

Reason for Caution: Mountain Valley Pipeline Economic Studies Overestimate Benefits, Downplay Costs

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Summary of Key Findings

Upon review of EQT-commissioned studies of the economic effects of the Mountain Valley Pipeline, we conclude that the studies overstate benefits to local communities. As importantly, we find that even a more careful and modest assessment of benefits is inadequate to meet the information needs of decision-makers and citizens: a full accounting of the likely costs (negative economic effects) must be developed, and its results must be compared to more realistic estimates of benefits.

- MVP studies over-estimate “Construction Benefits” to the MVP region.
 - The chosen modeling technique and choice of region for analysis result in overestimates of regional benefit.
 - Most construction jobs will be filled by non-residents, further depressing the local economic impact.
- MVP studies overestimate total employment effects of pipeline operation and maintenance.
 - The studies’ modeling approach is unreliable for predicting multiplier effects more than one year into the future. Only direct operation/maintenance jobs should be counted as long-term effects.
- MVP studies overestimate benefits from fuel switching.
 - The studies do not demonstrate how much, if any, fuel switching would actually occur.
 - Estimated benefits for Franklin County, Virginia seem so unlikely given potential demand that they should be removed entirely.
 - The studies do not account for how future increases in gas prices and gas price volatility would affect either the likelihood of fuel switching in the first place or the long-run magnitude of any benefits from switching that still might occur.
 - The studies ignore energy conservation and/or renewables as additional alternatives to which would-be gas users could switch.
- MVP studies overstate financial benefits to local governments.
 - Estimated revenue increases are tied to fuel switching that may not occur.
 - Any actual increases in tax revenue will fade over time.
 - Studies ignore potential reduction in net tax revenue due to changes in property values.
 - Studies ignore likely increases in local public service costs and fail to present estimates of net effects on local government finances.
- FERC, elected officials, citizens and businesses need to consider costs, not just benefits.
 - Benefits estimates alone do not provide sufficient information to support a decision to permit the Mountain Valley Pipeline.
 - A full accounting for the following costs is needed.
 - Lost ecosystem services, such as water quality, flood control, wildlife habitat and aesthetic value
 - Higher community service costs, including disaster preparedness, social services, and road maintenance
 - Reduced property values as safety risks, lost views and other factors are reflected in market prices
 - Diminished economic development opportunities if MVP-oriented land uses impair or impede existing opportunities.

Details related to these five issues comprise the remainder of this report.

Background and Policy Setting

The Mountain Valley Pipeline, proposed to carry natural gas some 294 miles from Wetzel County, West Virginia to the Transcontinental compressor station in Pittsylvania County, Virginia, has been described as necessary both to meet growing demand for natural gas and, by providing a cheaper alternative to other fuels, to support economic growth in the counties along its proposed route (see map). EQT corporation and Mountain Valley Pipeline LLC (“MVP LLC”)¹, including through FTI consulting, have developed estimates of selected economic effects of the proposed pipeline (Ditzel, Fisher, and Chakrabarti 2014b; Ditzel, Fisher, and Chakrabarti 2014a; “Resource Report 5: Socioeconomics (Draft)” 2015).

Estimates of the possible economic benefit of the MVP matter because they bear on the review of direct and cumulative environmental effects, which by law include economic effects, that the Federal Energy Regulatory Commission (FERC) must complete before issuing a “Certificate of Public Convenience and Necessity,” or in the vernacular, permitting the pipeline to be built and operated. This review is governed both by FERC’s own procedures and, ultimately, by the National Environmental Policy Act (Council on Environmental Quality 1978).

Economic benefit estimates also matter because they have been cited by political leaders and others as support for the notion that constructing and operating the pipeline will inevitably enhance economic well-being in Virginia and West Virginia (Petska 2015). This is an understandable concern, but as with the formal pipeline review and approval process, citizens and their public servants need to know more about the full range of economic effects—that is costs as well as benefits—before deciding whether the MVP will improve the lives and livelihoods of people living in the region it would traverse.

To advance the public discourse and ensure that citizens and decision makers have a more complete and correct picture of the economic effects of the MVP proposal, a consortium of non-profit organizations, community groups and concerned citizens in West Virginia and Virginia have asked Key-Log Economics, a Charlottesville-based consultancy, to review the three reports referenced above and to evaluate their claims of economic benefit from the MVP. This review is not the full picture either, but with it, we do sketch questions that FERC and others need to ask and answer as part of the official review.

Problems with Economic Impact and Benefit Estimates

Two studies by FTI Consulting, “Economic Benefits of the Mountain Valley Pipeline Project in Virginia,” and “Economic Benefits of the Mountain Valley Pipeline Project in West Virginia” (Ditzel, Fisher, and Chakrabarti

**Mountain Valley Pipeline:
Counties Included in FTI Studies**



¹ The Mountain Valley Pipeline would be built and operated by Mountain Valley Pipeline LLC, a joint venture between EQT Corporation, who commissioned the studies reviewed here, NextEra Energy, Inc., WGL Holdings, Inc., and Vega Energy Partners, Ltd. In this review, “MVP LLC” refers to this joint venture, and “MVP” refers to the pipeline itself.

2014b; Ditzel, Fisher, and Chakrabarti 2014a) (“The FTI studies”) estimate economic impacts and benefits in four areas:

- Economic impacts resulting from spending on the construction of the pipeline;
- Economic impacts due to the ongoing operation and maintenance of the pipeline;
- Energy cost savings for energy users who switch to newly available natural gas; and
- Taxes paid to county governments.

