Analysis of the Macroeconomic Impacts of the Proposed Champlain Hudson Power Express Project in New York

Prepared by London Economics International LLC

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

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1 Executive Summary

The Champlain-Hudson Power Express ("CHPE" or "the project") is a 333-mile underwater and underground HVDC transmission line that will deliver 1,000 MW of clean, low-cost energy into the New York City market. London Economics International LLC ("LEI") analyzed the potential economic benefits of the CHPE project in terms of the employment and impacts on Gross Domestic Product ("GDP") to New York State, using the PI+ model developed by Regional Economic Models, Inc. ("REMI").

The REMI PI+ model is a sophisticated policy and 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 and infrastructure projects, such as CHPE. It generates realistic-year-by-year estimates of the total regional effects of any specific policy initiative or large investment and infrastructure project. The REMI model used for this analysis was a twenty-three sector, three-region New York model.

Based on the LEI analysis, the CHPE will create more than 2,000 jobs in New York State and millions of dollars in new economic activity for the New York economy, on top of the electricity cost savings previously projected:

Construction period impact

- During the construction period (currently planned for 2013 to 2016), CHPE is projected to bring an average of more than 300 direct construction jobs, primarily union positions, to the state, with a peak of more than 600 direct jobs in 2015. In addition, CHPE is expected to spend an additional $100 million on average per year during the construction period in New York for installation.

- LEI's analysis suggests that the economic activity that will be generated by the construction phase will create an average of more than 1,200 indirect and induced jobs[1] and will increase New York's GDP by nearly $150 million per year.

Commercial operations period impact

- During the commercial operations phase, it is estimated that the increased supply of low-cost electricity delivered through this line will reduce electricity costs by more than $650 million a year in New York State. These annual electricity cost savings are expected to continue over the long term and will generate additional macroeconomic benefits for New York.

- Based on LEI's analysis using REMI's PI+ model, CHPE will produce an average of nearly 2,400 indirect and induced jobs over the first ten years of full operations of the CHPE project and will also benefit the New York economy by increasing the GDP by an average of approximately $600 million per year from 2017 to 2026.[2]

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[1] 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 businesses which provide goods and services essential to the construction or operations of the project, and induced jobs are jobs that are created in the sectors of the economy as a result of spending of the wages and salaries of the direct and indirect employees.

[2] 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 power market. The GDP impact is estimated using the REMI macroeconomic policy model. In fact, the electricity cost savings are the driver

2 Overview

The CHPE project is a 1,000 MW HVDC-based transmission line originating in the US-Canada border and terminating in the New York City ("NYC") zone of the New York Control Area (the New York Independent System Operator ("NYISO") administers wholesale power markets for the entire state). Transmission Developers Inc. ("TDI"), an Albany, New York-based company and the developer of the CHPE project, will make direct investments in New York State during the construction and operating phases of the project. For example, TDI will hire construction workers during the construction phase and full-time, New York-based employees and contracted labor (and services) during the operating phase. TDI's expenditures in the state of New York will result in new job creations and increased economic activities. In addition, the CHPE project is expected to lower the wholesale market price of electricity as a result of the energy flows on the transmission line. This reduction in electricity costs will also create incremental macroeconomic benefits for the state. Our analysis aims to quantify the impact of the direct, in-state investments during the CHPE construction period as well as the direct, in-state expenditures and reduced electricity costs during CHPE's commercial operations period on employment and GDP[3] in New York.

2.1 Modeling methodology

LEI utilized the dynamic forecasting and policy analysis PI+ model developed by REMI to measure the economic benefits of the CHPE project to New York State, namely change in employment and impacts on GDP. 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.[4] The REMI

(or input) to the increased economic activity that is represented by the GDP impact. The electricity cost savings that New York households and businesses receive as a result of CHPE spur economic activity by increasing consumption (households have more disposable income to spend on other goods and services) and increasing exports (because firms are able to lower their production cost and thus become more competitive). This then generates an expansion of economic activity as measured by GDP.

[3] GDP is commonly defined as the monetary value of all the finished goods and serviced produced within a country in a specific time period. It includes all private and public consumptions, government expenditures, investments and net exports that occur within the country.

[4] 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 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.

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 York, the REMI PI+ model was used by the Energy Protection Agency ("EPA") to measure the economic effects of renewable and energy efficiency measures proposed by New York State Energy Research and Development Authority ("NYSERDA") for adoption by the state of New York. It was also used by NYSERDA to evaluate the short and long-term impacts of higher utility rates to subsidize energy efficiency equipment and infrastructure. In addition, it was used by the EPA and NYSERDA to analyze the economic impact of a expanding a bio-diesel plant in New York. Furthermore, REMI's model has also been used to assess the macroeconomic benefits of a variety of energy infrastructure investments, including new generation and transmission. Within New York specifically, it has been used to assess the impact of building and operating a coal-gasification plant in Huntley, New York.

The REMI model used for this analysis was a twenty-three sector,[5] three-region New York model, consisting of the Upstate New York ("UPNY") region, Capital-Lower Hudson Valley ("C-LHV") region, and New York City-Long Island ("NYC&LI") region.[6]

2.2 Modeling inputs

TDI is expecting the project to undergo a 42-month construction phase,[7] starting in 2013 and finishing in September 2016. The operating life of the project, commencing in the 4Q 2016, is expected to go out thirty five years (or even longer). For our analysis, we have focused on the first ten years of operation. Given the significance of the installation costs for this project, nearly 50% of the estimated $2 billion capital cost for the CHPE project will be spent in New York to construct and install this project. Moreover, based on LEI's analysis of a 2018 test year, CHPE is expected to reduce the wholesale market price of electricity significantly in NYC&LI and C-LHV. Based on this analysis, the annual electricity cost savings to New York electricity consumers are estimated to be approximately $650 million and are expected to continue over many years.[8]

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[5] The list of the 23 sectors can be found in Section 5.2 of the Appendix.

