Economic Impacts of The R.E. Ginna Nuclear Power Plant

An Analysis by the Nuclear Energy Institute

February 2015

NUCLEAR ENERGY INSTITUTE

www.nei.org

Contents

Nuclear Energy Institute
1201 F St., NW, Suite 1100,
Washington, DC 20004-1218
202.739.8000

Executive Summary

The Robert Emmett Ginna Nuclear Power Plant (Ginna), located in Ontario, N.Y., has been a vital part of the region's energy portfolio, providing 100 percent carbon-free electricity since it began operating in 1970. In addition to the reliable, emission-free electricity that the plant generates and the jobs and economic stimulus it provides, the plant's involvement in the local community makes Ginna a significant economic contributor to the region and New York.

To quantify the employment and economic impacts of this facility, the Nuclear Energy Institute (NEI) conducted an independent analysis. Based on data provided by Constellation Energy Nuclear Group on employment, operating expenditures, revenues 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, the methodology employed in this analysis. (See Section 6 of this report for more information on the REMI methodology.)

Ginna employs about 700 people directly and adds another 800 to 1,000 jobs during reactor refueling outages. This direct employment creates more than 800 additional jobs in other industries in New York and the United States.

Key Findings

Ginna's operation supports:

Hundreds of jobs. Ginna employs about 700 people directly and adds another 800 to 1,000 jobs during reactor refueling outages. This direct employment creates more than 800 additional jobs in other industries in New York and the United States.

Clean electricity for New York. Ginna generates about 4 percent of New York's electricity. Emission-free electricity from Ginna prevents the release of more than 2 million tons of carbon dioxide annually, the equivalent of taking approximately 400,000 cars off the road. 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 Regional Greenhouse Gas Initiative carbon-reduction goals. Shutdown of Ginna 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, Ginna provides 581 megawatts of around-the-clock electricity for New York homes and businesses. Over the last 10 years, the facility has operated at more than 95 percent of capacity, which is above the industry average and significantly higher than all 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. Nuclear energy

provides reliable electricity to businesses and consumers and helps prevent power disruptions which could lead to lost economic output, higher business costs, potential loss of jobs, and losses to consumers.

Balanced portfolio of electricity options. Nuclear energy produces approximately 30 percent of New York's electricity and Ginna plays an important role in maintaining a balanced electric portfolio in the state. New York's other sources of electricity are natural gas, renewables and hydropower. New York policy leaders have expressed concerns about overreliance on any one source of electricity generation.

Emission-free electricity from Ginna prevents the release of more than 2 million tons of carbon dioxide annually, the equivalent of taking approximately 400,000 cars off the road.

Economic stimulus. Ginna's operation generates $358 million of annual economic output statewide and $450 million annually across the United States. This study finds that for every dollar of output from Ginna, the state economy produces $1.52 and the U.S. economy produces $1.91.

Tax impacts. The Ginna facility is the largest taxpayer in Wayne County, contributing more than $10 million in state and local property tax and sales tax in 2014. When calculating the total tax impact (direct and secondary), the plant's operations resulted in nearly $80 million in tax revenue to the local, state and federal governments.

Community and environmental leadership. Ginna is a corporate leader in its neighboring communities, supporting education initiatives, environmental and conservation projects, and numerous charitable organizations. Ginna employees are the largest United Way contributor in Wayne County. The plant also is one of the few nuclear energy facilities in America that is ISO 14001-certified, an internationally recognized environmental management standard.

In addition to quantifying Ginna's economic impacts, this analysis modeled the adverse effects to the state and national economies if the Ginna plant shuts down prematurely. The results show that Ginna is integral to the local and state economies. Since nuclear plants often are 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.

If Ginna closes prematurely, this analysis found that the initial output losses to New York would be $485 million. The output losses to the United States, including New York, would be $808 million in the first year after closure. The losses would increase annually to a peak of $691 million in New York and $1.3 billion nationally in the seventh year. The number of jobs lost peaks in the sixth year after the plant closes: 3,600 jobs in New York and 6,800 throughout the United States. Losses would reverberate for decades after the plant is shut down, and host communities may never fully recover.