The FTI studies employ methods and either make, or fail to examine, assumptions in the use of those methods that lead to overstatement of each of these benefits. Benefits during construction are overestimated due to inherent issues with the models used and the choice of the size of the study region. For the three latter areas, long-term benefits are overestimated due in part due to the choice of empirical methods and in part due to overly optimistic assumptions about whether and to what extent the MVP would induce firms, institutions and households to switch to natural gas from other fuels. Because they relate to the long-term impacts, it is the latter three sets of estimates where the FTI studies raise the most serious questions about the accuracy and value of the results.

The first problem related to long-term estimates is that input-output analysis is inappropriately used to estimate long-term impacts, resulting in bloated estimates of jobs “created” by the ongoing operation and maintenance of the MVP. The second problem is that estimates of the benefits from fuel switching are likely to be very sensitive to assumptions about how likely it is that the MVP would cause firms to decide to switch, a decision that itself would be very sensitive to expectations about the level and volatility of future natural gas prices. The FTI studies neither explain their assumptions about those decisions nor include any sensitivity analysis related to price levels and volatility. By assuming that firms and others who hypothetically could use gas actually would begin to do so because of the MVP, and by assuming that cost advantages of natural gas relative to other energy prices will persist and be stable, the authors overestimate the benefits from fuel switching.

The third major problem is that tax revenue projections do not appear to have taken downside financial risk into account. Namely, what will happen to ad valorem tax revenues when the shale gas prices rise, when existing or other proposed pipeline capacity eats into MVP’s market share, or when, inevitably, shale gas becomes too expensive to extract and transport? To the extent that the MVP would affect private property value, resulting reductions in property taxes must be netted out of projected increases in ad valorem taxes to provide an accurate picture of how the MVP will affect local government revenue. As importantly, likely increases in local government costs should be subtracted from projected net changes in revenue to provide county governments with information about how the MVP would affect their bottom line.

We address each of these problems in turn.

MVP LLC’s studies overestimate short-term impacts of MVP construction.

The FTI studies’ estimates of economic impacts resulting from spending on the construction of the pipeline suffer from inherent problems with input-output analysis, for which FTI used the IMPLAN data and modeling software. Input-output models are so-named because they purport to translate an exogenous change in the economy—that is, the “input,” which in this case is spending required to construct the proposed MVP—into “outputs,” which are spending by firms that MVP LLC would hire to build the pipeline, spending by firms that those firms would hire, and so on, plus spending by the households whose labor the various firms would hire. The spending by MVP LLC in this case would be a “direct” effect. Spending by the other firms would be the “indirect effects.” Spending by those households would be the “induced effects.” The ratio of the sum of all three effects to the direct effect is called the “multiplier.”

While intuitively satisfying, empirical input-output models like IMPLAN are built on a very restrictive set of assumptions about how those spending/hiring decisions are made. (See also the box on page 5.) Namely, the models assume that decisions are made the way they have always been made. Even though firms and people in the real world will adjust and innovate when faced with a new situation, firms and people in the input-output model will just do what they have always done. And since innovation tends toward cost minimization, using input-output models as a proxy for real-world decision-making tends to overestimate a firms' spending and results in overestimates of "multiplier effects" (Hoffman and Fortmann 1996). What that means in this case is that construction of the MVP will not involve as much indirect and induced spending, or create as many indirect and induced jobs, in the real world as the output from FTI's run of the IMPLAN model suggests.

Another caution—and another reason FTI's estimates of construction impacts are likely inflated—is that FTI chose to use the entire states of Virginia and West Virginia as regions for analysis. Regional economic impact depends on the degree to which direct, indirect and induced spending can occur within the study region. The bigger the region, the more likely it is that you can find a firm in the region from which to buy materials or services, and the more likely it becomes that one could hire labor from someone living inside the region. In other words, the larger the region, the larger the multiplier effect.² The FTI studies do not present a rationale for the choice of entire states as the study regions. While the appropriate regions might be somewhat larger than the 10 West Virginia and 5 Virginia counties the proposed MVP would cross, they should not consist of the entirety of both states.³ Consequently, the estimated multiplier effects and the benefits during construction, as presented in the FTI studies, are further overstated.

One final note regarding estimates of benefits during construction is that only 10% of the construction jobs would be filled by local workers. This estimate comes from MVP LLC's Draft Resource Report 5 and would relate the number of "direct" jobs included in the total jobs estimates in the FTI studies. (It is unclear whether the definition of "local" in Draft Resource Report 5 is as expansive as the state-wide regions considered by FTI.) With 90% of workers coming from outside the affected region, a lot less of workers' spending will occur inside the region. Unless accounted for in the use of IMPLAN—and FTI presents no information to suggest that it has accounted for the non-localness of construction workers—estimated multiplier effects will be inflated.

MVP LLC's studies overestimate employment impacts of MVP operation and maintenance.

The FTI studies use input-output modeling ("the IMPLAN framework") to project both short-term impacts from the construction of the pipeline and long-term or on-going impacts from the operation and maintenance (O&M) of the pipeline (Ditzel, Fisher, and Chakrabarti 2014a, 8; Ditzel, Fisher, and Chakrabarti 2014b, 11). While the former is generally reasonable (but see the cautions noted above), the latter is inappropriate. Briefly, input-output modeling is not suited for long-term economic impact assessment, and it has been empirically shown to be unreliable for that purpose. (See details in box on page 4.)

Using IMPLAN, the FTI studies project just 88 jobs across the two states (34 in Virginia and 54 in West Virginia) from the long-run operation and maintenance of the proposed MVP. The Draft Resource Report 5, on the other hand estimates, 25 "direct" O&M jobs for the long-run. This latter estimate seems reasonable, or at least it is in

² This result, and cautions about defining the right-sized region, are summarized in Hjerpe and Kim (2007).