[6] The three regions are consistent with the energy modeling LEI conducted to estimate the electricity cost savings. The list of counties assigned to each region can be found in Section 5.3 of the Appendix.

[7] Construction phase is expected to start either in late first quarter or early second quarter of 2013.

[8] LEI had tested in a previous analysis a ten-year timeframe and observed that the electricity costs savings were of similar magnitude over the ten years modeled. Therefore, for this analysis, LEI has assumed energy cost reductions consistent with the 2018 test year analysis for every year of the first ten full years of commercial operation, 2017-2026.

contact:
Julia Frayer/Cherrylin Trinidad
617-933-7221
Julia@londoneconomics.com

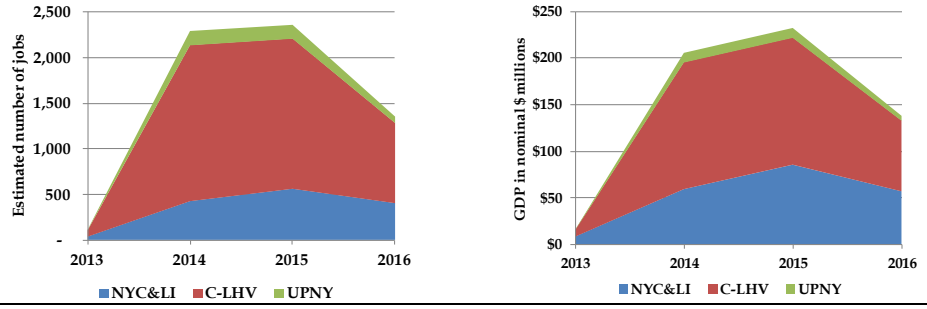
2.3 Modeling results

During the construction period, CHPE is projected to bring an average of more than 300 direct construction jobs, primarily union positions, to the state, with a peak of more than 600 direct jobs in 2015. In addition, CHPE is expected to spend an additional $100 million on average per year during the construction period in New York for installation.

Construction period impact

This direct spending will positively impact the New York economy, creating on average more than 1,200 additional indirect and induced jobs and increasing New York's GDP by nearly $150 million per year.

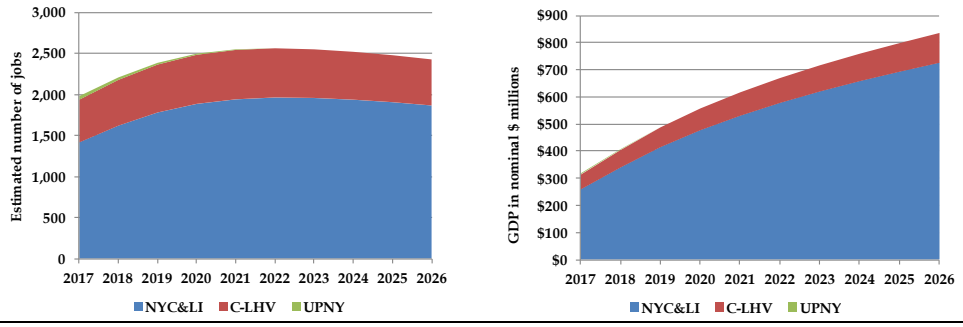
Figure 1. Estimated number of total new jobs created and increase in New York GDP during the construction phase



Commercial operations period impact

Once operational, the CHPE project will continue to generate positive macroeconomic benefits to the state of New York. LEI had previously projected that the increased supply of low-cost electricity delivered through this line will reduce electricity costs by more than $650 million a year. These annual cost savings are expected to continue over the long term and will have the effect of creating jobs and expanding economic activity in New York. LEI tested the macroeconomic impacts for the first ten years of commercial operations using the REMI PI+ model. During 2017-2026, CHPE will create an average of nearly 2,400 indirect and induced jobs per year and will increase New York's GDP by an average of approximately $600 million per annum.

Figure 2. Estimated number of total new jobs created and increase in New York GDP during the commercial operations phase



3 Macroeconomic impact on New York: construction phase of CHPE

The construction of the CHPE project is anticipated to start in 2013. Over the course of 42-month construction cycle, the CHPE project will create from approximately 20 to over 600 direct jobs per year in New York. Construction jobs will be associated with the construction of the converter station and the installation of the transmission cable within the state. 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 CHPE 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 New York, including non-labor installation costs, as well as fees and taxes paid to the local and state government. With more revenues/sales, businesses will have more profits and therefore be able to hire more people and/or make more investments. 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, permit costs and sales taxes, which the agencies can then include in their annual operating budgets and spend in their government operations. Figure 3 below is a simple illustration of how the CHPE project creates benefits to the state.

Figure 3. Simple illustration of how the CHPE project creates benefits to New York