Section 1

Background and Generation History

Date of operation:

R.E. Ginna nuclear power plant began generating electricity on June 1, 1970

Location:

Ginna is located on 426 acres along the south shore of Lake Ontario in Ontario, N.Y., about 20 miles northeast of Rochester

NRC License Expiration Year:

2029

Reactor Type:

Pressurized water reactor

Total Electrical Capacity:

581 megawatts, enough to power 400,000 homes year round

Owner:

Constellation Energy Nuclear Group LLC, a joint venture between Exelon Corp. and the EDF Group

Reliable Electricity Generation

Ginna has operated at a capacity factor of more than 95 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 High-Skilled, Well-Paying Local Jobs

Ginna employs about 700 full-time workers and is one of the largest and highest-paying employers in Wayne County. The annual payroll is approximately $100 million. Most jobs at nuclear power plants require technical training and typically are among the highest-paying jobs in the area. Nationwide, nuclear energy jobs pay 36 percent more than average salaries in a facility's local area.

In addition, every 18 months, the plant is refueled and specialized maintenance is conducted. During this time, Ginna supplements its workforce with an additional 800 to 1,000 skilled craft workers, primarily from local unions. Direct payroll for these contractors ranges from $19 million to $25 million depending on outage work scope.

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, Ginna's operation prevented 2.4 million metric tons of carbon dioxide,[1] about the same amount released by more than 400,000 cars each year. Overall, New York's electric sector emits more than 30 million tons of carbon dioxide annually. Ginna also prevents the emission of more than 1,000 tons of nitrogen oxide, equivalent to that released by nearly 60,000 cars, and 1,040 tons of sulfur dioxide. Sulfur dioxide and nitrogen oxide are precursors to acid rain and urban smog.

---

[1] *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

Economic Impacts for New York State and National Economies

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

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

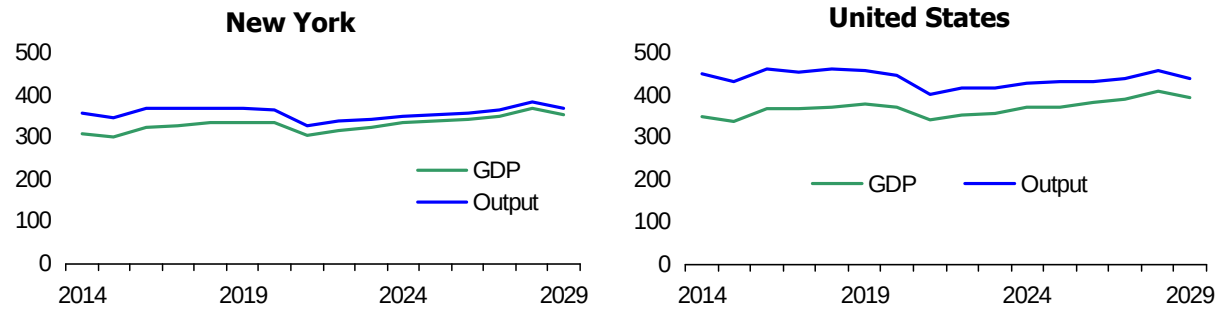
Output
The direct output is the value of power produced by Ginna. The secondary output is the result of how the direct output alters subsequent outputs among industries and how those employed at Ginna influence the demand for goods and services within the community.

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

Gross State Product
Gross state product is the value of goods and services produced by labor and property at Ginna—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.

This study evaluated how these factors affect economic activity at the state and national levels.

Figure 2.0
Ginna's Output Impact and Gross Domestic Product Contribution to New York and the U.S.
*(dollars in 2014 millions)**



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

Substantial Economic Driver

The direct output value of Ginna was $235.3 million in 2014 (the value of the electricity produced), with a total economic impact on the state of $358 million. In other words, for every dollar of output from Ginna, the state economy produced $1.52.

Ginna's total effect on the U.S. economy was more than $450 million. For every dollar of output from the plant, the U.S. economy produced $1.91. The plant contributed more than $300 million to New York's gross state product and nearly $350 million to U.S. GDP.

Figure 2.0 (previous page) shows the value of Ginna's output impact and contributions to GDP to the end of its Nuclear Regulatory Commission license period in 2029, using electricity price forecast data from the Energy Information Administration.

