Economic Impact of NextEra Energy's Seabrook Station

An analysis by the Nuclear Energy Institute

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Nuclear Energy Institute

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A letter from Professor of Economics Richard England

I was asked by NextEra Energy Seabrook Station to provide an independent review of the NEI report that details the economic impact of Seabrook Station. As a Professor of Economics and Natural Resources at the University of New Hampshire for 37 years, I have extensive experience with economic impact studies and the methodologies that are used.

Along with the plant's environmental benefits of generating safe, clean, carbon-free electricity, an important point in the report is how Seabrook Station offers hundreds of jobs with very high annual earnings. This direct impact of the plant's operations has a positive ripple effect throughout the economy. During recent years, a decline in manufacturing employment in New Hampshire and growth in retailing, tourism and health care jobs has had a depressing effect on average annual earnings in the state. Seabrook Station continues to offer jobs that support a middle-class living standard.

I read this report with great interest and after a thorough review, believe it to be accurate, factual and credible. I am familiar with the statistical model - called IMPLAN - that was used to derive estimates of Seabrook's direct, indirect, and induced impacts on the local, regional and national economies. IMPLAN is an established and widely respected statistical modeling tool that traces the linkages between activity in one particular industry and impacts on all other industries of the economy. IMPLAN is probably the most conservative of all the models that are currently being used to conduct economic impact studies.

Clearly, the data in this report shows the substantial and positive impact Seabrook Station has on our local, regional and national economies.

Sincerely,

Richard England, Ph.D.

Professor of Economics & Natural Resources
Paul College of Business & Economics
University of New Hampshire

Business and Industry Association
New Hampshire's Statewide Chamber of Commerce

A letter from the Business and Industry Association

Dear friends:

In recent years, the issue of maintaining an affordable, reliable and clean energy portfolio has become one of the key issues for policymakers and the business community. As our state continues to recover from the greatest economic crisis since the Great Depression, all of us must remain focused on ways to continue to enhance our state's economic competitiveness by keeping taxes and fixed costs like energy low.

Here in New Hampshire, since 1990, NextEra Energy's Seabrook nuclear plant has operated reliably, supplying enough safe, emissions-free energy for 1.2 million homes.

Importantly, in addition to providing affordable power, NextEra Energy Seabrook is helping to power the growth of our local economy. This study quantifies how Seabrook, in addition to providing hundreds of high-paying local jobs, is simultaneously contributing to the continued growth of other businesses here in New Hampshire. For example, in just one year, Seabrook Station alone contributed hundreds of millions of dollars in direct economic benefits, creating substantial additional economic activity across a variety of sectors.

The recent closure of the Vermont Yankee nuclear plant just across the border reminds us that we cannot take our energy resources – especially those that support jobs and simulate downstream economic activity - for granted.

Sincerely,

Jim Roche

President

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Executive Summary

Seabrook Station, located in Seabrook, New Hampshire, has been an integral part of the region's clean energy portfolio since operations began in 1990. Whether one looks at the tremendous amount of emissions-free energy generated by the plant, the jobs and economic stimulus it offers to various sectors of the economy, or the plant's involvement in the local community, there is no doubt Seabrook has positively contributed to the economic fabric of the region.

To help quantify the job creation and economic impact of this facility, the Nuclear Energy Institute (NEI) conducted an independent analysis of Seabrook's ongoing economic, fiscal and social impact based on data provided by NextEra Energy Seabrook, the majority owner of the facility.