³ To give a simple example for why this is so, consider this scenario: A nonresident construction worker fills his gas tank in Blacksburg. The station's owner, a Blacksburg resident, later spends a portion of her income on dinner out while vacationing in Virginia Beach. In FTI's estimation, the expenditure on that meal is a benefit of the construction activity, because the spending occurs in the Commonwealth. But a regional impact analysis with a more thoughtfully drawn study region boundary would identify that expenditure as a "leakage" of dollars from the true impact area to another region. The cost of the meal would correctly be ascribed to the attractiveness of Virginia Beach as a vacation destination. It would not be ascribed to the construction a pipeline in the New River Valley.

line with similar estimates for the Atlantic Coast Pipeline, also under FERC review (Chmura Economics & Analytics 2014). The difference of 63 jobs is generated by the IMPLAN model's "multiplier effect." They comprise "indirect" employment, or jobs in companies providing materials and services needed for operation and maintenance of the MVP, and "induced" jobs, which are jobs supported when the people with the direct and indirect jobs spend their pay at grocery stores, at the doctor, or for other local goods and services.

To ascribe these indirect and induced jobs to the MVP as the cause of that employment in the long-term is to assume that the workers in those indirect and induced jobs would otherwise be idle. Such an assumption is not realistic: idle workers in the real world typically re-train or re-locate to take already open jobs, or they create new employment opportunities for themselves. Those 63 jobs, in other words, will most likely exist *somewhere*

MVP Studies Misapply Input-Output Analysis to Ongoing Operations

The reports by FTI Consulting take an "economic base" approach to estimate economic impacts of the MVP during its construction phase, which is reasonable, and for the indefinite operation and maintenance phase, which is not. As Haynes et al. (1997) note:

Where the economic base approach gets into trouble is when it is used inappropriately as a tool for planning or predicting impacts of greater than one year in duration; a snapshot of current conditions tells little about the form a region's future economy may take.

The reason for this caution is that economic base theory and empirical input-output models grounded in that theory (e.g., the IMPLAN model used in the FTI reports) assume a static economy. In such an economy, there are no changes in relative prices, no input substitution or technological change in the production processes, no labor mobility, no change in products or consumers' tastes and preferences, no regional migration, and no changes in state and local tax laws—to name a few. The constant technology assumption, for example, prevents firms from using cost-savings innovations, forcing them to be inefficient, and the result is higher multiplier effects than are actually experienced (Hoffmann and Fortmann 1996).

Ironically, the assumption of no changes in relative prices and no input substitution, if applied consistently throughout the FTI studies, would also mean that the estimated "direct-use benefits" resulting from fuel switching to natural gas would be zero. (Fuel-switching is input substitution, and the addition of natural gas to the range of fuel choices is, in effect, a change in relative prices. If those changes cannot occur, they can produce no benefits.)

Due to these restrictive assumptions, economic base models have a dismal track record when it comes to predicting economic growth in the real world and in the long run. (The "long run" is more than a year into the future, when firm can change technology, prices can adjust, and people can change what they want to buy.) In a review of 23 studies, Krikelas (1991) compared predictions of the economic base model against the actual experience of the subject regions and found only 4 studies where the models correctly predicted longer run economic growth. Similarly, Robertson (2003) tested predictions from input-output models against actual experience in 15 communities in Southeast Alaska (a region in which many of the restrictive assumptions of economic base theory might actually apply). He found that initial economic stimulus does not "cause changes in economic activity serving local demand for the average community.... The implications of these results [are that] secondary economic impacts [i.e., "multiplier effects"] cannot be taken as a foregone conclusion in policy analysis" (p. iii).

In the case of the MVP, long-run job estimates based on such multiplier effects are highly suspect and should not be included among the long-run economic impacts of the pipeline.

with or without the direct MVP jobs. Operation of the pipeline, in other words, would no more create those jobs than it would form the methane pumped through it.

It may seem trivial to worry about whether 63 jobs are imaginary in a two-state region with more than 5.8 million full- and part-time jobs (Headwaters Economics 2015; U.S. Bureau of Economic Analysis 2015). Some of those 63 jobs, however, would have to be imagined in smaller communities where one or two jobs can make a big difference. It is all the more important, therefore, to avoid over-stating long-term impacts and over-promising economic benefits from the pipeline.

The MVP would no more create those additional 63 jobs than it would create the methane pumped through it.

MVP studies overstate benefits from fuel switching.

The FTI report estimates ongoing savings (and economic benefit) of \$5.6 million per year for the five Virginia counties and \$1.6 million per year for the ten West Virginia counties. All of the estimated savings in West Virginia would come from conversion of school and county/municipal fleet vehicles to natural gas (Ditzel, Fisher, and Chakrabarti 2014b, 3–5). In Virginia, the savings come from conversion of fleet vehicles, fuel switching by residential, commercial and municipal energy customers in Giles, Montgomery, Roanoke and Pittsylvania counties, which have natural gas now, and from the establishment of natural gas service in Franklin County (Ditzel, Fisher, and Chakrabarti 2014a, 3–4).

With the extension of natural gas accessibility to Franklin county representing \$2.58 million—nearly half—of the estimated fuel-switching benefits for Virginia, it is important to consider just how likely the installation of the necessary infrastructure might be. As the authors themselves note, “...the minimum demand level for an economic interconnection is approximately 1 billion cubic feet (1,000 MMSCF) annually” (Ditzel, Fisher, and Chakrabarti 2014a, 19). Their estimated demand potential in the county, however, is just 297.2 MMSCF, or about 30% of the economic threshold. The authors suggest that investors may choose to establish such an interconnection anyway, but they do not explain what would cause such a striking departure from the one-billion-CF-per-year rule of thumb.

Thus, the estimated long-term economic benefits of the MVP are driven by fuel-switching, but almost half of the fuel-switching in Virginia is assumed to happen under on a set of circumstances in a single county that are unlikely to occur. The effect of fuel-switching in Franklin County should not be included in the benefit tally. The total expected value of fuel switching benefits in Virginia (before considerations listed below) would therefore be \$3.1 million per year—that is, the amount projected for the Virginia counties that already have some access to natural gas.

