes By State [Data]. Retrieved October 14, 2015, from <http://www.propertytax101.org/>
- Proximity of Compressor Station Devalues Homes by as much as 50%. (2015, July 7). Catskill Citizens for Safe Energy. Retrieved from <http://catskillcitizens.org/learnmore/DEVALUE.pdf>
- Righter, M. (2016, June 10). Righter Comment, FERC DOCKET NO.: PF16-3, 20160610-5097(31508555).
- Robertson, G. (2003). *A Test of the Economic Base Hypothesis in the Small Forest Communities of Southeast Alaska* (General Technical Report No. PNW-GTR-592) (p. 101). USDA Forest Service, Pacific Northwest Research Station. Retrieved from http://www.fs.fed.us/pnw/pubs/pnw_gtr592.pdf
- Rugh, P. (2014, June 23). New York's Silent but Deadly Fracking Problem. Retrieved December 12, 2016, from <https://news.vice.com/article/new-yorks-silent-but-deadly-fracking-problem>
- Smith, S. (2015, September 9). As U.S. rushes to build gas lines, failure rate of new pipes has spiked. Retrieved October 7, 2015, from <https://www.snl.com/InteractiveX/Article.aspx?cdid=A-33791090-11060>
- Southwest Pennsylvania Environmental Health Project. (2015, February 24). Summary on Compressor Stations and Health Impacts. Southwest Pennsylvania Environmental Health Project. Retrieved from <http://www.environmentalhealthproject.org/wp-content/uploads/2012/03/Compressor-station-emissions-and-health-impacts-02.24.2015.pdf>
- Souza, S. J. (2016, November 28). Princeton Hydro, LLC Comment, FERC DOCKET NO.: CP16-486, 20161128-5178(31795719).
- Steinzor, N., Subra, W., & Sumi, L. (2013). Investigating Links between Shale Gas Development and Health Impacts through a Community Survey Project in Pennsylvania. *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, 23(1), 55–83. <https://doi.org/10.2190/NS.23.1.e>
- Stephens, M. J. (2000). A model for sizing High Consequence Areas Associated with Natural Gas Pipelines (Topical Report No. C-FER Report 99068). Edmonton, Alberta: C-FER Technologies. Retrieved from <http://nogaspipeline.org/sites/nogaspipeline.org/files/wysiwyg/docs/c-ferstudy.pdf>
- Subra, W. (2009, December). Health Survey Results of Current and Former DISH/Clark Texas Residents. Earthworks. Retrieved from http://www.earthworksaction.org/files/publications/DishTXHealthSurvey_FINAL_hi.pdf
- Subra, W. (2015, October 3). Toxic Exposure Associated with Shale Development. Subra Company and Earthworks Board.

