Economic Impacts of Completing the Dakota Access Pipeline

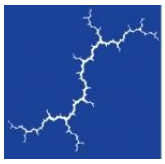
February 1, 2017

AUTHORS

Frank Ackerman, PhD
Pat Knight

Based on research performed for Fredericks Peebles & Morgan LLP, attorneys for the Cheyenne River Sioux.

The authors bear sole responsibility for this report, which does not necessarily represent the views of Fredericks Peebles & Morgan or the Cheyenne River Sioux.



Synapse
Energy Economics, Inc.

485 Massachusetts Avenue, Suite 2
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

EXECUTIVE SUMMARY

The Dakota Access pipeline, proposed in 2014, was designed to carry crude oil from the Bakken oil field in western North Dakota, through South Dakota and Iowa, to a pipeline hub in southern Illinois. The final stages of construction, not yet completed, have become the subject of a wide-ranging controversy involving multiple environmental, legal, cultural, and economic issues.

This document addresses one dimension of the controversy: the economic impacts of completing the Dakota Access pipeline. The principal conclusions, in brief, are:

1. The Dakota Access pipeline was planned in early 2014, when the price of oil was around $100 per barrel and production was steadily rising. Recent oil prices of $45 to $55 per barrel are below many estimates of the breakeven price for Bakken crude production. Bakken production, and transport of oil from the Midwest to the East Coast, have declined sharply since the end of 2014. These trends reduce the value of the pipeline and raise questions about the need for additional pipeline capacity.
2. Energy Transfer Partners (ETP), the developer of the Dakota Access pipeline, faces financial uncertainty and potential weakness. A planned $2 billion investment in the pipeline by other companies has been at least postponed, and could be cancelled. Since the pipeline was not in operation by the end of 2016, commitments from potential customers could be renegotiated or even cancelled. ETP's stock price has slumped to about half of its 2014 peak.
3. A study done for ETP projected relatively large one-time benefits from construction of the Dakota Access pipeline. Since the pipeline was reportedly 92 percent complete as of December 2016, most of the projected benefits of construction have already occurred. Completion of the pipeline would lead to only the remaining 8 percent of the estimated benefits of construction—a one-time gain of about 2,600 job-years and $400 million of income. Some accounts suggest that it is much more than 92 percent complete; if, for instance, it is 98 percent complete, the remaining gains would be about 650 job-years and $100 million of income.
4. The post-construction benefits of pipeline operation and maintenance are extremely small, amounting to less than 0.002 percent of annual employment and output in the four affected states—and less than 0.02 percent in North Dakota, where the Dakota Access pipeline plays the largest role in the state economy.
5. The largest post-construction economic benefit to the host states is the pipeline's contribution to state and local taxes. The same ETP study projected total tax payments of about $55 million per year, or 0.06 percent of total state and local taxes in the four-state region. The projected tax revenues (almost entirely property taxes) are based on 2014 estimates of the value of the pipeline, and could decline if the value of the pipeline turns out to be lower than originally expected.
6. There are hidden costs to completion and operation of the pipeline, including risks of costly accidents. If the Dakota Access pipeline operated year-round at full capacity, and matched the U.S. average for oil pipeline accidents, there would be accidental releases of 4,000 barrels of oil and total accident-related costs of $15 million *every year*. Worst-case accidents can be much more expensive than this, with major pipeline spills— some in the same states as Dakota Access—causing $60 to $90 million in cleanup costs and leaving private property unusable for years.

