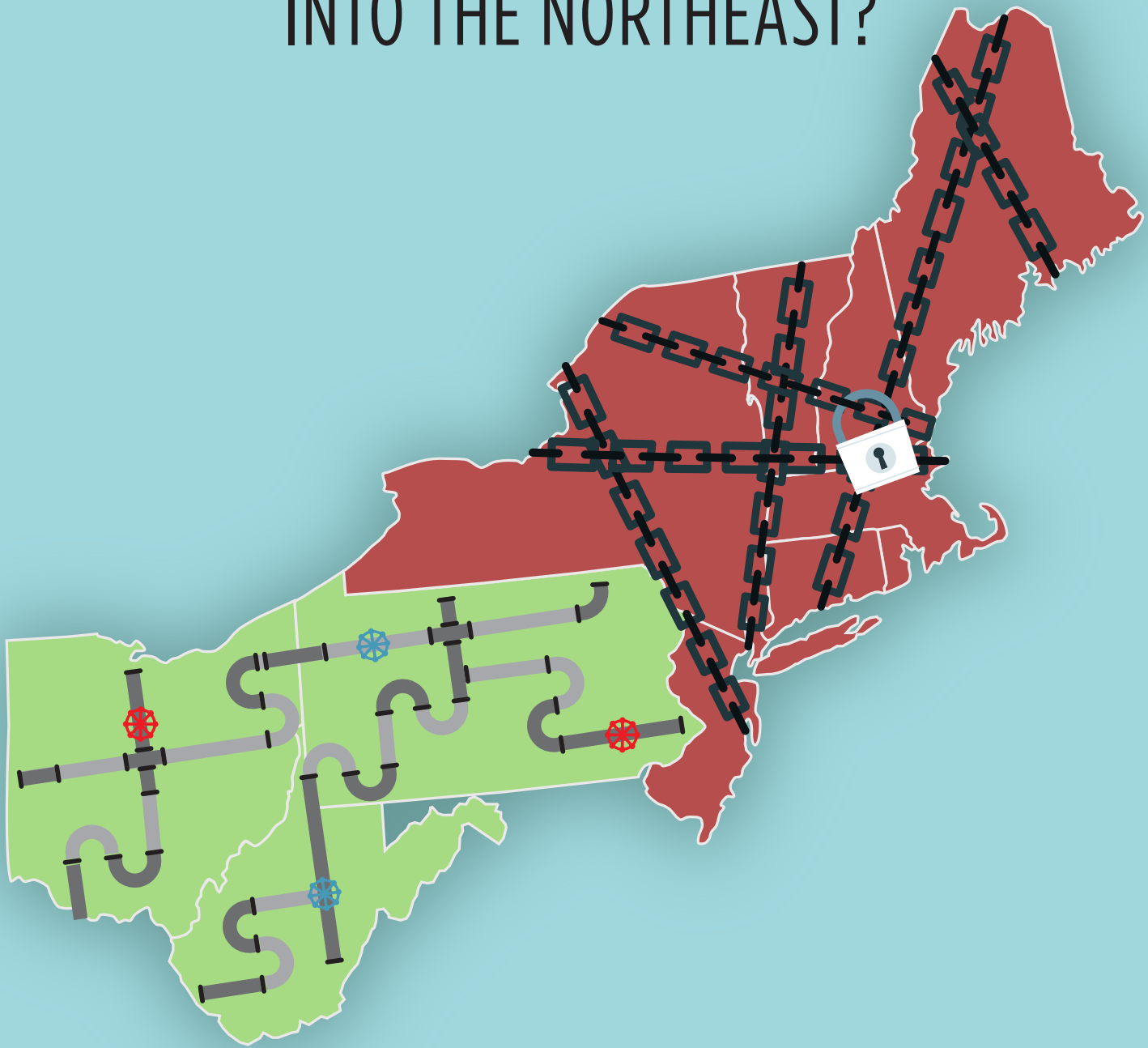
ENERGY ACCOUNTABILITY SERIES

U.S. CHAMBER OF COMMERCE
INSTITUTE FOR 21ST CENTURY ENERGY

WHAT IF...

PIPELINES AREN'T BUILT INTO THE NORTHEAST?



About the

ENERGY ACCOUNTABILITY SERIES

This paper represents the fifth entry in our **Energy Accountability Series** – a project that for the first time quantifies what the U.S. economy might look like in the future if certain energy-related policy proposals put forth by prominent politicians and their supporters were actually implemented today.

The Institute's first report, released in August 2016, modeled a scenario in which the development of oil, natural gas and coal on federal lands was phased out and eventually banned by political decree – a policy goal that was included in 2016 Democratic Party platform. Our second report, which came out in September 2016, imagined a world in which the historic renaissance in domestic energy production that has taken place in our country in recent years had never come to pass. The upshot, based on our analysis: 4.3 million jobs that exist today would have never been created.

For our third report, we examined what the impact might be on our economy if U.S. businesses and consumers were forced to pay as much for their energy as our friends in the European Union do for theirs – a self-imposed disadvantage that owes its existence to the bloc's overly restrictive energy policies. U.S. politicians (including former President Barack Obama) have cited Europe over the years as an exemplar on energy. Our report showed that those policies applied here could result in the destruction of more than seven million U.S. jobs and $670 billion in annual GDP.

Our fourth report, released prior to the November election, sought to better understand the impacts to the economic landscape if activists aligned with the so-called Keep It In the Ground campaign got their wish, and the deployment of hydraulic fracturing technology was banned nationwide. Our models found that such a scenario could result in the loss of nearly 15 million American jobs over the next five years, and force the United States to surrender its recently earned status as a global energy superpower – and all the geopolitical and security benefits that come with that status.

Our country's emergence as an energy superpower, and now even a net-exporter of natural gas, has generated broad-based economic benefits for all Americans, not just those who live in high-energy production states. But there's one part of our country that continues to be deprived of the full measure of benefits and cost-savings that would otherwise be available if it was properly linked up in our nation's vast and expansive natural gas pipeline network: the Northeast. Quantifying the ongoing costs of that isolation is the focus of our final report.

Not dissimilar to high energy prices in Europe, the Northeast's relative lack of access to clean-burning, low-cost natural gas is largely self-imposed – a function of some state and local political figures prioritizing the wishes of environmental groups ahead of the needs and interests of their constituents.

Even with the election now behind us, and support for nationwide infrastructure build-out at record levels, these impediments will remain intact absent a coordinated effort by those affected in the region to stand up and demand change. We're hopeful this report can be used to help further that cause, and that the broader **Energy Accountability Series** can play an important role in helping to inform the course the Trump administration takes on these and other critical issues.

OUR MISSION

The mission of the U.S. Chamber of Commerce's Institute for 21st Century Energy is to unify policymakers, regulators, business leaders, and the American public behind a common sense energy strategy to help keep America secure, prosperous, and clean. Through policy development, education, and advocacy, the Institute is building support for meaningful action at the local, state, national, and international levels.

The U.S. Chamber of Commerce is the world's largest business federation representing the interests of more than 3 million businesses of all sizes, sectors, and regions, as well as state and local chambers and industry associations.

What If Pipelines Aren't Built Into the Northeast?

Previous Energy Institute reports have provided both quantitative and qualitative detail with respect to how the dramatic increase in natural gas (and oil) production in the United States over the past half-decade has benefited businesses, consumers and communities across the nation.

These benefits have come in many different forms, from energy-usage cost-savings for consumers exceeding several thousand dollars per household per month, to the creation of millions of jobs and the lowering of the country's greenhouse-gas emissions profile to levels not seen since the mid-1990s.

But despite myriad economic and environmental advantages that have been created and broadly distributed to citizens all throughout the country, Northeast states haven't received their share of this bounty. Consequently, Northeast residents continue to pay some of the highest prices for delivered natural gas anywhere in the nation, despite living close to some of the most prolific natural-gas producing basins anywhere in the world.

The Trump administration has signaled that infrastructure development will be a major focus during its term in office, with the goal of creating tens of millions of new jobs and an unprecedented coalition of business, labor and community organizations coming together to support these initiatives. The continued build-out of our nation's energy transportation network should be part of this strategy. Having the proper pipeline infrastructure in place is just as important to the country and its residents as having good roads, safe bridges and world-class airports.