- Sullivan County Planning and Environmental Management. (2005). Sullivan County 2020 Comprehensive Plan. Retrieved from <http://www.co.sullivan.ny.us/Departments/DepartmentsNZ/PlanningandEnvironmentalManagement/PlansandStudies/SullivanCounty2020ComprehensivePlan/tabid/3236/default.aspx>
- Times Herald-Record. (2016, February 10). Highland board against compressor station. Retrieved December 1, 2016, from <http://www.recordonline.com/article/20160210/NEWS/160219900>
- Tourism Economics. (2016a). The Economic Impact of Tourism in New York: 2015 Calendar Year Catskills Focus. Oxford Economics. Retrieved from <http://explorerocklandny.com/wp-content/uploads/NYSTourism-Impact-Hudson-Valley-2015.pdf>
- Tourism Economics. (2016b). The Economic Impact of Tourism in New York: 2015 Calendar Year Hudson Valley Focus. Oxford Economics. Retrieved from <http://explorerocklandny.com/wp-content/uploads/NYSTourism-Impact-Hudson-Valley-2015.pdf>
- Tourism Economics. (2011). The Economic Impact of Tourism in New York: 2010 Calendar Year Catskills Focus. Retrieved from <http://catskillcitizens.org/learnmore/nystourismimpact-catskills.pdf>
- Tourism Economics. (2011a). The Economic Impact of Tourism in New York: 2010 Calendar Year Hudson Valley Focus. Oxford Economics. Retrieved from <http://www.iloveny.com/includes/content/docs/media/New-York-State-Tourism-Impact-Report-2010-hudson-valley.pdf>
- U.S. Census Bureau. (2015, July 6). TIGER/Line with Data [Data]. Retrieved August 5, 2015, from <http://www.census.gov/geo/maps-data/data/tiger-data.html>
- U.S. Department of Commerce. (2015a). Bureau of Economic Analysis, Regional Economic Accounts as reported in Headwaters Economics' Economic Profile System (headwaterseconomics.org/eps). Retrieved from <http://headwaterseconomics.org/tools/eps-hdt>
- U.S. Department of Commerce. (2015b). Census Bureau, American Community Survey Office, as reported in Headwaters Economics' Economic Profile System (headwaterseconomics.org/eps). Retrieved from <http://headwaterseconomics.org/tools/eps-hdt>
- U.S. EPA. (2016a, May). Greenhouse Gas Equivalencies Calculator [Data & Tools]. Retrieved August 21, 2016, from https://www.epa.gov/sites/production/files/widgets/ghg_calc/calculator.html#results
- U.S. EPA, Climate Change Division. (2016, June 12). Social Cost of Carbon [Overviews & Factsheets,]. Retrieved June 12, 2016, from <https://www3.epa.gov/climatechange/EPAactivities/economics/scc.html>
- U.S. EPA, Office of Environmental Programs. (2016, December 20). Comment letter, U.S. EPA to FERC Re: Mountain Valley Project and Equitrans Expansion Project Draft Environmental Impact Statement; Pennsylvania, West Virginia, and Virginia; September 2016 (FERC Docket Nos. CP16-10-000 and CP16-13-000; CEQ# 2016-0212) Accession number 20161221-5087(31852334). U.S. Environmental Protection Agency.
- Walker, M., & Koplinka-Loehr, S. (2014, July 9). Air Quality and Health Impacts of Milford Compressor Station Expansion. Clean Air Council. Retrieved from http://www.cleanair.org/program/outdoor_air_pollution/shale_gas_infrastructure/milford_compressor_station_air_impacts_commun
- Westlake, K. A. (2016, September). U.S. EPA Comments on the Final Environmental Impact Statement (FEIS) for the Leach Xpress Project and Rayne Xpress Expansion Project, Ohio, Pennsylvania, West Virginia, and Kentucky.

Wilde, L., Loos, C., & Williamson, J. (2012, February 15). Pipelines and Property Values: An Eclectic Review of the Literature. Retrieved October 14, 2016, from http://www.co.medina.oh.us/property_values.pdf

APPENDIX A: KEY-LOG ECONOMICS RESPONSE TO MILLENNIUM LLC AND CONCENTRIC

In this Appendix we provide further details regarding Millennium Pipeline Company LLC's and Concentric Energy Advisors' responses to DRN's earlier review, as summarized on p. 10. We begin with arguments put forth by Millennium, followed by arguments posed by Concentric. Our replies further document the unbalanced analyses prepared to date and presented in documents which focus on purported benefits of the proposed project without adequate consideration of the possible economic costs in and beyond the region.

Millennium Pipeline Company L.L.C.

From *Answer of Millennium Pipeline Company, L.L.C. to Comments on the Eastern System Upgrade Project* (Millennium Pipeline Company, L.L.C., 2016d):

Millennium Assertion 1: "Millennium Has Demonstrated That the ESU Project's Public Benefits Outweigh Any Potential Adverse Impacts" (Millennium Pipeline Company, L.L.C., 2016d, p.1).

Millennium LLC states that, "the Commission should apply the standard set forth in the [Natural Gas Act, or] NGA, in which the Commission determines whether a project is required by the public convenience and necessity pursuant to the criteria set forth in the Certificate Policy Statement. Under the Certificate Policy Statement, the Commission determines that a "need" for a project exists as part of its process of approving the project" (Millennium Pipeline Company, L.L.C., 2016d, p. 2).