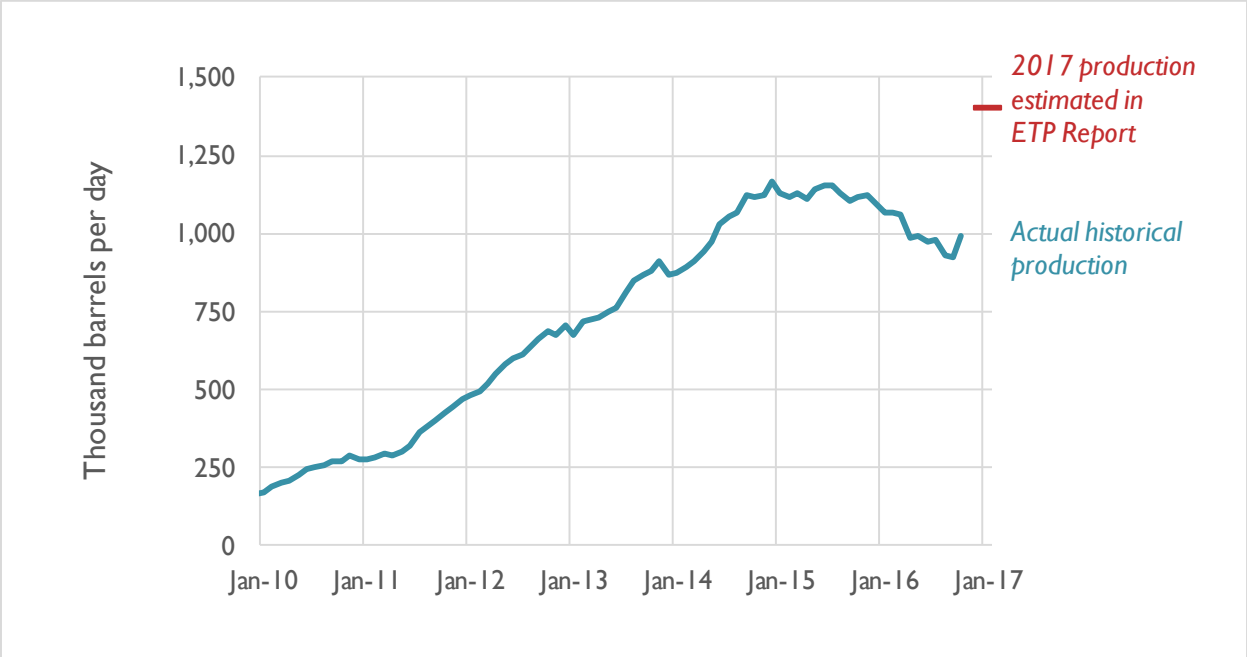
CONTENTS

1. Is North Dakota oil past its peak?

1.1. Evidence of the slump

The Dakota Access pipeline was proposed in early 2014, at a time when North Dakota oil production had been surging upward (see Figure 1), and oil prices had been hovering around $90 to $100 per barrel for several years (see Figure 2, next page). A 2014 study prepared for Energy Transfer Partners, the pipeline developer, said that "oil production in the area [was] expected to increase to more than 1.4 million barrels per day by 2017," showing the need for additional transportation capacity.[1]

Figure 1. Bakken (North Dakota) oil production, 2010 to present



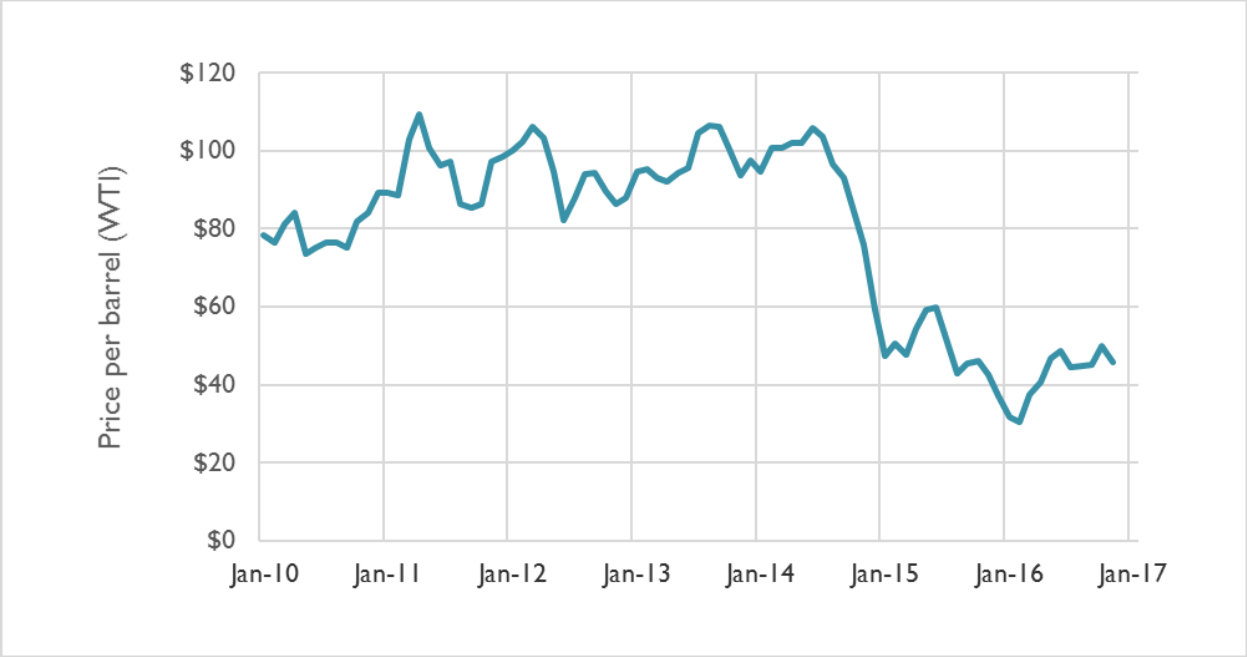
Source: https://www.dmr.nd.gov/oilgas/stats/historicalbakkenoilstats.pdf.

