Rhode Island Commerce
CORPORATION

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September 26, 2016

Ms. Luly Massaro
The Rhode Island Public Utilities Commission
89 Jefferson Blvd.
Warwick, RI 02888

Subject: The Narragansett Electric Company D/B/A National Grid Request for Approval of a Gas Capacity Contract and Cost Recovery Pursuant to R.I. Gen. Laws § 39-31-1 to 9; Docket No. 4627

Dear Ms. Massaro:

On July 1, 2016, the Rhode Island Commerce Corporation (Corporation) was notified by letter that The Narragansett Electric Company filed with the Public Utilities Commission (PUC), a Request for Approval of a Gas Contract and Cost Recovery provision on June 30, 2016.

Pursuant to R.I. Gen. Laws § 39-31-6(a)(1)(vi), Corporation is required to provide an advisory opinion on the expected statewide economic impacts resulting from the proposed contract.

In order to comply with the statutory requirement noted above, the Corporation engaged FTI Consulting, Inc., to undertake the analysis and prepare a report on the potential economic impacts this filing may have for the State of Rhode Island. A copy of the report is attached and its finding should be considered to fulfill the Corporation's statutory requirements in this matter.

Please do not hesitate to contact me, or Michael Walker of my staff at (401) 278-9100 should you have any questions.

Sincerely,

Darin M. Early
President and COO
Rhode Island Commerce Corporation

enclosure (1)

SEPTEMBER 23, 2016

FTI CONSULTING

THE ECONOMIC IMPACT OF THE ACCESS NORTHEAST PIPELINE ON RHODE ISLAND

PREPARED UNDER CONTRACT WITH THE RHODE ISLAND COMMERCE CORPORATION IN FULFILLMENT OF THE STATUTORY REQUIREMENTS ASSOCIATED WITH RHODE ISLAND PUBLIC UTILITY COMMISSION (RIPUC) DOCKET #4627

DISCLAIMER

This report has been prepared by FTI Consulting and is based upon the authors' review of third-party estimates of Access Northeast construction spending and their findings on regional electricity cost savings. The authors' also rely upon publicly available estimates of local purchase percentages of goods and services for pipeline projects. The economic impacts in this report, therefore, are subject to change based on any modifications to the estimates and findings relied upon.

Principal Authors:

Ken Ditzel Scott Nystrom

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Executive Summary

The Rhode Island Commerce Corporation ("Commerce RI") engaged FTI Consulting, Inc. ("FTI") to assess the potential economic impacts of the Access Northeast ("ANE") project in Rhode Island. The ANE project is a proposed series of pipeline upgrades across New York, Connecticut, Massachusetts, and Rhode Island. It consists of 123.4 miles of additional pipeline, 8 new or upgraded compressor stations, and 6.8 billion cubic feet (Bcf) of LNG storage capacity in Massachusetts. According to the project owners (Spectra Energy, Eversource Energy, and National Grid), the ANE project would provide gas transmission capacity for power generation during periods of peak gas demand in the winter.[1]

Using the IMPLAN model, FTI assessed the potential economic impacts of the pipeline on Rhode Island, in particular, and on its neighbors in Connecticut and Massachusetts. The economic impacts stem from the project's construction spending, operational spending, and its potential savings on electricity costs to consumers. Construction impacts would be short-term and would include expenditures related to the purchase, installation, and commissioning of the pipeline, the compressor stations, and an LNG facility, as well as construction jobs. The project's economic impacts due to its operation and potential electricity cost savings delivered to end-consumers would be long-term.

Table ES-1 shows the estimated impacts for Rhode Island, including direct, indirect, and induced impacts, during the two phases of the project (construction and long-term operations inclusive of electricity cost savings):

Table ES-1: Economic impact of the Access Northeast in Rhode Island

Economic Phase	Jobs Created (job-years)	GDP Created (2016 $ millions)	Labor Income Created (2016 $ millions)
Construction Phase (cumulative)	134	$15	$10
Operations and Electricity Savings (annual)	392	$33	$19

We estimate that 134 jobs would be added in Rhode Island during the construction phase and 392 jobs would persist thereafter once the ANE project begins operations. Connecticut and Massachusetts also would enjoy economic benefits from the project as most of the additional pipelines, compressor stations, and the LNG facility in Acushnet, MA, will be located there (see tables below). These states' impacts would have some spillover influence on the Rhode Island economy due to linked supply chains and commuting between the states.

Table ES-2: Economic impact of the Access Northeast project in Connecticut

Economic Phase	Jobs Created (job-years)	GDP Created (2016 $ millions)	Labor Income Created (2016 $ millions)
Construction Phase (cumulative)	1,858	$130	$99
Operations and Electricity Savings (annual)	1,197	$120	$67

Table ES-3: Economic impact of the Access Northeast project in Massachusetts

Economic Phase	Jobs Created (job-years)	GDP Created (2016 $ millions)	Labor Income Created (2016 $ millions)
Construction Phase (cumulative)	1,880	$156	$119
Operations and Electricity Savings (annual)	2,690	$270	$170

[1] Subsequent to the Massachusetts Supreme Judicial Court decision disallowing the ANE project from being ratepayer funded, National Grid and Eversource Energy have withdrawn from their contracts with Spectra; however, both companies have expressed publicly their commitment to moving the project forward.