They also state, "Because Millennium has demonstrated that the ESU project will have minimal impact upon landowners and the surrounding communities, the Project satisfies the Commission's economic balancing test" (Millennium Pipeline Company, L.L.C., 2016d, p.3).

Millennium is mistaken on both points.

It cannot be said that current procedures are sufficient to establish a need for or public benefit from proposed pipelines. As Commissioner Norman C. Bay noted in his statement attached to *Order Granting Abandonment and Issuing Certificates* in the National Fuel Gas Supply Corporation / Empire Pipeline, Inc. case (2017), in order to respond to increasing public interest in the Commission's work, FERC needs to further explore how it establishes need when completing certificate reviews. Bay notes, "The Commission has largely relied on the extent to which potential shippers have signed precedent agreements for capacity on the proposed pipeline" (Federal Energy Regulatory Commission, 2017). However, the problem with focusing on precedent agreements is that a "variety of other considerations, including, among others: whether the capacity is needed to ensure deliverability to new or existing natural gas-fired generators, whether there is a significant reliability or resiliency benefit; whether the additional capacity promotes competitive markets; whether the precedent agreements are largely signed by affiliates; or whether there is any concern that anticipated markets may fail to materialize" (Federal Energy Regulatory Commission, 2017).

FERC's policies and procedures for evaluating pipeline costs and benefits are not sufficient to ensure a true "economic test" of the merits of any natural gas infrastructure proposal. This is primarily because they rely on applicants overinflated estimates of benefits and ignore important external costs. (Please see "Policy Failure: The Review and Certification of Natural Gas Transmission Projects Discounts External Costs and Inflates Social Benefits" on p. 4 of this report.)

On the second point, and as we have explained in the body of this report as well as in the review to which Millennium responded, the contention that natural gas pipelines and related infrastructure have no effect on landowners is not defensibly argued by Millennium, and there are entire classes of external costs that Millennium has not considered at all.

Millennium Assertion 2: That "[the] Commission should reject DRN's³¹ misplaced suggestion to apply a cost-benefit analysis when evaluating the environmental impact of the Project" (Millennium Pipeline Company, L.L.C., 2016d, p. 2).

First, note that this argument is inconsistent with the first argument, which is that, at least in Millennium's view, the ESU project passes a cost-benefit test. If Millennium believes that cost-benefit analysis of its proposed project is invalid, then it should not also argue, on cost-benefit grounds, for approval of the project.

Second, note that Millennium's argument on this point is in the context of whether or not the National Environmental Policy Act requires FERC (or any agency) to balance or directly compare benefits and costs. It does not, but NEPA does require agencies to consider the effects of their actions on the human environment, and that includes economic effects (40 CFR 1508.8). As the NEPA regulations state "When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment" (40 CFR 1508.14). To make this perfectly clear, economic effects are benefits and costs. So while NEPA does not require that agencies directly compare benefits to costs, or to select an alternative for which benefits outweigh costs, it does require that those economic effects be considered as part of agencies' environmental reviews.

Third, Millennium has advanced their own studies of potential benefits to argue in support of the project.³² The reports ignore the full array of costs the project will inflict. To the extent Millennium wants to argue for a cost benefit analysis to support its project, it must consider the full picture which we help provide.

Rather than arguing, contrary to FERC and NEPA policy as well as its own past communication, that cost and benefit concerns are irrelevant, we would recommend that the applicant support

³¹ Our report *Economics of the Eastern System Upgrade: Credible and Complete Estimates of Benefits and Costs are Needed* (Phillips & Wang, 2016) was filed by DRN. References to DRN should therefore be interchangeable with Key-Log Economics.

³² See *Estimated Savings For New York Consumers From The Millennium Pipeline Eastern System Upgrade Project* (Concentric Energy Advisors, 2016), and *Draft Resource Report 5: Socioeconomics* (Millennium Pipeline Company, LLC, 2016b).

an independent, thorough, and rigorous evaluation of the full range of costs and benefits. Again, and based on our review of the information presented by the applicant to date, we do not believe that such an evaluation has previously been completed.

Our current report attempts to enumerate and quantify *some* of the key external costs likely to attend the construction and operation of the ESU project. We recommend that FERC use this information and/or expand and improve upon this effort.