Yet as the graphs demonstrate, both North Dakota oil production and prices have fallen in the last few years. Bakken oil production reached an all-time peak of 1.16 million barrels per day in December 2014, and has been below 1.0 million barrels per day since April 2016. The price of oil plunged in the second half of 2014, and remained below $60 per barrel for throughout 2015 and 2016. With large drops in the

[1] Siegelman, Harvey, Mike Lipsman, and Dan Otto. 2014. "An Assessment of the Economic and Fiscal Impacts of the Dakota Access Pipeline in North Dakota, South Dakota, Iowa and Illinois." Prepared for Dakota Access LLC, a subsidiary of Energy Transfer Partners, by Strategic Economics Group. Available at: http://nobakken.com/wp-content/uploads/2015/01/ETP-Report.pdf. Quote from page 4.

volume and the price of oil, the value of additional pipeline capacity is much lower than projected at the peak of the boom in 2014.

Figure 2. Oil prices (West Texas Intermediate), 2010 to present



Source: http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=A.

One of the indicators of the need for a new pipeline, as seen in 2014, was the shortage of rail transportation capacity. Yet as the federal Energy Information Administration (EIA) has reported, movements of crude oil by rail were down 45 percent in early 2016, compared to the same period in 2015; decreased rail shipments of oil from the Midwest (including North Dakota) to the East Coast accounted for about half the decline.[2] In October 2014, near the peak of production, 60 percent of oil shipments from North Dakota left the state by rail; by September 2016, only 29 percent of North Dakota oil shipments went by rail.[3] As Lynn Helms, head of the North Dakota Department of Mineral Resources, reportedly said, "As production has declined, [Dakota Access] is a little less critical."[4]

For the first nine months of 2016, the total volume of crude oil shipments, by tanker, pipeline, barge and rail, from the Midwest to the East Coast was down 52 percent from the same period in 2015, as shown

---

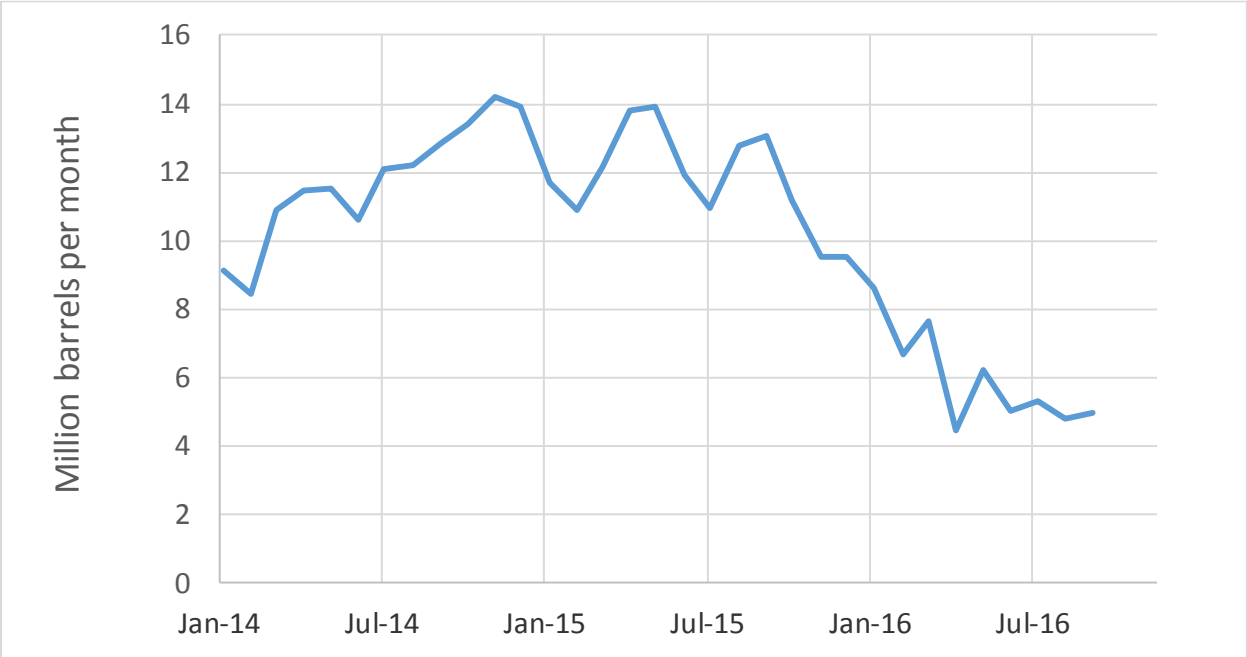
[2] U.S. Energy Information Administration (EIA). 2016. "Crude-by-rail volumes to the East Coast are declining." *Today in Energy*. August 3. Available at: http://www.eia.gov/todayinenergy/detail.php?id=27352.

[3] Hughlett, Mike. 2016. "Dakota Access pipeline delay hurts developer, not necessarily N.D. oil producers." *Minneapolis Star Tribune*. December 10. Available at: http://www.startribune.com/dakota-access-pipeline-delay-hurts-developer-not-necessarily-n-d-oil-producers/405685586.

[4] As reported in Hughlett, 2016.

in Figure 3. A small change in the relative prices of U.S. vs. imported crude led many East Coast refineries to switch to imports, emphasizing the unpredictability of demand for oil pipeline capacity.