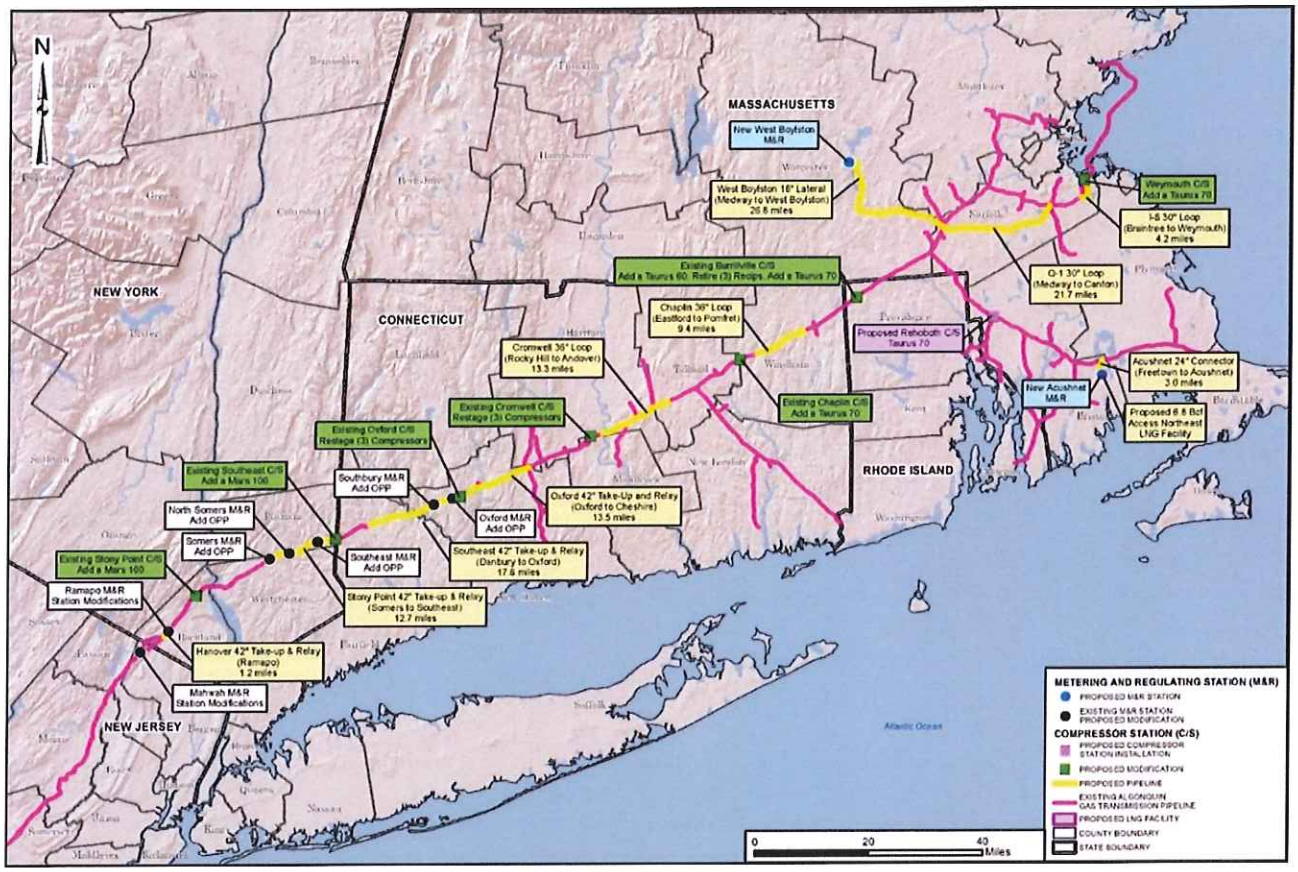
Background

Commerce RI retained FTI Consulting to assess the potential economic impacts of the Access Northeast project on Rhode Island and its neighboring states. Impacts include the project's influence on state and regional employment, GDP, labor income, and tax revenues. This report provides a summary of the ANE project, the various aspects of its construction and operations, and its economic impacts on Rhode Island, Connecticut, and Massachusetts The report also includes an appendix describing IMPLAN, a software program and input-output (IO) model designed to assess the impacts of policies and projects at a national, regional, state, and local level, and the data sources and assumptions underlying the inputs into IMPLAN and the results.

Introduction

The ANE project – a joint venture among Eversource Energy, National Grid, and Spectra Energy – is a series of upgrades to existing infrastructure on the Algonquin Pipeline. It mostly consists of adding 123.4 miles of additional or upgraded gas pipelines in the New York, Connecticut, and Massachusetts. It also includes compressor stations in New York, Connecticut, Massachusetts, and one in Burrillville, Rhode Island. Finally, the ANE project includes a proposed LNG storage facility near Acushnet, Massachusetts. The map below shows the pipeline upgrades (in yellow), the enhanced compressor stations (in green and purple), and the LNG storage facility:

Figure 1: Map of ANE Pipeline Upgrades, Compressor Stations, and LNG Facility[2]



According to the project sponsors, the main purpose of the ANE project is to alleviate supply constraints in the New England gas market to better serve power generation needs. New England is nearby ample natural gas supplies in the Marcellus Formation of upstate New York, Pennsylvania, Ohio, and West Virginia. While nearby these supplies, New

[2] http://www.burrillville.org/sites/burrillvilleri/files/uploads/access_northeast_-_feb_16_briefing_presentation.pdf, Slide 7

England states have had much different end-user natural gas prices. For example, in 2014, average end-use natural gas prices in Rhode Island were $13.07 per MMBtu as compared to $8.33 per MMBtu nationally (a 57% premium).[3] This difference affects electricity costs, as well. The average end-user price for electricity in June 2016 for Rhode Island was 15.50¢ per KWh versus 10.64¢ per KWh nationally (a 46% difference).[4]

From a macroeconomic perspective, these cost and price differences adversely affect the New England economy by engendering a higher cost of living for its residents, which discourages migration, reduces real purchasing power of their incomes, and places industry in the region at an economic disadvantage relative to other regions. Additional natural gas pipeline capacity to further link supply from the west with New England could help alleviate these differences. To quote the independent system operator of the New England power market, ISO-New England or ISO-NE, "[a]ddressing natural gas infrastructure constraints is currently the region's highest-priority challenge."[5]

ANE is purported to address this challenge. It would provide an additional 0.9 Bcf/day of capacity to gas power plants in Connecticut, Rhode Island, and Massachusetts and 6.8 Bcf of storage at the Acushnet LNG facility.[6] According to Spectra Energy, this is enough fuel for 5,000 MW of electricity generation from natural gas plants.[7]

There are other reports, mostly notably by Black & Veatch ("BV")[8] and ICF,[9] that model the New England electrical sector with and without the ANE project. Gas generation, once relatively rare in New England, now constitutes over 50% of electricity supply in the region. This share is expected to grow in the coming years with retirements of existing coal,[10] nuclear, and oil-fired power plants.

The BV and ICF reports discuss that gas prices for generators could spike in the winter months when gas distributors, locked into firm contracts to deliver heating fuel to residential, commercial, and industrial customers on cold days, begin to utilize most of the available pipeline capacity. To quote, "[w]ithout new gas infrastructure, relatively little pipeline capacity will be available for interruptible services in the winter months, as local gas distribution companies continue to utilize their firm capacity."[11] Moreover, "[a] gas supply deficit is a serious threat to the reliable operation of the New England electric system that, under certain conditions, could result in costly electric system disruptions."[12] The results of these analyses are inputs into our study on Rhode Island economic impacts.