Table 2.0
Ginna's Direct and Secondary Effects on U.S. Economic Sectors
(output in millions of 2014 dollars)

Sector Description	New York	United States
Utilities	$237.52	$238.13
Manufacturing	$8.72	$52.00
State and Local Government	$25.39	$29.50
Professional, Scientific, and Technical Services	$13.92	$22.63
Finance and Insurance	$7.91	$18.00
Health Care and Social Assistance	$11.75	$15.50
Real Estate and Rental and Leasing	$8.88	$14.00
Retail Trade	$8.59	$12.63
Construction	$8.39	$12.13
Information	$4.75	$10.50
Wholesale Trade	$5.86	$10.00
Administrative and Waste Management Services	$5.70	$10.31
Accommodation and Food Services	$4.40	$7.50
Other Services, except Public Administration	$3.09	$5.25
Transportation and Warehousing	$1.15	$4.69
Management of Companies and Enterprises	$0.47	$2.41
Arts, Entertainment, and Recreation	$1.10	$1.97
Educational Services	$0.98	$1.63
Forestry, Fishing, and Related Activities	$0.01	$0.19
Total	**$358.00**	**$450.31**

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

The third largest sector that benefits from Ginna's operation in New York is professional, scientific and technical services due to the volume of specialized services required to operate and maintain a nuclear power plant. Aside from tax payments, Ginna's largest U.S. impact is on the manufacturing sector, particularly for purchases of pumps, motors and other equipment. A full depiction of the sectors in the United States that benefit from the facility is in Table 2.0.

Ginna's output also stimulates the state's labor income and employment. The plant employs about 700 people in permanent jobs and another 800-1,000 jobs during refueling outages. These jobs stimulate more than 800 additional jobs in other sectors in New York and the United States. Table 2.2 details the numbers and types of jobs that Ginna supported in 2014. Workers at the plant are included in the occupation categories in the table. Because Ginna hires hundreds of workers every 18 months to help with refueling/maintenance outages, Table 2.2 also shows the number of jobs created in outage years and non-outage years.

Economic Stimulus Through Taxes

Ginna's operation results in a total tax impact of $80 million to local, state and federal governments. Constellation Energy Nuclear Group pays more than $10 million in state and local property and sales taxes annually and is Wayne County's largest taxpayer. This is the direct impact. There also are secondary impacts, because plant expenditures increase economic activity, leading to additional income and value creation and, therefore, to higher tax revenue.

Table 2.1
Total Tax Impacts of Ginna's Economic Activity in 2014
*(in 2014 millions of dollars)**

Plant	State and Local	Federal	Total
Ginna	$15.6	$62.3	$77.9

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

Ginna's impact on the 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 provides the multipliers and summarizes the total effects for each region.

Table 2.2
Ginna Supports Direct and Secondary Jobs During Non-Outage and Outage Years

	New York		United States	
Occupation	**Non-Outage**	**Outage***	**Non-Outage**	**Outage***
Sales and related, office and administrative support	399	440	598	602
Installation, maintenance and repair	228	282	259	309
Management, business and financial	177	196	244	246
Production	144	174	202	221
Computer, mathematical, architecture, engineering	124	142	149	156
Building and grounds cleaning and maintenance	86	90	145	139
Health care	86	92	127	122
Transportation and material moving	61	64	127	124
Construction and extraction	91	100	121	122
Other	223	233	341	334
Total	**1,619**	**1,813**	**2,313**	**2,375**

Table 2.3
Ginna's Impact on the State and National Economies in 2014 (dollars in millions)

Description	Direct	Secondary	Total	Multiplier
New York				
Output	$235.3	$136.2	$358.0	1.52
Employment (non-outage)	700	919	1,619	2.31
Employment (outage)	925*	888	1,813	1.96
United States				
Output	$235.3	$243.6	$450.3	1.91
Employment (non-outage)	700	1,613	2,313	3.30
Employment (outage)	925*	1,450	2,375	2.57

** Outage workers are converted to full-time equivalents.*

Section 3

Economic Impacts of Ginna's Retirement

If Ginna shuts down, in the first year, the initial output losses to New York and the United States are $485 million and $808 million, respectively. The losses increase each year until the seventh year after Ginna's retirement, when the lost output peaks at $691 million for New York and $1.3 billion for the United States.

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 prematurely 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. Recent analysis shows that California's carbon dioxide emissions increased by more than 35 percent, due in large part to the closure of the two reactors. Moreover, when San Onofre was operating, there was virtually no spread in wholesale electricity costs between southern and northern California. When the plant shut down in 2012, the spread between prices in the two regions increased to approximately $7 per megawatt-hour. In 2013, the spread widened further—to about $10/MWh. It is expected to remain at that level for the rest of the decade. This is significant for a state that already has one of the highest retail electricity rates in the country.

