Analysis of the Macroeconomic Impacts of the Proposed New England Clean Power Link Project

Prepared by London Economics International LLC

Using the Regional Economic Models, Inc. ("REMI") PI+ Model

June 9, 2014

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Table of Contents

Table of Figures

1 Executive Summary

The proposed New England Clean Power Link ("NECPL" or the "proposed Project") is a 150-mile underwater and underground HVDC transmission line that will deliver 1,000 MW of clean, low-cost energy into the New England wholesale power market. The NECPL will be located in Vermont. London Economics International LLC ("LEI") analyzed the potential economic benefits of the proposed Project in terms of the employment and Gross Domestic Product ("GDP")[1] impacts to Vermont and the rest of New England, using the PI+ model developed by Regional Economic Models, Inc. ("REMI").

The REMI PI+ model is a sophisticated economic forecasting model that is widely used in both the public and private sectors to simulate the dynamic and interactive effects over time and across industries that result from large investments, policy changes, and infrastructure projects, such as NECPL. PI+ generates year-by-year estimates of the total regional effects of any specific policy initiative or large investment. The REMI model used for this analysis was a seventy sector, state-level model that covers the entire New England region.[2]

Based on the LEI analysis, NECPL will create on average more than 640 direct, indirect, and induced jobs in Vermont during its 36-month construction phase and 2,000 jobs across New England (including Vermont) in the first ten years of commercial operations. In addition, NECPL will generate almost $400 million dollars annually in new economic activity for the New England region as a whole during the first ten years of commercial operations.

Construction period impact

- During the construction period (currently planned for 2016 to 2018), NECPL is projected to create an average of more than 140 direct construction jobs annually in Vermont and spend $80 million in the form of construction-related services in Vermont. This local employment and spending will expand state economic activity (as measured by Gross Domestic Product, or "GDP") by $58 million per annum on average, or approximately 0.2% of Vermont's GDP based on 2012 GDP levels.[3]

- LEI's analysis suggests that the economic activity that will be generated by the construction phase will also ripple through the rest of New England. NECPL's construction phase will generate on average more than 850 jobs, including 670 indirect and induced jobs,[4] across

[1] GDP is commonly defined as the monetary value of all the finished goods and services produced within a country (or within a region/state) over a specific time period. It includes all private and public consumption, government expenditures, investments and net exports that occur within the country (or region/state).

[2] The full list of economic sectors in the REMI PI+ model is included in Section 5.5 in the Appendix.

[3] Vermont's 2012 GDP was over $29 billion in nominal terms, according to US Department of Commerce, Bureau of Economic Analysis.

[4] Total jobs are the sum of the number of direct jobs, indirect jobs, and induced jobs. The direct jobs include the jobs that are needed for the construction or commercial operations of the project, indirect jobs are jobs created by the

New England (including Vermont), and will increase New England's regional (including Vermont) GDP by approximately $78 million per year.

Commercial operations period impact

- Operation of NECPL would allow low-cost, low carbon emission from Canada to flow into New England. During the first ten years of commercial operations (2019-2028), LEI anticipates that the increased supply of low-cost electricity delivered through NECPL will reduce electricity costs to retail customers across New England (industrial, commercial, and residential) by approximately $195 million a year.[5]

- During the first ten years of commercial operations (2019-2028), LEI estimates that Vermont's GDP would increase by an average of $30 million per annum due to reduction in energy costs, and an increase in jobs and spending within Vermont for continued operations and maintenance of the transmission line.

- Based on LEI's analysis of those reduced electricity costs using REMI's PI+ model, together with the on-going local spending by NECPL for operations and maintenance of the transmission project, NECPL will produce an average of more than 2,000 direct, indirect and induced jobs across New England during the first ten years of commercial operations (2019-2028), and lead to an increase in regional GDP by an average of approximately $400 million per year.[6]

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businesses which provide goods and services essential to the construction or operations of the project, and induced jobs are jobs that are created in other sectors of the economy as a result of spending of the wages and salaries of the direct and indirect employees. Jobs include full-time, part-time, and seasonal employment.

[5] These electricity market price reductions were simulated using LEI's proprietary simulation model, POOLMod. The price reductions assumed that energy flows on NECPL would amount to 8.32 TWh of energy per year. For purposes of the energy market simulations, the ISO-NE Control Area was divided into nine zones based on major transmission interface constraints, consistent with ISO-NE's Regional System Plan ("RSP") market topology.

[6] The annual electricity cost savings and the increase in GDP are conceptually both economic benefits. However, these two benefits are not mathematically additive. The electricity cost savings are estimated using simulation of the wholesale energy market. The GDP impact is estimated using the REMI macroeconomic policy model. In fact, the electricity cost savings are a key driver (or input) to the increased economic activity that is represented by the GDP impact. The electricity cost savings that New England households and businesses receive as a result of NECPL spur economic activity by increasing consumption (households have more disposable income to spend on other goods and services) and increasing business output (because firms are able to lower their production cost and thus become more competitive and increase production). This then generates an expansion of economic activity as measured by GDP.

2 Overview

The proposed Project is a 1,000 MW HVDC-based transmission line originating at the US-Canada border and terminating in Ludlow, Vermont. Therefore, the energy on NECPL would flow into the Vermont zone of the New England Control Area and serve as a new supply resource in the wholesale power market administered by the New England Independent System Operator ("ISO-NE").

Proposed New England Clean Power Link Route

TDI New England ("TDI"), the developer of the proposed Project, will make direct investments in the State of Vermont during the construction and operating phases of the project. For example, TDI will hire construction workers during the construction phase. TDI will also hire employees and contracted labor (and services) based in Vermont during the operating phase of the project. TDI's expenditures in the state of Vermont will result in the creation of new jobs and increased economic activity in Vermont and across the New England region. In addition, the proposed Project is expected to lower the wholesale market price of electricity as a result of the energy flows on the transmission line. This will lead to a reduction in electricity costs for New England ratepayers, and in turn, create incremental macroeconomic benefits for the New England region. Our analysis aims to quantify: (i) the impact of the direct, in-state investments during the NECPL construction period; (ii) the direct, in-state expenditures (in Vermont) during both construction and commercial operations; and (iii) the reduction in region-wide electricity costs during NECPL's commercial operations period and its effect on employment and GDP.

2.1 Modeling methodology

LEI utilized the dynamic forecasting and policy analysis PI+ model developed by REMI to measure the local economic benefits of the proposed Project to Vermont and other states in New England. LEI focused on change in employment and expansion of state GDPs. The REMI PI+ model incorporates several modeling approaches, including input-output ("I/O"), computable general equilibrium theory, econometric equations, and new economic geography theory to

create a comprehensive model that understands detailed interrelated changes in a regional (or state) economy.[7]

The REMI model is used by government agencies (including most US state governments), consulting firms, non-profit institutions, universities, and public utilities. The PI+ model, which is a leading economic-forecasting and policy-analysis model, estimates comprehensive economic and demographic effects in wide-ranging initiatives, such as: economic impact analysis; policies and programs for economic development, infrastructure, environment, energy and natural resources; and state and local tax changes. In New England, the REMI PI+ model was recently used by the Committee for a Green Economy ("CGE") to measure whether or not a carbon tax in Massachusetts could improve the state economy.[8] Furthermore, the PI+ model has been used to assess the macroeconomic benefits of a variety of projects and policy by public institutions including Vermont's Department of Public Service, Vermont Legislative Joint Fiscal Office, Rhode Island Department of Revenue, New Hampshire Department of Employment Security, Maine Governor's Office of Policy and Management, and Connecticut Department of Economic and Community Development.

The REMI PI+ model used for this analysis was a seventy sector,[9] six-state New England model, consisting of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

2.2 Modeling inputs

TDI is expecting the NECPL to undergo a 36-month construction phase, starting in 2016 and finishing by the end of the first quarter of 2019. The operating life of the project, commencing in the second quarter 2019, is expected to go out forty years (or even longer).[10] For our analysis, we have focused on the first ten years of operations. Given the significance of the installation costs for this project, over $80 million in capital costs for the NECPL project will be spent in

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[7] An Input/Output ("I/O") analysis is a type of applied economic analysis that tracks the interdependence among various producing and consuming sectors of an economy, by capturing inter-industry transactions and accounting for how businesses react to additional demand for goods and services and how consumers are likely to spend their money. An I/O model measures the relationship between a given set of demand for final goods and services and the inputs required to satisfy this demand. It was first introduced by Wassily Leontief, which won him the Nobel Memorial Prize in Economic Sciences in 1973.