Figure 3. Crude oil shipments from Midwest to East Coast, 2014 to present



Source: Crude oil movements by all modes of transport from PADD 2 (Midwest, including North Dakota) to PADD 1 (East Coast), http://www.eia.gov/dnav/pet/pet_move_ptb_a_EPC0_TNR_mbbl_m.htm.

1.2. The breakeven price for Bakken oil production

Some industry sources claim that the breakeven price for Bakken oil production is as low as $30 per barrel. But numerous independent analyses have found that prices of $60 or more are needed to make North Dakota oil production profitable. An analysis by one industry consulting group finds that the Bakken oil field is the most expensive major onshore producing area in the lower 48 states, requiring a breakeven price above $60 per barrel.[5] Another study reaches a similar conclusion, estimating a breakeven price of $67 for Bakken oil, compared to $51–$60 for other major producing areas.[6] In November 2015, one oil industry analyst found that only 1 percent of the Bakken area and 4 percent of the wells drilled since 2000 could break even at then-current prices of about $48 per barrel. At that

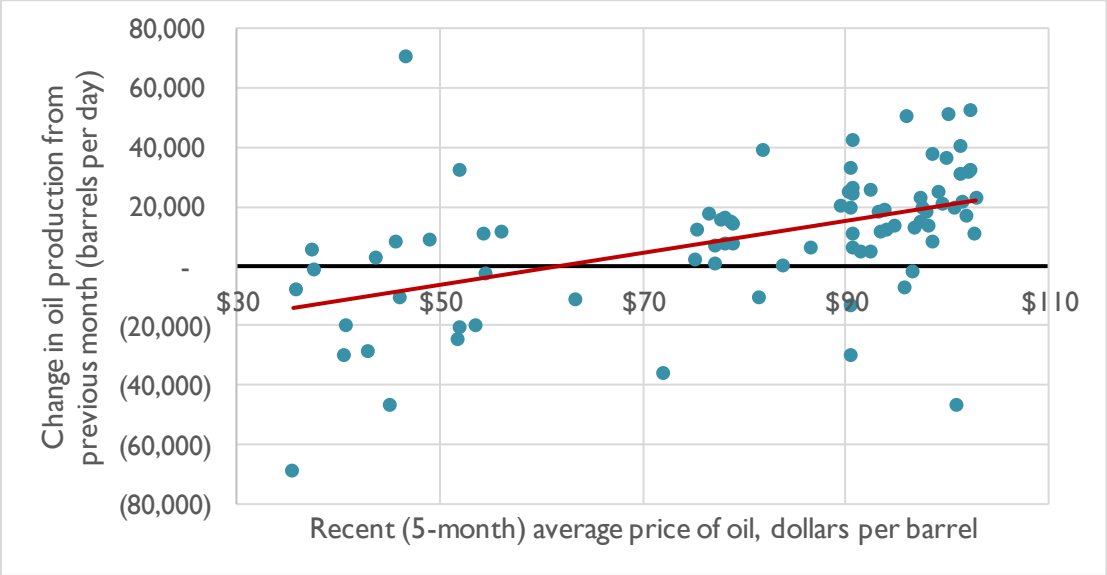
[5] KLR Group. 2016. "The Dynamic and Global Oil & Gas Industry: Next Steps for 2016 & 2017." Available at: http://www.theoilandservicesconference.com/downloads-2016/KLR-Group.pdf.

[6] http://www.oilandgas360.com/median-breakeven-price-oil-55-per-barrel-gas-3-50-per-mcfe-klr/

price, the analyst concluded, "The leading producing companies evaluated in this study are losing $11 to $38 on each barrel of oil that they produce…"[7]

To examine this issue in greater depth, we performed our own statistical analysis, comparing the monthly change in Bakken oil production to an average of recent oil prices. We found a strong relationship, as shown in Figure 4.[8] Our analysis implies that, on average, North Dakota oil production is rising when the price of oil is above $61.50 per barrel and falling when the price is lower than that.

Figure 4. Change in North Dakota oil production versus price, 2010–2016



Sources: See Figure 1 and Figure 2, Data are for January 2010 through October 2016.

Note: The vertical axis shows the one-month change in Bakken oil production. The horizontal axis shows the five-month unweighted average of WTI oil prices.

The price of oil has been below $60 per barrel since December 2014, so it is not surprising that North Dakota production has continued to decline. North Dakota's proved reserves of oil—that is, resources that can be extracted with current technology and prices—dropped by 838 million barrels from 2014 to 2015, due to the fall in price.[9]

[7] http://www.artberman.com/only-1-of-the-bakken-play-breaks-even-at-current-oil-prices/

[8] If y is the one-month change in production, in barrels per day and x is the five-month average WTI oil price, we found y = 541.28x – 33318.8 (n = 82, r^2 = 0.243, and the t statistic on the slope is 5.1). For a point representing May data, y is the change in production from April to May, while x is the average price for January to May – and similarly for other months.