Millennium Assertion 3: That DRN [Key-Log Economics] agrees that Millennium’s estimated economic benefits of the ESU Project are “substantial” (Millennium Pipeline Company, L.L.C., 2016d, p. 5).

In full, Millennium states, “Despite DRN’s [Key-Log Economics]’ contention that the Concentric Study overestimates the Project’s economic benefits, DRN’s [Key-Log Economics] recognizes that the Project has substantial economic benefits”³³ (Millennium Pipeline Company, L.L.C., 2016d, p. 5). Here, Millennium seems to mistake the enumeration of the ways in which it has overstated the economic benefits of the project with agreement that the [true] benefits are “substantial”. To be clear, we have not claimed that the benefits are *nonexistent*, but rather, and as we have explained previously (Phillips & Wang, 2016) as well as in the current report, there are several reasons to suspect that the benefits will be fewer or smaller than Millennium has claimed. In addition, when compared to the high level of costs the project inflicts, the benefit claims do not appear to be high enough to economically justify the project.

Millennium Assertion 4: “The Commission Should Disregard DRN’s Assertions That the ESU Project Will Adversely Affect Property Values” (Millennium Pipeline Company, L.L.C., 2016d, p. 6).

Millennium states that we have not cited “credible studies or information” regarding our claim that pipelines adversely affect property values in our initial review. Estimation of land price effects was not intended to be a part of that initial review. Our evaluation of the project’s external costs presented in this report however, includes such estimates and we stand behind our method—including use of credible studies and information—for estimating the extent to which the ESU project would affect nearby property values. (See the section titled “Effects on Property Value,” p. 17)

Moreover, in both the initial review and in this report, we described in detail the fundamental flaws in the studies on which Millennium bases its claim that proximity to natural gas infrastructure does not affect property value. To summarize, those studies do not account for the extent to which buyers know that the property they purchased was near a pipeline, and they do not compare prices for properties that are, in any meaningful sense, nearer to, versus farther from, natural gas infrastructure. These flaws render the studies’ results meaningless, and they are simply not credible as the basis for any conclusion regarding the effects of natural gas infrastructure on property value. (See the sections “Effects on Property Value”/ “Studies Concluding That Proximity to Pipelines Do Not Result in Different Property Values Are Not

³³ In the quoted passage, Millennium attributes this contention and recognition to Delaware Riverkeeper Network. They reference page 7 of DRN’s submission to FERC which is in fact in the Key-Log Economics’ report attached to DRN’s letter.

Actually Comparing Prices for Properties That Are Different” (p. 17 and p. 21) of this report for details on the flaws in the studies in question.)

Millennium Assertion 5: That “The Commission Is Not Required to Utilize the Social Cost of Carbon to Evaluate Impacts of Greenhouse Gas Emissions Associated with the Project” (Millennium Pipeline Company, L.L.C., 2016d, p. 9).

In support of this argument, Millennium notes that “the Commission had determined that the social cost of carbon is a useful tool for considering climate benefits of rulemakings and policy alternatives, but not for considering the environmental impacts associated with individual pipeline projects” (Millennium Pipeline Company, L.L.C., 2016d, p. 9) and repeats the components of the Commission’s rationale for this determination. These components and our response are as follows:

1. There is a lack of consensus on the appropriate discount rate.

Key-Log’s response: The debate of what discount rate to use for the evaluation of future effects of public projects and decisions is longstanding, and is not limited to questions about natural gas infrastructure. While it is correct to say that there is not a consensus on what particular discount rate to use, it is spurious in the extreme to suggest that the lack of consensus means that one should not consider the costs to which the (or any) discount rate is applied. The correct way to deal with this is to consider a range of different discount rates and to consider the range of estimates of impact (costs) under different discount rates.

2. The social cost of carbon does not measure actual incremental impacts of a project; and “there are no established criteria for identifying the monetized values that are to be considered significant for NEPA purposes” (Millennium Pipeline Company, L.L.C., 2016d, pp. 9-10).

