Economic Impacts of The Indian Point Energy Center

An Analysis by the Nuclear Energy Institute

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NUCLEAR ENERGY INSTITUTE

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Executive Summary

The Indian Point Energy Center (Indian Point), located in Buchanan, N.Y., has been a vital part of the region's energy portfolio, providing 100 percent carbon-free electricity since Unit 2 first began operating in 1974. In addition to the reliable, emission-free electricity that the station generates and the jobs and economic stimulus it provides, the plant's involvement in the local communities makes Indian Point a significant economic contributor to the region and New York.

Indian Point's operation supports 3,800 jobs in its surrounding counties and more than 1,600 additional jobs throughout the rest of New York State.

To quantify the employment and economic impacts of this facility, the Nuclear Energy Institute (NEI) conducted an independent analysis. Based on data provided by Entergy Nuclear (Indian Point's operator) on employment, operating expenditures and tax payments, NEI conducted the analysis using a nationally recognized model to estimate the facility's economic impacts on the state and national economies. Regional Economic Models, Inc. (REMI), developed the Policy Insight Plus (PI+) economic impact modeling system, which is the methodology employed in this analysis. (See section 6 of this report for more information on the REMI methodology.)

Key Findings

Indian Point's operation supports:

Indian Point prevents emissions of 8.5 million metric tons of carbon dioxide annually, approximately the same amount of carbon dioxide released by more than 1.6 million cars each year.

Thousands of jobs. Indian Point employs about 1,000 people directly and stimulates another 2,800 jobs in its surrounding counties. This direct employment leads to another 1,600 jobs in other industries in New York State and an additional 5,300 jobs outside the state for a total of 10,700 jobs throughout the country.

Clean electricity for New York. Indian Point generates about 10 percent of New York State's electricity. Emission-free electricity from Indian Point prevents the release of 8.5 million metric tons of carbon dioxide annually, approximately the same amount of carbon dioxide released by more than 1.6 million cars each year. For perspective, New York's electric sector emits more than 30 million tons of carbon dioxide annually. Nuclear energy provides nearly 60 percent of the state's carbon-free electricity, which helps New York meet its carbon-reduction goals under the Regional Greenhouse Gas Initiative (RGGI). Closing Indian Point would undo all the renewables investment made by New York in the past decade to comply with RGGI requirements.

Reliability benefits. During full-power operation, Indian Point provides 2,061 megawatts of around-the-clock electricity to New York homes and businesses. Over the last ten years, the station has operated at more than 93 percent of capacity, which is above the industry average and significantly

higher than other forms of electric generation. This reliable production helps offset the potentially severe price volatility of other energy sources (e.g., natural gas) and the intermittency of renewable electricity sources.

Balanced portfolio of electricity options. Nuclear energy produces approximately 30 percent of New York's electricity, and Indian Point plays an important role in maintaining a balanced electric portfolio in New York. New York's electricity supply consists primarily of natural gas, nuclear energy, renewables and hydropower. New York policy leaders have expressed concerns about overreliance on any one source of electricity generation.

Indian Point's operation generates $1.3 billion of annual economic output in the local counties, $1.6 billion statewide and $2.5 billion across the United States.

Economic stimulus. Indian Point's operation generates $1.3 billion of annual economic output in its local counties, $1.6 billion statewide and $2.5 billion across the United States. This study finds that for every dollar of output from Indian Point, the local economy produces $1.27, the state economy produces $1.55 and the U.S. economy produces $2.48.

Tax impacts. The Indian Point facility is one of the largest taxpayers in Westchester County, contributing about $30 million in state and local property taxes in 2014. When calculating the total tax impact (direct and secondary), the plant's operation results in $340 million in tax revenue to the local, state and federal governments.

Community and environmental leadership. Indian Point has invested millions of dollars in studying, monitoring and repopulating fish and other aquatic life in the Hudson River, and contributes millions of dollars and thousands of hours of time to dozens of charitable organizations in the lower Hudson Valley communities where its employees live.

Indian Point's operation results in $340 million in tax revenue to the local, state and federal governments.

In addition to quantifying Indian Point's economic impacts, this analysis modeled the adverse effects to the local, state and national economies if the Indian Point reactors were to shut down. The results show that Indian Point is integral to the local and state economies. Since nuclear plants are often the largest, or one of the largest, employers in the regions in which they operate, the loss of a nuclear power plant has lasting negative economic ramifications on surrounding communities.

This analysis found that the output losses to the local counties from Indian Point's closure would reach as high as $2.3 billion, the rest of New York would lose another $600 million, and the U.S. another $2.1 billion. The total output losses to the United States would reach $5.0 billion at their peak. The number of jobs lost peaks at 5,300 in the local counties, another 2,300 in the rest of New York and another 9,000 throughout the United States for a total job loss of 16,600. Losses would reverberate for decades after the plant is shut down, and host communities may never fully recover.

Section 1

Background and Generation History

Indian Point Energy Center

First dates of operation
Unit 1 (retired) - 1962
Unit 2 - 1974
Unit 3 - 1976

Location
Buchanan, NY (County of Westchester)

License Expiration Years[1]
Unit 2 - 2033
Unit 3 - 2035

Reactor Types
Pressurized water

Total Electrical Capacity (Megawatts)
Unit 2 - 1,020
Unit 3 - 1,041

Reliable Electricity Generation

Indian Point's two operating reactors, units 2 and 3, have operated at a capacity factor of about 93 percent for the last 10 years, above the industry average. Capacity factor, a measure of electricity production efficiency, is the ratio of actual electricity generated to the maximum possible electric generation during the year.

Hundreds of Local Jobs

Indian Point employs about 1,000 full-time workers and is one of the largest and highest-paying employers in Westchester County. Its annual payroll is approximately $140 million. Most jobs at nuclear power plants require technical training and are typically among the highest-paying jobs in the area. Nationwide, nuclear energy jobs pay 36 percent more than average salaries in a plant's local area.

