The Beacon Hill Institute

The Economic Impact on Massachusetts of the Proposed Northeast Energy Direct Pipeline

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Executive Summary

For years, high energy costs in Massachusetts have posed a barrier to economic growth. While the state is well endowed with human capital in the form of a highly-skilled, well-educated workforce, "hard industries" are difficult to sustain. Massachusetts needs to expand gas transmission capacity, particularly as New England converts most of its coal-fired electric plants to gas. The inability to exploit the lower price of natural gas is to a detriment not only of industrial users of energy but also commercial and household users.

The Beacon Hill Institute has analyzed the economic effects of building the Northeast Energy Direct (NED) project, which would upgrade, extend and build new pipeline through New York, New Hampshire and Massachusetts. The Institute used the proprietary IMPLAN (Impact Analysis for Planning) model to determine short-term economic impacts and then applied its STAMP (State Tax Analysis Modeling Program) model to determine long-term impacts. Table ES-1 displays the short term impacts.

Table ES-1: Economic Impact of the NED Construction Project (IMPLAN)

Impact Type	Employment (jobs)	Labor Income (millions $)	Value Added (millions $)
NED Project	680	159	NA
Direct Effect	157	11	14
Indirect Effect	97	8	12
Induced Effect	890	50	80
Total Effect	1,824	228	106

We report four types of impacts – the project, the direct, indirect, and induced impacts. The ***project impact*** accounts for NED hiring local workers and their wages. The ***direct impact*** represents the amount of money spent by the firm in the state economy on its purchases. The ***indirect impact*** represents the spending done by other businesses that are supplying goods and services to the project. Finally, the ***induced impacts*** refer to the income and employment created as a result of the spending done by employees of the NED construction project.

The Institute found that the project would lead to the creation of 1,824 temporary jobs that would pay $228 million in wages. The short-term benefit to the local economy would be $106 million in new production.

Our STAMP model shows the long-term effects of the pipeline on the Massachusetts economy. The Institute estimated the impact on the economy of:

- Scenario (1): building a pipeline with 1.2 Bcf/d (billion cubic feet per day) and
- Scenario (2): building a pipeline with 2.2 Bcf/d.

Table ES-2 shows the economic effects of Scenario 1, which we estimate would eliminate 70% of the natural gas shortage in Massachusetts and thus reduce energy prices. The lower energy prices would lead to the creation of 9,420 jobs by 2020. Investment would increase by $735 million and real disposable income would increase by $1.7 billion, or $610 per Massachusetts household.

Table ES-2: Scenario 1: Long-Term Economic Impact of NED on Massachusetts in 2020 (STAMP)

Total employment (jobs)	9,420
Investment ($ millions)	735
Real disposable income($ millions)	1,700
Real disposable income per household($)	610

Table ES-3 shows the economic effects of Scenario 2, which would eliminate virtually the entire winter natural gas shortage in Massachusetts. A further reduction in energy prices would lead to an employment increase of 12,025 jobs by 2020. Investment would increase by $906 million and real disposable income would increase by $2.133 billion, or $770 per Massachusetts household.

Table ES-3: Scenario 2: Long-Term Economic Impact of NED on Massachusetts in 2020 (STAMP)

Total employment (jobs)	12,025
Investment ($ millions)	906
Real disposable income($ millions)	2,133
Real disposable income per household($)	770

These findings suggest that consumer welfare would increase dramatically — offering relief to the region's perennial energy cost problems. Lower energy cost would translate into investment in manufacturing where the high price of electricity and natural gas has long served as a barrier to growth. Thus, the increased availability of natural gas could sustain and increase the state's competitive advantage.

Overview

After years of depending on the vagaries of foreign energy markets, the United States is on the verge of becoming self-sufficient in energy due to the shale oil and gas revolution. Today, the United States is producing 3.5 million barrels of shale oil per day and about 9.5 trillion cubic feet (Tcf) of shale gas.[1] Investment in the industry has increased from 0.4 percent of GDP to 0.9 percent between 2004 and 2012. Jobs in the national oil and gas sector during the same period increased 52 percent. There is no indication that natural gas consumption will slow down either in the U.S. or globally. In the West gas consumption is expected to grow between 20-30 percent from 2010 to 2035; consumption in Asia will roughly double during the same period.[2]

Production of natural gas — increasingly critical to electric generation and home heating — has increased by more than 25 percent from 2007 to 2013.[3] As a result, the price of natural gas has been cut nearly in half. According to the Brookings Institution, the shale gas revolution has increased the welfare of natural gas consumers by $79 billion per year during this period. Taking into account producer losses of $30 billion due to price decreases, the net benefit to the U.S. economy is estimated to be $49 billion.[4] (Producer loses were offset in part by the development of new wells.)