California will replace the lost electricity from San Onofre primarily with new natural gas-fired power plants, renewable resources, and imports from out of state. Customers are expected to pay billions of dollars to replace electricity generation at San Onofre.

As discussed in Section 2, the operation of Ginna creates significant economic benefits for New York and beyond. This facility is at significant risk of premature retirement because of a perfect storm of economic challenges—sluggish economy, historically low natural gas prices, and the unintended consequences of current energy policies. The REMI model measures the long-term impact to the New York and U.S. economies if Ginna is shut down prematurely. The economic impacts of a shutdown are analyzed over a 20-year period.

State and National Comprehensive Economic Loss

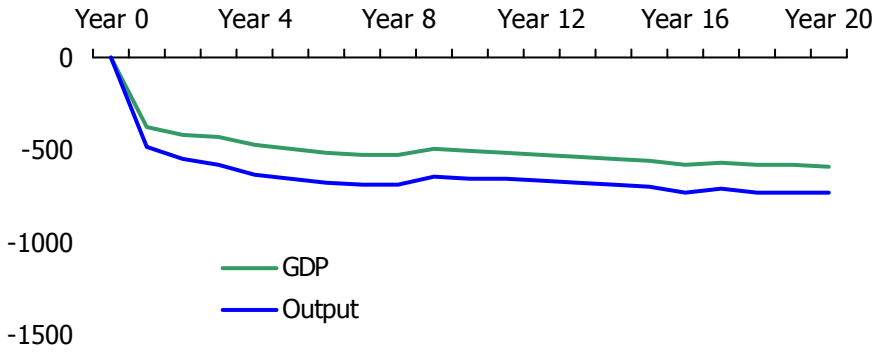
When a productive facility ceases operations, the economic loss affects local, state and national areas for decades. Figure 3.0 shows the value of Ginna's lost output and lost gross state product for the first 20 years the plant is shut down.

In the first year, the lost output in New York and the United States would be $485 million and $808 million, respectively. The losses increase each year until the seventh year after Ginna's retirement, when the lost output peaks at $691 million for New York and $1.3 billion for the United States. Over that period, the 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.

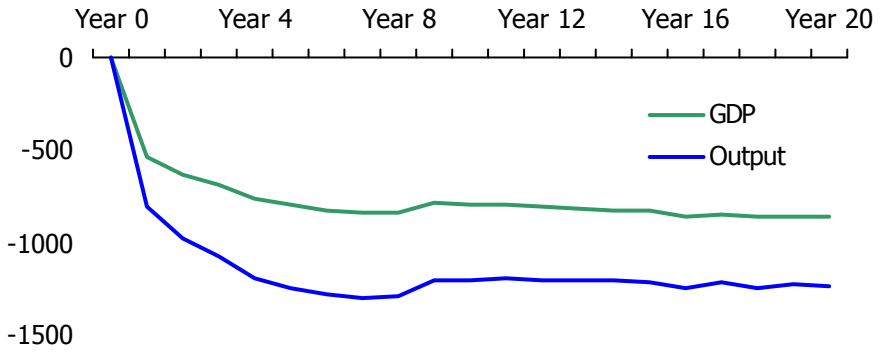
A nuclear power plant shutdown has a greater economic impact than operation. The impacts shown in this section are larger than those in Section 2 primarily

Figure 3.0
Ginna's Lost Output and Gross State Product in New York and the United States
(dollars in 2014 millions)

New York



United States



due to the migration of workers and families moving away from the area in search of new jobs.

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 the state and local governments because of a loss in tax revenue estimated at $19 million. Further, nearly 250 jobs would be lost at the state and local government levels.

A full depiction of the sectors affected by Ginna's shutdown is in Table 3.0, which shows the lost output in the seventh year when the losses are at their highest in the United States.