[8] REMI. "Modeling the economic, demographic, and climate impact of a carbon tax in Massachusetts". July 11, 2013.

[9] The list of the 70 sectors can be found in Section 5.5 of the Appendix. The seventy-sector model provides detailed analysis that is a generally accepted model in New England in evaluating economic impact and has been utilized by Vermont Agency of Commerce & Community Development, Maine State Planning Office, and University of Southern Maine, among others.

[10] Inputs to the PI+ model are conservative, with construction costs based on engineering firms' estimates and actual expenses for projects of similar nature. The construction cost estimates reflect the reality that not all jobs can be filled by Vermonters and labor from greater New England, and some of the direct jobs will be filled by labor from non-New England states. These expenditures outside of New England are not included in the inputs to the PI+ model.

Vermont to construct and install this project.[11] In addition, NECPL will bring on average 140 direct construction jobs annually to the state of Vermont during the period of construction. Once commercial operations begin, NECPL is expected to reduce the wholesale market price of energy in ISO-NE, for the benefit of consumers. Based on LEI's analysis, the reduction in retail electricity costs to New England electricity consumers is estimated to be approximately $195 million per year on average for the first ten years of commercial operations. Electricity cost savings are projected based on simulation modeling of the ISO-NE wholesale market (assuming a 95% utilization rate on the NECPL project). On average over the ten years modeled, NECPL produces over $1/MWh reduction in annual average energy prices across the region. LEI then estimated retail market impacts based on the simulated wholesale price reductions and projected retail load exposure to wholesale energy market prices.[12]

2.3 Modeling results

During the construction period, NECPL is projected to bring an average of more than 140 direct construction jobs annually to the state of Vermont. In addition, NECPL is expected to spend an additional $80 million throughout the construction period in Vermont for services and materials related to the installation process.

Construction phase impact

This direct spending will positively impact Vermont's economy, creating on average more than 640 jobs annually, including 500 additional indirect and induced jobs, and increasing Vermont's GDP by $58 million per year.[13] Furthermore, due to the close economic ties among the New England states, NECPL will also create approximately 200 jobs per year in the rest of New England (excluding Vermont), with 97 jobs in Massachusetts, 45 jobs in New Hampshire, 36 jobs in Connecticut, 26 jobs in Maine, and 12 jobs in Rhode Island. NECPL will also increase other New England state GDPs by an average of $20 million per year during the construction period, with Massachusetts' GDP increasing by $10 million, New Hampshire's GDP rising by $4 million, Connecticut's GDP rising by $3 million, and Maine's and Rhode Island's GDPs each increasing by approximately $1 million.

[11] This figure excludes all HVDC cable, transformers, breakers, spare parts, and other costs that will be required to make the project "operational."

[12] The detailed distribution of change in wholesale energy prices is presented in Section 5.1 in the Appendix, and retail energy savings by customer type across the six New England states are presented in Section 5.4 in the Appendix.

[13] To put it into perspective, Vermont's GDP in 2012 was over $29 billion, implying NECPL's impact during the construction period would contribute to approximately 0.2% of Vermont's GDP. Total employment in 2012 was approximately 428,000 in the state, implying NECPL would increase employment in the state by 0.1%.

Figure 1. Estimated number of total jobs created by NECPL during the construction phase

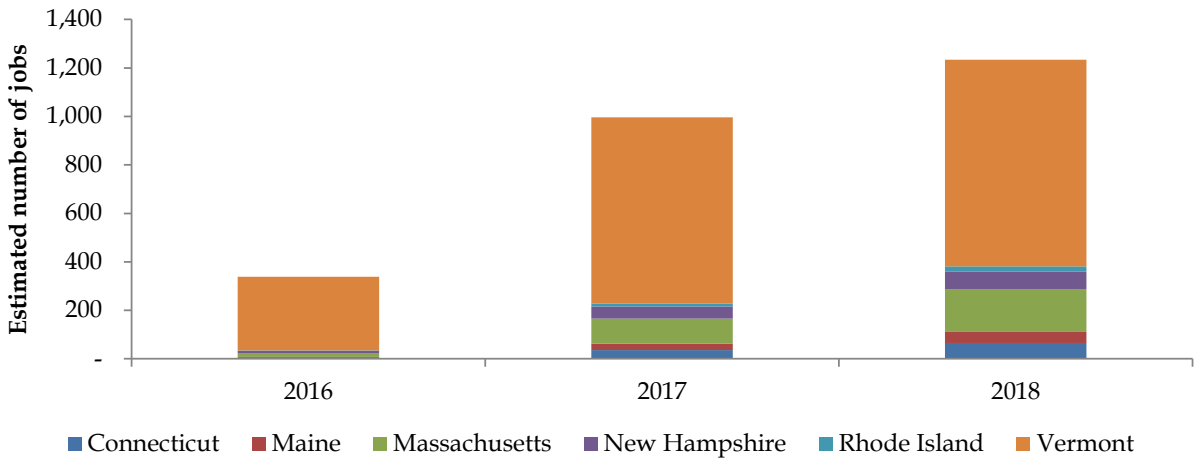
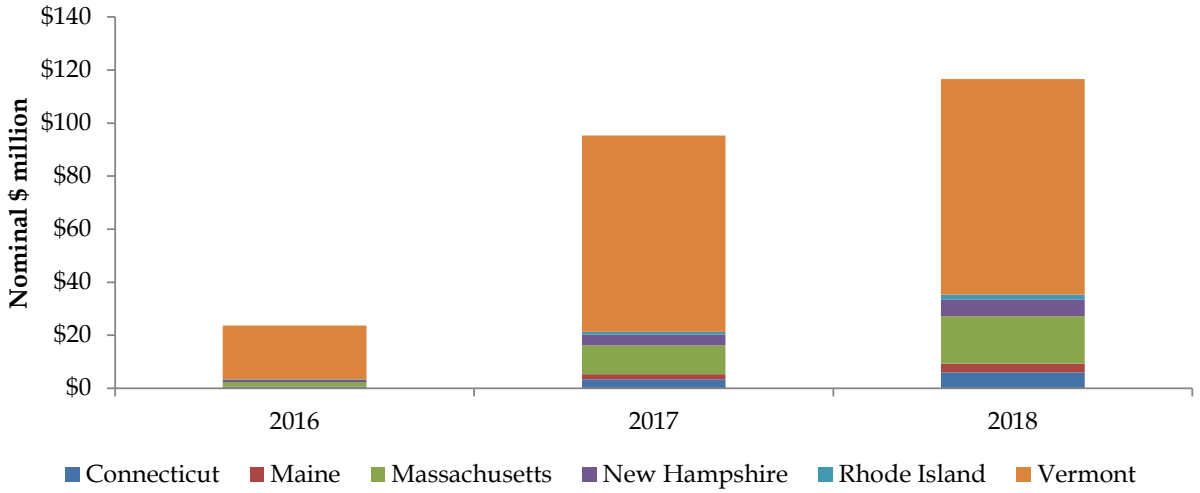


Figure 2. Estimated increase in state GDPs during the construction phase



Commercial operations phase impact

Once operational, the proposed Project will continue to generate positive macroeconomic benefits across New England. LEI has projected that the increased supply of low-cost electricity delivered through this line will reduce energy costs to retail customers by approximately $195 million a year on average from 2019-2028. These annual electricity cost savings will have the effect of creating jobs and expanding economic activity across New England. Furthermore, NECPL will continue to create direct jobs in Vermont, in order to operate and maintain the transmission line. LEI tested the macroeconomic impacts for the first ten years of commercial operations using the PI+ model. In total, during the 2019-2028 timeframe, NECPL will create an average of more than 2,000 indirect and induced jobs per year and will increase New England's

GDP by an average of approximately $400 million per annum.[14] Towards the end of the first ten years of its commercial operations, NECPL's impact on the energy market would decline as compared to the first years of commercial operations. This phenomenon is expected because the wholesale energy market will have "re-balanced" itself by then with new entry and load growth. As a consequence of lower retail energy cost savings, we observe reduced macroeconomic benefits in the longer term.