The reason for that billion-CF-per-year threshold, of course, is that the high fixed costs of establishing the interconnection must be spread over a large enough cumulative supply of (and demand for) gas that the market price per CF falls to within reach of individual customers. A

Unless demand for natural gas in Franklin County turns out to be more than three times the estimated level, nearly half of the estimated benefits from fuel-switching in Virginia would never materialize.

similar dynamic applies to smaller-scale decisions about switching to natural gas. Homeowners need to determine whether to purchase or convert to a gas furnace. Municipal governments and public institutions need to consider whether or how fast to replace their fleet vehicles. And manufactures need to decide if converting a

process from electric to gas heat is worth the up-front investment. The FTI studies do take such private fixed costs into account, and the benefit estimates reflect costs savings net of those investments.

The studies do not, however, explain or provide information that makes it possible to evaluate their assumptions regarding the level of fuel switching in any of the 15 counties. The authors reference their review of “press statements...interviews with private and public entities in the counties and states, and [interviews with] local distribution companies and municipal agencies to gauge the fuel switching and manufacturing expansion potential in the counties” (Ditzel, Fisher, and Chakrabarti 2014a, 8; Ditzel, Fisher, and Chakrabarti 2014b, 9). The studies also include lists of manufacturing firms in selected counties in the study region (see Table 7 in each report). The implication is that the listed firms represent potential fuel switchers. That implication, however, needs to be documented with information regarding the probability that each of the listed firms would switch to natural gas, when each would make the switch, and whether the switch would be complete or would cover just some portion of the firm’s fuel consumption.

The Virginia report lists the AEP Glen Lyn facility, which shut down this May, among the potential future natural gas customers. This suggests at a minimum that FTI’s estimates of potential fuel switching are in need of a downward revision. It would also seem prudent to revisit the estimates of potential natural gas demand from the other listed firms to see if their plans might have changed in the nine months since the studies’ publication. Much more could change for these firms before the proposed MVP would come online, and any estimate of benefits from fuel switching should be tempered by an assessment of the risk that the switching may never occur.

The studies also err in their unstated but obvious assumption that fuel switching to natural gas will continue to provide an advantage in terms of *variable* costs in the mid- to long run. The fuel switching decision, after all, is as simple as deciding whether differences in the price of inputs (say gas versus oil), will be large enough to justify the investment in changing equipment, storage facilities, and processes to enable the future use of gas instead of the more expensive fuel. If the price advantage of gas is expected to persist long enough to recoup the up-front investment and longer term financing costs, then fuel switching could make sense. But if the price difference is expected to erode over time, fewer energy users would convert to natural gas.

Natural gas prices are almost guaranteed to increase significantly in the future. One reason is that even though the boom in unconventional natural gas is just a few years old and some worry about what to do with the “glut” of gas in regions like the Marcellus Shale (McMullen 2015), the industry is already experiencing the so-called “Red Queen Syndrome.” This refers to the need to drill more and more wells (all of which are expensive) just to maintain a level of production sufficient to attract new investment. (The syndrome is so named from *Through the Looking Glass*, in which the Red Queen tells Alice that “It takes all the running you can do to stay in the same place.”)

This is a matter of the geological reality that, once hydrofracturing has begun, shale gas “diffuses and becomes impossible to extract without drilling costly new wells” (Engdahl 2013), coupled with the financial reality that returns for early investors are sometimes supported by investments by later investors. Regardless of whether branding this arrangement a “Ponzi scheme” is fair, there will come a time when returns on existing wells are not supported by the gas they produce. Investment, rig count and production will drop; prices will rise. (Gies 2015; McGraw 2015; Powers and Shaefer 2015).

In addition, natural gas development tends to target the most productive plays first, and the next increment of production will be more expensive to achieve. Added to the financial and geological forces driving the Red Queen Syndrome, this means that gas will become less abundant, more expensive, or both. As the *Wall Street*

Journal reported in June, the rate of increase in gas supplies is slowing, the glut is becoming less severe, and prices are rising (Puko 2015).

The prospect of large increases in liquefied natural gas exports are another reason to discount estimates of future direct-use benefits of gas carried by the MVP. A 2013 analysis by Charles River Associates warns that under a high export scenario domestic natural gas prices could triple, resulting in particularly detrimental effects on the manufacturing and power generation sectors (Ditzel, Plewes, and Broxson 2013). As the authors note, the inexorable logic of supply and demand does indeed apply to the natural gas market: “[their analysis shows that] higher rates of natural gas demand are not sustainable without significantly higher natural gas prices” (p. 8).

Volatility in natural gas prices, even without an increase in the average level of those prices, can have a similar effect on fuel-switching behavior. Risk averse consumers, business owners, or municipal and commercial facilities managers would have to realize average costs savings plus a bit more—a “risk premium”—to make their variable, or risky, cost savings feel the same as stable cost savings.

It seems clear that both rising prices and increased volatility are more matters of “when” than “if.” The U.S. Energy Information Administration projects that natural gas prices will rise 2.3 times as fast as the next most expensive form of energy (oil) and more than 4.6 times as fast as the cheapest (electricity) between now and 2040 (US Energy Information Administration 2015). In light of such long-term projections, it seems reasonable that enthusiasm for making large investments in facilities and equipment that run on gas rather than other forms of energy would be dampened.

If the gap between the price of natural gas and the price of other fuels were to narrow sooner, that dampening would be even more pronounced. Powers and Shaefer interpret current data from the Marcellus and other gas-producing regions as indications that we are close to “peak gas,” with declines in production and increases in price to follow (Powers and Shaefer 2015). With rig counts dropping and unit production costs exceeding prices, they conclude:

Unless it is different this time (and it never is), the greatly reduced gas and oil rig counts will result in lower production and higher prices in both the short and long term.