The ANE project specifically targets the New England gas-fired power plant fleet. According to Spectra Energy, it links closely to 60% of existing gas plants and has an additional 2,750 MW of proposed capacity along its route.[13] The company expects ANE to help these plants operate more normally during the winter by reducing price spikes and the potential for supply shortages. They also anticipate it would allow them to reduce the generation from or retire older, less-efficient coal-fired or oil-fired plants in the Northeast.

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[3] http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_sum/html/sum_pr_tx.html&sid=US
[4] https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a
[5] http://www.iso-ne.com/about/regional-electricity-outlook/grid-in-transition-opportunities-and-challenges/natural-gas-infrastructure-constraints
[6] http://www.burrillville.org/sites/burrillvilleri/files/uploads/access_northeast_-_feb_16_briefing_presentation.pdf, Slide 4
[7] http://www.burrillville.org/sites/burrillvilleri/files/uploads/access_northeast_-_feb_16_briefing_presentation.pdf, Slide 4
[8] http://www.ripuc.org/eventsactions/docket/4627-NGrid-DR-PUC1-Redacted.pdf
[9] http://www.accessnortheastenergy.com/content/documents/ane/Key_Documents/ICF-Report-on-Access-Northeast-Project1.pdf
[10] Brayton Point Power Station, a 1,530 MW coal plant in Somerset, Massachusetts and the largest coal plant remaining in New England, will shut down in May 2017, https://thinkprogress.org/the-largest-coal-fired-power-plant-in-new-england-is-shutting-down-3eee568a6d21#.fc3qkamuo
[11] http://www.accessnortheastenergy.com/content/documents/ane/Key_Documents/ICF-Report-on-Access-Northeast-Project1.pdf, Page 4
[12] http://www.accessnortheastenergy.com/content/documents/ane/Key_Documents/ICF-Report-on-Access-Northeast-Project1.pdf, Page 4-5
[13] http://www.burrillville.org/sites/burrillvilleri/files/uploads/access_northeast_-_feb_16_briefing_presentation.pdf, Slide 4

Economic Impact Modeling Process

FTI applied the IMPLAN model to estimate the economic impact and jobs created from ANE's construction, operations, and end-user electricity savings in Connecticut, Massachusetts, and Rhode Island. The IMPLAN model is an input-output modeling system that tracks the movement of expenditures 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. The IMPLAN data sets represent all industries within the regional economy (rather than extrapolating from national averages) and come from data collected by federal agencies.[14] A more detailed description of the IMPLAN model is available in Appendix A.

The economic impacts calculated by IMPLAN include direct impacts, indirect impacts, and induced impacts:

- **DIRECT IMPACTS:** The economic activity that results from the ANE project includes expenditures in New York, Connecticut, Rhode Island, and Massachusetts. These are the industries providing "direct" materials, construction labor, management, and technical services (i.e., engineering and design) for the project components.
- **INDIRECT IMPATS:** These are the economic activities resulting from the "direct" industries spending a portion of their revenues on goods and services provided by their supply chain in New England. These supply chain industries represent a second order or "indirect" impact of the original ANE expenditures on Rhode Island and its neighbors.
- **INDUCED IMPACTS:** These are the economic activities resulting from spending by employees within the "direct" and "indirect" industries. The benefactors of the "induced" impacts are primarily consumer-related businesses such as retail, restaurants, and personal service industries. These "induced" impacts represent the third order impact.

Through direct, indirect, and induced impacts, IMPLAN provides the economic "ripple" effect, or the "multiplier," which tracks the impact of each dollar of spending or income as it cycles through the economy to suppliers and households.

The first step of modeling in IMPLAN is estimating the direct spending and cost savings from the project.

The categories of these changes include:

1. **Pipeline construction spending**
    a. Pipeline construction and retrofit costs
    b. Compressor station construction and retrofit costs
    c. LNG facility construction costs
2. **Pipeline operations spending**
    a. Pipeline operational costs
    b. LNG facility operational costs
    c. Property tax revenues generated
3. **Consumer electricity cost savings**
    a. Residential net electricity savings
    b. Commercial net electricity savings
    c. Industrial net electricity savings

[14] The 2013 IMPLAN dataset includes data from the U.S. Bureau of Labor Statistics (BLS) "Covered Employment and Wages" (CEW) program; U.S. Bureau of Economic Analysis (BEA) "Regional Economic Information System" (REA) program; U.S. BEA Benchmark IO Accounts of the U.S.; BEA output estimates; BLS Consumer Expenditure Survey (CXS); U.S. Census Bureau's "County Business Patterns" (CBP) program; U.S. Census Bureau's "Decennial Census and Population Surveys;" U.S. Census Bureau "Censuses and Surveys;" and the U.S. Department of Agriculture (USDA) "Agricultural Census"

In the second step, FTI assigned each of these the direct spending and cost savings to one of the 536 sectors in the IMPLAN model. In the third step, FTI ran the IMPLAN model for the construction and operation phases. The results include:

- **Employment Contributions:** The direct, indirect, and induced annual average jobs for full-time, part-time, and seasonable workers as well as the self-employed throughout the various industries.
- **Gross Domestic Product (GDP):** GDP is the sum of all new economic activity in an economy. IMPLAN derives it from the value of an industry's output versus the value of the input goods necessary to produce a good – the "value-added" of each step in a production process is the contribution to GDP after this accounting for intermediate goods. It includes wages and benefits paid to employees and the self-employed, monies collected by industries not included in operations (profits and capital consumption allowances, payments for rents, royalties), and all payments to the government (excise taxes, sales taxes, customs duties) with the exception of payroll and income taxes.
- **Labor Income:** These are the wages and benefits paid to wage and salary employees and profits earned by the self-employed. Labor income demonstrates a complete picture of the income paid to the entire labor force.
- **Tax Revenues:** IMPLAN generates federal, state, and local tax revenue estimates based on a historical mapping of tax revenues with economic activity.

Assumptions and Inputs

Pipeline, Compressor, and LNG Facility Spending

The ANE project owners and its consultants estimate the entire project will cost $2.4 billion[15] to $3.0 billion.[16] It includes 13.9 miles of pipelines in New York, 53.8 miles of pipelines in Connecticut, and 55.7 miles of pipelines in Massachusetts. It also includes the seven upgraded compressor stations, one new one, and the LNG facility in Acushnet, Massachusetts.

Of the $2.4 billion to $3.0 billion that the ANE project's owners need to spend, we estimate that $250 million (or 8.3%–10.4%) of the project costs would come from goods and services in the three-state region of Rhode Island, Connecticut, and Massachusetts. The remainder would come from the rest of New England, the rest of the U.S., or specialized equipment from overseas.