Unfortunately, even if a significant portion of these surface infrastructure investments are directed to high-population density states in the Northeast, the fate of much-needed energy infrastructure build-out activities in the region is far less certain. The good news is that a number of pipeline development projects have been proposed over the past several years, with several developers currently in various stages of the process for securing permits from state, federal and at times even local regulatory agencies.

The bad news is that if past is prologue, we should expect that many of these projects will never be able to acquire the approvals they need to get off the ground. A recent example is the decision in April 2016 by regulators in New York to deny a crucial water-quality permit (one already approved by federal regulators) to the builders of the Constitution Pipeline, which would transport more than 600 million cubic feet of natural gas per day from the Marcellus region in Pennsylvania to consumers in New England.

The fifth report in our **Energy Accountability Series** imagines and subsequently models a scenario in which the status quo continues to win the day, in which politicians in the Northeast continue to complain about the high prices their constituents pay for natural gas, while in the next breath railing against any developer with the audacity to put the pipes in the ground necessary to correct that very situation.

Of course, it's no secret by now that Northeast residents pay more for natural gas than other parts of the country. But how does that price premium impact the broader Northeast economy? How many jobs are these higher-than-they-should-be natural gas prices

destroying – or preventing from being created in the first place? And how much household income is being needlessly frittered away owing to these anachronistic policies? These are the questions we ask and answer in this report.

Before we answer those questions, allow us to highlight just a few recent quotes from some politicians and the interest groups that support them underscoring their opposition to commonsense and desperately needed energy infrastructure projects in the region:

> "The growing rallying cry of the climate movement, to keep fossil fuels in the ground, is taking hold, and not just in the form of chants and headlines, but in the form of cancelled gas pipelines..."
>
> Sierra Club, May 2, 2016

> "Each of these new infrastructure projects should be stopped because it extends the fossil fuel era a few more disastrous decades."
>
> Bill McKibben, founder of 350.org, DNC platform committee member, Jan. 19, 2016

> "The Pipeline Opposition Action Group is dedicated to stopping the high-pressure fracked gas pipelines ... plus all related fossil fuel infrastructure."
>
> 350 Massachusetts

> "The industry's pipeline projects must be stopped."
>
> Food & Water Watch

> "I believe the Northeast Energy Direct pipeline that would carry fracked natural gas for 400 miles through 17 communities is a bad idea and should be opposed."
>
> U.S. Sen. Bernie Sanders (I-Vt.), Nov. 29, 2015

"I have opposed Kinder Morgan's proposed pipeline through Massachusetts and New England because of concerns that it could have led to the export of American natural gas to foreign countries, the impact it would have had on local communities in Massachusetts, and its potential to worsen climate change."

U.S. Sen. Ed Markey (D-Mass.), April 20, 2016

"[W]hile building the Northeast Direct Gas Pipeline would provide the economic benefit of providing good jobs with good wages for local labor, the project as a whole is not in the public interest."

Former Massachusetts State Sen. Benjamin B. Downing (D), July 25, 2014

"Governor Cuomo ... stood up to the oil and gas industry and effectively shut down the Constitution Pipeline project ... And the fact that this historic decision comes on Earth Day ... makes it all the more significant."

Catskill Mountainkeeper, April 22, 2016

"We want an end to New York's ruinous dependency on fracked gas, along with all of the hateful, harmful infrastructure that comes with it ... An end to fossil fuels is our united goal."

Sandra Steingraber, co-founder, New Yorkers Against Fracking, Jan. 15, 2016

Contents

1 EXECUTIVE SUMMARY

The United States has experienced a dramatic increase in natural gas production and consumption in recent years thanks in large part to the development of natural-gas rich reservoirs in basins such as the Marcellus and Utica. This addition to the market of literally billions of cubic feet (Bcf) of natural gas per day has had the effect of creating millions of new jobs, generating billions in new revenues and royalties, and bringing about a fundamental change to our nation's energy systems – particularly as it relates to electricity generation and distribution.

Despite the historic increase in natural gas production, as well as the economic and environmental advantages that have come with it, infrastructure development has not proceeded at a similar and corresponding pace, particularly in the high-density Northeastern United States, which in this report is defined as the six New England states, plus New York, New Jersey and Pennsylvania.

The upshot? Whereas the broad-based benefits of increased domestic resource production have been distributed widely and broadly across most of the United States – and even to regions hosting very little upstream activity – **millions of citizens in Northeast states have been denied the opportunity to take full advantage** of both the direct and indirect benefits that the energy renaissance has made possible for fellow Americans living elsewhere.

The Federal Energy Regulatory Commission (FERC) routinely issues updates that report and comment on this trend, noting in a recent submission that "with the exception of the Northeast ... regional price differences across the country were not large, a sign that midstream investments over the past 10 years have largely relieved natural gas transportation constraints." [1]

According to federal regulators, there is nothing mysterious about the fact that Northeast residents pay so much more for their natural gas than everyone else. In that same report, FERC declares that "pipeline constraints" in and near several distribution points throughout the Northeast region were responsible for "higher [natural gas] prices for consumers."[2] A more recent report, issued in late December by the non-profit North American Electric Reliability Corporation, cited a "lack of adequate gas infrastructure" as the primary driver for "winter reliability challenges" in the Northeast. [3]

An examination of historical natural gas and electricity prices shows how much more the Northeast states pay for their natural gas relative to the rest of the country. Based on federal data, we know that:

- Northeast residents pay **29 percent more for their natural gas** than the U.S. average, and **44 percent more for their electricity.**
- Six of the 10 states where residents pay the highest prices for electricity in the country are New England states, with Connecticut, Rhode Island, Massachusetts and New Hampshire all **above 16 cents per kilowatt hour** (national average: 10.42)[4]
- Industrial users in the Northeast **pay more than double for their natural gas** than the U.S. average, and **62 percent more for electricity.**

Given its lack of indigenous resource availability, lack of available fuel storage capacity, and aforementioned lack of pipelines, the Northeast relies mainly on pipeline imports from Canada and liquefied natural gas (LNG) imports from overseas to meet demand, particularly during peak periods in the winter.

Currently, natural gas demand in New England averages nine to 10 Bcf/day, with demand peaks in the winter reaching 20.8 Bcf/day. **The existing natural gas delivery network is simply not robust enough to facilitate these spikes.**

Natural gas pipeline capacity into the region will reach 21.6 Bcf/day only if one includes in that calculation the pipeline expansion projects currently under evaluation and the continued influx of new LNG imports. In other words, even in the best possible case, which is far from the most plausible one, almost no margin will exist between the consumers' peak demand number and the installed supply number.

As part of this project, we modeled the economic impact of continuing with the status quo, which is best defined as a severely constrained ability to build new energy development infrastructure into the region. Among our findings:

- The loss of nearly **78,400 jobs by 2020**
- The displacement of more than **$4.4 billion in labor income**
- The destruction of nearly **$7.6 billion in GDP**

We also took a closer look at how the inability to get new energy infrastructure projects permitted in the regions could impact individual Northeast and New England states:

- New England: **22,900 jobs lost | $2.0 billion in lost state GDP**
- Massachusetts: **8,700 jobs lost | $792 million in lost state GDP**
- Pennsylvania: **21,900 jobs lost | $2.4 billion in lost state GDP**
- New York: **17,400 jobs lost | $1.6 billion in lost state GDP**
- New Jersey: **11,600 jobs lost | $1.2 billion in lost state GDP**

We also ran an impact analysis on two states that reside outside the Northeast, but which would also stand to be adversely impacted in economic terms if prohibitions were placed on pipeline development in the Northeast.

- Ohio: **2,100 jobs lost | $295 million in lost state GDP**
- West Virginia: **2,500 jobs lost | $159 million in lost state GDP**

Notwithstanding the new administration's stated support for investments in key energy infrastructure, it's important to note again that the primary impediments to these projects advancing in the Northeast do not originate in Washington. A coordinated effort by those affected in the region will be required to influence local and state policy-makers to finally end what is in effect a unilateral blockade, one denying residents access to cheaper, cleaner, more proximal and more reliable sources of natural gas.