Key findings of this study include the fact that Seabrook's operation supports:

- **Hundreds of jobs with higher-than-average wages:** Seabrook directly employs 650 people. In addition, these jobs are typically higher-paying than many others in the region. In Rockingham and Stafford counties alone, Seabrook employees make more than double the average amount for other workers.
- **Reliable, clean energy for New Hampshire:** Seabrook generates approximately 40 percent of New Hampshire's total electricity and generally operates at a capacity factor at or above industry average. Because the energy produced at Seabrook is emissions-free, its operation prevents the emission of nearly four million tons of carbon dioxide annually, which is the equivalent of taking almost 700,000 cars off the road.
- **Economic stimulus through "ripple" effects:** The plant's continued operation stimulates $535 million of economic growth locally, and a staggering $1.4 billion across the entire United States economy. Further, this study finds that for every dollar of output from Seabrook, the local economy produced $1.34, while the New Hampshire and Massachusetts economies produced $1.39 and $1.10, respectively.

Seabrook is also an active corporate leader in the surrounding communities, and offers support for educational initiatives, environmental and conservation projects, and various charitable organizations. Seabrook's financial contributions to local environmental groups over the past decade have amounted to more than $1 million.

NextEra Energy and NEI cooperated in developing this study. NextEra Energy provided data on employment, operating expenditures and tax payments for the existing unit. NextEra also provided expenditure totals specific to the counties surrounding the plant.

NEI conducted the project by applying a nationally-recognized model to estimate the direct and indirect impacts of the existing plant on the local community. MIG, Inc. developed the IMPLAN (Impact Analysis for Planning) economic impact modeling system, which is the methodology employed in this analysis.

Section 1: Background and Generation History

First date of operation

Seabrook Station began commercial operation on August 19, 1990

Location

Seabrook is located on the seacoast of southern New Hampshire and encompasses 900 acres

License Expiration Year

2030

Reactor Type

Pressurized water

Total Electrical Capacity

1,247 megawatts

Owned By

88.2 percent: NextEra Energy Seabrook

11.6 percent: Massachusetts Municipal Wholesale Electric Co.

0.1 percent: Hudson Light & Power Dept.

0.1 percent: Taunton Municipal Lighting Plant

Reliable Electricity Generation

Since operations began, Seabrook Station has maintained capacity factors at or above the industry average. Capacity factor, a measure of production efficiency, is the ratio of actual electricity generated compared with the maximum possible generation if the plant were to operate at full capacity for one year. In 2004 and 2010, Seabrook achieved its best capacity factors of 99.9 percent.

Seabrook's operation avoided creating 3.7 million metric tons of carbon dioxide, approximately the same amount of carbon dioxide released by more than 700,000 cars each year.

Hundreds of Local Jobs

Seabrook Station employs 650 full-time workers, 346 of whom reside in Rockingham County and 155 in Stafford County.

The jobs provided by the plant are also typically higher-paying than most jobs in the area. Full-time Seabrook employees who live in Rockingham County earn, on average, about $109,340 per year. This is substantially higher than the average earnings of workers in the county—about $47,080 per year. (See Table 1.0)

Full-time employees who live in Stafford County earn, on average, about $138,560 a year compared to the average earnings of workers in the county of about $45,520 per year.

Safe for the Environment

Nuclear power generates large-scale amounts of electricity without emitting greenhouse gases. As such, state and federal policymakers recognize it as a necessary source of safe, reliable energy that can help address climate change while meeting our nation's growing demand for electricity and energy independence.

In 2012, Seabrook's operation avoided creating 3.7 million metric tons of carbon dioxide, approximately the same amount of carbon dioxide released by more than 700,000 cars each year.

Seabrook also prevented the emissions of nearly 1,000 tons of nitrogen oxide, which is equivalent to that released by more than 50,000 cars. Further, the station prevented 1,800 tons of sulfur dioxide in 2012. Sulfur dioxide and nitrogen oxide are primary causes of acid rain.

Table 1.0 Seabrook's Employment by New Hampshire County

County	Seabrook			City/County Total[a]	
	Permanent Employees	% Employed Work Force	Average Earnings	Employed Work Force	Average Earnings[b]
Rockingham, NH	346	0.3	$109,340	135,000	$47,080
Stafford, NH	155	0.3	$138,560	45,000	$45,520

[a] *Bureau of Labor Statistics – 2012*

[b] *Earnings, defined as the sum of wage and salary income, represent the amount of income received regularly before deductions for personal income taxes, Social Security, Medicare, etc.*

Section 2: Economic and Fiscal Impacts on Local, State and National Economies

Seabrook's economic impact is critical to New England and beyond.