The reason for the small share for the three-state region is that the direct spending requires many goods and services sourced from other states. For example, much of the value of the project is in steel pipe or compressor turbines. Neither of these components is likely to come from New England, but rather from the U.S. Midwest or Southwest. Likewise, most of the direct construction spending for ANE would go to entities based other states. The one exception is the Burrillville Compressor Station, located in the northwest corner of the state at the "triple-junction" between Connecticut and Massachusetts.

The operation of the project – the line, compressors, and LNG facility – would bring a relatively small number of direct pipeline jobs into the region. Most would be located at the Acushnet LNG facility. Rhode Island, receiving only one upgraded compressor station, would likely only have a small portion of these additional operational jobs in the region.

Appendix B describes the data sources, methodology, and assumptions we used to develop inputs into IMPLAN.

Burrillville Compressor Station Spending

ANE calls for a redevelopment of the Burrillville Compressor Station. This includes expanding one of the facility's buildings, installing a new Solar Taurus 60 gas turbine compressor,[17] demolishing part of an edifice, removing three older

[15] http://www.accessnortheastenergy.com/content/documents/ane/Key_Documents/ICF-Report-on-Access-Northeast-Project1.pdf, Page 15
[16] http://www.pressherald.com/2016/08/24/spectra-vows-to-continue-pipeline-project/
[17] http://s7d2.scene7.com/is/content/Caterpillar/C10550246

compressors, and replacing them with a new Solar Taurus 70 gas turbine compressor[18] to operate alongside two existing units.

Figure 2: Satellite image of Burrillville Compressor Station, with Burrillville to the east[19]

Solar Turbines, headquartered in San Diego, California[20] and a subsidiary of Caterpillar, Inc., headquartered in Peoria, Illinois,[21] does not have any manufacturing facilities in Rhode Island or New England. The company lists its closest locations as Upper Saddle River, New Jersey (near the New Jersey-New York border, west of the Tappan Zee Bridge) and Pittsburgh, Pennsylvania.[22] Its parent commonly has production in the U.S. Midwest. We therefore attribute the majority of the capital expenditures for equipment and support to other states, regions, or countries. The primary impact to Rhode Island from the Burrillville Compressor Station upgrades would be a portion of the construction labor expenditures.[23]

Electricity Cost Savings

According to ICF, electricity consumers in New England could enjoy $380 million to $800 million in net cost savings per year with the operations of the ANE project.[24] We applied the average of $590 million per year in a pro-rated fashion (based on historical electrical demand by sector and state) to the three-state region of lower electricity costs for residential, commercial, and industrial consumers in the area.

Using data from the U.S. Energy Information Administration ("EIA"), we subdivided these savings for New England down to the sectors based on their historical share of electricity consumption by state and economic sector. We then subdivided among the broad sectors in EIA (residential, commercial, and industrial) down to individual IMPLAN industry sub-sectors using IMPLAN data on their electricity consumption costs.

Appendix C describes our process for spreading the forecasted electricity market and consumer savings determined by ICF and BV to the states, households, and industry sub-sectors.

Natural Gas Cost Savings

We do not include any potential end-user natural gas cost savings in our modeling. While ANE adds natural gas transmission capacity to the region, the natural gas local distribution companies ("LDC") tend to lock into long-term contracts with "first call" for natural gas transmission during the winter to supply natural gas primarily for space heating

[18] http://s7d2.scene7.com/is/content/Caterpillar/C10550242
[19] https://www.google.com/maps/place/Algonquin+Gas+Transmission+Co/@41.967864,-71.755569,15z/data=!4m5!3m4!1s0x0:0xd74865a171ab70f2!8m2!3d41.967864!4d-71.755569
[20] https://mysolar.cat.com/en_US/about-us.html
[21] http://www.caterpillar.com/en/contact.html
[22] http://s7d2.scene7.com/is/content/Caterpillar/CM20150630-30875-28751
[23] Construction labor spending on New England compressor stations was estimated from PennEnergy Research, "U.S. Pipeline Study," http://ogjresearch.stores.yahoo.net/us-pipeline-economics-study.html
[24] http://www.accessnortheastenergy.com/content/documents/ane/Key_Documents/ICF-Report-on-Access-Northeast-Project1.pdf, Page 15

purposes. Therefore, the LDCs are not impacted as much by spikes in the natural gas spot market. Electricity generators, however, tend to purchase more fuel in the short-term market (i.e., spot market) where the remaining pipeline capacity is sold and natural gas prices can be more volatile.

To quote ICF, "[distribution utilities] contract for firm pipeline capacity based on potential peak day demand of their firm service customers under extreme winter weather conditions." With natural gas to regional consumers assured even during the most frigid of conditions, this leaves the primary impact of the ANE on the power sector.

Economic Impact Results[25]

We include results for jobs, GDP, and personal income for Rhode Island and its neighbors of Connecticut and Massachusetts. We focus on these states because of their close proximity and because the majority of ANE's expenditures and operations would take place within them.

While there would be economic impacts on New York (from the relatively short 13.9 miles of pipeline upgrades there, 11.3% of total miles, or 14.6% of total inch-miles), the state's impacts were not included because any spillover impact to Rhode Island is likely to be negligible given the distance between them.

The same is true of Maine, New Hampshire, and Vermont receiving benefits from lower electricity costs across the ISO-NE territory (according to the BV and ICF studies). We do not include these states because they likely will have an insignificant indirect and induced effect on Rhode Island.

Construction Spending

This phase of the project includes the construction of the ANE pipeline expansions in Connecticut and Massachusetts, the new and upgraded compressor stations in all the states below, and the new LNG facility in Bristol County, Massachusetts. In this context, "direct" jobs in Table 1 are mostly construction jobs (with a few additional jobs for material inputs to the pipeline. "Indirect" impacts include the supply chains affected by the ANE project's construction, and "induced" impacts are the effects of labor income becoming consumer spending and stimulating economic activity in localized, consumer-centric industries. **These impacts are not annual, but rather the sustained impact through the construction phase of the project in 2017 and 2018.[26] After the construction phase ends upon the commencement of service in Q4 of 2018, we would expect these impacts to dissipate.**

Table 1: Employment created by ANE project pipeline, compressors, and LNG facility (job-years)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	1,132	997	43	2,172[27]
Indirect Effect	298	368	43	710
Induced Effect	429	514	48	990
Total Effect	1,858	1,880	134	3,872

Table 2: Cumulative GDP created by ANE project pipeline, compressors, and LNG facility (2016 $ millions)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	$56	$69	$7	$132