Lastly, it is not just declining production that will be the source of extreme volatility in coming months—rising demand will help push the US natural gas market to extremes. With the retirement of between 25 and 50 GW of coal fired power plants that will largely be replaced by gas-fired plants, and the opening of dozens of chemical and fertilizer plants—sharply rising natural gas prices over the next two years is virtually guaranteed.

Increasing demand at a time of falling production will radically change the landscape of gas market despite the widely held belief that today’s status quo of low prices will continue.

Rising gas prices would of course be good for the owners of rights to gas and for the drillers and energy services companies that extract the gas. But higher prices would not be good for the end users on whose fuel-switching behavior FTI’s estimates of long-run benefit depend. Again, if these potential customers are economically rational, they will take the expected future increases and volatility in gas prices into account, and at least some of them will refrain from making that all-important fuel switching decision.

Neither volatility in natural gas prices nor the likely erosion of the cost advantages of natural gas were incorporated into the FTI studies’ estimates of benefits stemming from fuel switching. This could and should have been accomplished by adding a risk premium to the price of natural gas (and to competing energy sources, as appropriate) and/or by running different scenarios for varying levels of cost savings for natural gas relative to

other fuels. Such an approach would have made the estimates more realistic and useful for public discourse and decision-making.

It is worth noting that the FTI studies do not consider that there are other energy sources, including conservation and renewables, to which would-be gas customers could otherwise switch. A firm considering a switch away from conventional electricity could install solar panels and continue to use existing electrically-powered equipment rather than having to converting to gas-using versions. Homeowners could add insulation, upgrade to more energy efficient appliances, and install solar panels of their own. Such conversions to (or additions of) renewables to one's energy use also require up-front or fixed costs, but the ongoing cost savings would be less subject to the risk of increases in price of solar energy, which of course will remain free. Conversion to renewables might or might not be the preferred course for those firms, homeowners, and others who the studies assume will switch to natural gas, but by ignoring this obvious possibility, the studies further inflate their estimates of potential benefits of switching to gas.

One final caution on the topic of fuel switching is that the study seems to rely heavily on the story of the Celanese manufacturing facility in Giles County, Virginia as an archetype for what could happen if the MVP were to be built. Celanese decided in 2012 to convert its coal-fired boilers to natural gas to reduce pollution and increase efficiency. But Celanese made its decision to convert to gas without the presence or even the prospect of the Mountain Valley Pipeline. It is possible that there are further Celanese-style success stories waiting in the wings to take advantage of the proposed MVP. But just like Celanese, some of those potential converts to natural gas could make the switch without the MVP. In other words, at least some of the benefits from fuel switching that the FTI studies ascribe to the MVP could well happen using the infrastructure already in place. The cost savings associated with such cases should therefore not be counted as part of the benefits promised by the MVP.

MVP studies overstate expected tax revenues while ignoring public service costs.

In the FTI studies, tax revenues for local government are projected using a capitalized income approach. In this approach, net income for MVP LLC is estimated from its projected revenue and "...a set of proxy assumptions for operational and maintenance costs, selling, general, and administrative costs, cost of capital, debt/equity ratio, construction and long-term interest rates, and depreciation method and period" (Ditzel, Fisher, and Chakrabarti 2014a, 8; Ditzel, Fisher, and Chakrabarti 2014b, 8). Missing from this list of assumptions, however, is any consideration of risk or uncertainty regarding natural gas prices (see above) or other market factors that could reduce the capitalized income and therefore local tax revenue.

One important risk is that the MVP could turn out to be unnecessary. The US Department of Energy projects only a modest need for additional interstate pipeline capacity to meet demand from electric power generators (US Department of Energy 2015). New pipelines are one way to address that need, of course, and MVP is but one of several proposed for the Marcellus region. Other competition will come from increased capacity from the upgrade of existing lines, and more will come as one-way lines are converted to handle bi-directional flow. Each of these would erode MVP's potential market share. The less need there is for the MVP, the lower will be both its net revenue and its tax payments to local governments.

Another risk is related to the price volatility and long-term price trends already discussed. Volatility in the short run and increasing prices in the long run would reduce the quantity of gas demanded by end users. Less demand by end users means less need for transmission, and again, lower revenue for MVP and local governments.

Furthermore, there is no indication in the FTI studies that there would ever be any end to the stream of estimated tax revenue. But gas is a nonrenewable resource that will become economically and/or technically

impossible to recover long before the methane itself is used up. When there is no more gas to transmit from the Marcellus, there will be no more capitalized income, and the stream of revenue will evaporate. Whether revenues from the MVP will last 5, 10 or 30 years, local governments would be right to discount the projected level of revenue to account for both year-by-year variation in annual tax revenue and for the limit to the number of years during which there will be any revenue at all.

The question of public service costs and reduced property value are included in the following section. But briefly, it is at least possible that the construction and ongoing operation of the proposed MVP will negatively affect property values. Exposure to the risk of injury and death, limitations on the productivity of farm and forestland, and impaired vistas that might otherwise be enjoyed by landowners farther away could all reduce the market value of properties in the region. Property tax revenues would fall as well, leaving local governments with the choice of raising tax rates (which would have its own negative impact on market prices)⁴, or cutting local services in order to balance their budgets.

The latter of these options would be particularly challenging, because the MVP, if built, would add to the cost side of local governments' budgets. As just one example, the potential for pipeline explosions means that local governments all along the route will need to increase the number and training level of their first responders, purchase equipment, develop and keep updated emergency response and evacuation plans, and otherwise be prepared 24/7/365 for mass casualty events. Such considerations make it clear that the promise of new revenue alone is much less than county and municipal governments need to know before deciding whether the MVP presents a net gain for their citizens.