In order to have a full and comprehensive analysis of the real economic and fiscal impact of the plant, there are a few terms that should be first defined. NEI applied the Impact Analysis for Planning (IMPLAN) model to expenditure data provided by NextEra Energy to develop estimates of these effects (more information on IMPLAN in Section 5).

Direct Spending: This measures the total amount of spending directly from Seabrook to a specific entity or industry. For the purposes of this study, it encompasses total compensation for plant employees – benefits, salaries, and wages – as well as outside industries that receive direct expenditures from Seabrook.

Economic Impact: The full economic impacts of the plant can be assessed through direct effects and secondary effects. The variables used to analyze these effects are:

- **Output:** the value of production of goods and services
- **Labor income:** workers' earnings
- **Employment:** jobs provided

Direct Effects: The direct effects (or direct output) measure the estimated value of the power production from Seabrook, which for 2011 was $400 million. It does not include subsequent spending effects. The value includes consumer benefits, investor relations, plant purchases, salaries and taxes, which reflects the total output of products and services associated with the plant.

Secondary Effects: The secondary effects (or secondary output) includes subsequent spending effects. These effects are divided into two categories: indirect and induced.

- **Indirect effects** cover how Seabrook's spending alters subsequent spending among suppliers. For example, when Seabrook buys a hammer for $5, it contributes directly to the economy. Consequently, the company that makes the hammer also has to increase its purchases of steel and wood to maintain its inventory, increasing output in the steel and wood industries. The steel and wood industries then will have to purchase more inputs for their production processes, and so on. The result will be an indirect economic impact that is greater than the $5 initially spent for the hammer.
- **Induced effects** measure how changes in labor income (those employed by Seabrook) influence the final demand for goods and services within a particular community. This induced effect has a subsequent effect on all sectors producing basic, intermediate and final goods and services. This study evaluated how each of these effects changed economic activity at the local, state and national level.

Local Expenditures

In 2011, Seabrook's expenditures within the counties around the station – Rockingham, Stafford and Essex (MA) – totaled $133 million, or 43 percent of the plant's total spending for that year ($312 million). Table 2.0 below illustrates the various industries that benefited from Seabrook's direct economic input.

Much of the immediate local spending is seen in the amount of labor the plant employs. As expected, much of the local impact is seen in plant employee wages and benefits – about $79 million (or 59 percent of the expenditures within the counties). Much of this stays "home" within the respective counties, further stimulating the economy.

Other sectors that are touched locally involve mostly specialized work – equipment and machinery rental, plant maintenance and consulting.

For every $1 of output from Seabrook, the local economy produced $1.34.

Table 2.0 Seabrook Expenditures in Essex, Rockingham and Stafford Counties (dollars in thousands)

Description	Amount
Commercial and industrial machinery and equipment repair and maintenance	$25,506
Investigation and security services	$12,524
Other support services	$6,408
Petrochemical manufacturing	$2,156
Business support services	$2,044
Architectural, engineering and related services	$1,457
All other miscellaneous professional, scientific and technical services	$685
Retail - Motor vehicle and parts	$550
Electric power generation, transmission and distribution	$480
Offices of physicians, dentists, and other health practitioners	$457
Other	$2,107
Subtotal	**$54,373**
Total Compensation[a]	**$78,860**
Total	**$133,233**

[a]*Total compensation includes wages, salaries and fringe benefits based on data provided by NextEra Energy.*

Local Comprehensive Economic Effect

The economic investment of Seabrook in the local community has a multiplier effect across nearly every sector of its economy. While the plant's direct output value was $400 million, the study found the total impact on the local region was $535 million. That puts the output multiplier at 1.34, so for every dollar of output from Seabrook, the local regional economy produced $1.34.