The energy market is radically different from the old days of energy crises and worries about shortages. Horizontal drilling and fracking have enabled natural gas and oil extraction at levels that were unthinkable in previous decades. Deposits once considered out of reach are now accessible. According to forecasts from the Energy Information Administration, fossil fuels will continue to supply more than 81 percent of the nation's energy through 2040.[5] Moreover, shale gas extracted from once-unreachable places underground now makes up 40 percent of all the U.S. production, with a resulting positive

[1] Congressional Budget Office (CBO), "The Economic and Budgetary Effects of Producing Oil and Natural Gas from Shale," (December 2014) https://www.cbo.gov/publication/49815.

[2] Richard G. Newell and Stuart Iler, "The Global Energy Outlook," *NBER Working Paper* 18967 (April 2013), http://www.nber.org/papers/w18967.

[3] Catherine Hausman and Ryan Kellogg, "Welfare and Distributional Implications of Shale Gas," *Brookings Papers on Economic Activity*, BPEA Conference Draft, (March 19-20, 2015). http://www.brookings.edu/~/media/projects/bpea/spring-2015/2015a_hausman.pdf.

[4] Ibid.

[5] Energy Information Administration, Annual Energy Outlook 2015, (April 14, 2015) http://www.eia.gov/forecasts/AEO/ .

impact on federal revenue collections.[6] The expansion of shale gas production has had a greater impact on energy prices than that of shale oil. [7]

The electric power sector, which has been shifting away from coal and oil generation to natural gas has benefited immensely from lower prices.[8] The transition also comes with substantial environmental benefits since natural gas emits fewer greenhouse gases than coal and oil. The debate about climate change mitigation aside, natural gas will remain a far superior alternative to renewable energy because of its abundance and reliability. Natural gas is needed as a backup for solar and wind energy, given the intermittent reliability of those sources. In the near future, renewables can be expected to capture only 9.5 percent of the total U.S. energy market.[9]

The New England region would greatly benefit if it were able to take advantage of the natural gas revolution. To a high-energy-cost state like Massachusetts, the shale revolution should be welcome news. However, New England lacks the infrastructure from which to transport readily produced natural gas from other parts of the country. The inadequacy has been well documented. Existing pipelines cannot meet increased consumer and industrial demand.

In its 2014 outlook, ISO-NE (Independent System Operator, New England), the region's grid operator, said: "New England only benefits from the low price of sales gas if it can move into the region – and that will take more pipeline capacity."[10] Massachusetts runs the risk of seeing rapidly rising energy prices as coal plants here and in other states move toward compliance with the Clean Power Plan. Natural gas —not renewables — is the most likely candidate to replace dirtier coal plants.

New England paid the highest natural gas prices in the nation in 2013. But higher prices are only part of the story. The lack of supply also undermines the goal of sustaining cleaner gas generating electric plants. Because local distribution companies focus primarily on residential and commercial customers during peak winter periods, that leaves less natural gas for electric companies with natural gas plants to generate power. The results of this unwelcome dynamic are higher prices for Massachusetts consumers while other parts of the nation reap the benefits of lower prices of domestic shale gas. It is a scenario that is likely to repeat every winter season.