Figure 3. Estimated number of total new jobs created in New England during the commercial operations phase

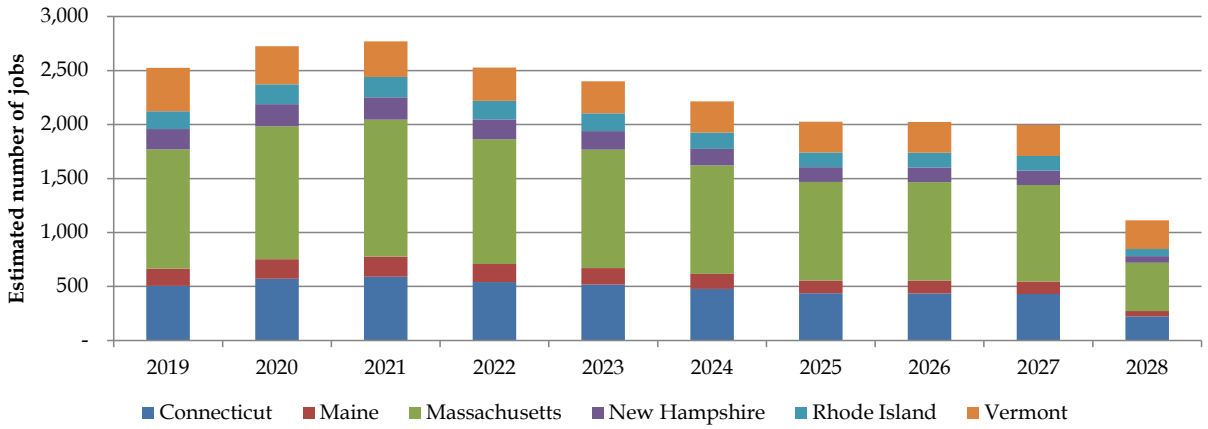
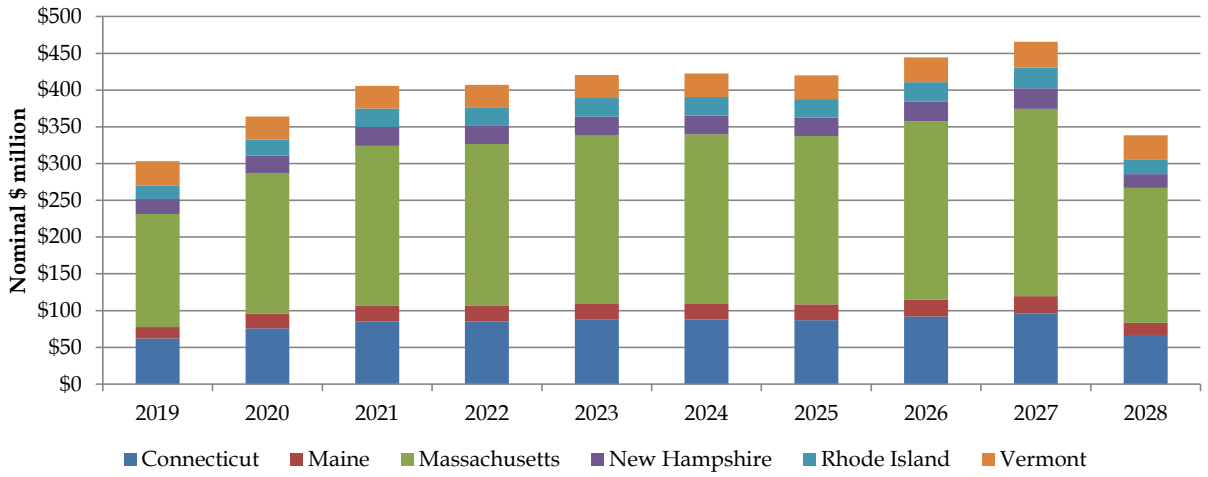


Figure 4. Estimated increase in state GDPs during the commercial operations phase

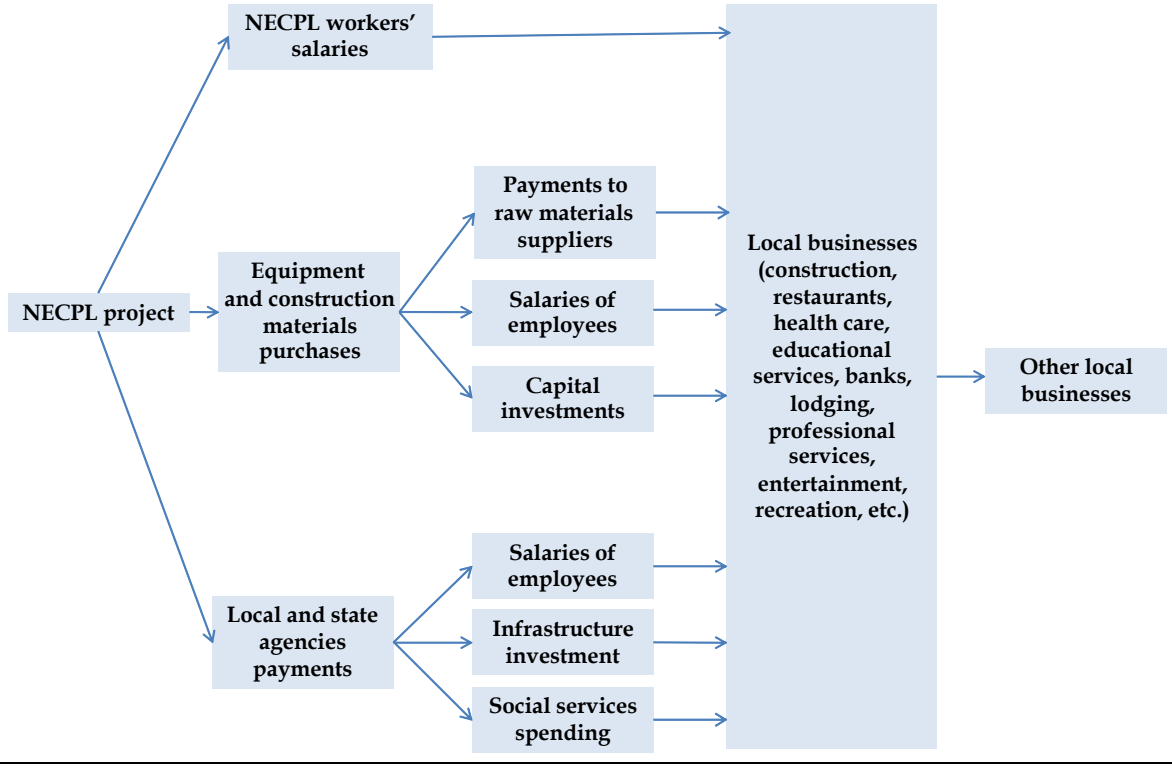


[14] To put the modeled impacts into perspective, the New England regional GDP in 2012 was over $828 billion; this implies NEPCL would expand the New England economy by around 0.05% as compared to historical GDP levels. In addition, in 2012, total employment across all New England states combined was approximately 9 million; therefore, NEPCL would increase regional employment by 0.02%.

3 Macroeconomic impact on Vermont and rest of New England: construction phase of NECPL

TDI expects to begin construction of the proposed Project in 2016. Over the course of the 36-month construction cycle, the proposed Project will create on average approximately 140 direct jobs per year in Vermont. Construction jobs will be associated with the construction of the converter station and the installation of the transmission cable in Vermont. In addition to actual construction services, TDI will need to hire administrative staff and pay for various on-site services (e.g., engineering services and other technical services). The in-state (direct) jobs created by NECPL will result in an increase in demand for other goods and services within the state (for example, construction workers will spend a portion of their salaries on food and lodging in the vicinity of the construction site). The project will also incur direct spending in Vermont, including non-labor installation costs, as well as fees and taxes paid to the local governments and the state government. With more revenues/sales, businesses will have more profits and therefore be able to hire more people and/or make capital investments to expand production. In addition, some of the payments that TDI is expecting to make during the construction phase will also go to the state and local government agencies, for example, to pay for permit costs, and taxes, which the agencies can then include in their annual operating budgets and spend in their government operations. Figure 5 below is a simple illustration of how the NECPL creates benefits to Vermont and other states in New England.