Safe and Clean for the Environment

Nuclear energy facilities generate large amounts of electricity without emitting greenhouse gases. State and federal policymakers recognize nuclear energy as an essential source of safe, reliable electricity that meets both our environmental needs and the state's demand for electricity.

In 2013, Indian Point's operation prevented the emission of 8.5 million metric tons of carbon dioxide,[2] about the same amount released by more than 1.6 million cars each year. Overall, New York's electric sector emits more than 30 million tons of carbon dioxide annually. Indian Point also prevents the emission of more than 4,500 tons of nitrogen oxide, equivalent to that released by nearly 236,000 cars, and 4,000 tons of sulfur dioxide. Sulfur dioxide and nitrogen oxide are precursors to acid rain and urban smog.

[1] Entergy applied for a renewed license for units 2 & 3 in 2007, which would allow the reactors to operate until 2033 and 2035, respectively. The reactors continue to operate under their initial 40-year license until the federal license renewal review concludes.

[2] Emissions prevented are calculated using regional fossil fuel emission rates from the U.S. Environmental Protection Agency and plant generation data from the U.S. Energy Information Administration.

Section 2

Benefits for the Local, State and National Economies

NEI used the REMI PI+ model to analyze economic and expenditure data provided by Indian Point to develop estimates of its economic benefits (more information on REMI can be found in Section 6).

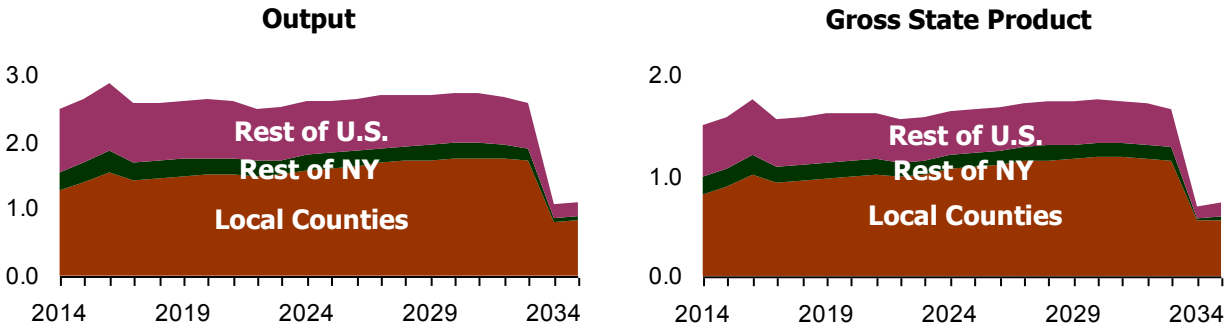
The economic impacts of Indian Point consist of direct and secondary impacts. The main variables used to analyze these impacts are:

Output
The direct output is the value of power produced by Indian Point. The secondary output is the result of how the direct output alters subsequent outputs among other industries and how those employed at the facilities influence the demand for goods and services within the region.

Employment
The direct employment is the number of jobs at Indian Point. Secondary employment is the number of jobs in the other industries as a result of Indian Point's operation.

Gross State Product
Gross state product (GSP) is the value of goods and services produced by labor and property at Indian Point—e.g., sales minus intermediate goods. In the REMI model, electricity is the final good from a nuclear plant. Intermediate goods are the components purchased to make that electricity.

Figure 2.0
Indian Point's Total Output and Gross State Product Contribution to its Local Counties, New York and the U.S. *(in 2014 billions of dollars)**



** Regional electricity price forecasts based on the Energy Information Administration's* Annual Energy Outlook 2014.

Local, State and National Comprehensive Economic Effects

The direct output value of Indian Point is estimated to be more than $1.0 billion in 2014 (the value of the electricity produced), with a total economic output impact on the local counties of $1.3 billion. In other words, for every dollar of output from Indian Point, the local counties produce $1.30. The local counties analyzed are Westchester, Orange, Rockland, Putnam and Dutchess.

Figure 2.0 (previous page) shows the value of Indian Point's output impact and contributions to GSP on the local counties, the rest of New York and the rest of the U.S. The contributions extend to the end of Indian Point 2 and 3's 60 years of operation, in 2033 and 2035, respectively, using electricity price forecast data from the Energy Information Administration.

Table 2.0
Indian Point's Estimated Total Output on U.S. Economic Sectors in 2014
(in millions of 2014 dollars)

Sector Description	Local Counties	Rest of New York	Rest of U.S.	Total
Utilities	$924	$9	$22	$955
Manufacturing	$13	$23	$251	$287
State and Local Government	$111	$22	$52	$185
Finance and Insurance	$11	$50	$103	$164
Real Estate and Rental and Leasing	$26	$39	$51	$116
Health Care and Social Assistance	$46	$21	$42	$109
Professional, Scientific, and Technical Services	$16	$24	$57	$97
Administrative and Waste Management Services	$32	$11	$44	$87
Retail Trade	$27	$15	$41	$83
Information	$8	$23	$47	$78
Transportation and Warehousing	$1	$6	$70	$77
Wholesale Trade	$18	$13	$39	$70
Accommodation and Food Services	$9	$6	$24	$39
Other Services, except Public Administration	$10	$8	$21	$39
Construction	$15	$5	$17	$37
Mining	$0	$0	$22	$22
Management of Companies and Enterprises	$1	$2	$14	$17
Arts, Entertainment, and Recreation	$2	$5	$7	$14
Educational Services	$2	$4	$7	$13
Total	**$1,272**	**$286**	**$931**	**$2,489**

In 2014, Indian Point's total output in the New York economy was more than $1.5 billion. For every dollar of output from the plants, the New York economy produced $1.55.