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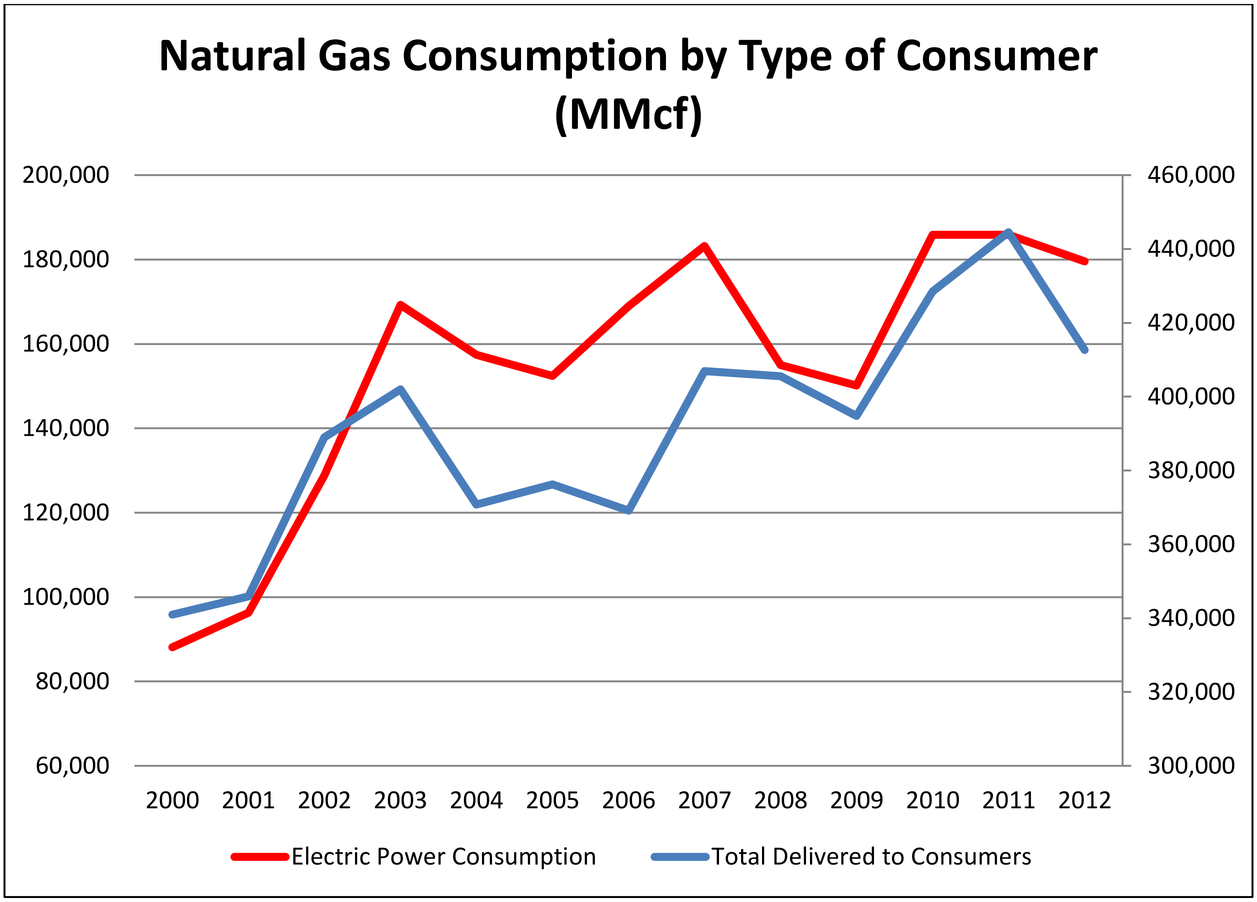
[6] CBO, "Economic and Budgetary Effects,"21. The CBO estimates that federal royalties from fracked oil and gas could total $300 million per year by 2024.
[7] Ibid.
[8] Brookings, 16.
[9] Mark J. Perry, American Enterprise Institute, Carpe Diem blog, (April 15, 2015), http://www.aei.org/publication/thursday-evening-links-6/. For a global perspective, see Richard G. Newell and Stuart Iler, See Table 4.
[10] ISO-New England, *2014 Regional Electricity Outlook*, (February 25, 2014):30, http://www.iso-ne.com/static-assets/documents/aboutiso/fin/annl_reports/2000/2014_reo.pdf.

Liquid Natural Gas (LNG) tankers are an alternative transport method. But LNG, which must be converted from a gaseous state to a liquid state and back to a gaseous state for delivery to consumers, is especially expensive. According to ISO-NE, "LNG tends to be four to five times more expensive than the typical price of gas sourced from the Marcellus Shale." Siting new port facilities to receive tankers has long been a contentious issue.



The shift to natural gas has been driven only in part by consumer choices – households switching from oil burners to gas heaters. State government also has had a guiding hand by closing down coal-fired plants and taking nuclear power plants offline. In Massachusetts, electric power generation from natural gas rose from 28 percent of total generation in 2000 to 68 percent in 2012.[11] Total natural gas consumption rose by 24 percent over the same period.[12]

[11] Energy Information Administration, Table 5. "Electric Power Industry Generation by Primary Energy Source, 1990-2012," http://www.eia.gov/electricity/state/massachusetts/.

[12] Calculations based upon data from the Energy Information Administration, "Natural Gas Consumption by End Use," http://199.36.140.204/dnav/ng/ng_cons_sum_dcu_SMA_a.htm.

If a consensus emerges for building out energy infrastructure, the question facing public officials becomes: How much is needed? Under current conditions New England has the capacity to import 2.7 billion cubic feet per day (Bcf/d) through existing pipelines (LNG delivery, Canadian imports and proposed new pipelines are not included). Winter conditions can ramp up demand to 4.5 Bcf/d, and this does not include what is needed for the generation of electricity. The consultancy firm Competitive Energy Services (CES) estimates that all six New England states require an additional 2.5 Bcf/d. Massachusetts, which consumes 50 percent of all New England usage would require 1.2 Bcf/d of extra capacity.[13] Most of that new capacity would go to electricity generation. Other research suggests that pipeline shortage in Massachusetts is persistent even under low demand scenarios.[14]

Tennessee Gas Pipeline Company, LLC is seeking to undertake "The Northeast Energy Direct Project." The Market Portion of the Northeast Energy Direct project from Wright, New York to Dracut, Massachusetts will include the construction of approximately 53 miles of pipeline co-located with existing utility corridors in New York, 64 miles of pipeline in Massachusetts, approximately 71 miles of pipeline in New Hampshire generally co-located with existing corridors, and additional laterals and loops.