[9] EIA. 2016. "U.S. oil and natural gas proved reserves declined in 2015 because of lower prices." *Today in Energy*. December 15. Available at: http://www.eia.gov/todayinenergy/detail.php?id=29172.

None of this bodes well for the value of, or the need for, the Dakota Access pipeline. With reduced production volumes, existing oil transportation capacity may be more than adequate. Thus, a new pipeline might have to lower its prices to win customers away from other carriers. And each barrel that could be carried by the pipeline is now worth about half as much as in early 2014.

2. FINANCIAL UNCERTAINTY SURROUNDING ETP

Energy Transfer Partners (ETP), the developer of the Dakota Access pipeline, has bet heavily on its ability to complete the pipeline—and on the profitability of the pipeline once in operation. Since ETP has not yet won this bet, there is continuing uncertainty about the company's financial prospects. Its stock price, as seen in Figure 5, has roughly paralleled the movement in oil production and prices seen in Figures Figure 1 and Figure 2: ETP stock peaked at about the same time as Bakken oil production, and is now around half of its peak level.

Figure 5. ETP stock price, 2012 to present

Source: http://finance.yahoo.com.

In August 2016, a joint venture of Enbridge Energy Partners and Marathon Petroleum announced plans to buy 37 percent of the Dakota Access pipeline for $2 billion. The original agreement gave them until December 31, 2016 to make a final commitment to the purchase. But in late December, amid continuing uncertainty about the pipeline, Enbridge and Marathon extended the deadline, giving themselves until

March 31, 2017 to decide whether to terminate the agreement, or to go through with it.[10] The purchase would result in a major infusion of cash into ETP; the extended deadline means at least a delay, and a continued risk of cancellation, of that payment. ETP's parent company, Energy Transfer Equity (ETE), has $1.2 billion in debt maturing in 2017, far in excess of its available cash.[11] Both ETP and ETE will be under serious financial pressure if Enbridge and Marathon ultimately decline to purchase a substantial share of the Dakota Access pipeline.

Another financial concern for ETP involves commitments from its potential customers, again with a missed deadline at the end of 2016. Dakota Access signed contracts with customers for most of the pipeline's capacity, at a time of higher prices and predicted oil production. These contracts included clauses allowing renegotiation if the pipeline did not begin operation by January 1, 2017. Now that that date has passed, the customers could in theory demand to renegotiate their contracts, or could end their commitments to Dakota Access.[12] (ETP has challenged this account. However, it has also made contradictory statements on the subject, which are difficult for outsiders to evaluate.)[13]

Contracts renegotiated in 2017 are likely to be much less favorable to ETP due to declining prices and volumes, as well as the apparent abundance of oil transportation capacity. And winter weather conditions in North Dakota could prevent completion of the pipeline by the revised deadline of March 31, 2017, even if it receives all necessary regulatory approvals. If the pipeline is eventually completed, investors and customers alike may demand better terms from ETP (or back out altogether), based on the much-reduced value of Dakota Access capacity under current market conditions. This will leave ETP in a weaker financial position than anticipated in the optimistic advance planning for the pipeline.

10 Johnson, Brooks. 2016. "Enbridge stalls on Dakota Access purchase." Duluth News Tribune. December 23. Available at: http://www.duluthnewstribune.com/business/energy/4186059-enbridge-stalls-dakota-access-purchase.

11 Kunkel, Cathy. 2016. "IEEFA Update: More Weaknesses Seen in Companies Behind the Dakota Access Pipeline Project." *Ieefa.org*. December 21. Available at: http://ieefa.org/ieefa-update-weaknesses-seen-companies-behind-dakota-access-pipeline-project/.

12 Kunkel, Cathy and Clark Williams-Derry. 2016. "The High-Risk Financing Behind the Dakota Access Pipeline: A Potential Stranded Asset in the Bakken Region of North Dakota." Prepared for the Sightline Institute. Available at: http://www.sightline.org/research_item/dakota-access-pipeline-driven-by-high-risk-financing-in-overbuilt-region/.

13 Williams-Derry, Clark. 2016. "Dakota Access Pipeline: Misleading the Court, the Public… or Both?" www.sightline.org. December 20. Available at: http://www.sightline.org/2016/12/20/dakota-access-pipeline-misleading-the-court-the-public-or-both/.

3. PIPELINE CONSTRUCTION IMPACTS: ALMOST OVER BY NOW

Discussion of the economic benefits of the Dakota Access pipeline has often focused on the substantial impacts of construction. The ETP report projected that pipeline construction would create nearly 33,000 job-years,[14] nearly $5 billion of increased production and sales, and $156 million in state and local taxes in the four-state region.[15] Important technical questions have been raised about the accuracy of that report.[16] However, in this and following sections we assume that the ETP report is accurate, and demonstrate that it is projecting very small benefits from completion of the pipeline.