FERC, the Public, and Individuals must Consider Benefits AND Costs

In any other context, it would seem too obvious to point out that it is the net benefits, or benefits minus costs, that should bear on a public decision like permitting the MVP. And yet apart from the private costs of investments in infrastructure, equipment, or processes needed to accomplish fuel switching, the studies considered here largely ignore the public and external costs that would attend the construction, operation, and presence of the MVP. This nearly exclusive focus on benefits means, at a minimum, that the jury is still out on whether the MVP is good or bad, at least economically, for the citizens and communities it will affect in West Virginia and Virginia.

Arguably, consideration of the public or external costs of the MVP should be thoroughly covered in FERC's Environmental Impact Statement. MVP LLC's final version of Resource Report 5 (available now in draft form) should also provide information on these costs. To date, MVP LLC offers only vague assurances that the proposed MVP would impose no or only minor costs on agriculture, recreation, and other economic activities. It also claims that there would be no impact on property values (based on what is in our view a selective review of the literature on the subject) and that increases in community service costs would be minor and would occur only during the construction phase ("Resource Report 5: Socioeconomics (Draft)" 2015, 5–24ff). The draft promises more substantive treatment of these issues in the final version of Resource Report 5 to be submitted with its filing with FERC.

In the meantime, other entities, including local governments, citizen groups, and businesses would be wise to conduct their own independent assessment of these costs to better ensure that all of the relevant information can be brought to bear on the permitting decision. A short list of the relevant vectors by which the MVP would impose costs include the following:

⁴ Phillips (2004) is one example of empirical research demonstrating that property values increase with proximity to protected areas (that preserve viewsheds and other values) and decrease with higher tax rates.

1. **Lost Ecosystem Services.** The first vector is the effect of natural gas transmission on the environment and the echoes of that effect in the well-being of people in and beyond the region. From the construction phase, through years of operation (with and without potential leaks, explosions and other accidents), and on to eventual obsolescence and decommissioning, the MVP will alter the ecosystems it crosses. Surface and subsurface disturbance, alteration of watercourses, impacts on groundwater, fragmentation of habitat, visual blight, creation of travel corridors for invasive species, lost timber production, and other changes are all likely (and many are certain) effects of the MVP. Each of these effects will alter the capacity of the landscape to provide so-called “ecosystem services” – that is, “the benefits to people supplied by nature” (Reid et al. 2005; USDA Forest Service 2012). These benefits include: water to drink or as a resource for farms, vineyards, breweries, and distilleries; scenic amenities and recreational opportunities for residents and visitors; fiber production; nutritional and cultural value enjoyed by hunters and anglers; and protection from injury and property loss. These ecosystem services all have tangible value to people and are true economics assets that can be valued in monetary terms. Each will be diminished by the construction, operation and presence of the MVP, with concerns for water quality (due to a loss of erosion control) and air quality (due to emissions from compressor stations overwhelming ecosystems capacity to absorb pollutants) being particularly acute concerns.
2. **Higher Community Services Costs.** Like communities impacted by the shale gas boom itself, communities along the pipeline can expect a wave of impacts as transient workers come and go, roads are damaged by extra and extra heavy traffic, and as people suffer increases in physical and mental illnesses including asthma, depression, anxiety and others triggered by exposure to airborne pollutants, noise, and emotional, economic, and other stress. See, for example, Ferrar et al. (2013), Healy (2013), Fuller (2007), Campoy (2012), and Mufson (2012). While the shale gas boom and related “downstream” development is so new that definitive studies have not been completed, these and other reports do raise important questions about the impact of rapid expansion of natural gas on physical, mental, social, and fiscal health of people and communities. Some 90% of the workers who will build the MVP will be transient, with little connection to local communities (“Resource Report 5: Socioeconomics (Draft)” 2015). As the experience of communities in the Bakken and other parts of the Marcellus indicate, off-hours behavior of transient, temporary workers can increase needs for law enforcement, social services, drug abuse treatment, and other services. All of these add to the local costs, and added tax revenues or other fees paid by energy companies might or might not cover the added bills.
3. **Reduced Property Values.** The third vector of cost is more localized and well-understood: pipeline corridors and all gas transmission infrastructure entails the transfer of at least some portion of current landowners’ property to the gas industry. Landowners are typically paid some estimate of fair market value for the acreage directly occupied by rights of way and the infrastructure itself. But that acreage is typically a small fraction of the total area on which property value will decline. Properties within the earshot, blast radius, leak plume, and other physical contact with pipeline right-of-way and compressor stations will obviously suffer the greatest losses. Properties farther away that become less desirable, and therefore less marketable, because of impaired views or reduced enjoyment of recreation and other ecosystem services will lose value as well. While current legal precedent may require only that owners of property taken and physically occupied by natural gas infrastructure be compensated, economic efficiency demands that the full reduction in the value of all properties be considered and weighed against the estimated benefits of the MVP.

We are aware that the Commission has previously held that natural gas pipelines have, at most, an ambiguous and non-permanent effect on property values. In its Final EIS regarding the Constitution Pipeline,

for example, the Commission cited two articles that conclude, respectively and in brief, that effects on property value from the presence of a pipeline can be either positive or negative (Diskin et al. 2011) and that a negative effect on property values due to a pipeline explosion diminishes over time (Hansen, Benson, and Hagen 2006). Neither of these studies is definitive for the Mountain Valley Pipeline.