Figure 5. Simple illustration of how the NECPL project creates benefits to Vermont and other states in New England



Due to the close economic ties between Vermont and other New England states, there will also be spill-over effects in the form of additional indirect and induced jobs and expanding economic activity (as measured by GDP) throughout New England. For example, retail and administrative services demanded by NECPL in Vermont would further induce manufacturing activities and financial services provided by firms located in other New England states, such as Massachusetts and Connecticut. REMI's PI+ model incorporates these interregional linkages and calculates the impact of NECPL on other New England states' economies.

The construction phase of the NECPL is estimated to create an average of 850 total jobs throughout New England (including Vermont) from 2016 to 2018, with peak employment impact estimated at over 1,230 jobs in 2018. In addition, nearly seventy-five percent (75%) of these estimated total jobs will be located in Vermont, and the remaining new jobs will be dispersed throughout the rest of New England, as shown in Figure 6. This total job estimate includes direct, indirect, and induced jobs. On average, ten percent (10%) of these total jobs are direct jobs, nearly fifteen percent (15%) are indirect jobs, and the rest are induced jobs as shown in Figure 7. Furthermore, more than thirty-five percent of these total jobs (or 35%) will come from the construction sector. It can also be noted that some of the most affected industries are related to services required by the construction workers, such as local government, professional/technical services, health care, accommodations, and food services/restaurants. Figure 8 shows the percentage share of total jobs created by NECPL during the construction phase in each affected sector.

Figure 6. Estimated number of new jobs in New England as a consequence of the proposed Project during the construction phase

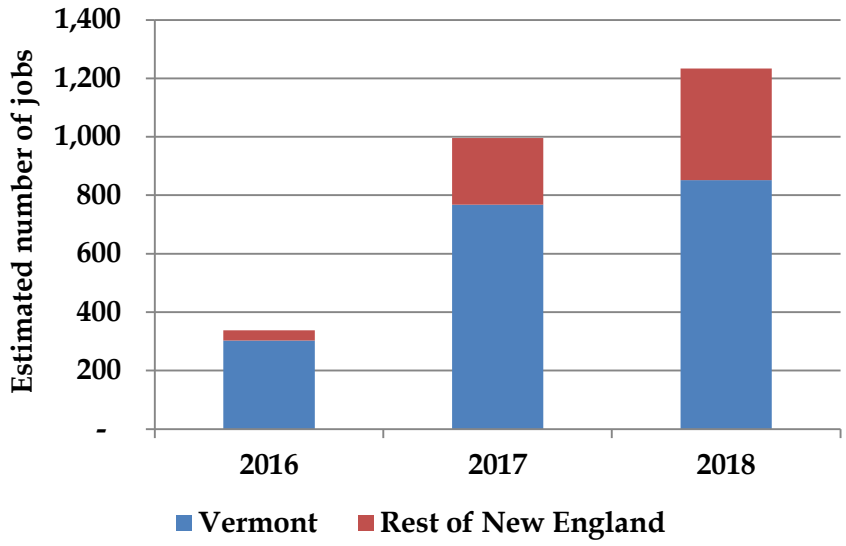


Figure 7. Estimated number of new jobs in Vermont from the proposed Project during the construction phase (by source of jobs)

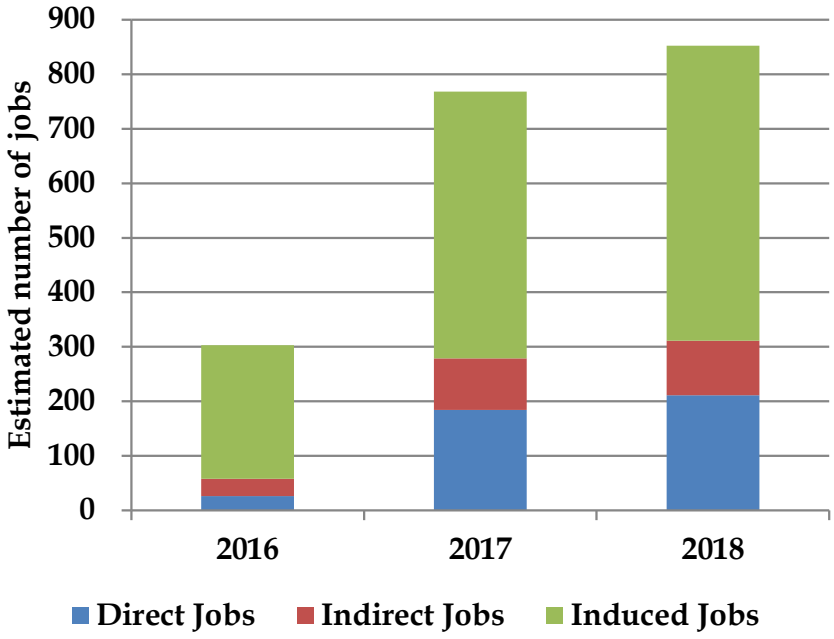
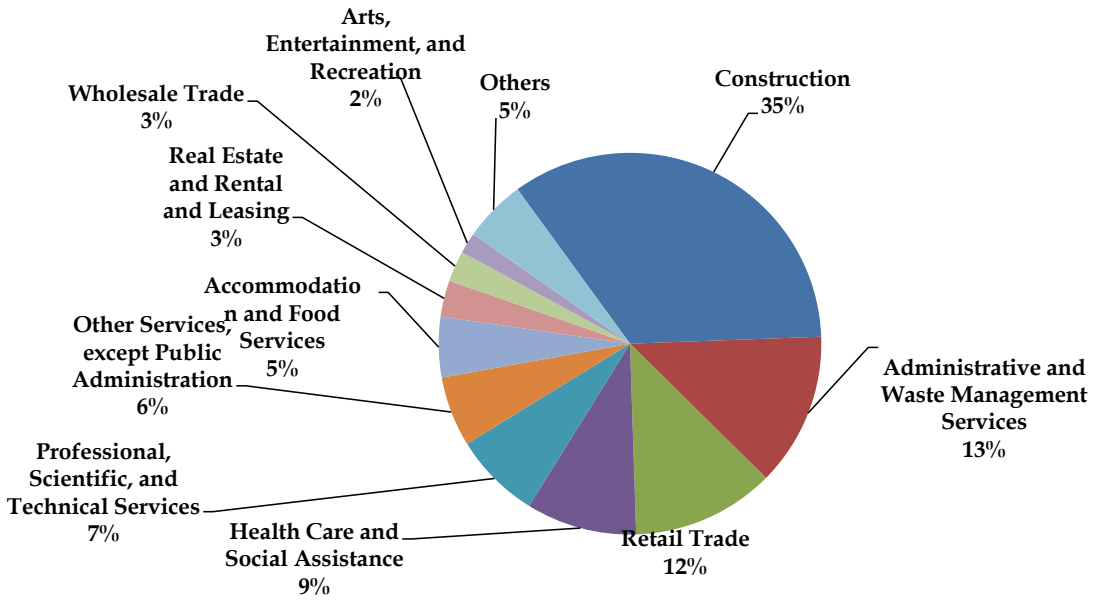


Figure 8. Breakdown of new jobs in New England by sector during the construction phase