CITATIONS

1 State of the Markets Report 2015, FERC, March 2016. Available at: https://www.ferc.gov/market-oversight/reports-analyses/st-mkt-ovr/2015-som.pdf

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4 http://www.energyxxi.org/map-retail-electricity-prices-state

CHAPTER 2

CURRENT STATE OF PLAY

While much of the country has benefited from the massive influx of new natural gas supplies entering the marketplace over the past decade, the Northeast has not been able to reap quite as much of the benefit of that trend notwithstanding its proximity to major producing formations like the Marcellus and Utica. One reason why: the work of activist groups allied with the so-called Keep It In the Ground campaign to oppose and in some cases prevent desperately needed pipeline infrastructure projects from moving forward.

But a closer analysis of the Northeast's future supply capabilities shows that the current infrastructure as it presently exists will not be able to keep pace with forecasted growth rates in demand.

The polar vortex that took place in the winter of 2014 was an indicator of what happens when insufficient supply comes face-to-face with peak demand, leading to extraordinary price spikes that in this case put the public's safety and well-being at risk. With forecasts pointing to colder winters in the near-term for the Northeast, the region can ill afford to ignore its critical infrastructure needs.

The economic consequences associated with continuing to deny developers' requests to extend and improve pipeline capacity in the region are significant, with our analysis forecasting the loss of more than $7.6 billion in GDP owing to the effect of higher natural gas and electricity prices on the broader economy, plus the loss of investments tied to the development activities themselves.

Even with all of its obvious economic and environmental benefits, natural gas infrastructure development continues to encounter outsized political resistance.

Notably, most of this push-back continues to be registered in states that do not have a long history when it comes to pipeline development. Polling data consistently shows that most Northeast residents aren't fully aware of how much more they pay for their energy than everyone else in the country. Common sense suggests they'd be angry if they were.

According to federal data, Northeast states have some of the highest delivered natural gas prices in the entire country, with residential and commercial consumers paying about 30 percent more overall than the average American household.

The Northeast region has been studied closely over the years and many reports have sought to sound the alarm on the significant supply curtailments that may occur if infrastructure build-out is not prioritized to meet growing demand.

One recently released independent study, produced on behalf of the Eastern Interconnection Planning Collaborative,[1] reviewed the adequacy of the natural gas pipeline delivery system in the region to meet the needs of the gas-fired electric generation under various conditions over a 10-year horizon. Among its other core conclusions was that there are significant constraints on the ability to deliver natural gas to residences and businesses as well as to gas-fired power plants to the point where even advanced planning does not provide sufficient relief.[2]

There were two headline events in the past year that point to the difficult environment that prospective pipeline developers should expect to face as they seek to secure the approvals they need to commence their projects:

- The **Constitution Pipeline** was placed on hold because regulators in New York denied at the last minute a critical water-quality permit to Williams. Interestingly, the company had acquired precisely this same permit from federal regulators earlier in the year.
- The **Access Northeast** pipeline has been placed on hold after a court in Massachusetts ruled that none of the costs associated with the build-out of the line could be redirected back to ratepayers, notwithstanding the project partners having received previous assurances to that effect. The project's sponsor, Spectra Energy, announced in a Dec. 2016 state filing that it now does not expect work to begin before 2019.[3] In January 2017, Eversource, the largest utility in New Hampshire, filed a formal motion asking the court to reconsider its ruling, citing continuing high natural gas prices for its customers.

The natural gas system in New Jersey, New York, and New England is expected to become more constrained as federal, state, and local regulatory actions promoting the use of natural gas move forward in the coming years. In addition, the planned and targeted closures of up to 6,075 MW of nuclear plants in the Northeast will increase the demand for natural gas to fill the power supply gap. For example, New York Gov. Andrew Cuomo has successfully pressured the owners of the Indian Point nuclear power plant to shutter its operations.

> "Because of the benefits of the Marcellus here in the Northeast, we're bringing [natural] gas out of the wellhead at a $1.96 MMBtu. In fact, Pennsylvania gas is almost a dollar cheaper than [benchmark-priced] natural gas."
>
> **Robert Powelson, Pa. PUC commissioner; as quoted by POLITICO, Dec. 28, 2016**

Incongruously, the effort to stop the expansion of the nation's natural gas transportation network is moving forward at precisely the same time as other efforts take shape aimed at allowing residential and commercial consumers to switch over to natural gas as a replacement for fuel oil.

In 2011, the New York City Department of Environmental Protection issued regulations mandating the phase-out of No. 6 residual fuel oil for heating by 2015 and No. 4 residual fuel oil for heating by 2030. The city also requires that all new boiler or burner installations must utilize cleaner fuels, which according to the city's definition includes natural gas.

The Northeast currently finds itself on a conflicted path when it comes to natural gas. The demand for natural gas is projected to increase significantly in the near-term, and for the first time ever, that phenomenon has become wholly independent of the weather. Decisions made years ago related to fuel-switching and electricity generation have essentially "locked in" the future demand expansion – even while the demand side has failed to keep up.

Based on the current supply and demand picture, no rational analyst would consider to the current situation in the Northeast to be either sustainable or tenable. Something, as they say, has got to give.

CITATIONS

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3 http://www.bostonherald.com/business/business_markets/2016/12/gas_giant_spectra_delays_3_billion_ne_pipeline_project

3

NORTHEAST NATURAL GAS & ELECTRICITY PRICES

Since 2008, natural gas prices in the U.S. (Henry Hub) have been declining from a high of $13.31/MMBtu in June 2008 to a low of just $1.49/MMBtu in March of this year.[1] The shale revolution has played an obvious role in facilitating this steady price decline, which itself has had the effect of disrupting major segments of the country's energy system.

For the first time, natural gas-fired electricity generation has surpassed coal generation on an annual basis in 2016.[2] Additionally, in the future as more traditional sources of electric generation find themselves under pressure owing to carbon constraints, natural gas is projected to claim an even greater share of the nation's electricity generation.

But as we continue to see in the Northeast, a low natural gas price at the wellhead does not always equate to a low price at the delivery point for that same molecule of natural gas. The extent to which it is depends almost entirely on the costs associated with bringing those supplies to the marketplace.

HIGHER ENERGY PRICES IN THE NORTHEAST

Across the board, Northeast natural gas and electricity prices are significantly higher than the rest of the country across all sectors. While several factors play into this trend, the availability of natural gas supply into the region is one of the primary drivers.

For example, the Federal Energy Regulatory Commission's (FERC) 2015 State of the Markets Report notes that "with the exception of the Northeast, including New England, regional price differences [in natural gas] across the country were not large," a clear sign, FERC said, that "midstream investments [made] over the past 10 years have largely relieved natural gas transportation constraints."[3] FERC goes on in that same report to note that "pipeline constraints near Algonquin Citygates in Boston, Transco Zone 5 in the Mid Atlantic, and Transco Zone 6 New York, resulting in higher prices for consumers in 2015."[4]

Using EIA's historical price data, we can see just how high prices actually are compared to the U.S. average. As Table 1 shows, the price premium that consumers in the Northeast are forced to pay for natural gas is between **29 and 106 percent above the U.S. average price.**

On the electricity side, the story is similar. Without greater access to low cost fuel supply, the Northeast is forced to rely on relatively more expensive imports, which has a direct impact on the delivered price for electricity (Table 2).

Consumers in the Northeast pay anywhere from 40 to 62 percent more per MWh for their electricity relative to residents in the rest of the country. Coupled with high natural gas prices, Northeast consumers are at a serious disadvantage. In fact, recent press has shown

Table 1: 2015 Delivered Natural Gas Prices by Sector

Sector	U.S. Average Delivered Price ($/Mcf)	Northeast Average Delivered Price ($/Mcf)	Northeast Price Premium
Residential	10.38	13.35	29%
Commercial	7.91	10.30	30%
Industrial	3.91	8.04	106%
Electric Power	3.37	4.26	26%

Table 2: 2015 Delivered Electricity Prices by Sector

Sector	U.S. Average Delivered Price ($/MWh)	Northeast Average Delivered Price ($/MWh)	Northeast Price Premium
Residential	126.7	182.3	44%
Commercial	105.9	147.9	40%
Industrial	68.9	111.7	62%

increased concern over high energy prices affecting the local economy.

In New Hampshire, business leaders organized a letter in support of Northeast Energy Direct, a $3.3 billion project that would have brought natural gas from New York into New England. The letter expressed concern that the state's economy "could be short-circuited by the high cost of energy" if the pipeline was blocked.[5] A month later, the company announced it would no longer be proceeding with the project.