For a number of reasons, the Commission must look beyond these studies to make an adequate examination of the impact of new, large, high-pressure natural gas transmission lines and associated infrastructure (e.g., compressor stations) on property values. One reason is that the subjects of those studies differ from the MVP scenario in some important ways, including the setting, uses, and age of the pipelines. Another is that the Diskin et al. article uses methods that are simply inadequate for the purpose of discerning the effect of a pipeline among the many factors that influence the value of a given piece of property. In addition, the subject of that study was a second pipeline installed in residential areas already home to a natural gas pipeline. Thus, the residents experienced little change in their exposure to physical danger, visual blight or other impacts. The impact of the first pipeline, in other words, would already have been capitalized into property values by the time the second pipeline was installed. One would therefore expect the incremental impacts of going from one pipeline to two pipelines to be relatively small compared to going from no pipeline to one pipeline. The latter would obviously be the situation for much of the proposed MVP route.

The subject of the second study was a liquid petroleum pipeline which may present different risk and other impacts than a high-pressure gas pipeline such as the proposed MVP. More importantly, the study focused not on the construction of a new pipeline but on the explosion of an existing one. Using more robust methods, Hansen, Bensen and Hagen did find a significant price effect after the explosion, but the effect did decay over time (2006).

We do not dispute these findings, but we would caution that the effects of the construction of the MVP could be quite different. One reason is the rapidly evolving means by which real estate transactions are formed. The information and tools available to homebuyers have changed dramatically in the nine years since the publication of the Hansen study, and they have changed radically since the explosion in 1999 that triggered the (temporary) drop in land prices its authors discovered. It is quite possible in that case that the rebound of prices occurred due to a lack of readily available information about the explosion to later purchasers. People buying a home in the years following the 1999 explosion could not query Zillow to see the history of land prices near the pipeline, nor could they explore online maps to see what “locally undesirable land uses” exist near homes they might consider buying. Nor did they have access to YouTube and repeated opportunities to find and view news stories, citizens’ video, etc. describing and depicting the explosion and its aftermath.

It is not that no such information existed—prospective buyers could always have consulted paper records kept by the local government agencies to learn the sales history, and they could have researched the neighborhood using older techniques. But internet-based tools have certainly changed the ways people shop for homes. We are now in a real world much closer to the competitive economic model that assumes that all buyers have full information about the homes they might buy. Even the proverbial space alien landing on earth with an eye toward buying property near the proposed MVP corridor would quickly learn that the property is in fact near the corridor, that there is a danger that the property could be adversely affected by still-pending project approval, and that fossil fuel pipelines and related infrastructure have an alarming history of negative health and environmental effects. Accordingly, the price that s/he (or any human) would offer for a home near the MVP will be lower than the price offered for one farther away or in

another community or region entirely.

Reductions in real estate value are not merely hypothetical. Landowners and realtors along the proposed route of the Atlantic Coast Pipeline in central Virginia report that buyers have backed out of contracts and that other buyers are simply less interested in potentially affected properties (Smith 2015).⁵ In a more systematic review Kielisch (2015) provides evidence that natural gas pipelines negatively affect property values in a wide range of settings. In one of his reported studies, more than 60% of would-be buyers would not purchase properties that are exposed to the life safety and other risks associated with natural gas pipelines. The would-be buyers who stay in the market would pay 21% less for properties exposed to such risks, even when informed that the probability associated with those risks is small.

Naturally, any reduction in property values would have implications for local public finance. Property tax revenues could drop, and local governments may need to raise property tax rates to meet budget obligations. This effect would be even more pressing if local public service costs rise while property tax revenues fall.

4. **Diminished Economic Development Opportunity.** Fourth and finally are the effects that the MVP could have on the region's existing economic development opportunities. The Virginia counties in the path of the MVP, for example, have been experiencing lower unemployment (at 3.4%), much faster population growth, and faster personal income growth than the average for non-metro Virginia. Non-labor income (consisting primarily of investment income and age-related transfer payments) is growing very quickly: it has increased by 43% since 2000, while income from wages and salaries increased by just 4.3% over the same period (Headwaters Economics 2015; U.S. Bureau of Economic Analysis 2015).

In similar fashion, the 10 West Virginia counties compare well to the average of the non-metro portion of the state. Population is declining overall, but it is declining more slowly in the 10-counties the MVP is proposed to cross. The unemployment rate is slightly lower, but employment has grown by more than twice as much (7.2% versus 3.1%) across the 10 counties than it has in the whole of non-metro West Virginia (Headwaters Economics 2015; U.S. Bureau of Economic Analysis 2015).

While such simple comparisons are not definitive (see below regarding FTI's comparison of Harrison and Webster County, West Virginia), they do beg the question of whether new natural gas infrastructure is necessary to support appropriate and sustainable economic development in this region. Indeed the trends noted above could well characterize a region that is capitalizing on its attractiveness to tourists, retirees, vacation homeowners, and footloose entrepreneurs in diverse industries. It could be taking advantage of what Mcgranahan, Wohan and Lambert call the "Rural Growth Trifecta" of outdoor amenities, a creative class of workers, and the right entrepreneurial context (innovation-friendliness) (2010).

In contrast to an older demand-side view of economic development in which jobs are created in a place and then people go to where the jobs are, an evolved supply-side understanding puts amenities and people first. Niemi and Whitelaw explain this in this way:

As in the rest of the Nation, natural-resource amenities exert an influence on the location, structure, and rate of economic growth in the southern Appalachians. This influence occurs through the so-

⁵ FERC's docket for the pre-filing phase of the Atlantic Coast Pipeline (PF15-6) is rife with testimony from landowners concerned that their property will be, or already has been, negatively affected by the mere possibility of that pipeline's construction.

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, 54).