Should NED proceed? What are the short-term and long-term benefits? What is the economic value of adding capacity?

Regulators, public officials and ordinary citizens need to know how a project will affect the local economy directly (that is to say how much activity will be generated building the pipelines in terms of investment, construction and jobs). They also need to know the long-term effects of increased pipeline capacity on the economy. This study seeks to measure both short-term and long-term effects.

To measure the short-term effects The Beacon Hill Institute applied the IMPLAN® (Impact Analysis for Planning) model to estimate components such as local purchases and employment. To measure the long-term effects the Institute applied its Massachusetts State Tax Analysis Modeling Program (MA-STAMP). This model can be applied to changes in both tax and regulatory policies. It permits the user to measure the effects of regulatory policy changes on key economic indicators such as employment, income and investment.

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[13] Richard Silkman, Mark Isaacson, Competitive Energy Services, "Report to the Tennessee Gas Pipeline Company, LLC, (December 5, 2014), http://tinyurl.com/q2pqyuw.

[14] Elizabeth A. Stanton, PhD et. al, "Massachusetts Low Gas Demand Analysis: Final Report," Synapse Energy, RFR-ENE-2015-012 Prepared for the Massachusetts Department of Energy Resources (January 7, 2015) See also Synapse Energy for Mass DOER 12/18/204 report. http://synapse-energy.com/sites/default/files/Massachusetts%20Low%20Demand%20Final%20Report.pdf.

Short-Term and Long-Term Economic Effects

The NED pipeline would be built by the firm Kinder Morgan (KM) at a capacity of 1.2 Bcf/d. However, the NED pipeline is expandable to 2.2 Bcf/d. During the construction of the pipeline, KM plans to spend $1.3 billion on labor, capital goods and materials in Massachusetts. The project will include nine new meter stations in Massachusetts. These expenditures would serve to increase economic activity through direct purchases from local vendors, through NED workers spending their wages in Massachusetts and purchases by local vendors to provide goods and services to the NED construction project. These constitute the short-term economic effects.

The pipeline will also provide long-term and more durable benefits by relieving the natural gas shortage and thus price spikes such as those incurred by Massachusetts over the recent winter. Consequently, electricity prices would fall as the state's electric utilities would be able to utilize more abundant and cheaper shale natural gas from Pennsylvania, instead of expensive alternatives, such as LNG and oil. Household and commercial consumers of natural gas would also realize savings from lower natural gas prices.

BHI considers the long-term economic effects of the pipeline under two scenarios. The first scenario considers the effects of the NED pipeline with a capacity of 1.2 Bcf/d and the second scenario considers the effect of pipeline with 2.2 Bcf/d.

Short-Term Effects

The short-term, local economic impact of the NED pipeline construction project on Massachusetts depends on the magnitude of KM's spending on the project. To determine this impact, it is crucial to understand how these expenditures flow through an economy. Are the dollars being spent on local goods and services or do they spill out into other states? Where do the construction employees live and spend the bulk of their earnings? For the pipeline, some purchases will fall outside the state and thus will not impact the local economy. For instance, many of the specialized parts used in the pipeline will be manufactured outside the state.

Although there will therefore be spillover benefits to other parts of the country, the construction of the pipeline will have local effects as well. The project will have a substantial local effect through its employment of workers and their subsequent purchases in the economy.

This local effect will have several components. Spending on the project will have a "ripple" effect whose influence flows through to other sectors and households in the state. In essence, the initial spending in one sector brings about spending in other sectors. This process creates income and employment as it reverberates through the state business community. Depending on the size of the initial impact, these ancillary effects can be quite large. In other words, each expenditure has what economists call "a multiplier effect" that represents the recycling of money and income in an economy. By determining the multiplier for each category of expenditures, it is possible to simulate the initial spending and trace its influence through an economy. By measuring the change in economic indicators (employment, for instance) we can calculate the ultimate economic impact.

There are four types of effects that new spending generates in an economy – the project itself and the direct, indirect and induced impacts of the project. The ***project impact*** consists of the wages paid workers hired by NED to build the pipeline. The ***direct impact*** consists of the money spent by NED on its purchases in the local economy. This spending directly creates income and employment for NED vendors. The ***indirect impact*** consists of the spending done by other businesses that are supplying the NED vendors' goods and services. This spending in turn creates employment and income for the vendors. Finally, the ***induced impacts*** consist of the income and employment created as a result of the spending by employees of NED, the local NED vendors and their vendors. Restaurants, retail stores, gasoline stations, etc. all benefit from the local spending by employees (both residents and non-residents of Massachusetts).