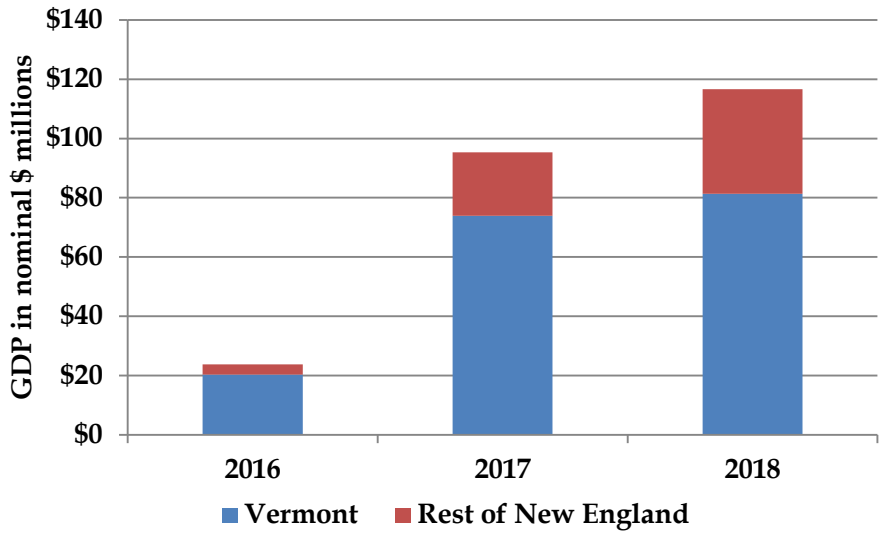


Note: Others include the following sectors: Educational Services; Finance and insurance; Forestry, fishing and related activities; Information; Management of Companies and Enterprises; Manufacturing; Mining; Transportation and Warehousing; and Utilities.

In addition to jobs created by the project, NECPL will also improve the state's and region's economy. On average, between 2016 and 2018, the construction phase of NECPL will infuse

approximately $78 million per year in the New England economy. In total, as a result of the jobs and in-state spending, in 2017, the project is expected to raise Vermont's GDP by over $58 million. NECPL would also positively impact the rest of New England (excluding Vermont) by an average of $20 million per annum.

Figure 9. Estimated increase in state GDPs in Vermont and rest of New England during the construction phase (in nominal $ million)

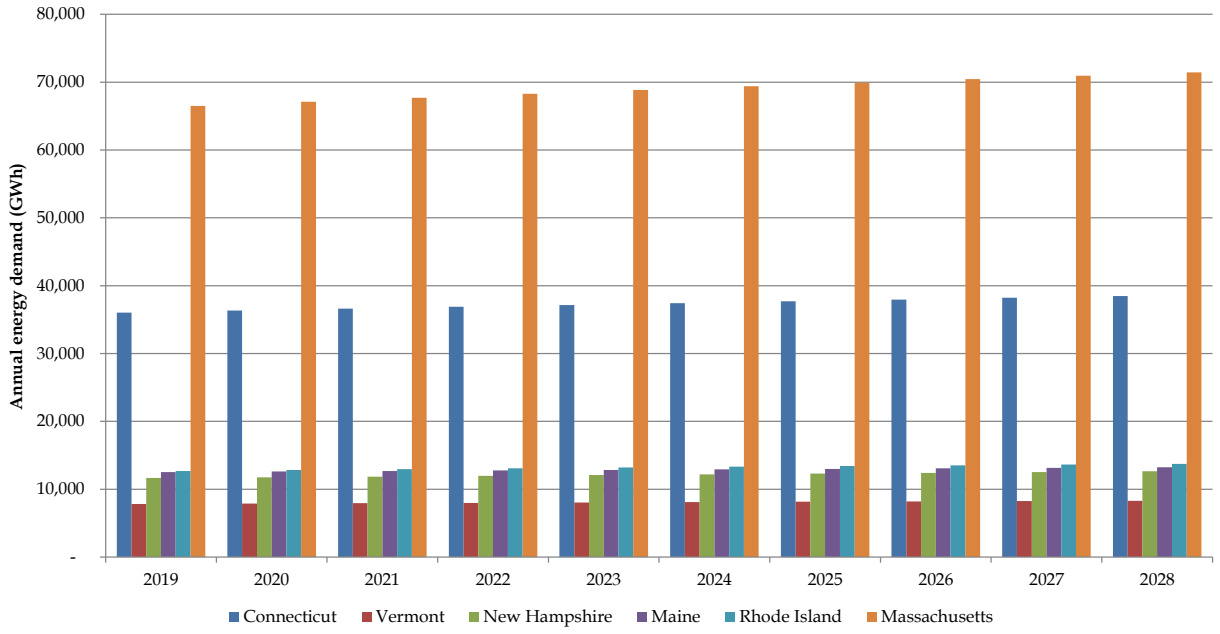


4 Macroeconomic impact on New England: operations phase of NECPL

The commercial operations phase of the proposed Project is expected to start in 2019. Although the construction-related jobs will come to an end, TDI will continue to create direct jobs in Vermont and consume local services and spend for the operation and maintenance of the Project. TDI will also be paying taxes,[15] service fees, and making land lease payments. Similar to the construction period, the direct jobs and local spending during commercial operations will create an opportunity for more jobs throughout New England.

Moreover, once the NECPL starts commercial operations, the low cost, low-carbon renewable energy transmitted by the project will displace production from other, more expensive generating resources and thereby lower the market price of electricity throughout ISO-NE. Figure 10 presents the forecasted load in each New England state, and Figure 11 presents the annual average wholesale energy price change due to NECPL.[16]

Figure 10. Forecasted load in New England state during NECPL's commercial operations phase

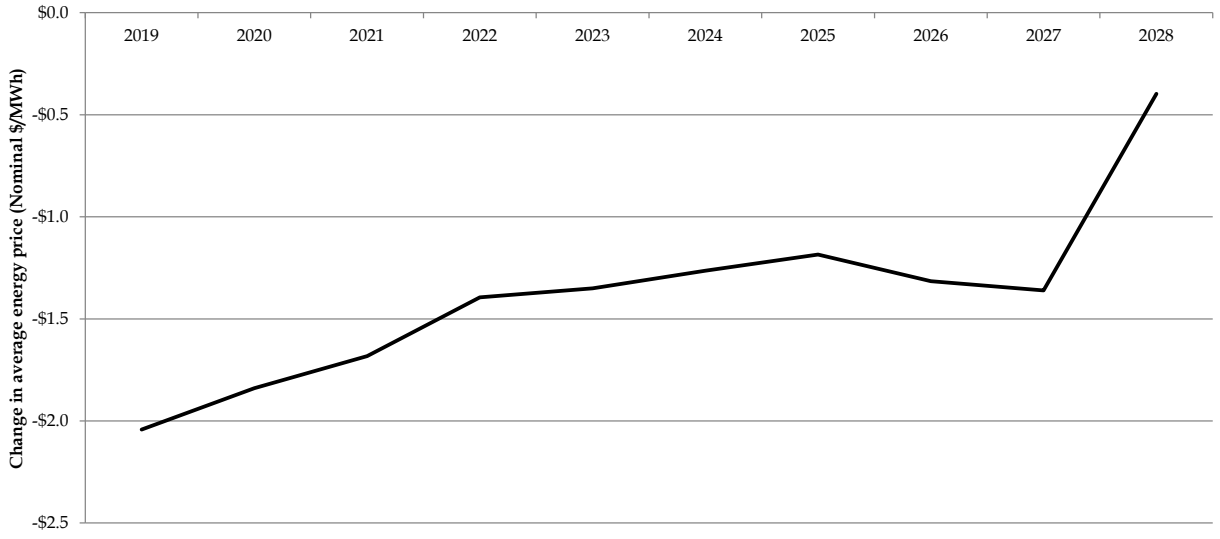


Source: ISO-NE Capacity, Energy, Load, Transmission report ("CELT") 2013

[15] NECPL increases Vermont's local tax revenues through property taxes.

[16] Detailed breakdown of residential, commercial, and industrial load, together with assumed level of contracted energy demand, is presented in Section 5.2 and Section 5.3 in the Appendix.

Figure 11. Modeled change in wholesale energy price during NECPL's commercial operations phase



Source: LEI analysis

Based on LEI's analysis, the energy flows on the 1000 MW NECPL are projected to reduce wholesale energy market prices by over $1/MWh on average over the ten years and that will then lead to reduced retail energy costs of approximately $195 million per annum for ISO-NE in the aggregate. By 2028, after 10 years of commercial operations, the impact of NEPCL to wholesale energy market prices would be absorbed by market dynamics, as new capacity would be required to meet load growth and replace retired units in New England.