Indian Point's total output on the U.S. economy was nearly $2.5 billion. For every dollar of output from the plants, the U.S. economy produced $2.48. The two reactors contributed $800 million to New York's gross state product and another $500 million to U.S. GDP.

Indian Point's largest impact to the local counties and New York is on the utilities sector. The next greatest impact to the local counties and New York is on state and local governments. This is due to Indian Point's large tax base from salaries, and sales and property taxes generated from the plant's spending.

As for the economic impacts to the U.S., the second largest sector that benefits from Indian Point's operation is manufacturing, particularly for purchases of pumps, motors and other equipment. A fuller depiction of the sectors that benefit from the facility is in Table 2.0 (previous page).

Indian Point's output also stimulates the state's labor income and employment. The plant employs about 1,000 people in permanent jobs. These jobs stimulate nearly 9,700 additional jobs in other sectors in the surrounding counties, New York State and the United States. Table 2.2 on the following page details the quantity and types of jobs that Indian Point supports. Workers at the plants are included in the occupation categories in the table.

Economic Stimulus Through Taxes

Indian Point's operations resulted in a total tax impact of $340 million to local, state and federal governments. Entergy Nuclear pays about $30 million in property taxes to the state and local governments. This is the direct impact. There also are secondary impacts, because Indian Point's expenditures increase economic activity, leading to additional income and value creation and, therefore, to higher tax revenue.

Table 2.1
Estimated Total Tax Impacts of Indian Point in 2014
*(in 2014 millions of dollars)**

Plant	State and Local	Federal	Total
Indian Point	$71.9	$268.1	$340.0

** Calculated based on a percentage of gross domestic product.*

Indian Point's impact on the local, state and national economies is substantial. By producing affordable, reliable electricity, the plant is a hub of economic activity for New York and a boost to the national economy. Table 2.3 below provides the multipliers and summarizes the facility's total economic impacts on the local, state and national economies.

Table 2.2
Indian Point Supports Direct and Secondary Jobs

Occupation	Local Counties	Rest of New York	Rest of U.S.	Total
Utilities	1,009	9	29	1,047
State and Local	649	148	447	1,244
Administrative and Waste Management Services	442	137	647	1,226
Health Care and Social Assistance	430	209	406	1,045
Retail Trade	352	183	543	1,078
Other Services, except Public Administration	224	143	373	740
Professional, Scientific, and Technical Services	115	152	379	646
Accommodation and Food Services	114	76	318	508
Finance and Insurance	40	127	375	542
Other	421	442	1,745	2,608
Total	3,796	1,626	5,262	10,684

Table 2.3
Indian Point's Impact on the Local, State and National Economies in 2014
(dollars in 2014 millions)

Description	Direct	Secondary	Total	Multiplier
Local Counties				
Output	$1,003.0	$270.0	$1,273.0	1.27
Employment	1,000	2,796	3,796	3.80
Gross State Product			$821.0	
New York				
Output	$1,003.0	$556.0	$1,559.0	1.55
Employment	1,000	4,421	5,421	5.42
Gross State Product			$996.0	
United States				
Output	$1,003.0	$1,487	$2,490.0	2.48
Employment	1,000	9,684	10,684	10.70
Gross Domestic Product			$1,498.0	

Section 3
Economic Impacts of Indian Point's Retirement

Perhaps the best way to appreciate the value of a nuclear power plant is to examine what happens when it is gone. When the Kewaunee facility in Wisconsin closed in 2013, Kewaunee County lost 15 percent of its employment and 30 percent of its revenue—not to mention 556 megawatts of reliable, affordable electricity. In California, 1,500 jobs were lost when two reactors at the San Onofre nuclear facility were closed. Shutting down San Onofre made California's power supply more expensive in a state that already has among the highest power costs in the nation. A May 2014 study by the Energy Institute at Haas at the University of California Berkeley[3] estimated that closing the San Onofre nuclear power station increased the cost of electricity by $350 million during the first year, equivalent to a 13-percent increase in the total generation costs for the state, and caused carbon emissions to increase by an amount worth almost $320 million.

In the first year after both reactors close, the lost output in the surrounding counties would be $2.0 billion.

California will replace the lost electricity from San Onofre primarily with new natural gas-fired power plants, renewable resources, and imports from other states. Customers will pay billions of dollars to replace San Onofre's electricity generation.

As discussed in Section 2, the operation of Indian Point generates significant economic benefits for New York and beyond. In this section, the REMI model measures the long-term impact to the New York and U.S. economies if Indian Point closes. The economic impacts of the shutdown are analyzed for 20 years.