The project's expenditures can be divided into payroll and non-payroll expenditures. The project's non-payroll expenditures include transportation and purchases of materials. Table 1 provides a brief summary of the total expenditures in Massachusetts.[15]

As we would expect, payroll constitutes the largest component of the project's local expenditures and drives the impact on the local economy. Also, as was mentioned above, the highly specialized nature of the pipeline construction purchases creates a situation in which significant spending leaks from the local economy.

Table 1: Total Expenditures in Massachusetts

Category	**Total ($)**
Payroll expenditures	159,069,500
Local materials	11,513,881
Local components	62,957,188
Total	233,540,569

The expenditures presented above create additional indirect and induced economic impacts in the economy. As is detailed below, we present the impact of the NED construction project on the Massachusetts economy using three economic indicators: value-added and labor income and employment. Value-added represents a measure of the economic activity that ultimately sticks to the

[15] All figures include a 20.45 percent increase for contingency.

local economy. It consists of employees' wages, proprietors' income, indirect business taxes and corporate profit. It is the portion of output that is created locally.

For example, a consumer buys a t-shirt from a local shop in Massachusetts, and pays $5. Of this, $3.50 will go to the wholesaler, who is located outside of Massachusetts, $0.80 is earned as income for the local proprietor of the shop, $0.45 goes to the cashier behind the counter and $0.25 is collected in taxes. It is only appropriate to count the $1.50 that remains in Massachusetts as state economic activity, the rest is said to have "leaked" out of the economy. Employment represents the total change in jobs as a result of the direct, indirect and induced impacts of NED construction spending.

We report the impact of the NED project for the years 2017 and 2018. Table 2 below displays the results.

As a result of the spending by the NED project, its employees and vendors, an additional $135 million in value-added is created in Massachusetts. This represents true economic activity; dollars that stay in the local economy.

The direct impact of $12 million is a result of the direct spending by the NED project in Massachusetts. This spending, in turn, generates the indirect impact via spending by local vendors serving the NED project. The indirect effects contribute an additional $8 million to the Massachusetts economy. Finally, the spending by employees of NED and its vendors' employees contributes the final $115 million.

The NED project will employ 680 construction workers statewide. The direct impact of the NED project on employment is 157 additional jobs. The indirect impact, the result of the project's vendors' spending is 97 additional jobs and the induced impact, the result of vendor and NED employee spending, is 890 additional jobs. Thus, NED will lead to the creation of 1,824 additional, temporary jobs in Massachusetts. The employment impact represents the job creation due to spending by NED, its vendors, and employees.

The additional employment will translate into higher incomes for workers. KM is expected to spend $159 million on salaries and wages for Massachusetts workers. The direct impact on labor income of $11 million is a result of the direct spending by NED project in Massachusetts. This spending, in turn, generates the indirect impact via spending by local vendors serving the NED project. The indirect effects contribute an additional $8 million in labor income. Finally, the spending by employees of NED and its vendors' employees contributes $50 million to labor income. The total increase in labor income would be $228 million.

Table 2: Economic Impact of the NED Construction Project

Impact Type	Employment	Labor Income (millions $)	Value Added (millions $)
NED Project	680	159	NA
Direct Effect	157	11	14
Indirect Effect	97	8	12
Induced Effect	890	50	80
Total Effect	1,824	228	106

Long-Term Effects

As stated above, the long-term effects derive from NED's ability to eliminate natural gas supply shortages in times of high demand and thus moderate prices to natural gas consumers – most notably electric utilities. The shortages caused recent electricity rates to skyrocket. The ample supply from NED would reverse these electricity rate increases.

Many different factors determine the price of natural gas in Massachusetts. Demand is primarily driven by average winter daily temperatures, electricity demand and the number of households that use natural gas for heat. Supply is almost perfectly fixed depending on the throughput capacity of pipelines and the availability of LNG supply to the region.

BHI estimates that the NED pipeline could save residential, commercial and industrial natural gas customers almost $367 million in 2020. In addition, we estimate that the NED pipeline could save the electricity consumers approximately $1.020 billion dollars in 2020, for a combined saving s of $1.387 billion dollars. The appendix provides details of the methodology.

Table 3A below shows how the NED pipeline under scenario 1 would affect the annual natural gas and electricity bills of households and businesses with average consumption of each in Massachusetts. The NED pipeline would save families $132 per year; commercial businesses $798 per year; and industrial businesses $16,385 per year.

In addition, The NED pipeline would save families $75 per year; commercial businesses $452 per year; and industrial businesses $4,169 per year on their natural gas bills.

Table 3A: Scenario 1 Annual Effects of the NED Pipeline on Natural Gas and Electric Prices in 2020

Type of Ratepayer	Natural Gas Bill ($)	Electricity Bill ($)	Total ($)
Residential	-75	-132	-207
Commercial	-452	-798	-1,250
Industrial	-4,169	-16,385	-20,554

Table 3B below shows how the NED pipeline under scenario 2 would affect the annual natural gas and electricity bills of households and businesses with average consumption of each in Massachusetts. The NED pipeline would save families $204 per year; commercial businesses $1,238 per year; and industrial businesses $25,415 per year.