On average, only two percent (2%) of the energy cost reductions can be attributed to Vermont. Not only is demand in Vermont low compared with the other New England States, most of its power (over 60%) is sold under long-term contracts signed before 2014. These contracts will defer the impact of the lower wholesale prices created by NECPL until contract expiration. As described in Section 5.4 in the Appendix to this Report (page 23), the rest of the retail energy cost reductions are attributable to the other New England states, with close to forty-seven percent (47%) of the regional retail energy cost reductions attributable to Massachusetts, twenty-seven percent (27%) attributable to Connecticut, ten percent (10%) attributable to Rhode Island, close to eight percent (8%) attributable to Maine, and seven percent (7%) attributable to New Hampshire. These cost reductions impact different end users in a number of meaningful ways, which the REMI PI+ model captures.

Lower power prices to consumers are likely to boost economic activity. When electricity prices decrease, households will have higher income for the same level of energy consumption and therefore more income that can be used to purchase other goods and services. This "income effect" increases demand for other goods and services, and can boost production of other sectors of the economy, thereby resulting in increased employment and further economic benefits. In REMI's PI+ model, the effects created by lower residential electricity costs are captured in trends in personal expenditures and patterns of labor migration (e.g., lower electricity cost can attract people to move to an area).

Commercial and industrial customers, especially those that rely heavily on electricity use, may also experience an "income effect" as a result of changes in electricity prices. Electricity costs are generally treated as a variable cost in business (or a component of costs of goods sold). Assuming the same production level in the short term, decreases in electricity costs will increase profitability. In the medium term, businesses facing decreasing electricity costs may choose to increase production, and that may mean expansion of their capital, which then induces demand in other industries. For example, this will indirectly create opportunities for additional employment as production expansions typically require additional labor. Businesses will also require incremental inputs to their production process which will, therefore, indirectly increase demand for key inputs, thereby affecting those other intermediary sectors of the economy. There will also be a substitution effect, where possible technically and economically sensible (as a result of relative price changes) electricity use will displace other fuel use in the economy. In the long run, businesses that have production cost savings from lower electricity costs may choose to expand their capacity through capital expenditures, which in turn will also increase production levels and create additional employment opportunities and result in tertiary economic impacts.[17]

Including ongoing operations in Vermont and (and therefore inclusive of the direct jobs that TDI will need to manage to operate and maintain the transmission infrastructure) and the electricity cost savings throughout New England discussed above, the NECPL project will increase the number of jobs in New England by an average of more than 2,000 jobs over the first ten years of commercial operations. The majority of these jobs are induced jobs that span a variety of service industries. During the first ten years of operation, fourteen percent (14%) of these estimated new jobs will be in Vermont, nearly half of the jobs (or 45%) in Massachusetts, twenty-one percent (21%) in Connecticut, and almost equally at seven percent (7%) among Maine, New Hampshire, and Rhode Island.[18] As presented previously in Figure 3 in page 11, the number of jobs created in New England as a result of NECPL's commercial operations peaks at 2021, and slowly decreases as the benefit from lower retail energy costs also declines over time. By 2028, the proposed Project's impact on the wholesale energy market will be dampened as the wholesale market re-balances. The reduced retail energy cost savings with time then lead to slow reduction in the new jobs created.

[17] Long-term capacity expansion of businesses is included in REMI PI+ model through a capital stock adjustment process. The stock adjustment process assumes that investment occurs in order to fill the gap between the optimal and actual level of capital. New investment provides a strong feedback mechanism for further growth, since it represents immediate demand for building and equipment that are to be used over a long period of time.

[18] Note that the amount of jobs created in each state is not linearly correlated to the amount of energy costs savings. The amount and types of jobs created also depends on the labor productivity in each state, the industrial mix, and also the economic linkages between each state.

Figure 12. Estimated number of total jobs in Vermont created by NECPL during its commercial operation (by source of jobs)

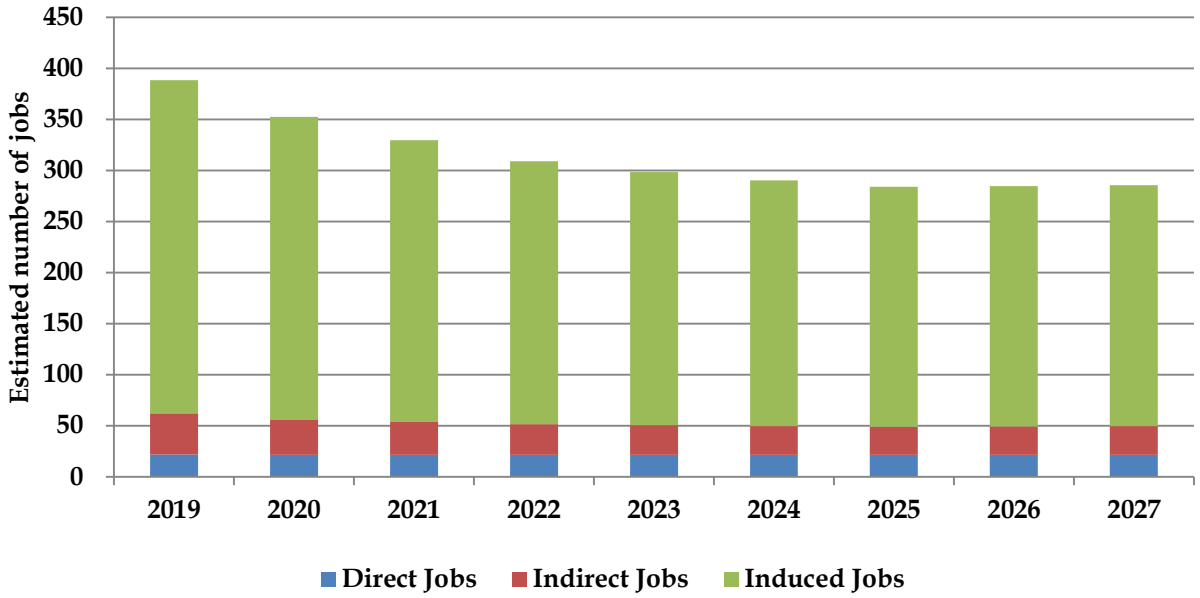
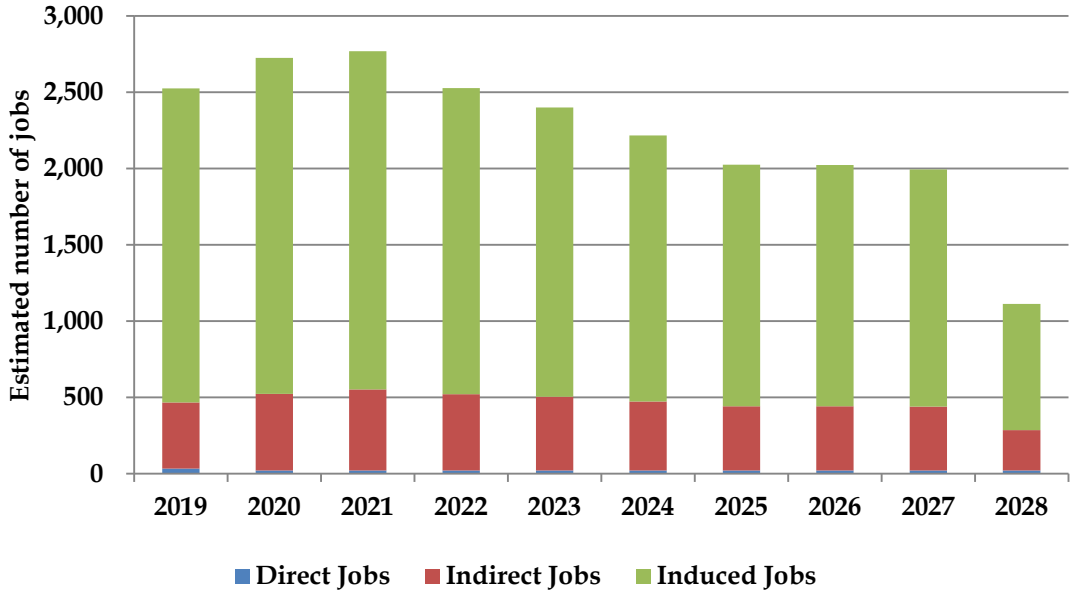