Local, State and National Comprehensive Economic Loss

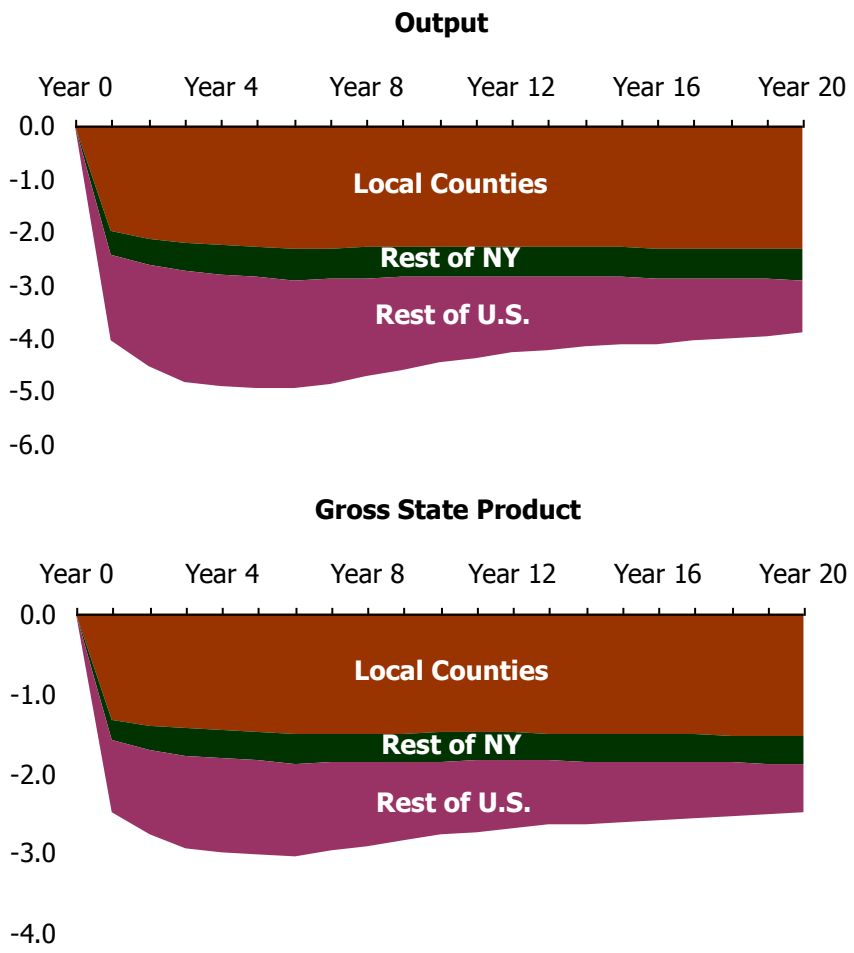
When a productive facility ceases operations, the economic loss affects local, state and national areas for decades. Figure 3.0 shows the value of Indian Point's lost output and lost gross state product if unit 2 and unit 3 close.

In the first year after both units close, the lost output in the surrounding counties would be $2.0 billion, another $0.4 billion throughout the rest of New York and another $1.6 billion throughout the rest of the United States - a total of $4 billion. The losses increase each year until Year 6, when the lost output peaks at $5.0 billion for the U.S. Over that period, the local counties, New York and U.S. economies shrink because of lost output that cascades across virtually all sectors, taking years to filter completely through the economy.

A nuclear power plant shutdown has a greater economic impact than its operation. The impacts shown in this section are larger than those in Section 2 primarily because of the migration of workers and families away from the area in search of new jobs.

[3] *"The Value of Transmission in Electricity Markets: Evidence from a Nuclear Power Plant Closure," by Lucas Davis and Catherine Hausman, Energy Institute at Haas, University of California Berkeley, May 2014, https://ei.haas.berkeley.edu/research/papers/WP248.pdf.*

Figure 3.0
Indian Point's Lost Output and Lost Gross State Product in New York and the United States *(in 2014 billions of dollars)*



In the nation as a whole, the shutdown primarily affects the utilities sector, followed by manufacturing and construction, then by specialized services in the professional, scientific and technical sector.

In New York, the third largest impact, behind construction, is on state and local governments because of a loss in tax revenue. Further, about 650 jobs would be lost at the state and local government levels.

A fuller depiction of the sectors affected by Indian Point's shutdown is in Table 3.0, which shows the lost output in Year 6 when the losses are at their highest in the United States.

Figure 3.1 shows the number of direct and secondary jobs lost in the local counties, New York and the U.S. after Indian Point's retirement. While the number of direct jobs lost remains flat, the number of secondary jobs lost increases during the first six years. This is because it would take five to seven years be-

Table 3.0
Peak Lost Output to Affected Sectors in Year 6 After Indian Point's Closure
(In 2014 millions of dollars)

Sector Description	Local Counties	Rest of New York	Rest of U.S.	Total
Utilities	-$1,577	-$4	-$30	-$1,611
Construction	-$252	-$39	-$208	-$499
Manufacturing	-$19	-$29	-$332	-$380
Professional, Scientific, and Technical Services	-$49	-$72	-$183	-$304
Real Estate and Rental and Leasing	-$21	-$108	-$147	-$276
State and Local Government	-$141	-$33	-$77	-$251
Finance and Insurance	-$10	-$68	-$165	-$243
Mining	-$2	-$3	-$213	-$218
Information	-$20	-$61	-$118	-$199
Retail Trade	-$57	-$30	-$85	-$172
Administrative and Waste Management Services	-$45	-$22	-$90	-$157
Health Care and Social Assistance	-$55	-$33	-$62	-$150
Wholesale Trade	-$37	-$28	-$81	-$146
Transportation and Warehousing	-$1	-$12	-$130	-$143
Accommodation and Food Services	-$19	-$16	-$52	-$87
Other Services, except Public Administration	-$11	-$11	-$32	-$54
Management of Companies and Enterprises	$3	-$5	-$33	-$35
Arts, Entertainment, and Recreation	-$3	-$9	-$13	-$25
Educational Services	-$3	-$5	-$7	-$15
Total	**-$2,319**	**-$588**	**-$2,058**	**-$4,965**

fore Indian Point's lost output filters through the local, state and national economies.

Figure 3.1 displays the population migration out of New York that would occur if the station were to close. By Year 6, about 3,300 people would move out of state, increasing to 4,800 by Year 20. Table 3.1 shows the number and types of jobs that would be lost when Indian Point retires. The number of jobs lost would peak at more than 5,300 in local counties; another 2,300 in the rest of New York; and another 9,000 in the United States for a total job loss of about 16,600.