Table 3B: Scenario 2 Annual Effects of the NED Pipeline on Natural Gas and Electric Prices in 2020

Type of Ratepayer	Natural Gas Bill ($)	Electricity Bill ($)	Total ($)
Residential	-82	-204	-286
Commercial	-490	-1,238	-1,728
Industrial	-4,522	-25,415	-29,937

In addition, The NED pipeline would save families $82 per year; commercial businesses $490 per year; and industrial businesses $4,522 per year on their natural gas bills.

BHI utilized the Massachusetts State Tax Analysis Modeling Program (MA-STAMP) to determine the effects of the reduced electricity prices due to the NED pipeline on the state.[16] MA-STAMP is a five-year dynamic Computable General Equilibrium model that simulates the economic effects of changes in costs (general and sector specific) and other "exogenous" variable changes. As such, it provides a mathematical description of the economic relationships among producers, households, governments and the rest of the world.

MA-STAMP is general in the sense that it takes all the important markets, such as the capital and labor markets, and flows into account. It is an equilibrium model because it assumes that supply equals demand in every market (goods and services, labor and capital). This equilibrium is achieved by allowing

[16] For a description about the MA-STAMP model see http://www.beaconhill.org/STAMP_Web_Brochure/STAMP_HowSTAMPworks.html. See also David G. Tuerck, "State Tax Policy: The Why and What of Economic Models," (February 28, 2002) http://www.beaconhill.org/STAMP-Method/Why-and-What-of-Economic-Modeling.pdf. See also http://www.beaconhill.org/STAMP-Method/ResponsetoITEPbybullet2014-0531.pdf.

prices to adjust within the model. And it is computable because it can be used to generate numeric solutions to economic cost changes.

BHI considers the long-term economic effects of the pipeline under scenario 1 with the NED pipeline capacity of 1.2 Bcf/d and the scenario 2 with the pipeline capacity of 2.2 Bcf/d. We assume the NED pipeline would complete construction prior to 2020 and would impact electricity and natural gas prices in 2020.

For scenario 1, we simulate a $1.387 billion dollar reduction in Massachusetts utility costs by reducing prices in the utilities sector. Table 4 displays the results.

Table 4: Scenario 1: Long-Term Economic Impact of NED on Massachusetts in 2020

Total employment (jobs)	9,420
Investment ($ millions)	735
Real disposable income($ millions)	1,700
Real disposable income per household($)	610

Massachusetts can expect to see 9,420 more jobs due to the reduction in utility prices. The state economy would see an increase in investment of $735 million as lower utility rates lower the cost of business expansion. This is especially true for industrial businesses that need to consume large quantities of electricity to operate.

The reduction in electricity bills would put more money back into household budgets. Real disposable income would increase by $1.7 billion, due to the lower electricity rates and the increase in employment brought about by the lower rates. This translates into an additional $610 dollars to every Massachusetts household.

For Scenario 2, we simulate a reduction in $1.8 billion dollar reduction in Massachusetts utility costs by reducing prices in the utilities sector. Table 5 displays the results.

Employment would increase by 12,025 jobs. The state economy would experience an increase in investment of $906 million.

Table 5: Scenario 2: Long-Term Economic Impact of NED on Massachusetts in 2020

Total employment (jobs)	12,025
Investment ($ millions)	906
Real disposable income($ millions)	2,133
Real disposable income per household($)	770

Real disposable income would increase by $2.133 billion, or an additional $770 dollars to every Massachusetts household.

These economic gains would translate into higher tax revenues as taxable income increases and business and household spending leads to higher sales tax receipts.

Conclusion

The Massachusetts economy has long thrived on its resilient nature. Not blessed by natural endowments, the state economy has drawn upon a supply of human capital applied to a diverse set of sectors ranging from health care and education to finance and high technology. In terms of new job growth since the end of the Great Recession, Massachusetts has kept pace with above average job growth. The record shows that Massachusetts is exceptionally competitive when it comes to the quality of its labor force, its record for innovation and the strength of its financial sector. A major problem is high energy costs. These costs have too often become an obstacle to sustaining the state's competitive advantage but also expanding the increasingly critical high tech based manufacturing sector in Massachusetts.[17]

The Northeast Energy Direct Project would reduce energy costs. We found that the project would introduce $300 million into the local economy on a short-term basis. In the long run, we found the project would increase employment and real disposable income and increase long-term investment by as much as $906 million.

The shale gas revolution may be the opportunity for Massachusetts to finally manage and trim its high energy costs. There is no question that Massachusetts —and the New England region — needs more gas pipeline capacity and an equitable financing mechanism.[18] This is all the more critical since the state seeks to meet its commitment to integrating costly renewable energy, which often, because of its intermittent nature, requires natural gas fired backup generation. The development of the pipeline will not diminish the state's commitment to developing clean energy since mandates are in place.