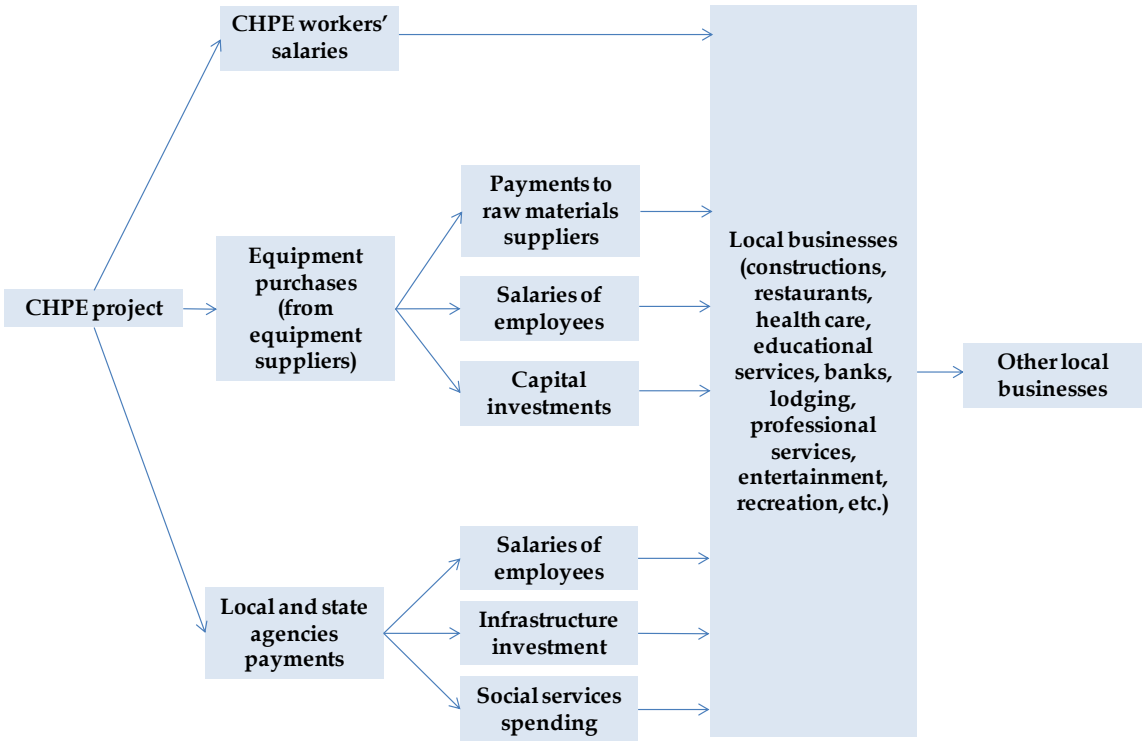


Figure 4 summarizes the assumptions of the macroeconomic modeling on the direct in-state spending (labor and non-labor) for the CHPE project during the construction phase. Overall,

given the scope of the installation effort, in-state labor and non-labor spending is expected to amount to nearly 50% of overall project costs.

Figure 4. Estimated number of direct jobs in New York during the construction phase

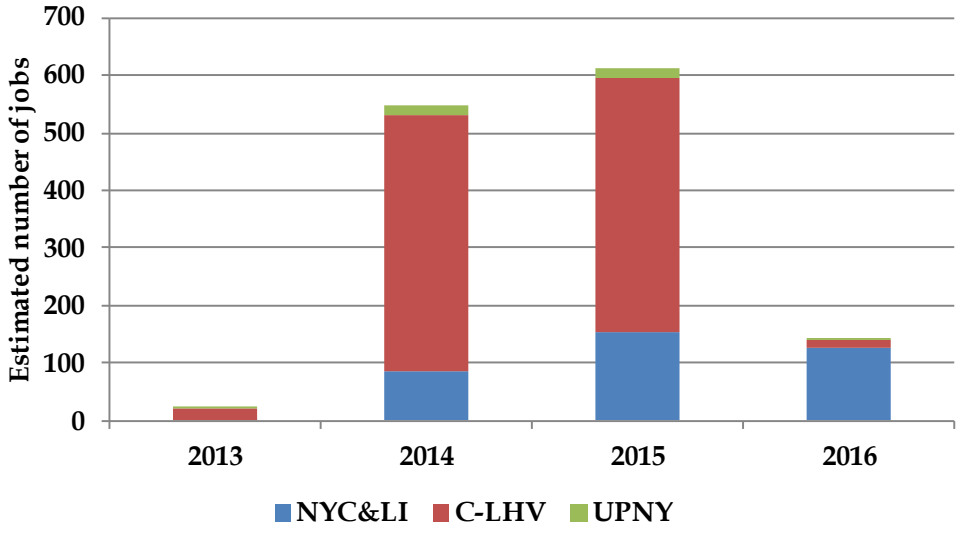
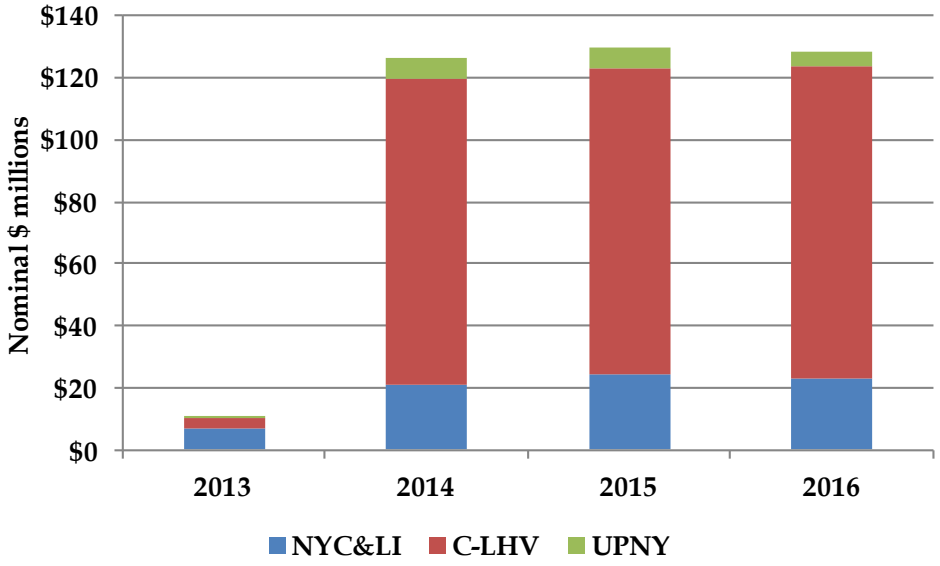


Figure 5. Estimated non-labor spending in New York during the construction phase (in nominal $ millions)



Source: TDI

The construction phase of the CHPE is estimated to create an average of approximately 1,500 total jobs from 2013 to 2016, with peak employment impact estimated at almost 2,400 jobs in 2015. In addition, more than 70% of these estimated total jobs will be located in C-LHV, almost a quarter (23%) in NYC&LI, and the rest in UPNY, as shown in Figure 6. This total job estimate includes direct jobs, indirect jobs, and induced jobs. On average, 20% of these total jobs are direct jobs, more than 40% are indirect jobs, and the rest are induced jobs as shown in Figure 7.