[25] Numbers may not add exactly due to rounding
[26] http://www.accessnortheastenergy.com/content/documents/ane/Fact_Sheets/Access_Northeast_Project_Overview.pdf
[27] Mostly in the construction industry

Indirect Effect	$32	$38	$4	$75
Induced Effect	$42	$49	$4	$95
Total Effect	$130	$156	$15	$302

Table 3: Cumulative labor income created by ANE project pipeline, compressors, and LNG facility (2016 $ millions)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	$55	$64	$5	$124
Indirect Effect	$20	$25	$3	$48
Induced Effect	$24	$30	$2	$57
Total Effect	$99	$119	$10	$228

Operational Spending

The operational phase (without yet accounting for electricity cost savings) of the ANE project's impact includes the employees that operate the pipeline and LNG facility and local tax revenues, particularly in Massachusetts and Rhode Island, paid by the project's property valuations. In Massachusetts, this is around $11 million per year from the LNG, and in Rhode Island, this is around $1.8 million per year from the upgrades to the Burrillville Compressor Station. "Direct" impacts here consider the actual jobs to operate the pipeline and LNG facility as well as additional government employment supported by tax revenues. "Indirect" impacts include those economic activities in the supply chain of the initial impacts, such as professional engineering services for pipeline operations or IT support for local government (which consists of many teachers and educators). "Induced" effects cover the payroll supported by these activities and their influence on the local consumer economy and its industries. **These impacts would sustain themselves on an ongoing basis through the operational lifetime of the ANE project in the 2020s and 2030s.**

Table 4: Annual employment created by ANE project pipeline, property taxes, and LNG operations (units)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	4	69[28]	7[29]	79
Indirect Effect	4	63	8	75
Induced Effect	6	127	7	139
Total Effect	13	259	22	294

Table 5: Annual GDP created by ANE project pipeline, property taxes, and LNG operations (2016 $ millions)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	$1	$23	$1	$24
Indirect Effect	$0	$6	$1	$7

[28] Roughly half at the Acushnet LNG facility, half local government supported by property taxes from the LNG storage facility
[29] Mostly from additional property tax revenues, as local government spending (education, infrastructure, etc.) is heavily localized and labor-intensive in the IMPLAN model

Induced Effect	$1	$12	$1	$13
Total Effect	$2	$41	$2	$45

Table 6: Annual labor income created by ANE project pipeline, property taxes, and LNG operations (2016 $ millions)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	$1	$19	$1	$21
Indirect Effect	$0	$5	$1	$6
Induced Effect	$0	$7	$0	$8
Total Effect	$1	$32	$1	$34

Electricity Cost Savings

This phase includes the ongoing impacts through the 2020s and the 2030s from the economic impact of electricity cost savings for New England (in BV and ICF's electricity sector modeling exercises). Table 7, Table 8, and Table 9 illustrate the effects that less costly electricity inputs have on the economy. When ANE makes natural gas more accessible to natural gas plants in New England, ensuing lower costs give more income to businesses and households. This windfall increases the income of businesses in the region and the purchasing power of households – with electricity cheaper, they are free to reallocate their spending towards general consumption in sectors such as retail, healthcare, or entertainment. "Direct" impacts below include the stimuli to industries in the region, "indirect" includes the effect on their supply chains," and "induced" includes two separate effects. First, it includes the normal sort of effect on payrolls from the direct and induced effects on industry. Second, it also includes the additional household income from the reduction in natural gas prices and the impact of higher real income and purchasing power.

Table 7: Annual employment created by electricity cost savings from ANE project (units)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	538	1,147	169	1,854
Indirect Effect	147	326	49	522
Induced Effect	498	958	152	1,608
Total Effect	1,184	2,431	370[30]	3,985

Table 8: Annual GDP created by electricity cost savings from ANE project (2016 $ millions)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	$50	$99	$13	$162
Indirect Effect	$19	$39	$5	$62
Induced Effect	$50	$91	$13	$154

[30] Job impacts roughly split half between savings to commercial and industrial consumers (direct) and residential consumers (induced)

Total Effect	$118	$229	$31	$378

Table 9: Annual labor income created by electricity cost savings from ANE project (2016 $ millions)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	$27	$60	$8	$94
Indirect Effect	$10	$24	$3	$37
Induced Effect	$29	$55	$8	$91
Total Effect	$66	$138	$18	$222

Total Operational Spending and Electricity Cost Savings

The results below combine the operational results with the electricity savings. Consequently, these tables are the total long-term impact of the ANE project on an annual basis, though the previous two table sets breaks them into their components. "Direct" impacts include the operations of the pipeline, the LNG facility, and electricity cost savings to industry. "Indirect" impacts include the supply multiplier for all industries, and "induced" includes payroll effects as well as lower household electricity costs.

Table 10: Annual employment from operations and electricity cost savings of ANE project (units)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	542	1,216	176	1,933
Indirect Effect	151	389	57	597
Induced Effect	504	1,085	159	1,748
Total Effect	1,197	2,690	392[31]	4,279

[31] Nearly the entire (94%) of these jobs from electricity savings, leaving that supply-side effect in New England electricity and natural gas markets the real driver of the impact in Rhode Island, in particular, and in New England overall (93%) adjusting for the higher but still diminutive number of operational jobs in other states

Table 11: Annual GDP from operations and electricity cost savings of ANE project (2016 $ millions)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	$51	$122	$14	$186
Indirect Effect	$19	$45	$6	$70
Induced Effect	$50	$103	$14	$167
Total Effect	$120	$270	$33	$423

Table 12: Annual labor income from operations and electricity cost savings of ANE project (2016 $ millions)

Impact Type	Connecticut	Massachusetts	Rhode Island	Aggregated Region
Direct Effect	$28	$79	$8	$115
Indirect Effect	$11	$28	$3	$43
Induced Effect	$29	$63	$8	$99
Total Effect	$67	$170	$19	$257

Rhode Island

Construction Phase

Table 13 details the industries most affected by the construction phase of the ANE project in Rhode Island. The construction industry and the air and gas compressor manufacturing industry have the largest expected employment impacts.[32] Employment resulting from induced spending from changes in payrolls drives the impacts for the remaining portion of the top ten industries.

Table 13: Top ten industries affected by the construction phase of the ANE project by employment

	Industries in the IMPLAN model	# of job-years
1.	Construction of other new nonresidential structures	33
2.	Air and gas compressor manufacturing	10
3.	Wholesale trade	7
4.	Full-service restaurants	4
5.	Real estate	3
6.	Retail – Clothing and clothing accessories stores	3
7.	Hospitals	3
8.	Retail – Non-store retailers	3
9.	Employment services	2
10.	Architectural, engineering, and related services	2

[32] We assume a very small percentage (5%) of the air and gas compressor manufacturing spending is attributable to Rhode Island.