Whether the state proceeds or not with new capacity, domestic natural gas will find a market, if not in the U.S. then worldwide as global demand will increase and pressures to lift export bans intensify.

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[17] For greater discussion on the prospects for strengthening advanced manufacturing in Massachusetts see *Advanced to Advantageous: The Case for New England's Manufacturing Revolution,* The New England Council/Deloitte Consulting LLP (April 2015): 76.

[18] Bruce Mohl, "Should electric ratepayers pay for gas pipelines: Unprecedented proposal comes with risks," *CommonWealth,* (February 19, 2015), http://tinyurl.com/mma2c28.

The extra capacity available to household, commercial and industrial users as well as for electric utilities, should, however, instead address the perennial supply and demand issues holding Massachusetts back.

Methodology

Estimating the Utility Rate Savings

The NED project's potential impact on utility prices derives from an increase in the supply of natural gas to Massachusetts consumers. The increase in supply would, in turn, eliminate the shortages of natural gas supply that has arisen in the peak demand times over the past few winters.

The NED project would affect electric utility prices to a greater degree than residential and commercial natural gas heating costs. Firms that distribute natural gas directly to customers, or local distribution companies (LDCs) enter into long-term contracts for pipeline, LNG and storage capacity known as peak shaving facilities. This puts electric utilities second in line. In other words, during times of peak natural gas demand, LDCs receive priority of pipeline sources over electric utilities.

BHI estimates the cost savings to utility customers using data from the U.S. Department of Energy's Energy Information Administration (EIA) and electric rates from the Massachusetts Office of Energy and Environmental Affairs.

We use the variable monthly basic service rate data from the Massachusetts Department of Energy and Environmental Affairs to estimate the impact of the NED pipeline on electric rates.[19] The data list the electric rates in cents per kilowatt hour that the major electric utilities (NSTAR, National Grid, Western Massachusetts Electric Co. and Fitchburg Gas & Electric) charged to residential, small, medium and large commercial and industrial customers from 2001 through a portion of 2015.[20]

We know that the natural gas shortage, and subsequent price spikes began appearing in the winter of 2012 - 2013.[21] However, since the electric utilities had already filed their rates for that winter the impact would not be felt until the winter of 2013 – 2014. Moreover, the impact of the natural gas shortage combined with the extremely cold winter due to the "polar vortex" led the utilities to underestimate the rates increases needed to compensate for these factors. Thus, in the winter of 2014-2015, the utilities filed the rate increases necessary to fully compensate for the natural gas shortage.

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[19] Massachusetts Department of Energy and Environmental Affairs, Energy and Utilities, Variable Monthly Basic Service Rates, http://www.mass.gov/eea/energy-utilities-clean-tech/electric-power/electric-market-info/basic-default-service/.
[20] NSTAR and Western Massachusetts Electric Co merged and became Eversource in 2015.
[21] Boston Business Journal, "Massachusetts Faces Natural Gas Shortage Despite National Surge,"
http://www.masslive.com/business-news/index.ssf/2013/02/massachusetts_faces_natural_gas_shortage.html (February 25, 2013).

To estimate the impact of the natural gas shortage on electric rates, we compare the rates for the winter (November – March) in the three-year period prior to 2014 to the rates in 2013-2014 and 2014-2015. We assume that the NED pipeline will have sufficient capacity to eliminate 70 percent of the winter seasonal natural gas shortages.[22] We multiply the difference in rates by the retail electricity sales for each type of customer and each month.[23] We then sum up the difference for all 12 months to arrive at our estimate of the electricity cost increases due to the natural gas shortage. For 2014, our calculation yields a total electricity increase to Massachusetts rate payers of $700 million. However, with the full value the rate increases hitting in 2015, the cost increases to $1.278 billion.

Our estimates compare favorably to other analysis for the entire New England region. A Competitive Energy Services report projected that the NED pipeline would produce annual electricity cost savings of $2.381 billion from building NED with a capacity of 1.2 Bcf/d.[24] If we distribute this savings to Massachusetts based on its ratio of electricity consumption as a percentage of total New England consumption (45.5 percent), then the savings for Massachusetts is $1.082 billion. This figure is remarkably close to the midpoint of our estimate, or $1.02 billion. We use the midpoint of our estimate.

We used a similar process to estimate the cost savings for households and businesses that heat with natural gas. The EIA provides monthly data for state level natural gas prices delivered to residential, commercial and industrial consumers. Since the NED pipeline will provide New England access to gas from the Marcellus shale rock formation, we use the price differentials between Massachusetts and Pennsylvania to estimate the savings.