Figure 3.1
Shutdown-Related Job Losses in New York and the United States

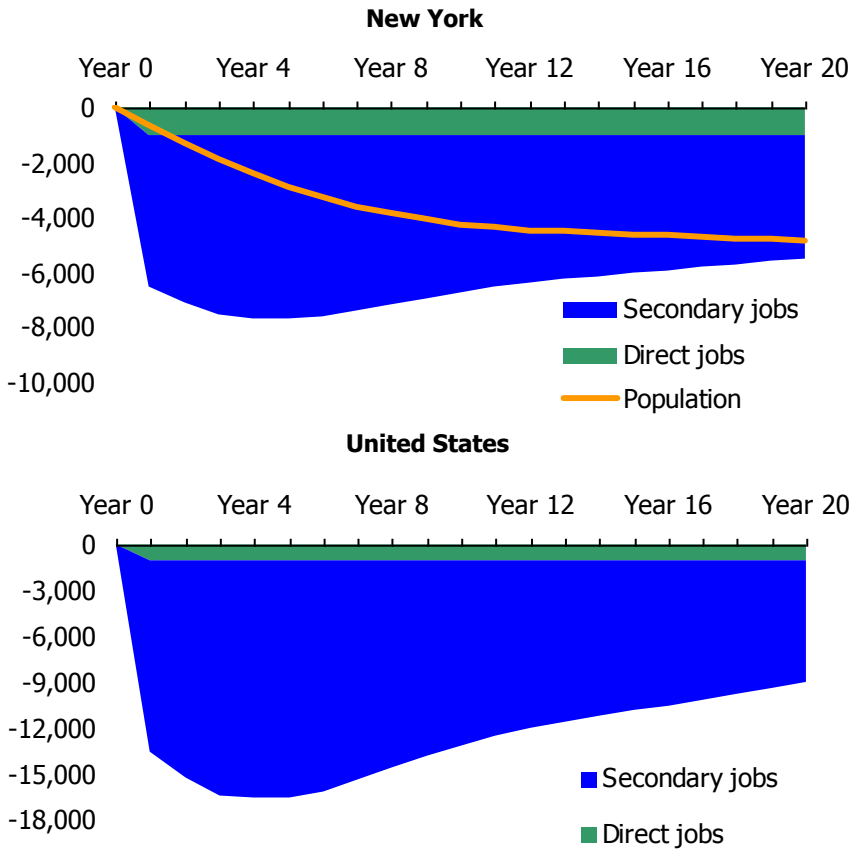


Table 3.1
Peak Direct and Secondary Jobs Lost in Year 4 After Indian Point's Closure

Occupation	Local Counties	Rest of New York	Rest of U.S.	Total
Construction	-1,516	-229	-1,558	-3,303
Administrative and Waste Management Services	-466	-197	-983	-1,646
Health Care and Social Assistance	-526	-310	-664	-1,500
Professional, Scientific, and Technical Services	-252	-306	-909	-1,467
State and Local	-651	-175	-555	-1,381
Retail Trade	-403	-204	-672	-1,279
Utilities	-830	-2	-22	-854
Accommodation and Food Services	-185	-122	-482	-789
Other Services, except Public Administration	-174	-132	-440	-746
Other	-344	-633	-2,686	-3,663
Total	-5,347	-2,310	-8,971	-16,628

Section 4

Entergy and Indian Point in the Community

In addition to the economic benefits the plant provides, Entergy maintains a significant presence in the local community surrounding Indian Point Energy Center.

As a major philanthropic partner, Entergy awards more than $1 million each year to charitable organizations in the lower Hudson Valley through Entergy's Corporate and Foundation Giving programs, which support local initiatives to help create and sustain thriving communities near their plants.

In the communities surrounding Indian Point, dozens of educational, environmental and other community organizations have benefited from the company's philanthropic engagement.

In addition, many of the company's approximately 1,000 employees are active in the community in which they work and live, volunteering thousands of hours each year to organizations that help better the community.

Indian Point is also a leader in emergency preparedness and training for regional emergency management professionals and volunteers. Training and education helps them develop skills to respond to all types of emergencies, many of which are much more likely to occur than a commercial nuclear power event.

Educational Endeavors

At Indian Point, Entergy is strongly committed to supporting local education efforts in the lower Hudson Valley and Westchester areas. Each year, Indian Point donates thousands of dollars as well as employee-hours to local educational institutions including individual schools and school districts, after-school programs, and co-curricular activities. Supporting local educational efforts in STEM academics (science, technology, engineering, and mathematics) is at the core of Indian Point's efforts. Some highlights include the yearly donation to Westchester's Science and Engineering Fair – a local science fair affiliated with the Intel International Science Fair serving budding scientists in Westchester and Putnam counties, the Peekskill City School District's 21st Century Science Program, and the Ossining High School's robotics program.

Environmental Support

Entergy is particularly proud of its commitment to reducing carbon emissions. Entergy has demonstrated a strong commitment to the environment in areas of sustainable development, performance excellence and environmental advocacy. The company has been named to the Dow Jones Sustainability World Index for 13 consecutive years.

Indian Point is committed to being a good steward of the local environment, and works hard to minimize any impact the plant may have on the local environment while providing the power required by New York electricity customers.

As part of Indian Point's commitment to protecting the local environment and the Hudson River in New York, it has spent nearly $100 million to develop and implement technologies to protect fish populations in the Hudson River. Indian Point operated a multimillion-dollar fish hatchery at the nuclear plant site from 1981 to 1991, which added 600,000 striped bass to the Hudson over the ten-year program, increasing the overall population of striped bass by millions. Indian Point has also contributed more than $50 million over more than 30 years to a fund which enables research on the Hudson River and aquatic life in it. This independently conducted research is accountable to the New York State Department of Environmental Conservation (DEC), and this vast body of information has been described by some expert biologists as the best set of fisheries data in the world.

New York State Nuclear Facilities' Prevention of Air Pollutants

- 11,000 short tons of Sulfur Dioxide
- 12,000 short tons of Nitrogen Oxide
- 22,000,000 metric tons of Carbon Dioxide

Nuclear generation is the single most effective emission control strategy and about two-thirds of our nation's emissions-free electricity comes from nuclear power plants, such as Indian Point in New York.