Key-Log’s response: The social cost of carbon, including upstream environmental impacts of natural gas production, is an important component of the external costs of any pipeline project. The social cost of carbon, is an economically essential component of the adverse impacts that, per FERC’s certification policy, must be considered.

Norman Bay, former Commissioner, in *Order Granting Abandonment and Issuing Certificates* (2017), stated that “the Commission has never conducted a comprehensive study of the environmental consequences of increased production from that region [the Marcellus and Utica]...Even if not required by NEPA, in light of the heightened public interest and in the interests of good government, I believe the Commission should analyze the environmental effects of increased regional gas production from the Marcellus gas production and Utica” (Millennium Pipeline Company, L.L.C., 2016d, pp. 4-5).

Millennium Assertion 6: “DRN Mischaracterizes the ESU Project’s Health Impacts” (Millennium Pipeline Company, L.L.C., 2016d, p. 10).

Millennium states, “DRN incorrectly applies the results of a study conducted on residents living in the vicinity of unconventional oil and gas production sites to population estimates of Sullivan and Delaware Counties” (Millennium Pipeline Company, L.L.C., 2016d, p. 10).

First, the premise of this criticism is incorrect. The studies in question were of people living near compressor stations, not oil and gas production sites. Second, we applied the rates of symptoms from those studies to a subset of the population of Sullivan and Delaware Counties, namely those persons living in Census Blocks within two miles of either the Hancock Compressor Station or the proposed Highland Station.

That said, the question of health effects has not yet been answered in a way that would allow for definitive estimates of the full range of possible health care costs that may ensue if the ESU project is approved. Millennium LLC released a report titled *Supplemental Information-Human Health Risk Assessment Report (2017b)* that uses modeling to evaluate the potential human health risks of possible exposure to air emissions during operation of the proposed compression stations. Results of the risk assessment show there are risks of cancer and other (unspecified “non-cancer”) health effects. Millennium discounts the health findings by asserting that the rate of cancer and other health effects are at levels that are below EPA’s acceptable risk range. For example, the adult cancer risk from exposure to potential emissions from the Hancock Compressor Station would be 6 in 100,000,000 and the EPA’s acceptable risk range is 1 in 10,000 to 1 in 1,000,000 (Millennium Pipeline Company, L.L.C., 2017b, p. 14).

However, and as noted in the body of this report, statistical and anecdotal evidence from areas around operating compressor stations suggest that actual (as opposed to modeled) air emissions exceed allowable levels and that people living closer to compressor stations experience more health symptoms like severe headaches, sleep loss, and others, than people living farther away (Macey et al., 2014; Steinzor, Subra, & Sumi, 2013; Subra, 2015). It is important to note that further epidemiological research would be required to determine the extent to which such effects are the result of exposure to emissions from compressor stations, as opposed to exposure to other factors, including other environmental hazards. Until results of such research is available, however, it is prudent to consider that health effects reported in the vicinity of other natural gas compressor stations could occur in the population living near proposed new and expanded facilities.

Concentric Energy Advisors

Supplemental Answer of Millennium Pipeline Company, L.L.C. to Comments on the Eastern System Upgrade Project (Millennium Pipeline Company, L.L.C., 2017a) includes material prepared by Concentric Energy Advisors, Inc. They raise two key contentions.

Concentric Assertion 1: That “Key-Log-Log’s Claim the Economic Impacts of the ESU project are Overstated is Incorrect” (Millennium Pipeline Company, L.L.C., 2017a).

1. Concentric claims that “using IMPLAN to estimate long-term economic impacts of large projects is a widely-accepted, commonly-used approach” (Millennium Pipeline Company, L.L.C., 2017a, p. 3).

Key-Log Economics does not disagree with the fact that IMPLAN is a widely used input-output model, but we would not agree that this use constitutes a defense of the quality of the model in general, of the applicability of the model to any particular research question, or of the value of any particular results obtained the model as a guide for public policy. To repeat, IMPLAN models a static economy, which assumes that there will be no changes in relative prices, no factor mobility, no change in products or consumers’ tastes and preferences, no regional migration, no changes in technology, and no changes in state and local tax laws – to name a few – during the years of the project operation considered. However, economies are constantly in flux, affected by policies, decisions made in businesses and households, and environmental factors.