Furthermore, more than half of these total jobs (or 60%) will come from the construction sector. It can also be noted that some of the most affected local industries are related to services required by the construction workers, such as health care, accommodations, and food services/restaurants. Figure 8 shows the percentage share of total jobs created by CHPE during the construction phase in each affected sector.

Figure 6. Estimated number of total jobs in New York from the CHPE project during the construction phase

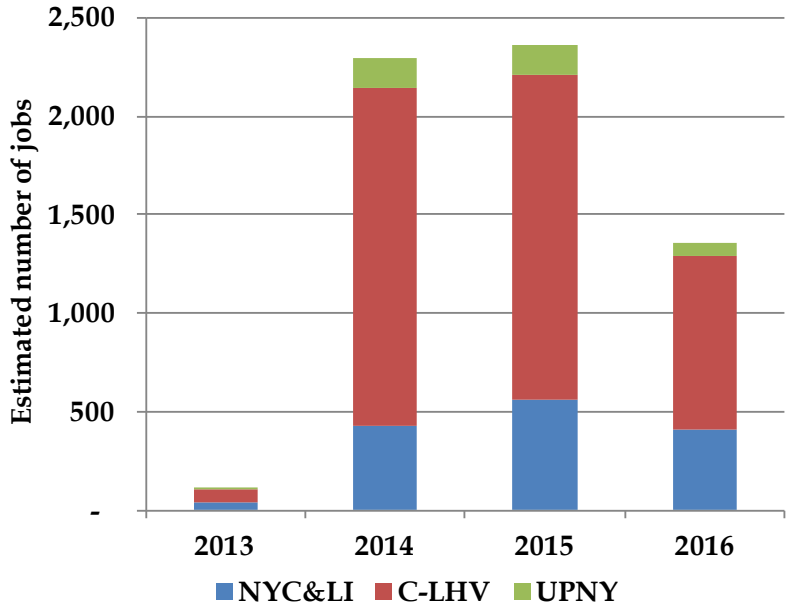


Figure 7. Estimated number of jobs in New York from the CHPE project during construction phase (by job type)

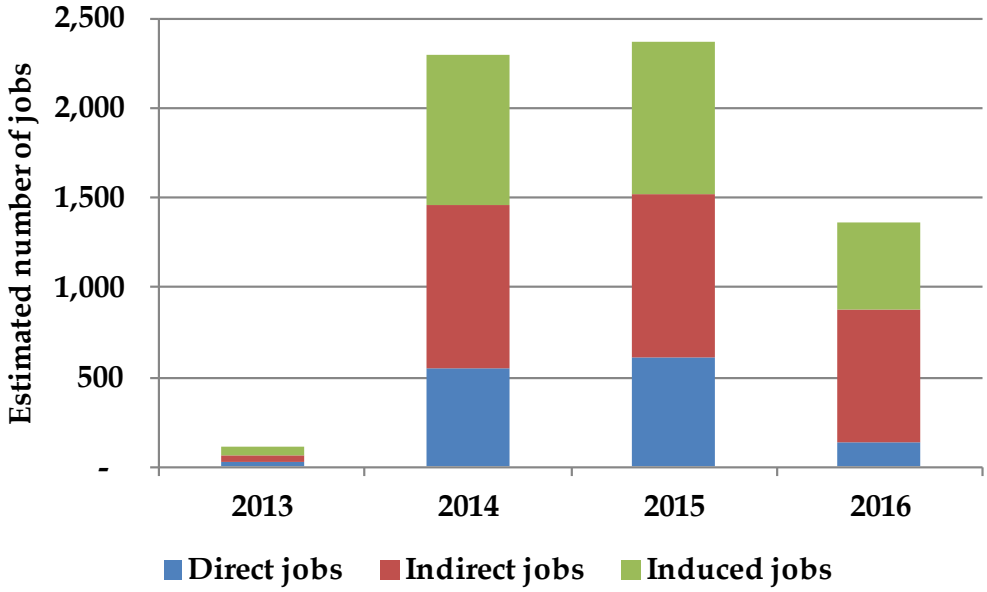
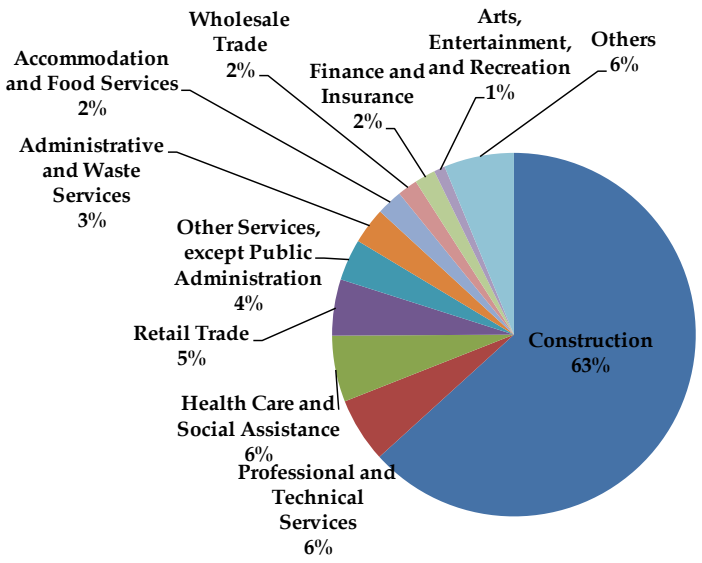