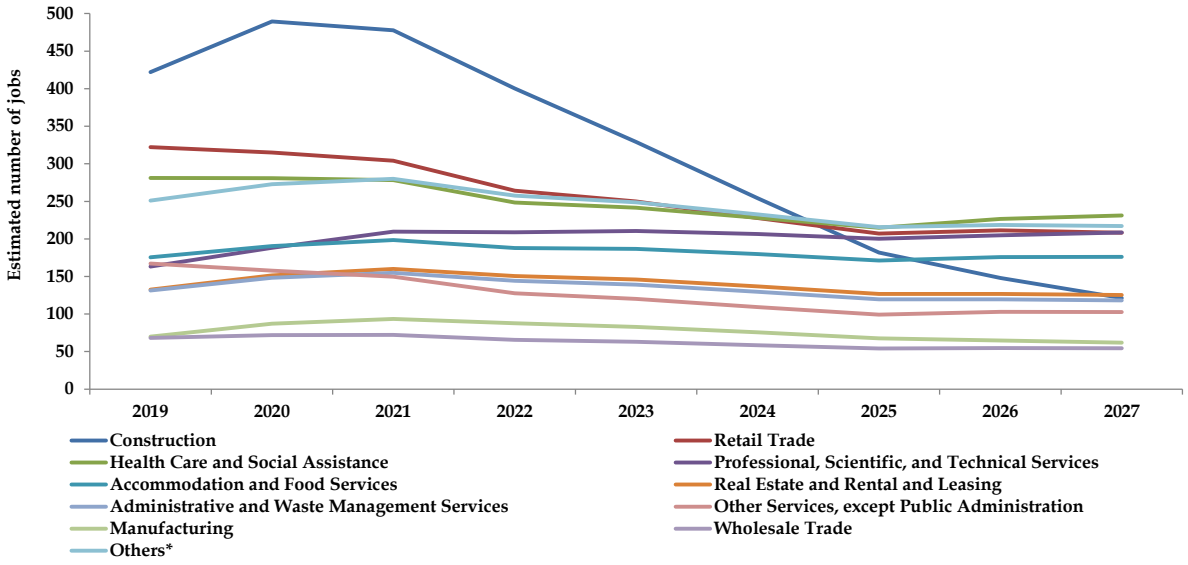
Figure 13. Estimated number of total jobs in New England created by NECPL during its commercial operation (by source of jobs)



During the first ten years of full operations of the NECPL, there will be a significant increase in the number of jobs in service sectors, such as: retail trade, health care and social assistance, professional, scientific and technical services, and accommodation and food services.

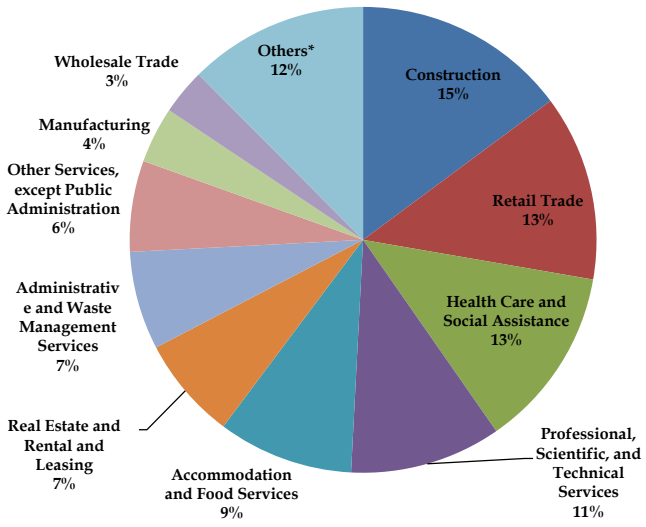
Figure 14 and Figure 15 illustrate the average distribution of new jobs created by sector in terms of total jobs and percentage terms, respectively.

Figure 14. Estimated number of new jobs in New England from NECPL commercial operations (by year and sector)



*Note: *Others include the following sectors: Arts, Entertainment, and Recreation; Educational Services; Finance and Insurance; Forestry, fishing and related activities; Information; Management of Companies and Enterprises; Mining; Transportation and Warehousing; and Utilities.*

Figure 15. Breakdown of jobs in New England by sector arising as a result of NECPL operations, average 2019-2028



*Note: *Others include the following sectors: Arts, Entertainment, and Recreation; Educational Services; Finance and Insurance; Forestry, fishing and related activities; Information; Management of Companies and Enterprises; Mining; Transportation and Warehousing; and Utilities.*

As a consequence of the estimated average annual energy market benefits of $195 million per annum that New England electric consumers will receive, the NECPL will expand the region's economy as measured by the increase in each state's GDP. For example, in 2019 – the first year of NECPL operations – state GDPs across New England are projected to increase by about $300 million in total. There are some lagged effects that take several years to evolve, as sector activity gradually responds to the electricity cost reductions, industry patterns shift, and labor movements across the region stabilize. Therefore, by 2027, taking into account inflation, New England's annual GDP will have increased by more than $460 million as a result of NECPL operations. The results are presented earlier in Figure 4 on page 11. Over the ten-year period, the project will contribute, on average, nearly $400 million per annum to the New England economy. Approximately eight percent (8%) of this will come from economic activities in Vermont, fifty-four percent (54%) from Massachusetts, twenty-one percent (21%) from Connecticut, and almost equally at six-percent (6%) from Maine, New Hampshire, and Rhode Island.

5 Appendix

5.1 Estimated change in wholesale energy price due to NECPL ($/MWh)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Average
ISO-NE system wide	(2.0)	(1.8)	(1.7)	(1.4)	(1.4)	(1.3)	(1.2)	(1.3)	(1.4)	(0.4)	(1.4)
Connecticut	(2.1)	(1.9)	(1.7)	(1.4)	(1.4)	(1.3)	(1.2)	(1.4)	(1.4)	(0.4)	(1.4)
Vermont	(2.0)	(1.8)	(1.6)	(1.3)	(1.3)	(1.2)	(1.1)	(1.3)	(1.3)	(0.4)	(1.3)
New Hampshire	(2.0)	(1.8)	(1.7)	(1.4)	(1.3)	(1.2)	(1.2)	(1.3)	(1.3)	(0.4)	(1.4)
Maine	(1.9)	(1.7)	(1.5)	(1.2)	(1.2)	(1.1)	(1.0)	(1.1)	(1.2)	(0.3)	(1.2)
Rhode Island	(2.1)	(1.9)	(1.7)	(1.4)	(1.4)	(1.3)	(1.2)	(1.4)	(1.4)	(0.4)	(1.4)
Massachusetts	(2.1)	(1.9)	(1.7)	(1.4)	(1.4)	(1.3)	(1.2)	(1.3)	(1.4)	(0.4)	(1.4)

Source: LEI forecast

5.2 Estimated breakdown of retail energy demand

State	Residential	Commercial	Industrial
Connecticut	43%	44%	12%
Maine	37%	32%	31%
Massachusetts	39%	35%	26%
New Hampshire	41%	41%	18%
Rhode Island	40%	47%	12%
Vermont	38%	36%	26%

Source: US Energy Information Administration (EIA)

5.3 Estimated percentage of load under long-term contracts

State	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Connecticut	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maine	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Massachusetts	5%	5%	5%	5%	4%	4%	4%	4%	4%	4%
New Hampshire	19%	19%	19%	18%	18%	18%	18%	18%	18%	17%
Rhode Island	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Vermont	64%	65%	66%	65%	63%	63%	63%	63%	63%	63%

Note: Above numbers were estimated by LEI based on research of long-term contracts. Load under long-term contracts are defined as energy procured under publicly available power purchase agreements, energy provided by generators under cost-of-service arrangements, and long-term energy supply positions filed with state public utility commissions and FERC.