Concentric should explicitly acknowledge the limitations associated with the use of 2014 IMPLAN data for future, multi-year impacts and the interpretation of model results. This includes stating what information would be needed to improve model predictions. For example, in order to project what a given economy will look like even five years from now, one would need to predict future demand for goods and services, the impact of new technologies on the production of goods and services, and the local availability of resources to meet that demand (Day, 2015).

2. Concentric asserts Key-Log’s claim of overstated economic benefits during construction is incorrect (Millennium Pipeline Company, L.L.C., 2017a, p. 3).

Key-Log Economics acknowledges and thanks Concentric for the clarification that they did not assume that the total cost of construction was injected into the economy four separate times over a four-year period. However, Concentric’s report only indicates that construction expenses would be approximately \$275 million—it does not provide a year-by-year breakdown—and it is therefore not possible for the reader to know how that figure was used within IMPLAN to estimate total constructions impacts. It would have been helpful if Concentric had included a table in their report showing annual construction activities and costs, especially as they vary from year to year (Concentric Energy Advisors, 2016). Specifically, how were the construction costs presented in Millennium’s *Abbreviated Application for a Certificate of Public Convenience and Necessity* (comprising \$41 million for Measuring and Regulation: \$41 million, \$114 million for Compressor, and \$120 million for Pipeline) (Millennium Pipeline Company, L.L.C., 2016c, Exhibit K) allocated each year during the construction period?

We remain concerned that the construction period assumed by Concentric is inconsistent with the construction period stated in documents previously filed with

FERC (which are also conflicting). In *Resource Report 1: General Project Description (2016a)*, Millennium states the construction period is one year (Millennium Pipeline Company, L.L.C., 2016a). In their *Abbreviated Application for a Certificate of Public Convenience and Necessity*, Millennium, “affirms that it had begun to incur capital expenditures for the Project” in December 2015 with a targeted in-service date of September 2018 (Millennium Pipeline Company, L.L.C., 2016c, p. 11), a period of at least two years. If the activities Concentric is including in “construction” differ from those that are described as “construction” in Resource Reports, such a distinction should be clarified to allay confusion to readers of Project documents.

3. Concentric Energy Advisors, Inc., state “Key-Log’s claim that Concentric’s economic benefits are overestimated by using the entire state of New York as the study region is without basis” (Millennium Pipeline Company, L.L.C., 2017, p. 6).

Concentric states that their study “analyzed the State of New York as the study area because the purpose of the study was to calculate and demonstrate the Project benefits to the State of New York” (Millennium L.L.C., 2017, p. 3). But this circular logic does not provide any reason the state is the correct level for analysis. While state-level impacts may be of interest to some, Concentric has not followed IMPLAN guidance regarding study region definition. IMPLAN documentation states, “The Study Area defines the boundaries of what will be included in the calculation of *local* impacts” (Day, 2015, p. 9; emphasis added). This geographic zone, “should include the region where the original impact occurs, the region of large suppliers whose impact should be included, and the location where most of the industry’s workers live and spend their earnings” (Day, 2015, p. 8). Based on this guidance from IMPLAN itself and on information provided in ESU project documents indicate that Delaware, Sullivan, and Rockland Counties would comprise the correct study region. The following statements related to the ESU support this four county study region:

- “...The economic benefits generated from the construction of the ESU project are largely expected to be realized in the areas where the infrastructure upgrades to the Millennium pipeline system are being undertaken (i.e., Delaware, Sullivan, Orange, and Rockland Counties), as Millennium intends to rely on local contractors, union labor, and construction materials wherever possible” (Concentric Energy Advisors, March 2016, p. 19).
- “[T]he socioeconomic effect area for the Project focuses on Orange, Delaware, Sullivan and Rockland Counties...” (Millennium Pipeline Company, L.L.C., 2016b, p. 5-2)
- These counties are identified as “Project Counties” and “Project Area” in *Resource Report 1: General Project Description* and *Resource Report 5: Socioeconomics* (Millennium Pipeline Company, L.L.C., 2016a and 2016b).
- Workforce estimates presented in Table 5-A8, “Summary of Estimated Construction Workforce and Payroll for the Project” of *Resource Report 5:*

Socioeconomics for Orange, Sullivan, Delaware and Rockland Counties are described as hired “locally” (Millennium Pipeline Company, L.L.C., 2016b, p. 33).