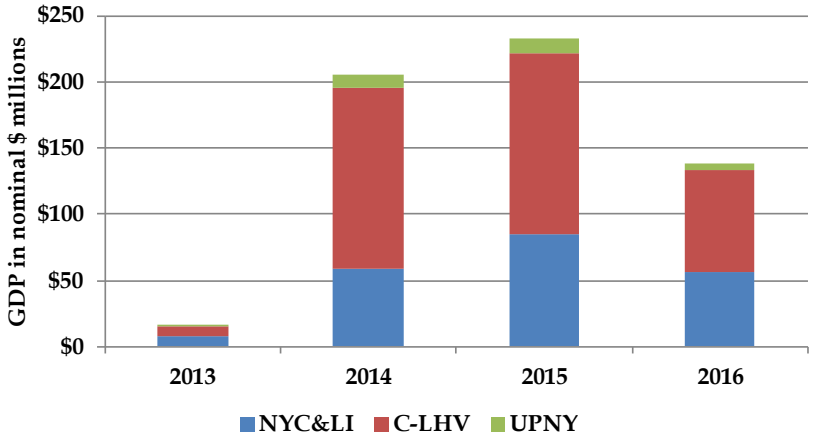
Figure 8. Breakdown of new jobs in New York by sector during the construction phase



Note: Others include the following sectors: Educational Services; Real Estate and Rental Leasing; Manufacturing; Information; Management of Companies and Enterprises; Transportation and Warehousing; Utilities; Mining; and Forestry, Fishing, Related Activities, and Other.

In addition to jobs created by the project, CHPE will also improve the state's economy. In 2015, the project is expected to raise New York's GDP by approximately $230 million. More than half of this will come from economic activities in the C-LHV region, based on the "location" of the project's spending during the construction phase (and the industries that receive such spending). On average, between 2013 and 2016, the construction phase of CHPE will infuse close to $150 million per year in the New York economy.

Figure 9. Estimated increase in New York GDP as a result of the CHPE construction (in nominal $ million)[9]



[9] An inflation rate of 3% per annum is assumed in the analysis of GDP impact throughout this study.

4 Macroeconomic impact on New York: operations phase of CHPE

The commercial operation of the CHPE project is expected to start in the fourth quarter of 2016. Although the construction jobs will come to an end, TDI will continue to create direct jobs and incur direct spending in New York, including permanent staff for its New York office and contracting for the operation and maintenance of the project, as well as paying taxes, service fees, and making lease payments. Figure 10 shows the breakdown of these direct jobs and non-labor spending during the commercial operations phase. Similar to the construction period, the direct jobs and spending of the CHPE project once commercial operations begin will create an opportunity for even more jobs in New York State.

Figure 10. Estimated number of direct jobs created in New York during the operations phase

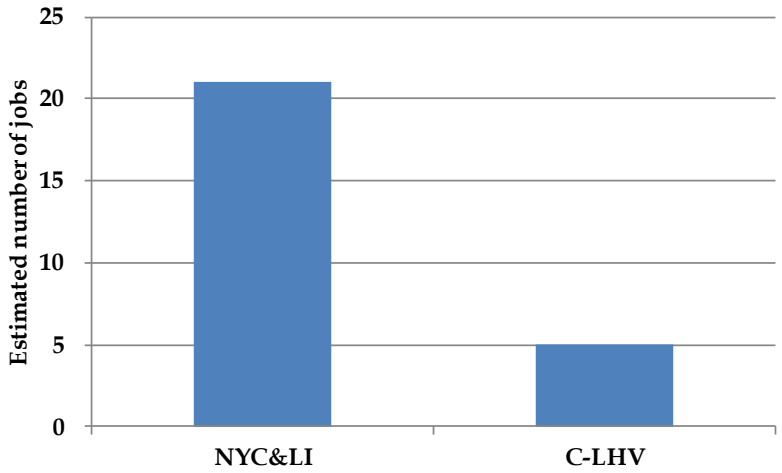
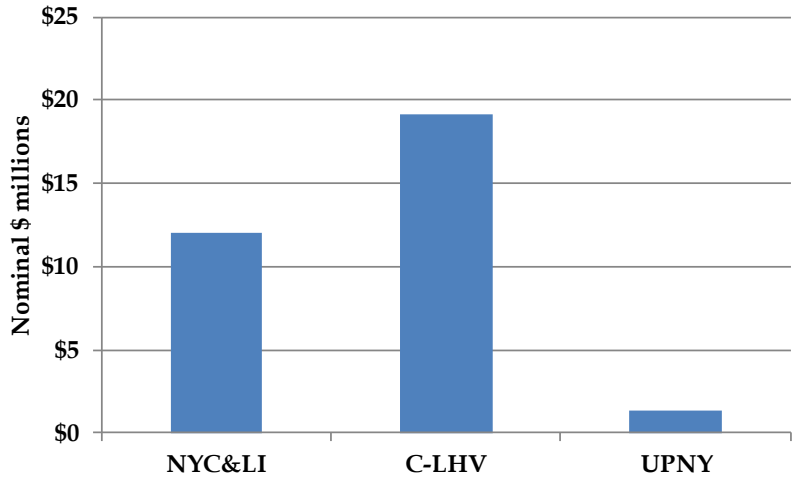


Figure 11. Estimated annual direct non-labor spending in New York during the operations phase– 2017 (nominal $ millions)



Source: TDI

Moreover, once the CHPE project starts commercial operation, 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 in NYC&LI and C-LHV. Based on an LEI analysis of the 2018 test year, the CHPE project is estimated to reduce electricity costs by approximately $650 million per annum for New York State.[10] Ninety-three percent (93%) of the energy cost reductions can be attributed to NYC&LI and the rest to C-LHV. There are no projected electricity cost savings in UPNY.