Most notably (and unsurprisingly), Seabrook affected power generation and supply – which includes the electricity produced by the plant – the most.

The second largest effect was seen in a sector called "owner-occupied dwellings," a designation designed by the U.S. Department of Commerce that estimates what homeowners would have to pay in rent if they did not own their home. It essentially measures the benefit of increased home values that are caused by increased labor from the plant's operation.

Other sectors that benefit from Seabrook include private hospitals, doctor's offices, insurance, real estate and others. A full depiction of the local industries that benefit from the plant is on the table below.

As table 2.1 depicts, Seabrook's output also stimulated the local region's labor income and employment, generating about $140 million in income and approximately 1,800 jobs locally.

Table 2.1 Most-Affected Industries in the Local Counties (dollars in thousands)

Industry Description	Output	Labor Income	Employment
Power generation and supply	$402,148	$79,205	550
Machinery and equipment maintenance	$25,658	$17,109	184
Investigation and security services	$12,635	$8,840	251
Owner-occupied dwellings	$10,464	-	-
Other support services	$6,489	$2,360	61
Real estate establishments	$6,256	$488	36
Offices of health practitioners	$5,028	$3,296	40
Food services and drinking places	$4,689	$1,844	80
Private hospitals	$4,291	$2,058	34
Monetary authorities	$4,033	$713	11
Other	$53,653	$23,905	553
Total	**$535,344**	**$139,816**	**1,799**

New Hampshire and Massachusetts Expenditures

The effect of Seabrook's statewide spending in New Hampshire and Massachusetts has similar impacts on the local surrounding counties. The plant spent $175 million for products and services (including labor) throughout the two states, and that spending represents approximately 56 percent of the nuclear plant's total expenditures of $312 million.

In terms of spending in New Hampshire, machinery and equipment maintenance, and investigation and security services claimed the largest spending categories after employee compensation. Other notable categories reflect the need for specialized workers including spending for scientific and technical services.

Table 2.2 Seabrook Expenditures (dollars in thousands)

Description	Massachusetts	New Hampshire
Commercial and industrial machinery and equipment repair and maintenance	$3,971	$28,450
Investigation and security services	$2,200	$13,898
Other support services	$975	$7,066
Other state and local government enterprises	$846	$2,316
Architectural, engineering and related services	$1,359	$1,725
Electric power generation, transmission and distribution	$226	$961
Environmental and other technical consulting services	$0	$921
All other miscellaneous professional, scientific and technical services	$685	$582
Services to buildings and dwellings	$0	$349
Maintenance and repair construction	$345	$101
Other	$7,385	$578
Subtotal	**$17,992**	**$56,946**
Total Compensation[a]	**$12,177**	**$88,277**
Total	**$30,168**	**$145,223**

[a]*Total compensation includes wages, salaries and fringe benefits based on data provided by NextEra Energy.*

State Comprehensive Economic Effect

Seabrook stimulates the state economies in an even broader way than at the local level. In fact, this study found that the total economic impact to the state of New Hampshire was $557 million and to the state of Massachusetts was $441 million. That places the output multiplier at 1.39 for NH and 1.10 to MA. In other words, for every dollar of output from Seabrook, the New Hampshire economy produced $1.39 and the Massachusetts economy produced $1.10.

The breakdown of industries that benefitted most from the plant's state outputs – along with boosts in labor income and job creation – closely resembles that at the local level.