The emissions-free power produced at Indian Point prevents the release of 8.5 million metric tons of carbon dioxide annually, approximately the same amount of carbon dioxide released by more than 1.6 million cars each year.

Community Leadership

Indian Point's community leadership extends beyond its role in championing education and environmental initiatives. Indian Point donates to community organizations that focus on bettering the lower Hudson Valley in New York State through a variety of measures, including:

- Hudson Valley Hospital Center
- Hudson River Health Care Community Health
- Historic Hudson Valley
- Guiding Eyes for the Blind
- Today's Students, Tomorrow's Teachers
- Phelps Memorial Hospital
- Meals on Wheels Rockland
- Girls Scouts Heart of the Hudson
- Rotary Club of Peekskill
- Salvation Army of Peekskill
- Westchester Arts Council

- Westchester Library System
- Peekskill City School District
- Hendrick Hudson School District
- Friends of Westchester County Parks
- Boys & Girls Club of Mt. Kisco

Indian Point employees have walked miles to combat juvenile diabetes, donated at dozens of onsite blood drives, educated local students on the science of electricity, built homes for people in need, hosted educational events to assist local non-profits, and contributed free air time to community organizations.

Indian Point's community impact can be felt across the lower Hudson Valley, Westchester County, and into New York City. Indian Point is a major philanthropic partner to the region in many ways, and its closure would impact the surrounding area's educational, environmental and community efforts negatively.

Section 5

Indian Point and the U.S. Nuclear Energy Industry

The Indian Point nuclear power plant plays a vital role in helping downstate New York and the state as a whole meet their demand for affordable, reliable and sustainable energy.

In 2014, electricity production from U.S. nuclear power plants was about 798 billion kilowatt-hours, nearly 20 percent of America's electricity supply. In New York, nuclear energy generates approximately 30 percent of the state's electricity, and Indian Point alone generated 17 billion kilowatt-hours of electricity.

Over the past 20 years, America's nuclear power plants have increased output and improved performance significantly. Since 1990, the industry has increased total output equivalent to that of 26 large power plants, when in fact only five new reactors have come on line.

U.S. nuclear power plants achieved a record performance capacity factor of 91.9 percent in 2014, while producing electricity at one of the lowest costs of any fuel source used to generate electricity. Indian Point's performance has met or exceeded the industry average for many years.

Nuclear Energy's Value Proposition

Nuclear energy's role in the nation's electricity portfolio was especially valuable during the 2014 winter, when record cold temperatures gripped the United States and other sources of electricity were forced off the grid. Nuclear power plants nationwide operated at an average capacity factor of 96 percent during the period of extreme cold temperatures. During that time, supply volatility drove natural gas prices in many markets to record highs and much of that gas was diverted from use in the electric sector so that it could be used for home heating.

Further, some of America's electricity markets are structured in ways that place some nuclear energy facilities at risk of premature retirement, despite excellent operations. It is imperative that policymakers and markets appropriately recognize the full strategic value of nuclear energy in a diverse energy portfolio.

That value proposition starts with the safe and reliable production of large quantities of electricity around the clock.

Renewable energy, an emerging part of the energy mix, is intermittent (the sun doesn't always shine and the wind doesn't always blow when generation is needed) and therefore unreliable; natural gas-fired generation depends on fuel being available (both physically and at a reasonable price); and on-site coal

piles can freeze. One of nuclear energy's key benefits is the availability of low-cost fuel and the ability to produce electricity under virtually all weather conditions. Nuclear power plants also provide clean-air compliance value. In any cap-and-trade system, nuclear energy reduces the compliance burden that would otherwise fall on carbon-emitting generating capacity.

Nuclear plants provide voltage support to the grid, helping to maintain grid stability. They have portfolio value, contributing to fuel and technology diversity. And they provide tremendous local and regional economic development opportunity, including large numbers of high-paying jobs and significant contributions to the local and state tax base.

Achieving Carbon Goals

New York is a member of the Regional Greenhouse Gas Initiative (RGGI) - the nation's first market-based program to cap and reduce greenhouse gas emissions. Participation in RGGI has yielded positive results for the state through cleaner air, job creation and lower electricity bills.

If Indian Point were to retire, fossil fuels would replace it. As a result, CO_2 emissions would increase by about 8.5 million metric tons each year.

A recent analysis by the investment bank UBS concluded that RGGI could hit its carbon price cap, and the state's greenhouse gas emissions would increase by more than 60 percent, if all of the state's reactors were to shut down. New York's current electricity mix consists of natural gas, hydro, renewables and nuclear. Nuclear energy plays an outsized role in helping the state achieve its clean air objectives by providing nearly 60 percent of the state's clean-air electricity. At the national level, nuclear energy provides 62 percent of the nation's clean electricity.

Affordable Energy for Consumers

In addition to increasing electricity production at existing nuclear energy facilities, power from these facilities is affordable for consumers. Compared to the cost of electricity produced using fossil fuels—which are heavily dependent on market fuel prices—nuclear plants' fuel costs are relatively stable, making consumers' electric bills more predictable. Uranium fuel is only about one-third of the production cost of nuclear energy, while fuel costs make up 78 percent to 88 percent of coal-fired and natural gas production costs.

Emphasis on Safety

Safety is the highest priority for the nuclear energy industry. Based on more than 50 years of experience, the industry is one of the safest industrial working environments in the nation. Through rigorous training of plant workers and increased communication and cooperation among nuclear plants and federal,

state and local regulating bodies, the industry is keeping the nation's 99 nuclear plants safe for their communities and the environment.

The U.S. Nuclear Regulatory Commission (NRC) provides independent federal oversight of the industry and tracks data on the number of "significant events" at each nuclear plant. (A significant event is any occurrence that challenges a plant's safety system.) The average number of significant events per reactor declined from 0.45 per year in 1990 to 0.02 in 2013, illustrating the emphasis on safety throughout the nuclear industry.