Figure 3.1 shows the number of direct and secondary jobs lost in New York and the United States after Ginna's retirement. While the number of direct jobs lost remains flat, the number of secondary jobs lost increases during the first six

Table 3.0
Peak Lost Output to Affected Sectors in Year 7 After Ginna's Closure *(in 2014 millions of dollars)*

Economic Sector	New York	United States
Utilities	−$288.89	−$292.47
Manufacturing	−$29.08	−$209.50
Construction	−$102.07	−$166.75
Professional, scientific and technical services	−$54.00	−$104.50
State and local government	−$48.50	−$75.75
Finance and insurance	−$10.81	−$54.00
Real estate and rental and leasing	−$23.53	−$62.25
Health care and social assistance	−$21.39	−$37.25
Retail trade	−$29.16	−$49.38
Information	−$26.11	−$57.00
Wholesale trade	−$19.38	−$42.13
Administrative and waste management services	−$11.38	−$29.94
Transportation and warehousing	−$3.27	−$25.63
Accommodation and food services	−$10.10	−$20.00
Other services, except public administration	−$6.41	−$15.88
Mining	−$0.07	−$39.69
Management of companies and enterprises	−$0.23	−$10.44
Arts, entertainment and recreation	−$2.96	−$6.16
Educational services	−$3.43	−$5.16
Forestry, fishing and related activities	$0.00	−$0.78
Total	**−$690.50**	**−$1,308.00**

years. This is because it would take five to seven years before Ginna's lost output filters through the local, state and national economies.

Figure 3.1 displays the population migration out of the state that would occur if the facility were to close. Ten years after closure, about 2,500 would move out of state, increasing to 2,900 in year 20. Since Ginna is one of the largest employers in Wayne County, it can be reasonably assumed that people also would migrate out of the county to other parts of the state.

Table 3.1 shows the number and types of jobs that would be lost when Ginna retires. In Year 1, more than 2,600 jobs would be lost in New York; 4,500 in the United States. In Year 6, job losses in the United States would be 6,828, of which 3,610 would be in New York.

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

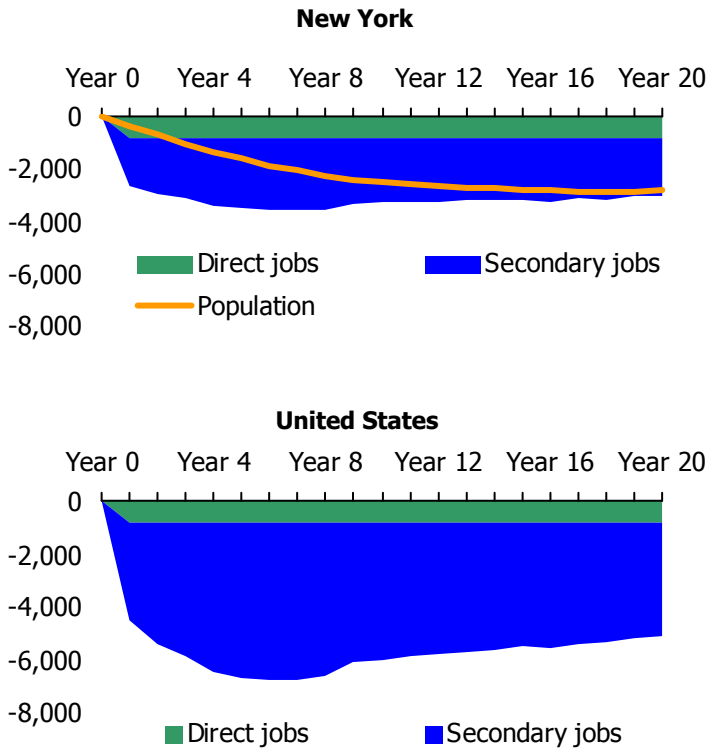


Table 3.1
Peak Direct and Secondary Jobs Lost in Year 6
After Ginna's Closure

Occupation	New York	United States
Sales and related, office and administrative support	−886	−1,711
Construction and extraction	−537	−1,001
Management, business and financial	−380	−715
Installation, maintenance and repair	−378	−548
Production	−234	−486
Transportation and material moving	−154	−433
Building and grounds; personal care and service	−158	−359
Computer, mathematical, architecture & engineering	−235	−396
Health care	−173	−312
Other	−475	−867
Total	**−3,610**	**−6,828**

Section 4

Community Leadership and Environmental Protection

Constellation Energy Nuclear Group is widely recognized as an important corporate citizen in its community. The company and employees at Ginna are dedicated to education, the environment and their community.