> "The population up there [in New England] has to pay exorbitant power bills, and the number one reason for that is that local gas, indigenous to the U.S., 300 miles away, the cheapest in the world, can't get up there. It's sinful."
>
> **Robert Christensen, Drexel Hamilton LLC; as quoted by Bloomberg, July 12, 2016**

A study by La Capra Associates for the New England Coalition for Affordable Energy found that the lack of new energy infrastructure "will cost New England households and businesses **$5.4 billion in higher energy costs** (in 2014 dollars) between 2016 and 2020."[6] The study estimates that the "lack of energy infrastructure will **reduce household spending by $12.5 billion.**"[7]

Concerns about natural gas price and availability have been vocalized by several U.S. senators representing New England states. In March 2014, soon after the polar vortex sent natural gas prices soaring, six U.S. senators sent a letter to the FERC, stating that "severe price increases like those we have seen in New England can hurt families and cripple businesses, especially manufacturers that rely on natural gas for power generation."[8]

The lead signatory of the letter was Sen. Ed Markey (D-Mass.), who earlier this year led a campaign to pressure Kinder Morgan to drop plans to build a 420-mile natural gas pipeline into the western part of his state.[9] In April, the company announced it would no longer be moving forward with the effort.

Higher levels of demand, coupled with the lack of new pipeline capacity, could keep the Northeast locked into the same high-cost energy situation it has been in over the past decade. And as the system becomes more constrained over time, this problem will be exacerbated even further.

Not only are consumers faced with higher energy bills, lower household income and spending, but there also is a potential for even greater damage on the Northeast's manufacturing and industrial economy, leading to even more significant economic losses for the region. And despite activists' claims to the contrary, renewable energy, while an important segment of the overall market, will not by itself be able to "cover"

for natural gas as a significant, dispatchable provider of baseload generation.

MACROECONOMIC INDICATORS IN THE NORTHEAST

High energy costs tend to negatively impact local, regional and national economies – especially when that cost burden is so far out of alignment with what's in place in neighboring jurisdictions. As part of our analysis, we pulled the lens back a bit to examine how some of the other major macroeconomic indicators in place in the Northeast region may have been impacted overtime by these higher costs – and vice-versa.

In 2015, the Northeast accounted for just over 16 percent of U.S. GDP.[10] Its growth over the past five years, however, has been below average. As shown in Table 3, the U.S. economy has been growing at a faster rate on average than the Northeast. Between 2010 and 2015, Northeast GDP grew by 1.0 percent, whereas U.S. GDP as a whole grew at 1.8 percent over the same period.

Table 3: Northeast vs. U.S. GDP Growth

Region	2010-15 Growth	Annual Average Growth
Northeast	5.3%	1.0%
U.S.	9.5%	1.8%

The Northeast's underperformance relative to the rest of the country when it comes to GDP growth isn't the only macroeconomic indicator worth highlighting. Job growth also has been weak compared to the U.S. as a whole, as shown in Table 4. A recent report by the Federal Reserve office in Boston confirms that "the New England economy continues to improve, but lags the nation in most measures."[11]

> "The existing pipelines carrying natural gas into New England are now running at or near maximum capacity … Addressing natural gas infrastructure constraints is currently the region's highest-priority challenge."
>
> **ISO New England, "Natural Gas Infrastructure Constraints"; accessed Dec. 27, 2016**

Table 4: Northeast vs. U.S. Jobs Growth[12]

Region	2010-2015 Growth	Annual Average Job Growth
Northeast	2.4%	0.5%
U.S.	5.8%	1.1%

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8 New England Senators Call for Review of Recent Natural Gas Price Increase, March 2014. Available at: http://www.markey.senate.gov/news/press-releases/new-england-senators-call-for-review-of-recent-natural-gas-price-increase

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11 New England Economic Indicators, Boston Fed, March 2016. Available at: https://www.bostonfed.org/economic/neei/current/neei.pdf

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CHAPTER 4

NATURAL GAS INFRASTRUCTURE AND MARKET NEEDS

Despite its proximity to abundant, cheap natural gas supply out of the Marcellus, the Northeast has seen pipeline constraints and prices increase over the past few years. These concerning trends can be blamed on several phenomena:

Upstream (natural gas production)

- Very little indigenous natural gas is produced in New England, and the same is true in New Jersey.
- While having tremendous natural gas resource potential, New York has placed a ban on what it calls "high-volume hydraulic fracturing," effectively preventing the commercial development of the Marcellus Shale.

Midstream (pipelines and storage)

- State governments and public-utility commissions have increasingly denied requests to have ratepayers contribute to the financing of natural gas infrastructure development
- Opposition from activist groups has slowed the permitting process, and spurred litigation
- New England has very few underground energy storage options owing to its unique subsurface geology

Given its lack of a resource base, lack of storage capacity, and constrained access to pipeline capacity, the Northeast relies mainly on pipeline imports from other parts of the United States and Canada and LNG imports from overseas to meet demand, particularly during peak periods in the winter.

Currently, natural gas demand in New England averages between nine and 10 Bcf/day, with demand peaking in the winter to around 20.8 Bcf/day. Natural gas pipeline capacity into the region is around 21.6 Bcf/day, including planned pipeline expansions and LNG imports. That leaves little room for demand spikes and future growth.

PROJECTING FUTURE SUPPLY NEEDS

Future projections related to the balance between supply and demand – making sure there's enough supply to maintain system reliability and stability -- is the key question in determining whether to expand energy infrastructure capacity. In the industry, we refer to these as "market needs" analyses.

In the electricity system, system operators often use a 15 percent minimum capacity reserve margin (calculated as excess capacity divided by peak demand) when determining the market needs for expanding supply capacity. The reserve margin serves as a buffer in case of unplanned circumstances, such as unexpected transmission line or substation outages that could reduce supply and thus impact the reliability of the grid.

When it comes to the Northeast's natural gas infrastructure, accurately defining the market need, inclusive of the reserve margin, has become especially important over the past few years. The three primary factors in determining market needs are as follows:

- **Economic growth.** This factor helps to establish a region's average demand growth going forward, as higher growth will place more burdens on existing infrastructure and require capacity expansions to meet baseline demand.
- **Structural changes to the economy.** Market forces and policy changes can affect baseline demand as well. For example,

declining costs for renewable energy "drop-ins" can partially offset the need for future natural gas demand in the power sector. Gas demand, though, could also increase under new policies. EPA's Clean Power Plan, whose prospects for implementation are admittedly weaker now than they were before the recent election, would have had a major impact in facilitating the transition away from coal generation toward renewables and natural gas.

- **Weather projections.** Weather plays an important role in these analyses owing largely to its variability. If expectations are that colder than normal winters will continue, for example, then more capacity will be needed to ensure supply availability, reliability, and system stability.

In the following section, we provide our forecast for the Northeast's market needs given these factors.

NORTHEAST DEMAND FORECAST

As part of this project, we ran a simulation of what the Northeast market need for additional pipeline capacity will be through 2022. To run the analysis, we first developed a demand forecast for the Northeast.

We started with the natural gas demand projections from EIA's 2016 Annual Energy Outlook (AEO). We chose to use an average of the AEO 2016 Reference case and the High Economic Growth case because planning for expansions should be based upon a reasonable "high" case in order to ensure adequate system availability, reliability, and stability.[1,2] Pipeline capacity, as with other large infrastructure investments such as bridges, ports, highways, the internet, and other networks, cannot be instantly added to the system. As such, one cannot plan for simply the average outcome and must consider a reasonable high case instead.

In addition to the Northeast's economic growth potential and structural changes in power sector demand (specifically, the ongoing structural shift from coal to natural gas), we included the potential and expected nuclear power plant closures in the Northeast in our demand forecast. We assume that these plant closures would be replaced with natural gas-fired, baseload power generation. Table 5 lists the power plant name, capacity, equivalent natural gas demand necessary for replacement, and potential retirement year.

The "Potential Retirement Year" column in Table 5 represents a likely scenario. The Fitzpatrick, Ginna, and Nine Mile Point plants in New York were slated to be retired in the next few years unless they received incentives.