General worker safety is also excellent at nuclear power plants—far safer than in the manufacturing sector. U.S. Bureau of Labor Statistics data show that, in 2013, nuclear energy facilities achieved an incidence rate of 0.1 per 200,000 work hours, compared to 0.8 for fossil-fuel power plants, 1.1 for electric utilities and 2.2 for the manufacturing industry.

Industry Trends: License Renewal and New Plants

The excellent economic and safety performance of U.S. nuclear power plants has demonstrated the value of nuclear energy to the electric industry, the financial community and policymakers. This is evidenced by the increasing number of facilities seeking license renewals from the NRC.

Originally licensed to operate for 40 years, nuclear energy facilities can operate safely for longer. Nuclear power plants are subject to a systematic and thorough NRC oversight program to ensure nuclear plant equipment continues to meet safety standards. This constant NRC oversight ensures a plant will operate safely throughout its life. The NRC granted the first 20-year license renewal to the Calvert Cliffs plants in Maryland in 2000. As of April 2015, 74 reactors had received license extensions and operators of 24 additional reactors either had submitted applications or announced that they will seek renewal. License renewal is an attractive alternative to building new electric capacity because of nuclear energy's low production costs and the return on investment provided by extending a plant's operational life.

In 2007, Entergy applied to the NRC for a renewed license for Indian Point units 2 & 3 which, if granted, would allow the units to operate until 2033 and 2035, respectively. The reactors continue to operate under their initial 40-year license until the NRC's license renewal review concludes. Indian Point 2 operates specifically under the federal regulation allowing for "timely renewal," which is a rule of general applicability providing for extension of a license for which a renewal application has been timely filed with the licensing agency. The license renewal application remains pending before the NRC. Indian Point 3 will operate under the same "timely renewal" provision beginning in December 2015, which marks the end of its current 40-year license.

Besides relicensing nuclear plants, energy companies are building new, advanced-design reactors. Georgia Power and South Carolina Electric & Gas are

building two advanced reactors each, near Augusta, Ga., and Columbia, S.C. These facilities are nearly halfway through their construction programs and employ more than 5,000 workers each now that construction is peaking. In addition, the Tennessee Valley Authority is completing construction of the Watts Bar 2 reactor in Tennessee.

Section 6

Economic Impact Analysis Methodology

This analysis uses the REMI model to estimate the economic and fiscal impacts of the Indian Point plants.

Regional Economic Models, Inc. (REMI)

REMI is a modeling firm specializing in services related to economic impacts and policy analysis, headquartered in Amherst, Mass. It provides software, support services, and issue-based expertise and consulting in almost every state, the District of Columbia, and other countries in North America, Europe, Latin America, the Middle East and Asia.

The REMI model has two main purposes: forecasting and analysis of alternatives. All models have a "baseline" forecast of the future of a regional economy at the county level. Using "policy variables," in REMI terminology, provides scenarios based on different situations. The ability to model policy variables makes it a powerful tool for conveying the economic "story" behind policy. The model translates various considerations into understandable concepts like GDP and jobs.

REMI relies on data from public sources, including the Bureau of Economic Analysis, Bureau of Labor Statistics, Energy Information Administration and the Census Bureau. Forecasts for future macroeconomic conditions in REMI come from a combination of resources, including the Research Seminar in Quantitative Economics at the University of Michigan and the Bureau of Labor Statistics. These sources serve as the main framework for the software model needed to perform simulations.

Policy Insight Plus (PI+)

REMI's PI+ is a computerized, multiregional, dynamic model of the states or other sub-national units of the United States economy. PI+ relies on four quantitative methodologies to guide its approach to economic modeling:

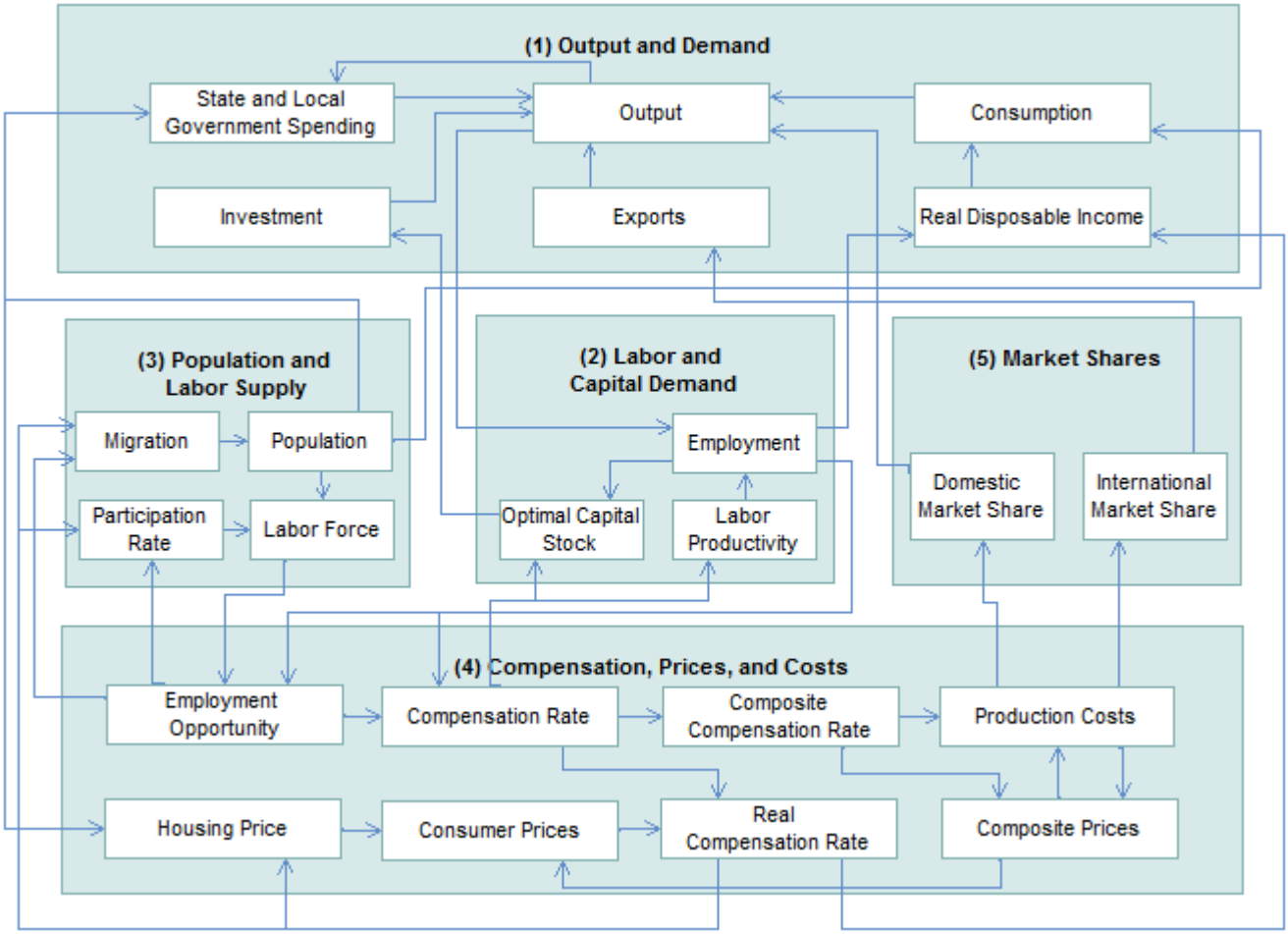
1. Input/output tabulation (IO)—IO models, sometimes called "social accounting matrices" (SAM), quantify the interrelation of industries and households in a computational sense. It models the flow of goods between firms in supply-chains, wages paid to households, and final consumption by households, government and the international market. These channels create the "multiplier" effect of $1 going further than when accounting for its echoing.
2. Computable general equilibrium (CGE)—CGE modeling adds market concepts to the IO structure. This includes how those structures evolve over time and how they respond to alternative policies. CGE incorporates concepts on markets for labor, housing, consumer goods, imports and the importance of competitiveness to fostering economic growth over time.

Changing one of these will influence the others—for instance, a new knife factory would improve the labor market and then bring it to a head by increasing migration into the area, driving housing and rent prices higher, and inducing the market to create a new subdivision to return to "market clearing" conditions.

3. Econometrics—REMI uses statistical parameters and historical data to populate the numbers inside the IO and CGE portions. The estimation of the different parameters, elasticity terms and figures gives the strength of various responses. It also gives the "time-lags" from the beginning of a policy to the point where markets have had a chance to clear.

4. New economic geography—Economic geography provides REMI a sense of economies of scale and agglomeration. This is the quantification of the strength of clusters in an area and their influence on productivity. One example would include the technology and research industries in Seattle. The labor in the area specializes to serve firms like Amazon and Microsoft and, thus, their long-term productivity grows more quickly than that of smaller regions with no proclivity towards software development (such as Helena, Mont.). The same is true on the manufacturing side with physical inputs, such as with the supply-chain for Boeing and Paccar in Washington in the production of transportation equipment. Final assembly will have a close relationship and a high degree of proximity to its suppliers of parts, repairs, transportation and other professional services, which show up in clusters in the state.

Figure 6.0



This diagram represents the structure and linkages of the regional economy in PI+. Each rectangle is a discrete, quantifiable concept or rate, and each arrow represents an equation linking the two of them. Some are complex econometric relationships, such as the one for migrant, while some are rather simple, such as the one for labor force, which is the population times the participation rate. The change of one relationship causes a change throughout the rest of the structure because different parts move and react to incentives at different points. At the top, Block 1 represents the macroeconomic whole of a region with final demand and final production concepts behind GDP, such as consumption, investments, net exports and government spending. Block 2 forms the "business perspective": An amount of sales orders arrive from Block 1, and firms maximize profits by minimizing costs when making optimal decisions about hiring (labor) and investment (capital). Block 3 is a full demographic model. It has births and deaths, migration within the United States to labor market conditions, and international immigration. It interacts with Block 1 through consumer and government spending levels and Block 4 through labor supply. Block 4 is the CGE portion of the model, where markets for housing, consumer goods, labor and business inputs interact. Block 5 is a quantification of competitiveness. It is literally regional purchase coefficients (RPCs) in modeling and proportional terms, which show the ability of a region to keep imports away while exporting its goods to other places and nations.

Conclusion

In 2014, Indian Point's total economic impacts (direct and secondary) to its surrounding counties were $1.3 billion in output and $800 million in gross state product. The total impacts to the country from Indian Point's operation are $2.5 billion in output and $1.5 billion in gross domestic product. The operation of the two nuclear power reactors at the Indian Point facility and its secondary effects account for 3,800 jobs in the surrounding counties, another 1,600 jobs throughout New York State, and another 5,300 jobs outside the state for a total of 10,700 jobs throughout the country.

The plant's economic benefits—on taxes and through wages and purchases of supplies and services—are considerable. In addition, plant employees further stimulate the local economy by purchasing goods and services from businesses around the area, supporting many small businesses throughout the region. The plant is the largest taxpayer in the county where it is located (Westchester).

The facility generated 17 billion kilowatt-hours of emission-free electricity in 2014, enough to serve the yearly needs for 2 million homes. This low-cost reliable electricity helped keep electricity prices in check in New York.

The Indian Point nuclear power plant is a leader economically, fiscally, environmentally and socially within New York and has far-reaching economic impacts across America.