The impacts of construction are one-time events, projected to occur at the time of expenditures on construction. As of early December 2016, the pipeline was reportedly 92 percent complete.[17] Therefore, most of these 33,000 job-years, along with the increases in sales and in tax payments from construction, have already taken place and cannot be counted as future benefits of pipeline completion.[18] If the pipeline is already 92 percent, only 8 percent of the overall construction impacts remain as benefits available in 2017. Table 1 compares the remaining construction impacts to the four-state economy of Illinois, Iowa, North Dakota and South Dakota, on the assumption that the pipeline is 92 percent complete.

Some descriptions of the pipeline suggest that it is already well above 92 percent complete, although we have not found any newer reports of the precise percentage of the total construction that has already been done. Table 2, below, repeats the calculation of remaining impacts of construction, on the assumption that the pipeline is now 98 percent complete.

14 A "job-year" is one full-time job for one year. Construction impacts are one-time events, measured in job-years, in contrast to the ongoing, multi-year employment created by operation and maintenance of a facility.

15 Siegelman, Lipsman, and Otto, 2014 (the ETP study).

16 http://mediad.publicbroadcasting.net/p/wium/files/Dakota_Access_Fact_Sheet.pdf

17 Dennis, Brady and Steven Mufson. 2016. "Army Corps ruling is a big win for foes of Dakota Access Pipeline." *Washington Post*. December 4. Available at: https://www.washingtonpost.com/news/energy-environment/wp/2016/12/04/army-will-deny-easement-halting-work-on-dakota-access-pipeline/?utm_term=.dc0b935b22a7.

18 For a similar argument from a major media source, see http://abcnews.go.com/Politics/majority-promised-dakota-keystone-pipeline-jobs-expected-temporary/story?id=45021909.

Table 1. Remaining construction impacts compared to four-state economy, assuming 92 percent completion

	Construction, total *(A)*	Construction, remaining *(B) =.08 * (A)*	Total, 4-state economy *(C)*	Remaining pipeline construction as a percentage of total *(D) = (B) / (C)*
Employment (job-years)	32,721	2,618	8,602,000	0.030%
GDP (million dollars)	$4,962	$397	$1,053,996	0.038%
State and local taxes (million dollars)	$156	$12	$94,932	0.013%

Sources: (A) ETP report. (C) Employment, in 2015, from Bureau of Labor Statistics, https://www.bls.gov/news.release/pdf/srgune.pdf*; output (GDP), in 2015, from Bureau of Economic Analysis,* https://www.bea.gov/newsreleases/regional/gdp_state/2016/pdf/qgsp1216.pdf*; state and local taxes, in 2014, from Census Bureau,* http://www.census.gov/govs/local/.

Table 2. Remaining construction impacts compared to four-state economy, assuming 98 percent completion

	Construction, total *(A)*	Construction, remaining *(B) =.02 * (A)*	Total, 4-state economy *(C)*	Remaining pipeline construction as a percentage of total *(D) = (B) / (C)*
Employment (job-years)	32,721	654	8,602,000	0.008%
GDP (million dollars)	$4,962	$99	$1,053,996	0.009%
State and local taxes (million dollars)	$156	$3	$94,932	0.003%

Sources: See Table 1.

As the tables show, the impacts of finishing construction of the Dakota Access pipeline are very small fractions of the regional economy. If it is only 92 percent complete (see Table 1), then the remaining pipeline construction would create a one-time gain of about 2,600 job-years, $400 million of GDP, and $12 million in state and local taxes. For the four-state region this amounts to 0.030 percent of a year's employment, 0.038 percent of a year's output, and 0.013 percent of a year's state and local taxes.

If it is 98 percent complete (see Table 2), then the remaining construction impacts are one-fourth as large: about 650 job-years, almost $100 million in GDP, and a mere $3 million of state and local taxes. These represent less than 0.01 percent (one-hundredth of one percent) of a single year's employment, GDP, and state and local taxes for the region.

If the pipeline was completed in 2017, the region would experience a one-time gain of this magnitude from the small amount of new construction. After that, the construction impacts would vanish; they are not recurring annual benefits.

Moreover, the construction of Dakota Access was not perceived as purely beneficial throughout the four states where it occurred. Despite the projected economic benefits of pipeline construction, the affected

communities did not always welcome Dakota Access. For one-third of the land needed for construction in Iowa, landowners initially refused access, forcing the pipeline to seek eminent domain.[19]

4. OPERATIONS AND MAINTENANCE IMPACTS: EVEN SMALLER

After construction is complete, the operations and maintenance of the pipeline will produce some recurring annual economic impacts. There are, however, almost no labor or local expenditures required to run a pipeline. The operations and maintenance impacts on the regional economy are even smaller than the remaining construction impacts, as shown in Table 3 and Table 4. Operating and maintaining the pipeline would add 143 jobs each year to the four-state total employment of 8.6 million.[20] It would also add $20 *million* to the region's $1 *trillion* GDP. Except in North Dakota, none of these impacts even reach one hundredth of a percent of the state totals. Pipeline operations and maintenance would add one new job for every 60,000 existing jobs in the region; in North Dakota, where the relative impacts are greatest, it would add one new job for every 6,000 existing jobs.