Operational Phase

This list shows the top ten industries most affected by the long-term operations and electricity cost savings from ANE (as measured by their employment impacts in IMPLAN). The industry sectors closely related to the consumer economy – real estate, healthcare, education, prepared food, and retail – feature the most heavily. These industries benefit the most from an increase in the real income of Rhode Island and neighbor's households from lower electricity prices.

Table 14: Top ten industries influenced by the total operational phase of the ANE project by employment

	Industries in the IMPLAN model	# of annual jobs
1.	Real estate	29
2.	Full-service restaurants	22
3.	Retail – Food and beverage stores	20
4.	Hospitals	17
5.	All other food and drinking places	14
6.	Limited-service restaurants	13
7.	Wholesale trade	12
8.	Nursing and community care facilities	10
9.	Junior colleges, colleges, universities, and professional schools	9
10.	Management of companies and enterprises	9

There is little direct impact in Rhode Island from the long-term operations of the ANE enhancements and expansions. Including the pipeline upgrades, the compressor stations, and the Acushnet LNG storage facility, Rhode Island receives between 1% and 2% of total capital expenditures (with New York around 15%, Connecticut near 50%, and Massachusetts between 30% and 35% depending on the exact cost of the LNG facility). The same logic stands to reason with the operational phase of the project, where the areas with the initial investments are more likely to have any long-term operational and maintenance jobs – particularly Acushnet, Massachusetts, where the facility have at least 25 operational jobs. Hence, the most influential part of the ANE project for Rhode Island is the implied changes to the electricity grid, its reliability, and the prices it offers to consumers.

Tax Revenues

Table 15 provides the state and local taxes associated with the ANE project during its construction and its operations. These taxes are an IMPLAN output.[33] The impacts for the construction phase are cumulative for the construction of the pipeline, while the operational and electricity savings are annualized for each year of the operation of the pipeline. The state and local governments in Rhode Island could gain $1.03 million in revenues during construction and $2.96 million in revenue each year of the ANE's existence from the direct, indirect, and induced economic activity described above.

Table 15: State and local tax revenues from ANE project (2016 $ millions)

Economic Phase	Connecticut	Massachusetts	Rhode Island
Construction Phase (cumulative)	$10.45	$10.16	$1.03
Operations and Electricity Savings (annual)	$11.57	$19.88	$2.96

[33] The tax revenue estimates in Table 15 are likely conservative in that we did not include the tangible personal property tax on the Burrillville compressor station upgrade, which we estimate to be approximately $1 million in the first year of the upgraded station's operation.

Clear River Energy Center

The Clear River Energy Center ("CREC") is a proposed natural gas power facility in Burrillville. CREC[34] would add a 1,000 MW natural gas combined-cycle plant[35] along the route of the Algonquin Pipeline, and it is one of the projects indicated by Spectra Energy as an intended market of the natural gas capacity.[36] **To be clear, ANE and CREC are different projects, each with their own proprietors, timelines, and separate regulatory reviews.**[37] While one is not contingent upon the other, they might have implied linkages given the interconnectedness of electricity and natural gas markets and the location of CREC abutting the Algonquin Pipeline. CREC could be another plant to draw from the additional capacity and LNG facility created by ANE. The expectation would be that a new gas-fired power plant, such as CREC, would operate more efficiently than many of the other capacity options in ISO-NE and provide additional reserve capacity during periods of annual peak demand.

Our analysis does not examine or include the economic impact of CREC.

However, Dr. Edinaldo Tebaldi of Bryant University in Smithfield, Rhode Island released a separate study on the economic impact of CREC.[38] Using IMPLAN, he estimated the jobs, GDP, and income created by CREC during its construction and its long-term operations. Tebaldi found the construction phase added 750 to 1,000 full-time equivalent ("FTE") jobs to the Rhode Island economy and approximately $150 million in labor income. He found the operations phase (the long-term out to 2034) added approximately 200 FTE employment and around $20 million in labor income. These results essentially double when including the impact in the other New England states to account for out-of-state suppliers, such as specialized, skilled labor or professional services in Boston or Hartford, or the rather porous borders between the various states of New England.

If CREC were somehow contingent on ANE, then Dr. Tebaldi's results (if accurate) would be in addition to ours.

[34] http://clearriverenergycenter.com/
[35] http://www.providencejournal.com/news/20160725/puc-questions-invenergy-about-need-for-new-power-plant-in-burrillville
[36] http://www.burrillville.org/sites/burrillvilleri/files/uploads/access_northeast_-_feb_16_briefing_presentation.pdf, Slide 4
[37] http://www.burrillville.org/spectra-energy
[38] http://www.ripuc.org/efsb/efsb/SB_Invenergy_application_sup%205.pdf