Educational Endeavors

Ginna employees believe that quality education and career development opportunities are among the most important tools to help communities prosper. Since 2010, Constellation Energy Nuclear Group has awarded several college scholarships to local high school students. Ginna employees also sponsor after-school programming through Big Brothers and Big Sisters designed to encourage interest in math and science.

Environmental Support

Ginna is dedicated to protecting the environment while meeting New York's clean energy needs. In 2010, Ginna became ISO 14001-certified, an internationally recognized standard that recognizes the plant's excellence in environmental stewardship. Ginna renewed its ISO 14001 certification in August 2013.

Located on Lake Ontario, Ginna plays a key role in protecting the regional environment. In addition to meeting all regulatory requirements and having a formal environmental management system, Ginna also:

- maintains nesting boxes for the Eastern Bluebird
- establishes on-site wildlife habitats
- maintains an active recycling program
- participates in the Ocean Conservancy International Coastal Cleanup and Adopt-a-Highway programs
- maintains an active role in the local community, providing environmental education programs to students and educators
- contributes financially to environmental organizations such as Ducks Unlimited and Seneca White Deer.

Community Leadership

Ginna employees are leading corporate citizens in Wayne County. Members of the facility's team serve their communities as volunteer firefighters, Scout leaders, emergency medical technicians, board members and more. They provide

thousands of hours to civic and community organizations and make significant contributions to charities each year.

Here are some examples:

- Constellation Energy Nuclear Group is the largest United Way contributor in Wayne County and its employees participate in the "Day of Caring."
- Ginna sponsors annual fundraising events for local organizations, including a golf tournament, bake sale and silent auctions.
- Over the past decade, the company also has contributed several thousands of dollars annually to various charitable groups and nonprofit organizations in Wayne and Monroe counties.

Section 5

Ginna and the U.S. Nuclear Energy Industry

The Ginna nuclear power plant plays a vital role in helping central New York and the state as a whole meet its demand for affordable, reliable and sustainable energy.

In 2013, electricity production from U.S. nuclear power plants was about 790 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 Ginna alone generated 5 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 an industry-leading performance capacity factor of 91 percent in 2013, while producing electricity at one of the lowest costs of any fuel source used to generate electricity. Ginna's performance has met or exceeded the industry average for many years.

The Value of Nuclear Energy

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.

Some of America's electricity markets, however, 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 as part of a diverse energy portfolio.

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

Renewable energy, while 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.

Retiring Ginna would undo all the renewables investment made by New York in the past decade to comply with RGGI. Since 2005, wind and solar that has come online generate about 3.6 billion kWh annually in New York, compared to 4.6 billion kWh annually from Ginna. If Ginna were to retire, fossil fuels would replace it. As a result, CO_2 emissions would increase by about 2.4 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 is heavily dependent on fuel prices—nuclear plant fuel prices are relatively stable, making costs to consumers 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 between nuclear plants and federal, state and local regulating bodies, the industry is keeping the nation's 100 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 0.06 in 2012, illustrating the emphasis on safety throughout the nuclear industry.

General worker safety also is excellent at nuclear power plants—far safer than in the manufacturing sector. U.S. Bureau of Labor Statistics show that in 2012, nuclear energy facilities achieved an incidence rate of 0.4 per 200,000 work hours, compared to 2.8 for fossil-fuel power plants, 3.1 for electric utilities and 3.9 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. The NRC granted the first 20-year license renewal to the Calvert Cliffs plant in Maryland in 2000. As of February 2015, 75 reactors have received license renewals, 17 reactors have filed applications for renewal and are under review and the remaining eight reactors have announced their intention to apply. Thirteen reactors have passed the 40-year mark and are operating safely and reliably with renewed licenses in this extended period. 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.

Besides relicensing nuclear plants, energy companies also 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 halfway through the construction program and will employ more than 5,000 workers each during the peak of construction. In addition, 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 Ginna plant.