These are extremely small numbers.

Table 3. Pipeline operations and maintenance jobs compared to regional employment

	Pipeline O&M jobs *(A)*	Total employment *(B)*	Percent *(C) = (A) / (B)*
Illinois	20	6,126,000	0.0003%
Iowa	25	1,639,000	0.0015%
North Dakota	66	404,000	0.0163%
South Dakota	32	433,000	0.0074%
Four-state total	143	8,602,000	0.0017%

Sources: See Table 1.

[19] http://www.thegazette.com/subject/news/government/eminent-domain-sought-for-one-third-of-iowa-land-on-bakken-pipeline-20151018

[20] Like all the employment estimates cited in this report, the 143 jobs per year created by pipeline operations and maintenance are the total of direct, indirect, and induced employment. In the technical language of employment studies, direct jobs are pipeline employees, indirect jobs are employees of vendors who sell goods or services to the pipeline, and induced jobs are created by consumer spending from the direct and indirect jobs.

Table 4. Pipeline operations and maintenance contribution to regional GDP (millions of dollars)

	Pipeline O&M output *(A)*	GDP *(B)*	Percent *(C) = (A) / (B)*
Illinois	$3.1	$776,882	0.0004%
Iowa	$3.7	$174,030	0.0021%
North Dakota	$8.9	$55,860	0.0159%
South Dakota	$4.2	$47,224	0.0089%
Four-state total	$19.9	$1,053,996	0.0019%

Sources: See Table 1.

5. TAX BENEFITS: DEPENDENT ON THE VALUE OF THE PIPELINE

The largest projected benefits of pipeline operation, relative to the size of the regional economy, are the contributions to state and local taxes. The estimated annual tax payments, according to the same ETP-sponsored study, would amount to about $55 million, or 0.06 percent of the four-state total of state and local taxes, and a few tenths of a percent in each of the three smaller states, as shown in Table 5. While larger in percentage terms than the employment and income impacts discussed in the preceding section, the tax benefits are still modest in absolute terms. No state gains as much as half of one percent in state and local taxes. Colorado gets more revenue *per month* from marijuana taxes and fees than North Dakota or South Dakota will get from a year's worth of Dakota Access property taxes.[21]

Table 5. Pipeline operations and maintenance contribution to state and local taxes (millions of dollars)

	Pipeline O&M taxes *(A)*	State and local taxes *(B)*	Percent *(C) = (A) / (B)*
Illinois	$0.8	$70,821	0.001%
Iowa	$27.7	$13,756	0.201%
North Dakota	$13.4	$7,212	0.186%
South Dakota	$13.7	$3,143	0.436%
Four-state total	$55.6	$94,932	0.059%

Sources: See Table 1.

The projected state and local tax payments resulting from pipeline operations are almost entirely property taxes, and hence dependent on the value of the pipeline. It would be more accurate to say that there will be annual tax benefits of $55 million *if* the value of the pipeline remains as high as projected by ETP's 2014 report. Yet as explained above, there is strong evidence that the Dakota Access pipeline is less valuable today than ETP expected in 2014. As the value of the pipeline drops, the projected

[21] http://www.hcn.org/issues/48.21/the-twisted-economics-of-the-dakota-access-pipeline

property tax payments, based on the value of property, would be correspondingly lower than $55 million.

Questions have been raised about the reliability of projected property taxes for other pipelines. South Dakota residents have complained that an existing pipeline, Keystone 1, has paid less than half of the property taxes promised in advance of construction, and that the state has assessed pipelines at unrealistically low values for tax purposes.[22] (In South Dakota the state Department of Revenue determines the value of pipelines for local property tax assessments.)[23]

[22] http://dakotafreepress.com/2015/09/21/state-lowballing-pipeline-property-taxes-time-for-transcanada-to-help-pay-teachers/

[23] http://puc.sd.gov/Dockets/HydrocarbonPipeline/2014/hp14-002faq.aspx

6. ACCIDENTS WILL HAPPEN

6.1. Average costs of pipeline accidents

If the Dakota Access pipeline comes into operation, its economic impacts will not all be beneficial to the host communities. Oil pipelines have accidents, releasing some of their contents, at a low but non-zero rate. We reviewed the federal data on crude oil and refined petroleum product pipeline accidents from 2002 to the present, and calculated average rates and costs of accidents.[24]

From 2002 to 2016 there were 4,847 oil pipeline accidents in the United States that released a total of more than 800,000 barrels of crude and refined products; more than half of the amount released was unrecovered. Measurable costs of these accidents, including emergency response and environmental cleanup, property damage, value of lost products, and other categories, totaled more than $3 billion (in 2016 dollars). Compared to the volume of oil transported by pipeline, there were 140 accidents per billion barrels, with an average cost of $0.092 per barrel transported.