Further explanation and empirical results related to the importance of amenities, rather than resource extraction or incentives to attract industrial development, can be found in Knapp and Graves (1989), Power (1996), Rosenberger and English (2005), and Nzaku and Bukenya (2005), to name a few. In light of these findings, statistics from the cash economy, such as differences in wages between high-amenity and heavily industrialized areas make perfect sense: people do trade off cash income for quality of life. They receive what Niemi and Whitelaw call a "second paycheck" in health, recreational access and other values, that compensates for the income they give up by not moving to a less desirable location (1999, 18).⁶

Natural gas development and operations can upset the economic apple cart in these communities by reducing quality of life. The likely result is that recent investments in appropriate economic development will not perform as hoped, and further development along the same lines will be discouraged. Workers, businesses and retirees who might otherwise choose to locate in communities near those operations will opt instead for locations that retain more of their rural character, pastoral landscapes, and quality of life.

We note that the FTI studies do address this issue somewhat, but it is done in a very selective and potentially misleading way. Table 4 of the West Virginia report presents a side-by-side comparison of selected infrastructure and economic performance indicators for Harrison and Webster Counties. The two counties differ in several respects reflected in the table, including that Harrison County has natural gas access while Webster does not. The authors stated conclusion is that "counties with extensive infrastructure access (rail, water, electricity, natural gas, interstates, broadband, etc.) are simply provided more opportunities to grow their economy" (Ditzel, Fisher, and Chakrabarti 2014b, 15). Setting aside debates over whether "growth" per se, as opposed to development, is what people living in those counties need or want, there are few economists who would dispute this conclusion.

Where the authors err is in the clear implication (given the topic and focus of the report) that it is access to natural gas infrastructure that makes a critical difference. No economist would draw this conclusion based on the evidence presented, and no reader of the report should be led to believe that it is Harrison County's access to natural gas that makes it have lower unemployment, for example, than Webster County.

Harrison is different than Webster in other important ways, including proximity to a regional airport, a population density ten times that of Webster, and a higher percentage of adults who have completed high school or college ("American FactFinder" 2015; "The National Map: Transportation" 2015). Any one of these and other factors (or a combination of them) could be much more important. Once other factors are considered, it could even be the case that natural gas access has no effect at all. Relevant information bearing on this question could easily be obtained through multiple regression analysis, but the authors do not attempt, or at least have not reported, such information.⁷

Even a broader descriptive analysis would shed more light on the question of whether natural gas pipelines and access to natural gas might influence economic development. Greenbrier County is one of the few West Virginia counties currently free of major natural gas infrastructure and, according to the FTI study,

⁶ See also Roback (1982; 1988) for earlier statistical analysis of this phenomenon.

⁷ The regional development literature is rife with models and examples for how such analyses can be performed and what tends most to influence economic growth. See Rasker et al. (2004), and Rosenberger and English (2005) as examples of the application of these models to rural areas with varying degrees of infrastructure and amenity access, along with other relevant factors.

Greenbrier County has “significantly lower” natural gas usage than in the rest of the state (Ditzel, Fisher, and Chakrabarti 2014b, 38). Even so, and among the 10 West Virginia counties proposed for the MVP, Greenbrier County’s employment and personal income growth since 1970 (60.9% and 128.3%, respectively) are second only to those of Doddridge County (80.3% and 140.3%). While one might take this as evidence that the shale gas boom (in Doddridge) trumps Greenbrier’s amenities as an engine of economic growth, consider Harrison and Wetzel Counties, Doddridge’s neighbors that are also in heart of the shale boom. Both counties lost population from 1970 to 2013 (Doddridge and Greenbrier gained people), and their growth in employment and personal income were far slower than Greenbrier’s (Headwaters Economics 2015; U.S. Bureau of Economic Analysis 2015).

Do these data prove that shale gas extraction or a surfeit of gas transmission infrastructure prevents economic development? Of course not, but neither does FTI’s presentation show, let alone prove, that natural gas causes economic development. Further study is warranted, and FERC should ensure that these questions are addressed seriously and thoroughly in its deliberations.

These external market and non-market costs of the proposed MVP are not side issues or mere niceties. They are crucial to the question of whether or not a new natural gas transmission pipeline would truly bring net benefits and serve the economic interests of the region and its constituent communities. Economic efficiency, not to mention sound public policy, require that decisions about the MVP be made with the best possible information about the total economic costs the pipeline would impose, alongside better information about the potential benefits than has been developed and presented by MVP LLC to date.

Conclusions and Recommendations

Given the cautions and considerations outlined above, we believe that the information presented to date regarding the economic effects of the proposed Mountain Valley Pipeline is both inaccurate for, and inadequate to, the task of informing public decisions about whether the MVP should or should not be permitted, built, and operated. Correcting these issues would require, at a minimum, the following actions:

- Revisit and revise estimates of the construction benefits using a right-sized study region.
- Adjust benefit estimates by considering only the direct effects (not indirect and induced effects) of operation and maintenance of the MVP.
- Remove Franklin County from estimates of direct benefits from fuel switching in Virginia.
- Conduct a rigorous sensitivity analysis to determine the extent to which fuel-switching benefits would occur with smaller price differentials between gas and other fuels and due to volatility of natural gas prices.
- Include conservation and renewables in the mix of alternatives against which potential fuel switchers would compare their current energy mix and/or an energy mix with added natural gas potential.
- Discount long-term property tax revenue projections to account for market-driven risk to ad valorem revenue and for reductions in private property value.
- Net public service costs out of projected changes in local tax revenue.
- Complete a thorough and rigorous evaluation of the full economic costs of the Mountain Valley Pipeline.

It is impossible to say at this point what the net effect, positive or negative, of the MVP would be. We can be certain, however, that more careful estimates of expected benefits would be lower than those presented by MVP LLC via the FTI studies to date. We can also be certain that the costs—that is, the negative economic impacts—of the proposed MVP (if constructed) will be higher than zero, which is the level stated or implied by the studies reviewed here. Further, stronger, and more comprehensive research is needed to determine how well more realistic estimates of benefits compare with the likely costs.

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