In August 2016, the New York's Public Service Commission announced the Clean Energy Standard, which will incent further operation by allowing these plants to obtain "zero emissions credits" through 2029.[3] The provision is being challenged in court by a group of energy companies and trade groups.[4] For the purposes of our modeling, we assume these incentives do not ultimately materialize and that financially struggling nuclear plants will close by 2018.

Gov. Cuomo announced in early Jan. 2017 that the Indian Point Energy Center will be shut down, with the first reactor retired by April 2020 and the second by April 2021.[5] Our analysis reflects this latest news and factors in how this closure will impact peak natural gas demand.

Table 5: Potential and Expected Nuclear Power Plant Closures and Equivalent Natural Gas Demand Necessary for Replacement

Nuclear Plant Name	Location	Capacity (MW)	Equivalent Natural Gas Demand at Peak (Bcf/d)	Potential or Announced Retirement Year
Fitzpatrick	NY	838	0.14	2018
Ginna	NY	580	0.10	2018
Indian Point	NY	2,069	0.35	2020-2021
Nine Mile Point	NY	1,900	0.32	2020
Pilgrim	MA	688	0.12	2019
Total Demand			**1.02**	

Finally, we adjusted the average annual demand to determine the peak gas demand for the Northeast. Because AEO data is provided on an annual basis, it averages out the peaks that occur throughout the year. To get a more accurate picture of peak demand levels (i.e., the level in which the pipeline system would be most constrained), we adjusted the forecasted average annual demand by a ratio of maximum to average daily demand. This ratio was determined and applied for each sector (i.e., Residential, Commercial, Industrial, and Electric Power) in the Northeast.[6]

Applying the ratio of maximum to average daily demand is necessary when accounting for weather variability. In 2014, inadequate pipeline capacity, high demand, and extreme weather conditions created by the polar vortex contributed to the dramatic increase in natural gas and electricity prices during the winter. In New York City, natural gas prices hit a record high of $120/MMBtu[7]; in Boston, prices rose to more than $75/MMBtu and averaged over $22/MMBtu (or 50 percent higher than the previous winter).[8] During this same period, day-ahead electricity prices spiked to over $500/MWh.[9]

> "We've been hearing loud and clear from business and residential customers about the need to lower and stabilize [natural gas] prices. Expanding the supply of [natural] gas into New England is one of the necessary actions that must occur as part of the effort to reduce energy costs and ensure reliability."
>
> ***Bill Quinlan, president of N.H. operations for Eversource; as quoted by Associated Press, Jan. 7, 2017***

After adjusting for power plant closures, we find that peak demand in 2017 is expected to reach 20.8 Bcf/d, increasing to 23.2 Bcf/d by 2020. The annual peak demand forecast is shown in Figure 1.

SUPPLY REQUIREMENTS

As shown, natural gas demand is projected to steadily increase in the Northeast region over the next four years. Given this level of demand,

the question becomes: does the current and projected pipeline infrastructure hold enough capacity to maintain reliability? The following analysis shows the Northeast's current gas supply capacity, future additions, and the supply gaps that exist for meeting future demand.

CURRENT PIPELINE CAPACITY STATUS

Using the EIA's State to State Region Inflow Capacity data,[10] we are able to determine the current pipeline capacity coming into the Northeast. This serves as an indicator of the actual natural gas deliveries that can flow into the region. As of 2016, the available inflow capacity into the Northeast equaled nearly 20.0 Bcf/d. New England's LNG import terminals offer another 2.6 Bcf/d of additional capacity onto the system (Table 6).[11]

PLANNED PIPELINE PROJECTS

Three projects currently in the planning stages would bring 1.58 Bcf/d of new capacity into the Northeast, and at least 15 other projects within the boundaries of the Northeast are also being planned – all of which would enhance system capacity and reliability if allowed to move forward Table 7 summarizes these projects.

FUTURE SUPPLY GAPS IN THE NORTHEAST

With a few new pipeline additions and expansions coming online in 2017, the overall pipeline capacity into Northeast will reach just over 21.58 Bcf/d. However, by 2018 this may not be enough capacity, especially given the possibility that supply reserve margins (excess capacity divided by demand) turn negative (Figure 2).

Based on the reserve margin forecast depicted above, it will be critical that new pipeline capacity be added to the system. If, for example, one of the region's LNG import terminals unexpectedly shut down during peak season, demand could move beyond the available supply almost instantaneously. This could have a major and deleterious impact on the broader system, bringing into play extremely high price spikes, power outages, reduced availability of household heating supply, and consumer cost increases measuring collectively in the billions of dollars.

Figure 1: Peak Demand Forecast for the Northeast

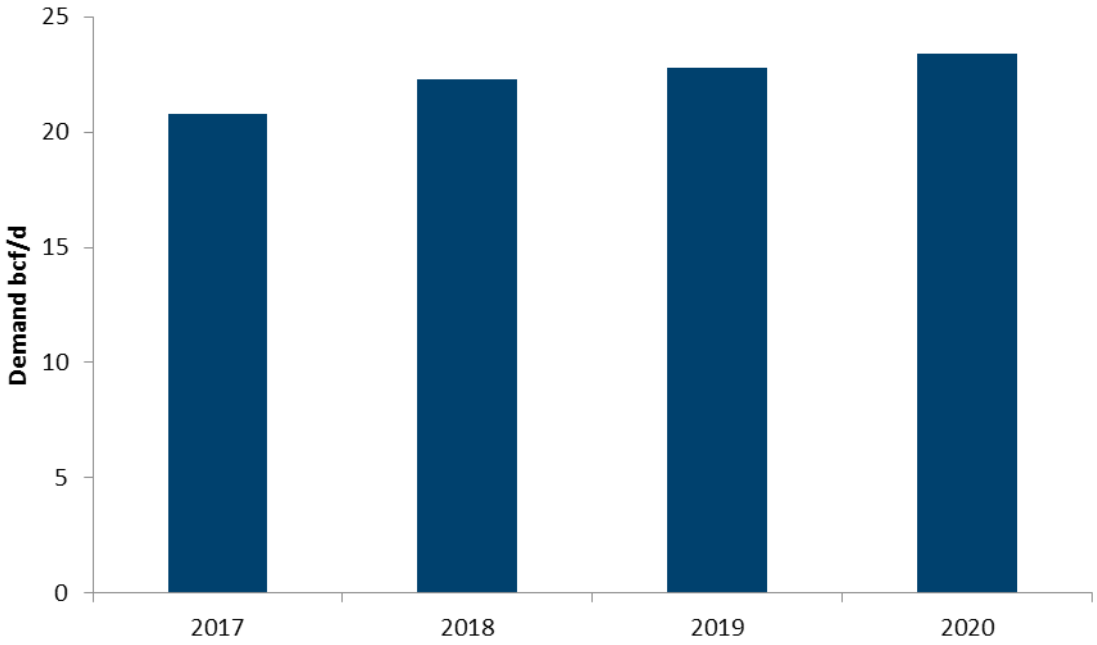


Table 6: Total Existing Inflow Capacity into the Northeast (Bcf/d)

Pipeline Capacity into the Northeast by Route	Capacity (Bcf/d)
Pennsylvania/ Delaware to New Jersey	8.4
Pennsylvania to New York	4.7
Canada to New York	3.2
Canada to New England	1.1
LNG Imports Capacity	2.6
Total	**20.0**