If the Dakota Access pipeline operated year-round at its design capacity (450,000 barrels per day, every day of the year), and if it matched national average accident rates, it would have 23 accidents per year, with a total yearly cost of $15 million.[25] This is a significant fraction of the expected tax benefits of the pipeline, as seen in Section 5, especially if those benefits are reduced due to the lower current economic value of the pipeline.

If Dakota Access allows a net increase in oil transportation, then it could also account for a net increase in accidents and their negative impacts. On the other hand, if Dakota Access goes into operation amid a glut of oil transport capacity, then it might only be moving some of the transportation impacts from one place to another. There would not necessarily be a net increase in accidents, but host communities would be right to complain that the new pipeline had needlessly moved those accidents onto their doorsteps.

6.2. How bad could it get?

The worst case for Dakota Access accidents would cause damages much greater than $15 million. While some pipeline accidents are small, others are very large. Each pipeline accident has the potential to

[24] Data were downloaded from the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration, http://www.phmsa.dot.gov/pipeline/library/data-stats/distribution-transmission-and-gathering-lng-and-liquid-accident-and-incident-data. Data definitions changed in 2002, making it difficult to compare earlier and later data.

[25] This calculation is based on costs per barrel. It might be preferable to calculate accident rates per barrel-mile, based on distance traveled as well as volume of oil. However, such data are not readily available. The Dakota Access Pipeline is 1,100 miles long, so if the national average barrel of pipeline oil travels less than 1,100 miles, then the average annual cost of Dakota Access accidents would be greater than $15 million on a per-barrel-mile basis.

cause catastrophic damage to the environment, and to render private property unusable for years to come. Here we review some of the worst recent pipeline spills.

In March 2013, ExxonMobil's Pegasus pipeline, carrying tar sands oil from Canada, ruptured in a suburban neighborhood in Mayflower, Arkansas. In all, 134,000 gallons (3,200 barrels) of oil were released.[26] Private property damages were initially estimated at $57 million, and other costs associated with pipeline cleanup were estimated by the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) to be $91 million. While the total cleanup costs associated with the Mayflower spill are not known, ExxonMobil paid a settlement of $5 million on charges that it violated the Clean Water Act and state environmental laws, although it did not admit liability.

In September 2013, Steve Jensen, a farmer in Tioga, North Dakota, discovered crude oil bubbling out of his wheat field.[27] In all, 882,000 gallons (21,000 barrels) of crude oil were released from the Tesoro High Plains Pipeline, damaging 14 acres of Jensen's wheat field in one of the largest oil spills ever in the continental United States. Cleanup and remediation operations occupied 35 acres, and are not expected to be complete until 2018, more than four years after the spill was discovered. Total cleanup costs are expected to be as high as $60 million. The Tesoro High Plains pipeline is a 6-inch steel pipeline, five times smaller in diameter than the 30-inch Dakota Access pipeline, so a Dakota Access accident could cause a much bigger spill.

In October 2016, a pipeline owned by Enterprise Products Partners leaked 319,000 gallons (7,600 barrels) of crude oil in Cushing, Oklahoma.[28] Initial estimates of the cost to clean up the spill have not yet been made public.

In January 2017, a pipeline owned by Magellan Midstream Partners LP began leaking 139,000 gallons (3,300 barrels) of diesel fuel onto private agricultural land in Iowa.[29] At this time, no estimates are available on the cost to clean up the spill or reimburse property owner. In 2010, Magellan paid over $460,000 for leaking 50,000 gallons of diesel and gasoline in two separate incidents in Iowa and Oklahoma. These fines indicate that Magellan may ultimately bear the responsibility for $1.3 million in penalties for the most recent pipeline accident, above and beyond any environmental remediation costs.

---

[26] http://uk.reuters.com/article/exxonmobil-settlement-idUKL1N10N26W20150812, http://www.phmsa.dot.gov/staticfiles//PHMSA/PipelineFailureReports/FIR_redacts_marked_2016_06_16_Redacts_applied.pdf

[27] http://www.cbsnews.com/news/massive-oil-pipeline-break-under-nd-farmers-wheat-field/, http://www.ndwatermonit.org/2016_Conference/5_Thursday130/3_Suess_TesoroBlackSlough.pdf

[28] http://www.reuters.com/article/us-pipeline-operations-seaway-oklahoma-idUSKCN12O16D

[29] http://www.npr.org/sections/thetwo-way/2017/01/26/511636325/its-a-big-one-iowa-pipeline-leaks-nearly-140-000-gallons-of-diesel

Can these accidents be avoided? Most pipelines now use automated leak detection systems, as ETP plans to do on the Dakota Access pipeline. Yet the available leak detection technologies are imperfect, and miss many pipeline spills. Since 2010, almost as many spills have first been detected by the public as by advanced detection systems. Leak detection systems missed 6 of the 10 biggest spills since 2010.[30] Even though Dakota Access plans to use such systems, there is no guarantee that it will avoid or quickly detect leaks.

[30] http://www.reuters.com/article/us-usa-pipelines-colonial-analysis-idUSKCN1200FQ