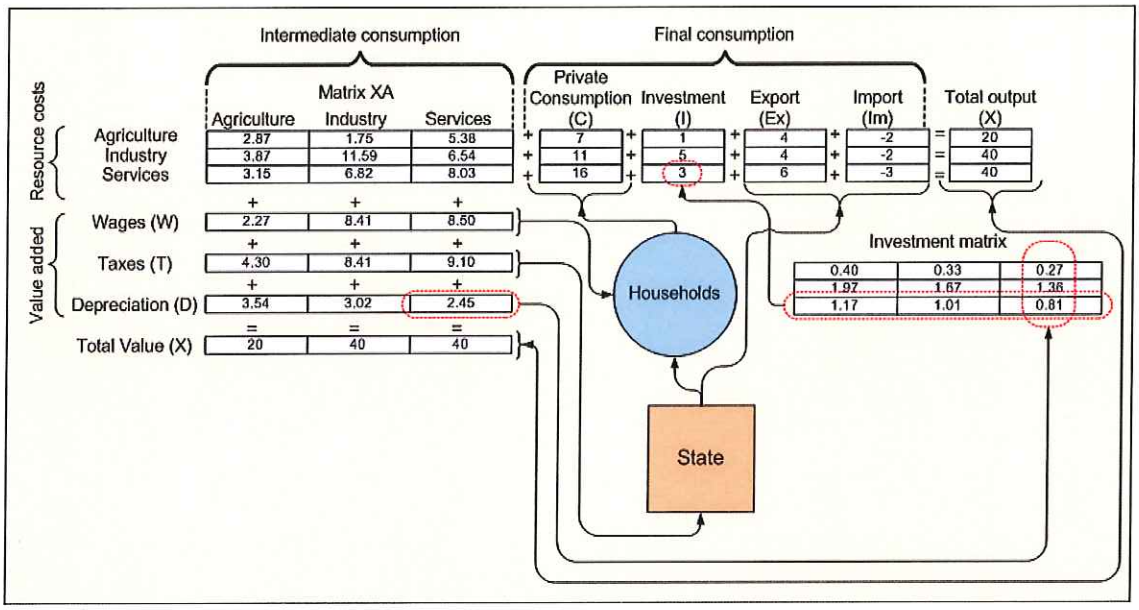
Appendix A: Description of IMPLAN Model

IMPLAN, produced by MIG, Inc.,[39] is a software program containing an IO model of regional economies. Our version of the program here included state concepts for Connecticut, Massachusetts, Rhode Island, and multi-regional linkages between the same. It sees wide applications throughout the fields of economic impact analysis and policy-related research.[40]

IMPLAN works by constructing a series of multipliers throughout the economy where an initial, "direct" type of economic activity will stimulate a supply chain and related industries. A classic example includes automotive manufacturing in the American Midwest or in the American South, where an automotive assembly plant will have a complex supply chain and parts suppliers feeding into it from all throughout the region and even the world. The suppliers necessary to construct a final automobile – parts manufacturers, materials suppliers for glass, rubber, leather, and electronics, professional services for accounting and legal review – are the "indirect" effect in the IMPLAN model. The direct and indirect industries also pay salaries to their employees, which goes to support the living expenses of households throughout the economy. These include the standard accoutrements of daily life or any family's budget, such as housing, healthcare, education, transportation, food, and entertainment. IMPLAN calls these changes from consumer spending the "induced" effects, which it also includes inside of the model and its overall results.

The core methodology underlying IMPLAN is an IO model, otherwise known as a Leontief table. Named for Wassily Leontief, a Nobel Laureate for this and other work,[41] a Leontief/IO model conceives of the economy as a series of transactions amid buyers and sellers. Each transaction must have both sides to succeed. Most of the transactions are between industries in a supply chain as well as households and industries (through purchases and wages paid on the labor market). Leontief constructed a matrix, with the inputs and outputs from each industry and households on each axis, which showed the volume of transactions between each sector and allowed for the computation of changes to the existing structure from external changes for policy analysis.

Figure 3: The structure of an example input-output model with three industries[42]



[39] http://www.implan.com/
[40] http://www.ci.richmond.ca.us/DocumentCenter/Home/View/6474
[41] http://www.econlib.org/library/Enc/bios/Leontief.html
[42] http://dankozub.com/simulation/

Our modeling follows this methodology in IMPLAN by adding changes to the production and income of industries and households in New England from ANE. IMPLAN then handles the calculation of the associated, spinoff, or "multiplier" impacts across the economy when accounting for the indirect and induced effects on secondary and tertiary industries.

Appendix B: Data Sources for Construction and Operational Spending

Pipeline Construction Spending

We estimated the cost of pipeline construction based on an inch-mile methodology.

- Cost per inch-mile of capacity addition from "North American Midstream Infrastructure through 2035: Leaning into the Headwinds," by ICF for the INGAA Foundation, Inc. at $155,000 per inch-mile nationally[43]
- Adjusted upwards by a factor of 1.61 (to $249,500 per inch-mile) for the Northeast region[44]

We then spread these costs across New York, Connecticut, and Massachusetts based on the report miles of construction and size of pipeline reported in the media and public record related to the ANE project:

- Specifically, the briefing presentation by Spectra Energy, *Access Northeast: Meeting New England's Energy Needs*
- The map on Slide 7, "Proposed Access Northeast Facilities – Project-wide" provided most of the data

We spread the construction expenditures between the industries in the IMPLAN model based on data from another New England pipeline project, Atlantic Bridge,[45] and a cost filing with the Federal Energy Regulatory Commission (FERC).[46]

Compressor Construction Spending

Information on the exact turbines at each facility came from the same map as the inch-mile data above.

We estimated the cost of the turbines themselves based on information from the manufacturer's website.[47] We assumed 5% of the value of the turbines showed up in New England for the initial installation and engineering of the facilities.

We added 35% to the cost of the turbines themselves to determine the cost of the facilities overall – including the construction and the building expenses to finalize the project. The 35% figure came from proprietary data provided by PennEnergy Research,[48] which had data on several compressor projects and their cost components across New England and the Northeast. The average expense for labor and construction beyond the cost of compressor turbines for this sample of projects was 35%. Hence, we used this parameter in our assumptions about Burrillville Compressor Station and the other stations in the project.

LNG Construction Spending

For the LNG facility, we looked for a similar facility in the New England region and data on its costs. We found a National Grid LNG facility in Providence, Rhode Island that cost $100 million for 2.1 Bcf (26 million gallon) of storage capacity.[49] That facility would be approximately 1/3 the size of the Acushnet project (6.8 billion); hence, we assumed $300 million for the ANE project with a small economy of scale for a 6.8 Bcf site over a 2.1 Bcf facility. For a further sense of scale, the Providence LNG storage facility has enough capacity to store all the natural gas fuel needed for heating in Providence – a city of 178,000 residents – for an entire winter. The additional LNG storage proposed under ANE in Acushnet would be over three times the size of that.

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[43] http://www.ingaa.org/File.aspx?id=27961&v=db4fb0ca, Page 22
[44] http://www.ingaa.org/File.aspx?id=27961&v=db4fb0ca, Page 22
[45] http://www.spectraenergy.com/Operations/US-Natural-Gas-Operations/New-Projects-US/Atlantic-Bridge/
[46] Cost data from filing in FERC Doc. CP16-9, October 2015
[47] https://mysolar.cat.com/en_US/products/power-generation/gas-turbine-packages.html
[48] http://ogjresearch.stores.yahoo.net/index.html
[49] http://www.providencejournal.com/article/20150715/NEWS/150719511

Pipeline Construction and LNG Construction Employment

A public release indicated, "Additionally, approximately 250 construction workers will be needed at the Acushnet site, with an additional 2,100 construction jobs expected to be created throughout the region for LNG storage and pipeline construction."[50] We adjusted the direct construction employment in the modeling to account for these exact figures.