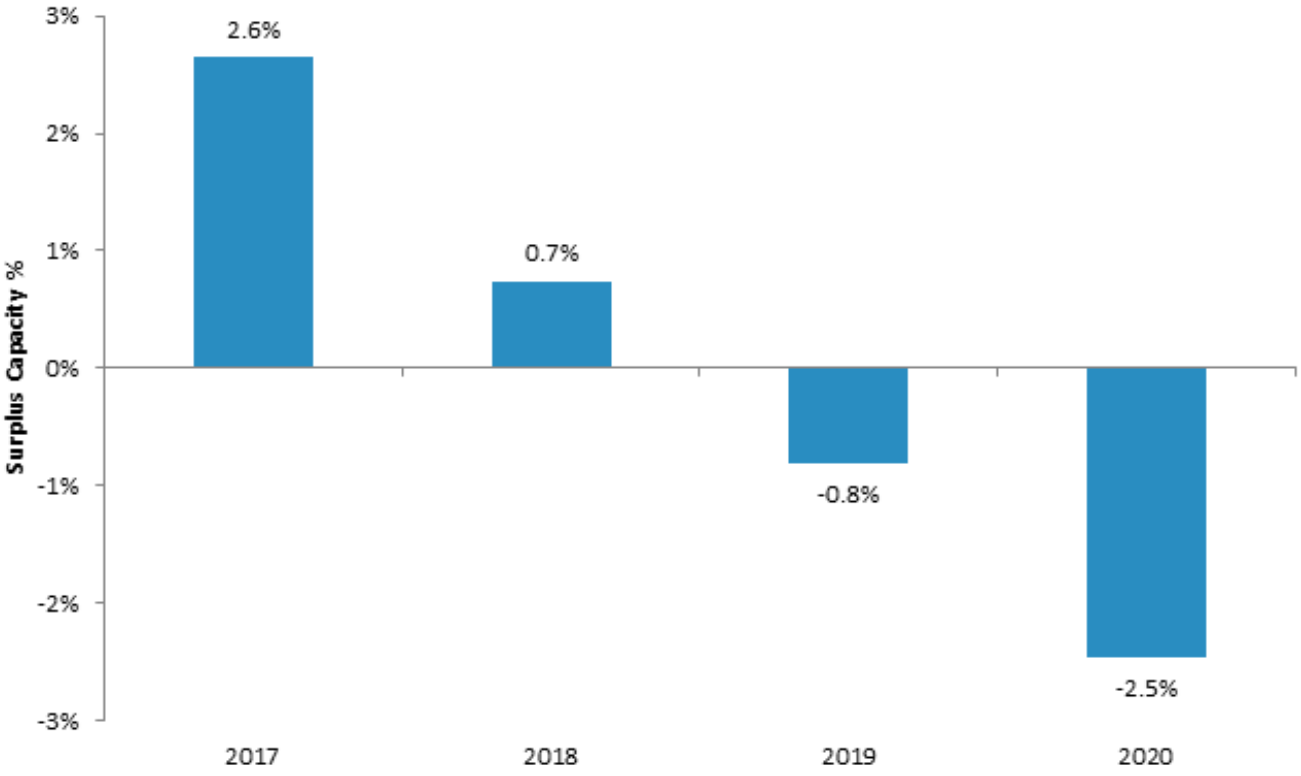
Table 7: Planned Pipeline Capacity Additions in the Northeast

Pipeline	State/Region to State/Region	Status	Capacity (Bcf/d)
Interstate into the Northeast			
PennEast	PA to NJ	Under FERC Review	1.00
Northern Access	PA to NY	Approved	0.48
Continent to Coast	Canada to NY	Approved	0.10
Total			**1.58**
Interstate within the Northeast			
Constitution Pipeline	NY to New England	FERC approved, but on hold due to NY state environmental review	0.63
Algonquin Incremental Market (AIM) Project	NY to New England	Under Construction	0.33
New York Bay Expansion	NY to New England	Under Construction	0.11
Access Northeast	NY to New England	On Hold	0.90
Atlantic Bridge Project	NY, CT, MA, and ME	Approved	0.13
South to North Project	NY to CT	Under Company Consideration	0.63
Total			**2.73**
Intrastate within the Northeast			
Connecticut Expansion Project	CT	Approved	0.07
Garden State Expansion Project	NJ	Approved	0.18
Wright Interconnector Project*	NY	FERC approved, but awaiting a NY state air permit	--
New Market Project	NY	Approved	0.08
Salem Lateral Project	MA	Under Construction	0.11
Valley Lateral	NY	Approved	0.13
Eastern System Upgrade	NY	Under FERC Review	0.23
Total			**0.80**

* Capacity increase is part of Constitution Pipeline;

Note: As of March 2017, FERC does not have a full quorum of commissioners to issue pipeline certifications. This analysis does not attempt to quantify the impacts of the lack of a quorum at FERC

Figure 2: Northeast Surplus Natural Gas Delivery Capacity



THE JONES ACT IMPACT

Originally passed by Congress nearly a century ago to support the country's Merchant Marine fleet after World War I, the Jones Act requires that maritime transport of cargo between points within the United States be carried by vessels that are owned by U.S. citizens, registered under the U.S. flag, and physically built in the United States.

But according to a 2015 report issued by the Government Accountability Office (GAO), "currently operating LNG carriers are nearly all foreign built and operated. LNG carriers have not been built in the United States since before 1980, and no LNG carriers are currently registered under the U.S. flag." [12]

In effect, this means that LNG regasification facilities based in New England have no practical ability to access LNG supplies that originate in or are sent out of the United States. In Boston, a terminal located on the Mystic River receives shipments of LNG primarily during the winter months almost exclusively from suppliers in Trinidad and Tobago. Recent reports indicate that shipments have only increased over the past several years, with import volumes reaching a three-year high in 2015.[13]

Of course, whether the Mystic River terminal receives its natural gas from Cove Point, Md. or Trinidad, the CH_4 molecules are the same. But the price consumers are forced to pay for those molecules is not. In that same GAO report cited above, the agency estimates that establishing a fleet of Jones-Act compliant LNG cargo ships

would add an additional $0.73 per MMBtu onto the price of the delivered product, representing a 24 percent increase in shipping rates that would be passed along to the consumer.[14]

Without the Jones Act, these costs would not apply, and consumers in the Northeast would be in line to access LNG supplies that are cheaper both in their origination (as natural gas at the wellhead) and in their delivery (as LNG shipments traveling 450 miles from Maryland, as opposed to 2,400 miles from Trinidad).

CITATIONS

1 Note that the AEO does not break out forecasted demand by specific states, but rather by region. To calculate New York and New Jersey forecasted demand, the Institute used the forecast for the appropriate region and multiplied by these states' historical share of natural gas consumption in the region between 2010 and 2015..

2 Total natural gas demand includes demand in the following sectors: Residential, Commercial, Industrial, Transportation, Electric Power Generation, and Other.

3 https://www.technologyreview.com/s/602079/new-york-state-has-a-plan-to-rescue-nuclear-power/

4 https://www.rtoinsider.com/federal-suit-new-york-nuclear-power-subsidies/

5 https://www.nytimes.com/2017/01/09/nyregion/cuomo-indian-point-nuclear-plant.html?_r=1

6 Note that data for Vermont was not available. However, it is assumed that Vermont follows the same demand curve shape as the rest of New England and New York.

7 Record winter withdrawals create summer storage challenges, EIA., June 12, 2014. Available at: http://www.eia.gov/naturalgas/review/winterlookback/2013/

8 Taming the polar vortex. (2014). Washington Post. Available at: http://www.washingtonpost.com/sf/brand-connect/wp/enterprise/taming-the-polar-vortex/

9 http://energyresearchcouncil.com/Polar-vortex-effect-on-electricity-prices.html

10 Data is available for download here: https://www.eia.gov/naturalgas/pipelines/EIA-StatetoStateCapacity.xls

11 These import terminals include: Distrigas, Northeast Gateway Project, and Neptune LNG. These terminals have a max sendout capacity of 1.0 Bcf/d, 0.8 Bcf/d, and 0.75 Bcf/d, respectively.

12 http://www.gao.gov/assets/680/673976.pdf

13 https://www.bloomberg.com/news/articles/2016-07-12/pipeline-phobia-keeps-new-england-s-unlikely-trade-route-open

14 http://www.gao.gov/assets/680/673976.pdf

CHAPTER 5

ECONOMIC IMPACT METHODOLOGY

The previous sections summarize the current state and capacity of the Northeast's natural gas infrastructure, as well as projecting out the region's future market needs. In this section, we quantify the economic impact of preventing pipeline development from moving forward in this region, and also take a look at the cascading impacts it could create for economic sectors across the entire value chain.

METHODOLOGY

The analysis presented here estimates the potential impacts over the next four years: 2017 to 2020. This time frame includes all recently announced pipeline projects while still capturing the increase in production to utilize the capacity, as well as the benefits of lower energy prices to end-consumers. Our economic impact analysis is divided into three natural gas value chain segments:

- **Upstream:** Natural gas extraction
- **Midstream:** Gas pipeline investments
- **Downstream:** End-consumers of natural gas and electricity

To estimate the economic impacts across these three segments, we used publicly available economic data from announced pipeline projects, energy demand forecasts, and announced retirements of nuclear generators.