This cost reduction impacts different end users in a number of meaningful ways, which the REMI model captures.

The electricity demand of residential customers or households is generally unresponsive to changes in electricity prices, as their demand for electricity is considered relatively inelastic. However, there is an underlying income effect that can come into play. The "income effect" is generated as a result of the changes in a consumer's real income following a price decrease. 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 increase in demand for other goods and services, resulting from an increase in household disposable income, can boost production of other sectors of the economy, thereby resulting in increased employment and further economic benefits. In the REMI model, the effects created by lower residential electricity costs are captured in trends in personal expenditures and patterns of labor migration, as well as attracting 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, subject to having ample spare capacity of their capital. 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.[11]

As a result of the annual operations in-state (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 discussed above, the CHPE project will create and support approximately 2,400

[10] LEI's energy market analysis shows that these electricity cost savings are achieved based on a 90% utilization rate on the project (equivalent to 7.88 TWh of energy per year). Please refer to Section 5.1 of the Appendix for the breakdown of the estimated electricity cost savings by region and consumer type.

[11] However, it should be noted that this long-term capacity expansion of businesses is not included in REMI PI+ model and therefore not reflected in the estimated increase in jobs and GDP. Therefore, the CHPE project might provide additional benefits not captured in this analysis.

total jobs per year over the first ten years of full commercial operations. The majority of these new jobs are induced jobs that span a variety of service industries. Moreover, during the first full year of the project operations, 72% of these estimated new jobs will be in NYC&LI, more than a quarter in C-LHV, and the rest in UPNY.

Figure 12. Estimated number of total new jobs in New York created by CHPE during the first ten years of commercial operations

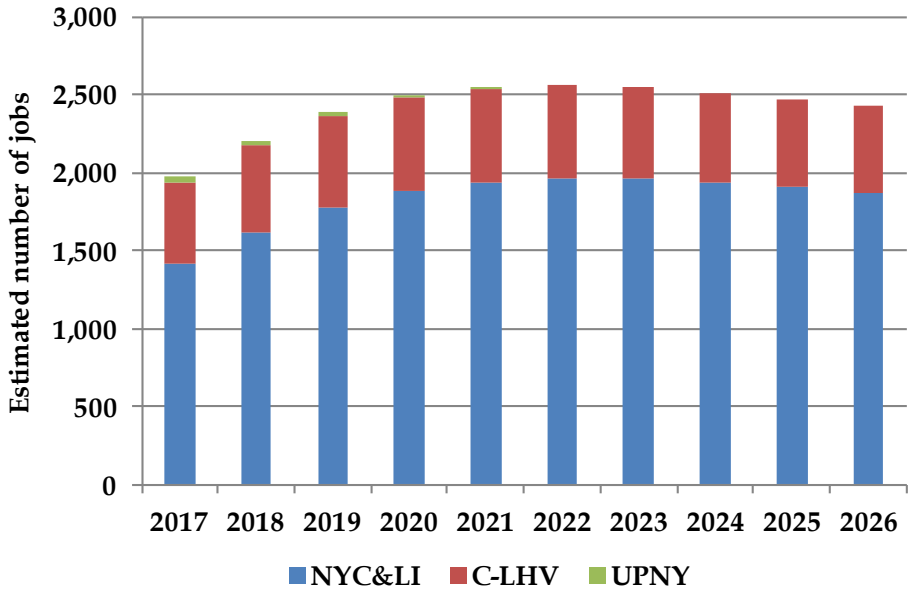


Figure 13. Estimated number of total new jobs in New York created by CHPE during the first ten years of commercial operations (by job type)

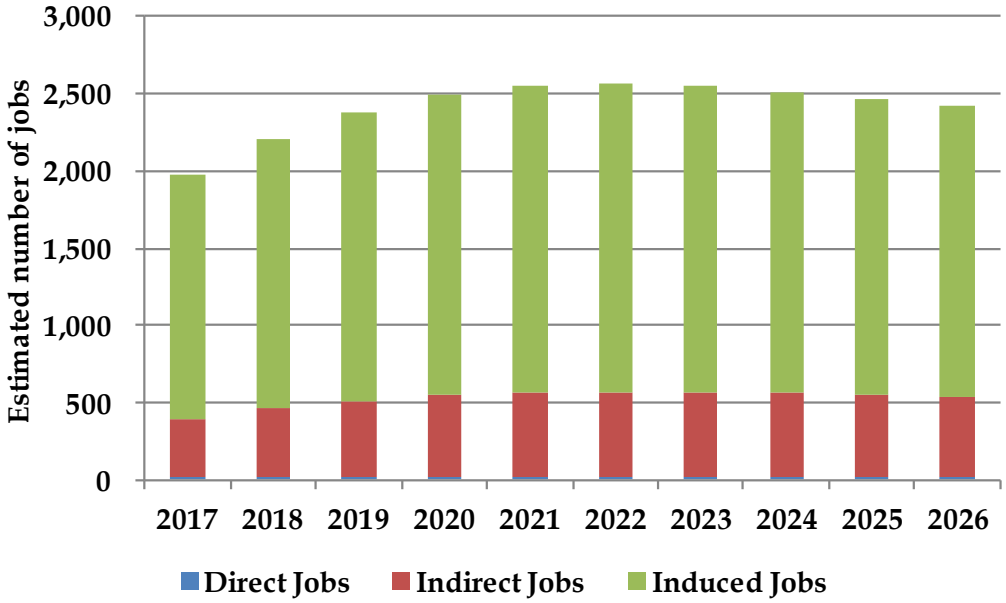


Figure 14. Breakdown of estimated new jobs in 2017 (by region)