The 250 jobs for Acushnet specifically went to Massachusetts. We prorated the remaining 2,100 construction jobs across the four states based on the estimated expenditures for pipelines and compressor stations. We modeled New York (out of the model though still included in the calculations) with 16.4% of the jobs, Connecticut with 50.0%, Massachusetts with 32.1%, and Rhode Island, only featuring one compressor station compared to the pipelines in other states, with 1.6%.

Pipeline Operational Spending

We assumed the permanent creation of 0.06 jobs per mile in pipeline operations to run the line and compressor stations. With the line additions of 123.4 miles, this translates into 7.4 permanent jobs. We prorated these jobs down to the four states involved in the project based on pipeline and compressor capital expenditures by state. This left 1.6% of these jobs for Rhode Island. This would be, in reality, a few weeks or months' worth of annual work at the Burrillville Compressor Station for maintenance and repairs. This work would likely combine with similar work at other stations throughout the region.

Compressor stations are mostly automatic in their day-to-day operations,[51] buttressing this assumption of a relative light impact on direct employment and labor income from the expansion of the facility.

LNG Operational Spending

Public media indicated 25 long-term, operational jobs at the facility. To quote, "Acushnet will receive property tax revenues of an estimated $10 million to $12.5 million annually, and 25 permanent jobs will be created when the new facility is operating."[52] We included the 25 jobs in the appropriate IMPLAN sector as direct employment in Massachusetts as a part of the project's operations. We added the average of the tax revenues ($11.25 million) to local government output in the Commonwealth.

Appendix C: Data Sources for Electricity Savings

The ICF report[53] detailed consumers in New England could see a **net** reduction in their electricity costs by $380 million to $800 million per year. BV reported a similar number, though we literally and specifically use the ICF number to undergird our results (under a series of assumptions described below) in this report. The "net" point in the first sentence of this paragraph is an important once – while Spectra Energy and the project's proponents have championed, "Once in service, Access Northeast is projected to save customers an average of $1 billion annually," this is a gross figure, not a net one. While **gross** savings on electricity per year might exceed $1 billion, the number does not account for the funding mechanism where electricity consumers will cede some of that surplus back to power generators and gas pipelines in order to pay for the construction of ANE.[54]

In essence, ANE will produce a surplus of approximately $1 billion per year for the New England region. Electricity consumers would collect some share of that (around half in the ICF numbers), and the owners of ANE would collect the remainder, using it to pay for the construction of the pipeline, its operation, and to provide a return to their investors. We used the net figures in calculating the impact on electricity consumers in IMPLAN for the former share of the regional windfall. This follows because the construction and operational expenditures for pipelines and the LNG facilities would reflect the latter share in IMPLAN.

Here is a list of major assumptions regarding the ICF numbers:

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[50] http://www.scnu.us/wp-content/uploads/2016/01/Access-Northeast-Factsheet-1pager.pdf
[51] https://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngcompressor/ngcompressor.pdf
[52] http://www.accessnortheastenergy.com/content/documents/ane/Key_Documents/ICF-Report-on-Access-Northeast-Project1.pdf, Page 2
[53] http://www.accessnortheastenergy.com/content/documents/ane/Key_Documents/ICF-Report-on-Access-Northeast-Project1.pdf
[54] http://nescoe.com/uploads/GasforElectricReliabilityGraphic_April2014.pdf

- $590 million in annual savings (the average between $380 million and $800 million)
- "New England" is a "hard" concept of six states – Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont – and includes all of those states and nothing outside them
    - Not a "soft" concept of a cultural region that might include parts of upstate New York or not include, for example, the southwest portion of Fairfield County, Connecticut with its strong attachments to NYC
    - This is the formal definition of "New England" of the U.S. Census Bureau[55] and the service territory of NE-ISO[56]
        - The latter fact makes the ICF numbers likely to be a formal New England concept, though this is still something of an assumption and, thus, reported here

We subdivided the regional number of $590 million per year down to state/sector (at the same time) and industry. For our division of state and sector, which occurred simultaneously, we used:

- The State Energy Database System (SEDS) from the U.S. Energy Information Administration (EIA):[57]
    - Residential sector electricity consumption estimates, 2014[58]
    - Commercial sector electricity consumption estimates, 2014[59]
    - Industrial sector electricity consumption estimates, 2014[60]

In those tables, SEDS reports electricity consumption by sector and state. We used this data to share out the proportion of electricity consumption going into each sector (R, C, and I) in each state (of the six) in New England:

Table 16: Share of electricity consumption, by sector and state, in New England (2014)

	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont	Aggregate Region
Residential	10.7%	3.9%	16.8%	3.8%	2.6%	1.8%	39.5%
Commercial	10.8%	3.3%	21.8%	3.7%	3.1%	1.7%	44.5%
Industrial	2.9%	2.8%	6.7%	1.6%	0.7%	1.2%	16.0%
Total	24.4%	10.1%	45.3%	9.2%	6.4%	4.6%	100.0%

We apportioned the electricity savings between the regions based on the shares in Table 16. From there, we multiplied the $590 million across the table, determining the impact of the electricity savings by state and sector:

[55] https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf
[56] https://www.iso-ne.com/about
[57] http://www.eia.gov/state/seds/
[58] http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_sum/html/sum_btu_res.html&sid=US
[59] http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_sum/html/sum_btu_com.html&sid=US
[60] http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_sum/html/sum_btu_ind.html&sid=US

Table 17: Electricity savings by sector and state (2016 $ millions)

	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont	Aggregate Region
Residential	$63	$23	$99	$22	$15	$10	$233
Commercial	$64	$20	$129	$22	$18	$10	$262
Industrial	$17	$17	$39	$10	$4	$7	$94
Total	$144	$59	$267	$54	$38	$27	$590

We did not include the results for Maine, New Hampshire, or Vermont. Those three states and Rhode Island are all small and relatively isolated from each other (with the much larger Massachusetts interceding in the middle). Massachusetts also contains the economic hub of the region in Boston. This makes much interaction between them unlikely.

Residential savings in Table 17 went to increased labor income and induced impacts in the IMPLAN model.

For commercial and industrial savings, we divided them based on the implied inter-industry demand for power transmission in the IMPLAN model. This would send the savings to industries that either (A.) are large, (B.) have electricity-intensive production processes, or (C.) ideally, both, to receive the largest share of the savings. In Rhode Island, the industries with the largest savings included the ones for real estate, management, hospitals, wholesale, food service, and education. Most of these industries are more (A.) – large – than they are energy-intensive, though education (with its sizeable campuses and massive older buildings to cool in the summer and heat in the winter) can be an exception. This allows our savings to reflect the local industry mixture.

We then entered these savings as additional income/sales by industry in IMPLAN.

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