We then ran these economic inputs through the IMPLAN model to estimate the overall macroeconomic effects of preserving the status quo, which effectively prevents new pipeline infrastructure from being developed in and into the region.

IMPLAN is a commonly used and highly regarded input-output modeling software and data system that tracks the movement of money and resources through an economy, looking at linkages between industries along the supply chain to measure the cumulative effect of spending in terms of job creation, income, production, and taxes. These aspects of the IMPLAN model help us understand and quantify the economic "ripple" (or multiplier) effect that tracks how each dollar of input, or direct spending, cycles through the economy to suppliers and ultimately to households.

UPSTREAM: ECONOMIC IMPACTS OF PIPELINE DEVELOPMENT

As previously mentioned, the outflow of new supply coming out of the Marcellus and Utica regions will not benefit Northeast residents as much as it could if much-needed infrastructure projects are not allowed to move forward. The key states poised to be supplying the Northeast with incremental natural gas supplies would be Pennsylvania, Ohio, and West Virginia.

These upstream states would lose out on sales and corresponding private sector capital expenditures (capex) without the planned pipelines being built. Using publicly available data on well decline rates and capex per well, we translated incremental demand into wells not drilled and then capex not spent within each state. The capex necessary for the additional production serves as the main input into the IMPLAN model across four expenditure categories:

- Extraction of oil and natural gas
- Drilling of oil and gas wells
- Construction of new non-residential structures
- Household income impacts (from land lease deals as well as royalty payments)

Our capex input into IMPLAN was proportionately distributed across Pennsylvania, Ohio and West Virginia based on historical production levels.

MIDSTREAM: ECONOMIC IMPACT OF PIPELINE DEVELOPMENT

The midstream economic impact data is derived from pipelines that specifically serve the Northeast region. We used FERC filings and also examined announcements from organizations such as the Northeast Gas Association to capture the full breadth of projects planned for the New England states, as well as New Jersey, New York and Pennsylvania.[1] Where detailed breakouts of project costs were not available, we apply a cost structure breakdown from projects where data were available.[2] The pipeline costs were distributed across the following expenditure sub-categories:

- Employee compensation
- Architectural, engineering and related services
- Iron, steel pipe and tube manufacturing
- Construction of other new nonresidential structures
- Insurance carriers (for contingency)
- Legal services
- Advertising, marketing and related services

The costs are then further refined to capture only the spending that would occur in the specific state of interest, filtering out any outlays that were or could have been made in other states.

We assume as part of this analysis that project costs are spread equally across the years in which the projects are active. For example, if a project was scheduled to start construction in 2016 and end it in 2018, and cost $300 million in total, we assume project expenditures of $100 million each in 2016, 2017 and 2018.

In situations where pipelines traverse several states, project costs were attributed according to the length of pipeline that was laid in each respective state. The economic impacts of more than $7.8 billion of announced pipeline capital expenditure were considered in this analysis.

DOWNSTREAM: IMPACTS OF LOWER COSTS TO END-USERS

According to two recent studies by Concentric Energy Advisor, increasing pipeline capacity and incentivizing supply will translate into reduce natural gas and electricity costs to end-consumers. [3] The studies focused on four primary areas of potential savings that could be achieved from additional pipeline infrastructure and lower market area natural gas prices:

- Electric consumers when natural gas-fired generation resources set the electric energy price based on lower market area natural gas prices ("Gas-Fired Generation Savings")
- Electric consumers when natural gas-fired generation resources could displace less efficient and more costly oil-fired generating resources, and set the electric energy price based on lower market area natural gas prices ("Oil-Fired Generation Displacement Savings")
- Industrial natural gas consumers that are purchasing natural gas supplies at lower market area natural gas prices ("Industrial Transport Customer Savings")
- Natural gas local distribution company (LDC) customers when LDCs have the opportunity to purchase more natural gas supplies from lower-cost, local Marcellus Shale production ("LDC Gas Supply Savings")

These cost savings were then divided up across every single economic sector (536 in total) and input into IMPLAN to fully capture the economic consequences if the costs savings were not realized. Cost savings were assessed for Pennsylvania, New Jersey, New York,[4] Massachusetts[5] and all of New England. The cost savings per year was directly proportional to the capacity expected to be online in each respective state.

CITATIONS

1 Pipeline projects that were considered expansions or upgrades in addition to new builds were included in this analysis

2 We used the Atlantic Bridge Project's filing to the FERC to serve as a representative distribution of project costs across spending categories.

3 "New England Cost Savings Associated with New Natural Gas Supply and Infrastructure", Concentric Energy Advisors, May 2012 & "Estimated Energy Market savings from Additional Pipeline Infrastructure Serving Eastern Pennsylvania and New jersey", Concentric Energy Advisors, March 2015.

4 New York was extrapolated using New England results and respective natural gas capacities. This is a conservative assumption since New York has a higher population than New England.

5 Massachusetts was prorated using State Energy Data System (SEDS) from the EIA.

6

NATIONAL ECONOMIC IMPACTS

The results show not just those directly associated with the pipeline or production industries, but also indirect impacts from suppliers to the operators as well as induced impacts from the earnings spent by the employees, contractors and suppliers. All results (unless otherwise noted) are presented in 2016 dollars.

Table 8 captures the total economic impact of a future in which planned pipeline development is prevented from moving forward in Northeast, combining all those impacts that would be realized across the upstream, midstream and downstream sectors in the states we studied. **Based on this analysis, we find that nearly $7.6 billion in total lost GDP opportunity would be the upshot of a no-pipeline policy, with an additional $3.8 billion in lost employee compensation over the next four years.** We also find that 78,400 job-years would not be created during the same span.

UPSTREAM

Pennsylvania, Ohio and West Virginia have established themselves as leaders of the energy renaissance movement, owing primarily to their development of the Marcellus and Utica basins. Under a scenario in which pipeline development in the Northeast is halted in the future, these states would also stand to be negatively impacted, especially insofar as the policy results in them losing access to otherwise viable markets for their products.

Table 9 shows that the three non-Northeast states we analyzed would stand to **lose more than $1.4 billion in state GDP and $522 million in employee compensation over the next four years if the development of pipeline projects into the Northeast is halted.** The thousands of potential jobs that will be lost also happen to be high-wage jobs compared to the national average. Production already has slowed recently due to falling prices, and the lack of access to a new market with significant and demonstrable demand for natural gas may further exacerbate the problem in these states.

MIDSTREAM

If all of the announced pipeline projects outlined earlier in this report were prevented from moving forward, nearly **14,900 jobs and $1.2 billion in state GDP impacts would disappear** or not be created in 2017 alone. As Table 10 shows, many of the pipeline projects that are currently still in need of additional permits to move forward are actually scheduled to be completed in 2017 and 2018. The lone exception is PennEast, which is

Table 8: Total Annual Economic Lost Opportunity if NE Pipeline Development is Prevented – Impacts to New England, New York, New Jersey, Pennsylvania, Ohio, and West Virginia

	2017	2018	2019	2020	Total
Employment (jobs)	16,188	21,925	20,136	20,106	78,355
Labor Income (millions)	$948.9	$1,252.3	$1,124.5	$1,119.2	$4,444.8
Employee Compensation (millions)	$790.9	$1,056.8	$956.3	$951.0	$3,755.2
GDP (millions)	$1,496.9	$2,071.7	$2,008.6	$2,027.4	$7,604.6

Table 9: Total Annual Upstream Economic Lost Opportunity Impacts to Pennsylvania, Ohio and West Virginia

	2017	2018	2019	2020	Total
Employment (jobs)	1,800	2,424	3,052	3,755	11,032
Labor Income (millions)	$109.9	$146.7	$183.8	$224.2	$664.6
Employee Compensation (millions)	$86.0	$115.2	$144.5	$176.7	$522.3
GDP (millions)	$237.5	$315.4	$393.6	$477.7	$1,424.2

scheduled to come online in 2019.

DOWNSTREAM

Among all the sectors we studied, the downstream sector stands to take the biggest hit under a no-new-pipeline scenario in the Northeast.