Source: FERC, Vermont Department of Public Service, Massachusetts Department of Energy Resources, Maine Public Utilities Council, and Connecticut Department of Energy & Environmental Protection

5.4 Estimated retail energy market benefits from the updated LEI analysis by region and consumer type (nominal $ millions)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Average
New England	**$ 277.8**	**$ 252.3**	**$ 232.9**	**$ 194.7**	**$ 190.4**	**$ 179.6**	**$ 169.7**	**$ 189.8**	**$ 197.8**	**$ 58.2**	**$ 194.3**
Connecticut	**$ 75.2**	**$ 68.4**	**$ 63.1**	**$ 52.8**	**$ 51.5**	**$ 48.6**	**$ 46.1**	**$ 51.3**	**$ 53.4**	**$ 15.7**	**$ 52.6**
Residential	$ 32.7	$ 29.8	$ 27.5	$ 23.0	$ 22.4	$ 21.2	$ 20.1	$ 22.3	$ 23.2	$ 6.9	$ 22.9
Commercial	$ 33.3	$ 30.3	$ 27.9	$ 23.4	$ 22.8	$ 21.5	$ 20.4	$ 22.7	$ 23.6	$ 7.0	$ 23.3
Industrial	$ 9.2	$ 8.3	$ 7.7	$ 6.4	$ 6.3	$ 5.9	$ 5.6	$ 6.2	$ 6.5	$ 1.9	$ 6.4
Maine	**$ 22.7**	**$ 20.4**	**$ 18.6**	**$ 15.4**	**$ 14.9**	**$ 13.9**	**$ 12.9**	**$ 14.7**	**$ 15.4**	**$ 4.5**	**$ 15.3**
Residential	$ 8.8	$ 7.9	$ 7.2	$ 6.0	$ 5.8	$ 5.4	$ 5.0	$ 5.7	$ 6.0	$ 1.7	$ 5.9
Commercial	$ 8.0	$ 7.2	$ 6.5	$ 5.4	$ 5.2	$ 4.9	$ 4.5	$ 5.2	$ 5.4	$ 1.6	$ 5.4
Industrial	$ 6.0	$ 5.3	$ 4.9	$ 4.0	$ 3.9	$ 3.6	$ 3.4	$ 3.8	$ 4.0	$ 1.2	$ 4.0
Massachusetts	**$ 129.1**	**$ 117.3**	**$ 108.4**	**$ 90.7**	**$ 88.6**	**$ 83.7**	**$ 79.1**	**$ 88.4**	**$ 92.2**	**$ 27.1**	**$ 90.5**
Residential	$ 47.7	$ 43.4	$ 40.1	$ 33.5	$ 32.8	$ 30.9	$ 29.2	$ 32.7	$ 34.1	$ 10.0	$ 33.4
Commercial	$ 41.6	$ 37.8	$ 35.0	$ 29.3	$ 28.6	$ 27.0	$ 25.5	$ 28.5	$ 29.7	$ 8.7	$ 29.2
Industrial	$ 39.8	$ 36.1	$ 33.4	$ 27.9	$ 27.3	$ 25.8	$ 24.4	$ 27.2	$ 28.4	$ 8.4	$ 27.9
New Hampshire	**$ 18.9**	**$ 17.3**	**$ 16.0**	**$ 13.4**	**$ 13.2**	**$ 12.5**	**$ 11.8**	**$ 13.3**	**$ 13.9**	**$ 4.1**	**$ 13.4**
Residential	$ 7.7	$ 7.1	$ 6.5	$ 5.5	$ 5.4	$ 5.1	$ 4.8	$ 5.4	$ 5.7	$ 1.7	$ 5.5
Commercial	$ 7.8	$ 7.1	$ 6.6	$ 5.5	$ 5.4	$ 5.1	$ 4.9	$ 5.5	$ 5.7	$ 1.7	$ 5.5
Industrial	$ 3.4	$ 3.1	$ 2.9	$ 2.4	$ 2.4	$ 2.2	$ 2.1	$ 2.4	$ 2.5	$ 0.7	$ 2.4
Rhode Island	**$ 26.3**	**$ 24.0**	**$ 22.2**	**$ 18.6**	**$ 18.3**	**$ 17.3**	**$ 16.4**	**$ 18.2**	**$ 19.0**	**$ 5.6**	**$ 18.6**
Residential	$ 10.7	$ 9.7	$ 9.0	$ 7.6	$ 7.4	$ 7.0	$ 6.7	$ 7.4	$ 7.7	$ 2.3	$ 7.5
Commercial	$ 12.5	$ 11.4	$ 10.5	$ 8.8	$ 8.6	$ 8.2	$ 7.8	$ 8.6	$ 9.0	$ 2.7	$ 8.8
Industrial	$ 3.2	$ 2.9	$ 2.7	$ 2.2	$ 2.2	$ 2.1	$ 2.0	$ 2.2	$ 2.3	$ 0.7	$ 2.2
Vermont	**$ 5.6**	**$ 4.9**	**$ 4.4**	**$ 3.7**	**$ 3.9**	**$ 3.7**	**$ 3.4**	**$ 3.9**	**$ 4.0**	**$ 1.2**	**$ 3.9**
Residential	$ 2.1	$ 1.8	$ 1.7	$ 1.4	$ 1.5	$ 1.4	$ 1.3	$ 1.5	$ 1.5	$ 0.4	$ 1.5
Commercial	$ 2.0	$ 1.8	$ 1.6	$ 1.3	$ 1.4	$ 1.3	$ 1.2	$ 1.4	$ 1.5	$ 0.4	$ 1.4
Industrial	$ 1.4	$ 1.3	$ 1.1	$ 1.0	$ 1.0	$ 0.9	$ 0.9	$ 1.0	$ 1.0	$ 0.3	$ 1.0

Source: LEI forecast

5.5 List of the 70 sectors used in the REMI PI+ Model

1. Forestry and logging; Fishing, hunting, and trapping
2. Agriculture and forestry support activities
3. Oil and gas extraction
4. Mining (except oil and gas)
5. Support activities for mining
6. Utilities
7. Construction
8. Wood product manufacturing
9. Nonmetallic mineral product manufacturing
10. Primary metal manufacturing
11. Fabricated metal product manufacturing
12. Machinery manufacturing
13. Computer and electronic product manufacturing
14. Electrical equipment and appliance manufacturing
15. Motor vehicles, bodies and trailers, and parts manufacturing
16. Other transportation equipment manufacturing
17. Furniture and related product manufacturing
18. Miscellaneous manufacturing
19. Food manufacturing
20. Beverage and tobacco product manufacturing
21. Textile mills; Textile products mill
22. Apparel manufacturing; Leather and allied product manufacturing
23. Paper manufacturing
24. Printing and related support activities
25. Petroleum and coal product manufacturing
26. Chemical manufacturing
27. Plastics and rubber products manufacturing
28. Wholesale trade
29. Retail trade
30. Air transportation
31. Rail transportation
32. Water transportation
33. Truck transportation
34. Couriers and messengers
35. Transit and group passenger transportation
36. Pipeline transportation
37. Scenic and sightseeing transportation; Support activities for transportation
38. Warehousing and storage
39. Publishing industries, except Internet

40. Motion picture and sound recording industries
41. Internet publishing and broadcasting, ISPs search portals and data processing
42. Broadcasting, except Internet
43. Telecommunications
44. Monetary authorities – central bank; Credit intermediation and related activities; Funds, trusts, & other financial vehicles
45. Securities, commodity contracts, investments
46. Insurance carriers and related activities
47. Real estate
48. Rental and leasing services; Lessors of nonfinancial intangible assets
49. Processional, scientific, and technical services
50. Management of companies and enterprises
51. Administrative and support services
52. Waste management and remediation services
53. Educational services
54. Ambulatory health care services
55. Hospitals
56. Nursing and residential care facilities
57. Social assistance
58. Performing arts and spectator sports
59. Museums, historical sites, zoos, and parks
60. Amusement, gambling, and recreation
61. Accommodation
62. Food services and drinking places
63. Repair and maintenance
64. Personal and laundry services
65. Membership associations and organizations
66. Private households
67. State and local government
68. Federal civilian
69. Federal military
70. Farm (crop and animal production)