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:

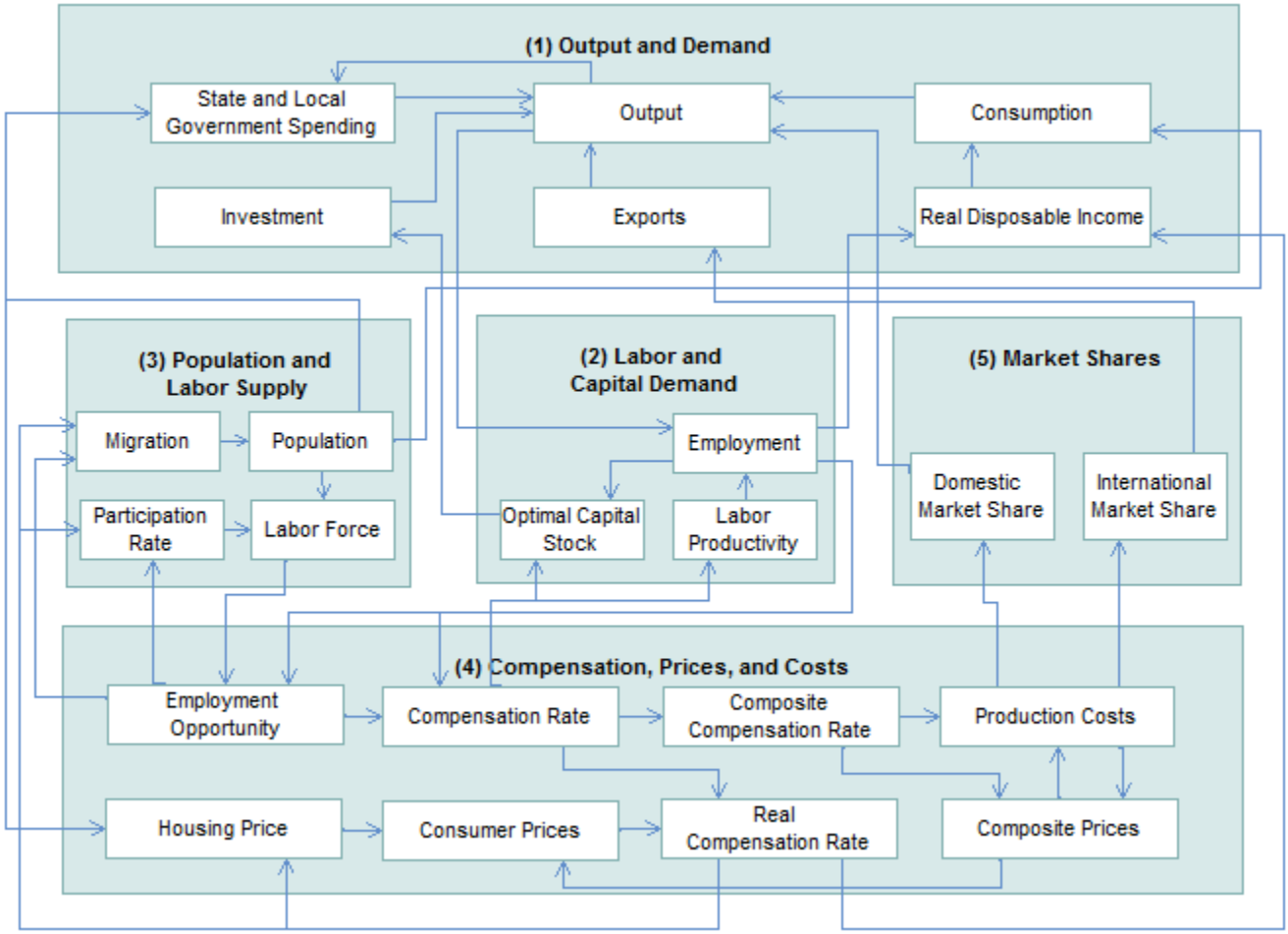
1. Input/output tabulation (IO)—IO models, sometimes called "social accounting matrices" (SAM), quantify the interrelation of industries and households in a computational sense. It models the flow of goods between firms in supply-chains, wages paid to households, and final consumption by households, 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 im-

portance 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

Ginna's economic benefits—on taxes and through wages and purchases of supplies and services—are considerable. In addition, plant employees 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.

In 2014, total economic impact (direct and secondary) to the country from Ginna's operation was $450 million in output and nearly $350 million in gross domestic product. The operation of the Ginna facility and its secondary effects account for 1,400 to 2,000 jobs in New York and throughout the country.

The facility generated almost 5 billion kilowatt-hours of low-carbon electricity in 2013, enough to serve the yearly needs for 400,000 homes. This low-cost reliable electricity helped keep electricity prices in check in New York.

The Ginna nuclear power plant is a leader economically, fiscally, environmentally and socially within New York and has far-reaching economic impacts across the United States.