Economic losses in this case are based on the savings that could have been enjoyed year after year if these pipelines were permitted to move forward. The economic impacts shown in Table are proportional to the additional capacity that would come online from 2017 to 2020.

We find that depriving the region of the lower natural gas prices that would have been available owing to proper pipeline build-out would result in nearly **$5 billion in lost GDP, $2.5 billion in lost employee compensation, $2.9 billion in lost labor income and 52,400 unrealized jobs** during the four year span. Higher energy prices would continue to be a burden on both residential and business consumers alike.

Table 10: Total Annual Midstream Economic Lost Opportunity Impacts to Pennsylvania, New England, New York and New Jersey

	2017	2018	2019	2020	Total
Employment (jobs)	7,886	6,277	734	-	14,897
Labor Income (millions)	$474.6	$377.7	$45.7	-	$898.0
Employee Compensation (millions)	$388.0	$310.6	$37.5	-	$736.1
GDP (millions)	$637.1	$504.8	$65.4	-	$1,207.2

Table 11: Total Annual Downstream Economic Lost Opportunity Impacts to Pennsylvania, New England, New York and New Jersey

	2017	2018	2019	2020	Total
Employment (jobs)	6,502	13,224	16,350	16,350	52,426
Labor Income (millions)	$364.3	$727.7	$895.0	$895.0	$2,882.1
Employee Compensation (millions)	$316.9	$631.1	$774.3	$774.3	$2,496.7
GDP (millions)	$622.3	$1,251.6	$1,549.7	$1,549.7	$4,973.3

7

STATE-LEVEL AND REGIONAL ECONOMIC IMPACTS

We also captured the economic impacts on a state by state basis. Certain states affect different sectors of the pipeline infrastructure more than others. Pennsylvania, New England, New York and New Jersey will be hardest hit from the scenarios we studied, whereas Ohio and West Virginia would lose out on a number of upstream opportunities.

NEW ENGLAND

Without much of an indigenous upstream segment to speak of, New England will see the greatest impacts primarily to its midstream and downstream sectors. We project the total midstream and downstream GDP losses to be $2.0 billion, as shown in Table 12 – with **$1.4 billion in GDP lost** due to shouldering higher than necessary energy prices.

The loss of planned pipeline upgrades within the region would also deprive the region of **$600 million in potential GDP impacts.** The midstream and downstream impacts translate to **22,900 potential job-years vanishing** – which itself results in over **$1.3 billion in labor income lost** over a four-year period.

MASSACHUSETTS

As the most populous of the six New England states, Massachusetts would absorb the greatest economic losses of any state in that region. Over a four-year span, our analysis indicates that Massachusetts could see GDP losses of nearly **$792 million, or roughly 40 percent of the total GDP lost** across New England. The 8,700 job-years that would vanish are also **roughly 40 percent of New England's job-loss total**.

Of the 8,700 job-years lost, roughly 62 percent of those come from downstream electricity price impacts to residential, industrial and commercial consumers, as depicted in Table 13. In other words: most people end up losing their jobs because their employers can't afford to pay their energy bills.

Table 12: Total Annual Economic Lost Opportunity - New England

	2017	2018	2019	2020	Total
Employment (jobs)	6,388	8,073	4,237	4,237	22,936
Labor Income (millions)	$374.5	$464.5	$231.6	$231.6	$1,302.3
Employee Compensation (millions)	$315.7	$395.3	$202.4	$202.4	$1,115.7
GDP (millions)	$530.3	$689.8	$388.9	$388.9	$1,998.0

Table 13: Total Annual Economic Lost Opportunity - Massachusetts

	2017	2018	2019	2020	Total
Employment (jobs)	1,629	3,429	1,800	1,800	8,658
Labor Income (millions)	$109.3	$212.4	$103.1	$103.1	$528.0
Employee Compensation (millions)	$93.7	$185.7	$92.0	$92.0	$463.4
GDP (millions)	$141.9	$311.4	$169.6	$169.6	$792.4

PENNSYLVANIA

Pennsylvania stands to be the biggest loser under a no-new-pipelines scenario, as shown in Table 14. Significantly, the commonwealth is projected to lose out on nearly **$2.4 billion in total GDP over a four year period,** with those impacts fairly evenly distributed among the streams. Pennsylvania could see thousands of potential jobs disappear across the upstream, midstream and downstream sectors and with them almost **$1.3 billion in labor income.**

NEW YORK

New York's total economic losses closely mirror those of New England, but would be felt almost entirely due to the projected downstream effects. New York would **lose about $200 million in GDP** due to lost opportunities in the midstream space, while the remaining $1.4 billion in GDP losses come from higher electricity and natural gas costs.

New York highlights how critical pipeline infrastructure is to the state economy as the higher prices alone would extinguish more than 87 percent of both the **$971 million in employee compensation** and **17,400 total job-years** losses, as shown in Table 15.

NEW JERSEY

Much like its neighbor, New Jersey also will be hard hit mostly due to downstream impacts from the lack of pipeline infrastructure being green-lighted in the future. More than 95 percent of the **$1.2 billion in GDP losses** between 2017 and 2020 come from downstream effects, as New Jersey essentially isolates itself from abundant natural gas supplies in nearby Pennsylvania, Ohio and West Virginia. Table 16 shows that over a four year span, **$673 million in labor income** and **11,600 job years would disappear** under a no-pipeline scenario.

OHIO

Ohio will lose out on nearly **$295 million in GDP over the next four years** based on our analysis, which is captured in Table 17. The state is poised to see significant increases in natural

Table 14: Total Annual Economic Lost Opportunity - Pennsylvania

	2017	2018	2019	2020	Total
Employment (jobs)	3,526	5,401	6,387	6,548	21,861
Labor Income (millions)	$210.9	$311.4	$362.4	$374.1	$1,258.9
Employee Compensation (millions)	$169.7	$255.8	$301.7	$311.3	$1,038.5
GDP (millions)	$357.1	$571.3	$711.3	$748.4	$2,388.1

Table 15: Total Annual Economic Lost Opportunity – New York

	2017	2018	2019	2020	Total
Employment (jobs)	2,281	4,662	5,462	4,981	17,385
Labor Income (millions)	$132.6	$262.8	$303.7	$272.2	$971.2
Employee Compensation (millions)	$113.6	$227.4	$263.9	$237.8	$842.7
GDP (millions)	$211.4	$430.0	$502.7	$457.1	$1,601.2

gas production as commodity prices continue to emerge from their recent lows, and Ohio is well positioned to service new markets in the Northeast assuming additional infrastructure is permitted to move forward.

While these results capture only the losses we would expect to occur owing to a drop in future production (thanks to an important market being blocked off), the analysis does not capture the deleterious impact that lower commodity price might deliver, which itself could be exacerbated by an over-supply situation wrought by the closing-off of Northeast markets.

WEST VIRGINIA

Finally, the state of West Virginia stands to lose out on more than **$124 million in labor income over the next four years**, and **$159 million in GDP impacts** thanks to policies in place in the Northeast that prevent new energy infrastructure from being permitted and approved (Table 18).

Table 16: Total Annual Economic Lost Opportunity – New Jersey

	2017	2018	2019	2020	Total
Employment (jobs)	3,241	2,777	2,777	2,777	11,572
Labor Income (millions)	$191.2	$160.7	$160.7	$160.7	$673.4
Employee Compensation (millions)	$162.5	$139.0	$139.0	$139.0	$579.6
GDP (millions)	$322.8	$280.4	$280.4	$280.4	$1,164.0

Table 17: Total Annual Economic Lost Opportunity – Ohio

	2017	2018	2019	2020	Total
Employment (jobs)	334	455	577	717	2,083
Labor Income (millions)	$18.7	$25.2	$31.8	$39.1	$114.9
Employee Compensation (millions)	$12.6	$17.1	$21.7	$27.0	$78.4
GDP (millions)	$48.8	$65.1	$81.4	$99.1	$294.5

Table 18: Total Annual Economic Lost Opportunity – West Virginia

	2017	2018	2019	2020	Total
Employment (jobs)	419	557	696	846	2,518
Labor Income (millions)	$20.9	$27.6	$34.3	$41.4	$124.1
Employee Compensation (millions)	$16.8	$22.2	$27.7	$33.5	$100.2
GDP (millions)	$26.4	$35.1	$43.9	$53.4	$158.9

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