- *Resource Report 5: Socioeconomics* states, “Approximately 60 percent of the construction workforce for the Huguenot Loop and 40 percent of the construction workforce for the aboveground facilities will be from the impacted and nearby surrounding areas” (Millennium Pipeline Company, L.L.C., 2016b, p. 5-6).

Concentric Assertion 2: That “Key-Log’s Claim the Energy Market Savings may be Overstated is Incorrect” (Millennium Pipeline Company, L.L.C., 2017a, p. 7).

1. Concentric Energy Advisors, Inc., state “the effect of Millennium’s alleged guaranteed rate of return on its investment in the ESU project is irrelevant to benefits to New York” (Millennium Pipeline Company, L.L.C., 2017, p. 7).

Key-Log Economics expressed concern that overestimates in the estimated benefit to New York electric utility customers from increased natural gas supplies resulted from Concentric’s failure to consider costs of the pipeline construction, including a rate of return. Millennium responded that New York ratepayers will not bear the costs of the Project because none of the ESU Project shippers directly provide service to New York customers (Millennium Pipeline Company, L.L.C., 2017a, p. 4). By estimating the benefits to New York consumers as a result of increased natural gas supply without considering the corresponding costs that will be borne by people other than New York consumers, Millennium has provided incomplete and unbalanced information regarding the net benefits to ALL consumers from the ESU Project.

With regard to the rate of return, Key-Log Economics acknowledges and thanks Concentric for clarifying that, “since the ESU project shippers elected negotiated rates for transportation on the ESU project, they will not be subject to Millennium’s cost-based recourse rates” (Concentric Energy Advisors, 2016, p. 7). While we understand, “there are no guarantees that Millennium, or any other natural gas pipeline, will fully recover their costs and earn a specified rate of return” (p. 8), Millennium expects its pre-tax 11.51% rate of return included in their *Abbreviated Application for a Certificate of Public Convenience and Necessity* (Millennium Pipeline L.L.C., 2016c, Exhibit N) to be realized since revenues from negotiated rates are estimated to exceed the cost of service: “As shown on Schedule 1, Line 9, the negotiated contract rates agreed to by Millennium and the Project Shippers for service on the Eastern System Upgrade Project, together with the anticipated revenues from the sale of the currently unsubscribed capacity, will generate reservation rate revenues that are greater than the Eastern System Upgrade Project cost of service by \$51,524 in year 1, and sufficiently cover the cost of the project over the 15-year primary term of the contract.”

2. Projected increases in renewable generation are not likely to significantly affect the energy market savings from the ESU project.

Concentric (2016, p. 12) states, “It is expected that the addition of the capacity associated with the ESU Project will result in lower natural gas prices than otherwise would be experienced...” based on their use of GPCM, a partial equilibrium model of the North American natural gas market which assumes perfect competition. There are a number of other factors influencing the natural gas market and prices however, and these should be acknowledged by Concentric in a discussion of the limitations of the modeling approach and results. These include additional sources of natural gas, such as new supplies from other natural gas pipeline expansions (U.S. Energy Information Administration, 2016); NYISO’s status as a net importer of electricity from other regional transmission organizations (Hibbard, Schatzki, Aubuchon, & Wu, 2015); and factors that affect demand, such as weather, state demand management programs and federal/state incentives. Furthermore it remains likely that generation of electricity from nonconventional and renewable energy sources will increasingly affect energy prices in the future - especially given New York’s commitment to achieve 50% of its electricity from renewable sources by 2030 (Morris, 2016; Kennedy, 2016). Furthermore, a recent article in *The Economist* describing the increasing growth rate of wind and solar energy notes that the more renewable energy is deployed, the more it lowers the price of power from any source (The Economist, 2017).