The differences between the two states show a remarkably stable pattern of higher gas prices in the winter months for Massachusetts relative to Pennsylvania, and the opposite in the summer months. The main factors affecting the price differentials between the two states are winter temperatures and availability and price of LNG sources. We acknowledge that over the past two winters, Massachusetts has experienced temperatures that have been significantly below average for longer time periods than normal. Nevertheless, pervious winters since 2000 have also experienced similar temperature recordings. For example, during the winter of 2006-2007 the price differential was $3 per thousand cubic feet averaged across all three customer types: residential, commercial and industrial. However, during the winters of 2002-2003 and 2009-2010, the average price differential was just over $1 per Tcf and during the mild winter of 2011 – 2012, the price difference was $0.68 per Tcf.

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22 Silkman and Isaacson, Report to Tennessee Gas Pipeline Company LLC, 5.

23 U.S. Department of Energy, EIA, Electricity Data Browser, Retail Sales of Electricity, Monthly: Massachusetts http://www.eia.gov/electricity/data/browser/#/topic/5?agg=0,1&geo=802&endsec=vg&linechart=ELEC.SALES.NEW-ALL.M&columnchart=ELEC.SALES.NEW-ALL.M&map=ELEC.SALES.NEW-ALL.M&freq=M&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin.

24 Silkman and Isaacson, 5.

Once again, we calculate the cost as the price differential multiplied by the consumption for that month. This was completed for the winter heating months (November-March) for the winters from 2001 – 2002 to 2014-2015. The average cost differential prior to the winter of 2013 – 2014 was $332 million, compared to the cost differential of $724 million in 2013-2014 and $1.001 billion in 2014-2015. The average cost difference over the two last winters is $862 million. The difference between the two periods is $530 million. Since NED will relieve 70 percent of the constraint in the gas pipeline, we multiply $530 million by 70 percent to get $371 million, which is our estimate of the cost savings to natural gas consumers from the NED pipeline.

To calculate the 2014 – 2015 cost difference we increased the $500 million dollar figure from November through January by 2/5 to account for February and March. This is likely an underestimate since the cold temperatures in Massachusetts didn't really kick in until February.

We used the same methods to calculate the effect of building NED with 2.2 Bcf/d of capacity. Under this scenario we assume the NED pipeline would eliminate 100 percent of the recent cost increases.

Ratepayer Effects

To calculate the effect of the policy on electricity ratepayers we used EIA data on the average monthly electricity consumption by type of customer: residential, commercial and industrial.[25] The monthly figures were multiplied by 12 to compute an annual figure. We inflated the 2013 figures for each year using the regional EIA projections of electricity sales.[26]

We calculated an annual percentage electricity decrease by dividing the total cost decrease — calculated in the section above — by the total electricity sales for 2020, or 11 percent. Then we applied the percentage to the projected electric bill. For example, we expect the average residential ratepayer to consume 7,500 kWh of electricity in 2020 and the expected price to be 16.98 cents per kWh in the same year for a total annual bill of $1,196. Therefore, we expect residential ratepayers to save $132 in 2020.

Modeling the Policy using MA-STAMP

We simulated these changes in the MA-STAMP model as a price decrease on the utility sector to measure the dynamic effects on the state economy. The model provides estimates of the proposal's impact on

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[25] Energy Information Administration, "Electric Sales, Revenue, and Average Price," (February 19, 2015) http://www.eia.gov/electricity/sales_revenue_price/.

[26] Energy Information Administration, "Electric Power Projections for North East Power Coordinating Council," http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=6-AEO2014&table=62-AEO2014&region=3-5&cases=ref2014-d102413a.

employment, wages and income. Each estimate represents the change that would take place in the indicated variable against a "baseline" assumption of the value that variable for a specified year in the absence of the NED pipeline.

Because the NED pipeline will reduce the cost of natural gas and electricity to households and firms the cost of goods and services will drop. These savings would typically manifest through lower utility bills for all sectors of the economy.

Within the MA-STAMP model[27], the reduction in natural gas and electricity prices reduces the cost of supplying natural gas and electricity to consumers, with attendant benefits in the form of job creation and new investment. Standard economic theory shows that a price decrease of a good or service leads to an increase in its overall consumption, and consequently a decrease in the production of that good or service.

[27] For a clear introduction to CGE tax models, see John B. Shoven and John Whalley, "Applied General-Equilibrium Models of Taxation and International Trade: An Introduction and Survey," *Journal of Economic Literature* 22 (September, 1984): 1008. Shoven and Whalley have also written a useful book on the practice of CGE modeling entitled *Applying General Equilibrium* (Cambridge: Cambridge University Press, 1992).

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The Beacon Hill Institute at Suffolk University in Boston focuses on federal, state and local economic policies as they affect citizens and businesses. The Institute conducts research and educational programs to provide timely, concise and readable analyses that help voters, policymakers and opinion leaders understand today's leading public policy issues.

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