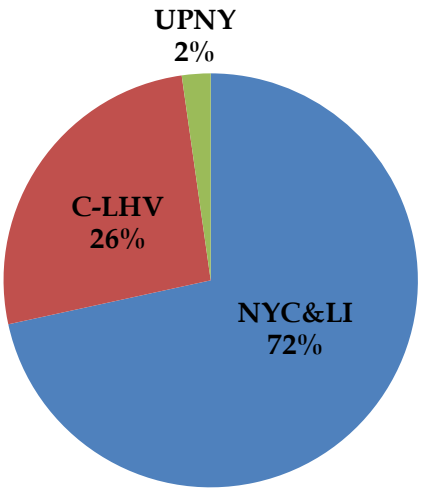
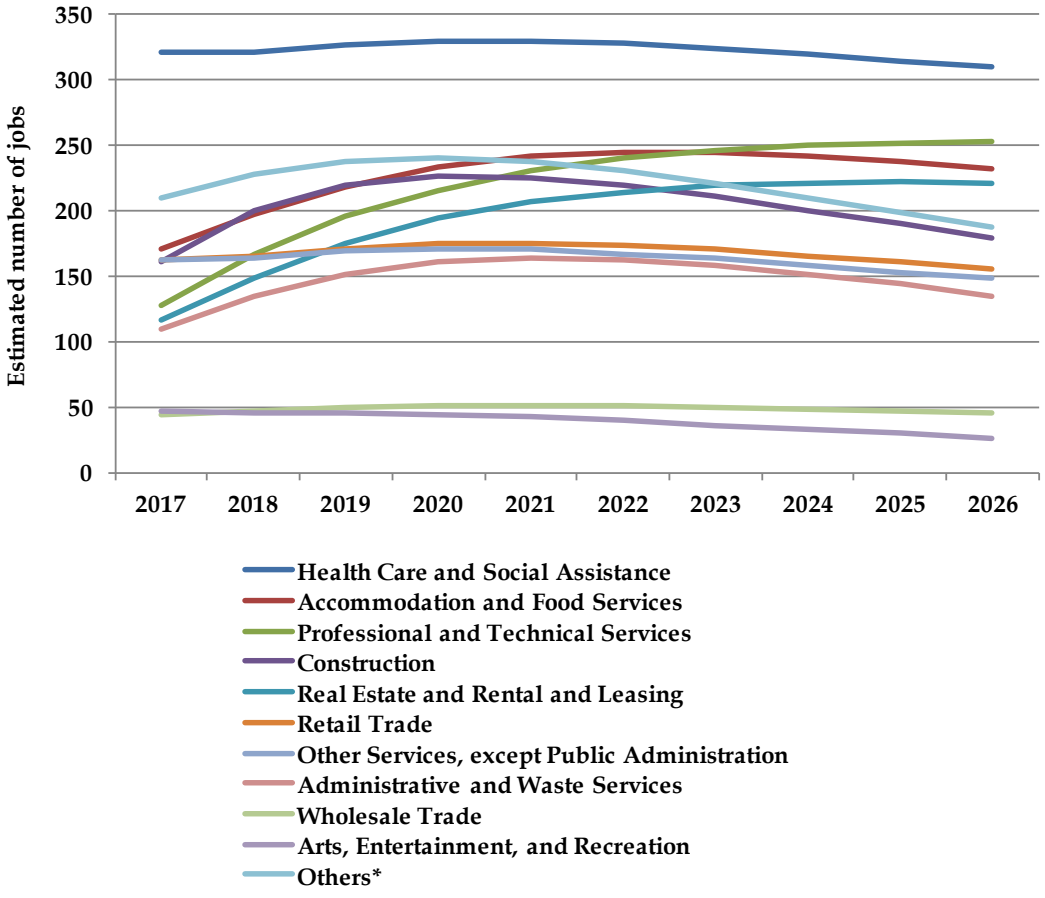


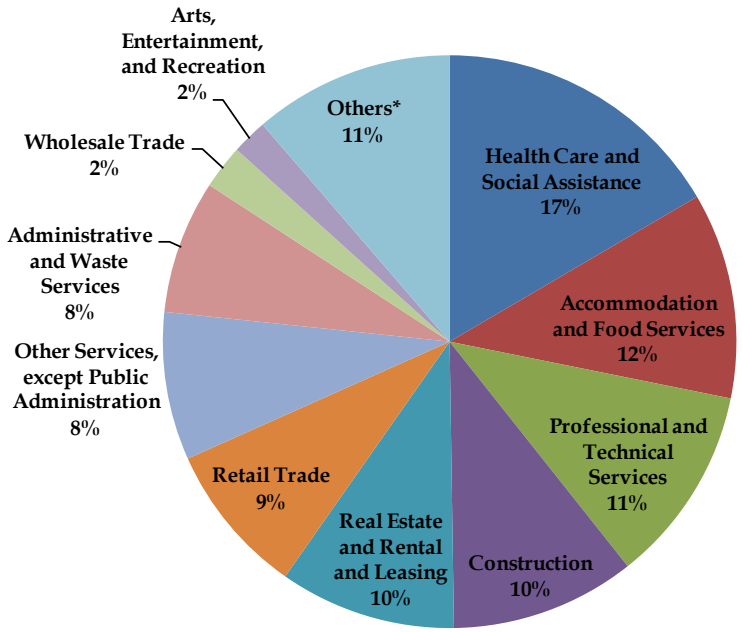
Figure 15. Estimated number of new jobs in New York from commercial operations (by year and sector)



*Note: *Others include the following sectors: Finance and Insurance; Information; Utilities; Manufacturing; Educational Services; Transportation and Warehousing; Management of Companies and Enterprises; Mining; and Forestry, Fishing, Related Activities, and Other*

During the first ten years of the full operations of the CHPE project, there will be a significant increase in the number of jobs in service sectors, such as: health care and social assistance; accommodation and food services; professional and technical services; and real estate and rental and leasing. Figure 15 shows the number of estimated jobs from each of the top ten affected sectors over the first ten years of commercial operations, while Figure 16 illustrates the average distribution of new jobs created by sector in percentage terms.

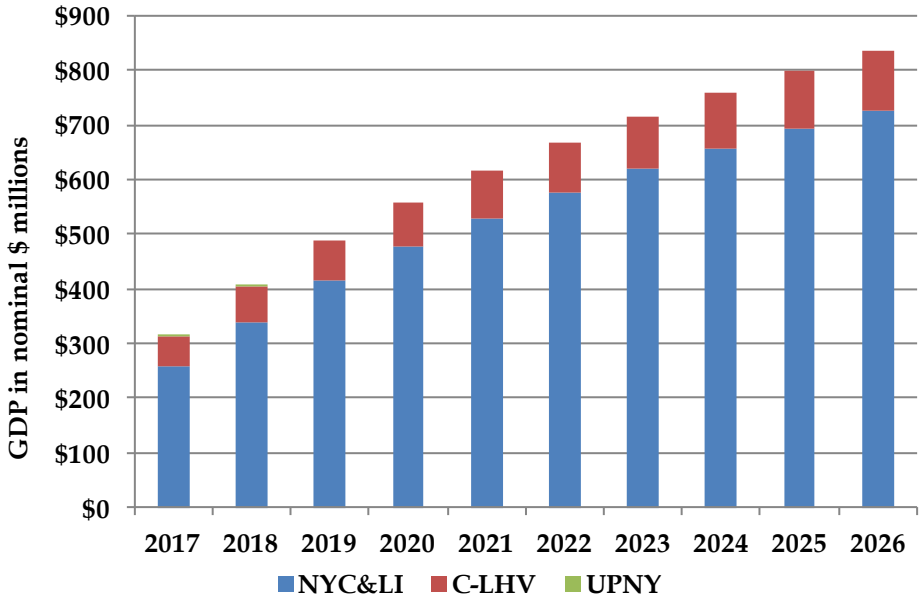
Figure 16. Breakdown of new jobs in New York by sector arising as a result of CHPE operations, average 2017-2026



*Note: *Others include the following sectors: Finance and Insurance; Information; Utilities; Manufacturing; Educational Services; Transportation and Warehousing; Management of Companies and Enterprises; Mining; and Forestry, Fishing, Related Activities and Other*

As a consequence of the estimated annual electricity cost savings of $650 million that New York electric consumers will receive, the CHPE project will expand the state's economy as measured by the increase in the state's GDP. For example, in 2017 – the first full year of CHPE operations – GDP is projected to increase by about $300 million. 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 state stabilize. Therefore, by 2026, taking into account inflation, New York's annual GDP will have increased by more than $800 million as a result of CHPE operations. Over the ten-year period, the project will contribute, on average, more than $600 million per annum to the New York economy. Approximately 86% of this will come from economic activities in the NYC&LI, 13% from C-LHV, and the rest from UPNY.

Figure 17. Estimated increase in New York GDP as a result of CHPE's operations ($ dollars nominal)



5 Appendix

5.1 Estimated electricity cost savings from 2018 test year by region and consumer type (nominal $ millions)

	C-LHV	NYC&LI	TOTAL
Residential	$ 18	$ 182	$ 200
Commercial	$ 18	$ 419	$ 437
Industrial	$ 11	$ 6	$ 17
Total	**$ 47**	**$ 607**	**$ 654**

5.2 List of counties assigned to each New York region

C-LHV	NYC&LI	UPNY	
Albany	Bronx	Broome	Oneida
Columbia	Kings	Cayuga	Onondaga
Dutchess	Nassau	Cattaraugus	Ontario
Essex	New York	Chautauqua	Orleans
Fulton	Queens	Chemung	Oswego
Greene	Richmond	Chenango	Otsego
Hamilton	Suffolk	Clinton	Saint Lawrance
Montgomery		Cortland	Schuyler
Orange		Delaware	Seneca
Putnam		Erie	Steuben
Renseelaer		Franklin	Sullivan
Rockland		Genesee	Tioga
Saratoga		Herkimer	Tompkins
Schenectady		Jefferson	Wayne
Schoharie		Lewis	Wyoming
Ulster		Livingston	Yates
Warren		Madison	
Washington		Monroe	
Westchester		Niagara	

5.3 List of the 23 major industries used in the REMI PI+ Model

1. Forestry, Fishing, Related Activities, and Other
2. Mining
3. Utilities
4. Construction
5. Manufacturing
6. Wholesale Trade
7. Retail Trade
8. Transportation and Warehousing
9. Information
10. Finance and Insurance
11. Real estate and Rental and Leasing
12. Professional and Technical Services
13. Management of Companies and Enterprises
14. Administrative and Waste Services
15. Educational Services
16. Health Care and Social Assistance
17. Arts, Entertainment, and Recreation
18. Accommodation and Food Services
19. Other Services, except Public Administration
20. State and Local Government
21. Federal, Civilian
22. Military
23. Farm (crop and animal production)