Table 2.3 Most-Affected Industries in Massachusetts (dollars in millions)

Industry Description	Output	Labor Income	Employment
Power Generation and Supply	$400.6	$12.3	48
Machinery and equipment maintenance	$4.0	$2.7	30
Management, scientific and technical consulting services	$3.5	$2.5	24
Construction of other new nonresidential structures	$3.4	$1.8	28
Owner-occupied dwellings	$2.3	-	-
Investigation and security services	$2.3	$1.5	51
Architectural, engineering and related services	$1.8	$1.1	14
Food services and drinking places	$1.6	$0.7	27
Real estate establishments	$1.5	$0.2	7
Monetary authorities	$1.2	$0.2	3
Other	$19.3	$8.6	149
Total	**$441.4**	**$31.4**	**380**

Table 2.4 Most-Affected Industries in New Hampshire (dollars in millions)

Industry Description	Output	Labor Income	Employment
Power Generation and Supply	$403.2	$88.8	531
Machinery and equipment maintenance	$28.7	$18.2	223
Investigation and security services	$14.1	$10.0	267
Owner-occupied dwellings	$12.3	-	-
Other support services	$7.2	$2.4	78
Real estate establishments	$6.9	$0.7	46
Private hospitals	$5.7	$2.8	44
Food services and drinking places	$5.5	$2.2	96
Offices of health practitioners	$5.4	$3.7	40
Wholesale trade businesses	$4.8	$2.1	25
Other	$63.7	$27.0	631
Total	**$557.5**	**$157.8**	**1,981**

National Expenditures

In 2011, total expenditures for products and services (including labor) by Seabrook totaled $312 million in the United States. Besides the $175 million of spending in New Hampshire and Massachusetts – which was previously discussed – the plant spent an additional $137 million elsewhere in the United States, largely for specialized products and services unique to the nuclear industry.

Once the net is broadened to include the entire country, the study illustrates that compensation is no longer the largest spending category for Seabrook. Compensation as a share of U.S. expenditures is much lower because plant employees live almost exclusively in New Hampshire, while spending on specialized products and non-labor services is often concentrated outside the state.

The largest non-labor spending category at the national level for Seabrook is for commercial and industrial machinery and equipment repair and maintenance. The second largest spending category is for various government and regulatory enterprises.

Table 2.5 Seabrook Expenditures in the United States (dollars in millions)

Description	Amount
Commercial and industrial machinery and equipment repair and maintenance	$39.5
Other federal government enterprises	$20.8
Investigation and security services	$18.2
Business support services	$17.2
Other electronic component manufacturing	$16.8
Motor and generator manufacturing	$14.9
Architectural, engineering and related services	$13.5
Other support services	$9.0
Construction of other new nonresidential structures	$6.9
Management, scientific and technical consulting services	$4.6
Other	$40.5
Subtotal	**$201.9**
Total Compensation[a]	**$109.9**
Total	**$311.8**

[a]*Total compensation includes wages, salaries and fringe benefits based on data provided by NextEra Energy.*

National Comprehensive Economic Effect

Seabrook's total effect on the U.S. economy was $1.4 billion. Given that the total output from the plant was only $400 million, this means the output multiplier for the U.S. economy was an outstanding 3.43. For every dollar of output from the plant, the U.S. economy reaped $3.43.

Power generation and supply boosted the economic effect for this large region, but in many respects the economic stimulus was felt in the same industries as at the local and state level.

Table 2.6 Most-Affected Industries the United States (dollars in millions)

Industry Description	Output	Labor Income	Employment
Power generation and supply	$415.8	$112.3	668
Owner-occupied dwellings	$50.7	-	-
Machinery and equipment maintenance	$41.0	$24.9	368
Real estate establishments	$37.4	$3.7	246
Wholesale trade businesses	$30.7	$13.0	168
Monetary authorities	$27.9	$5.3	75
Food services and drinking places	$26.1	$10.0	459
Private hospitals	$24.3	$12.3	183
Petroleum refineries	$24.1	$0.6	2
Offices of health practitioners	$23.7	$15.2	195
Other	$671.5	$251.9	5,139
Total	**$1,373.2**	**$449.1**	**7,503**

As this study has shown, Seabrook's impact on the local, state and national economies is substantial. By producing affordable, reliable energy, the plant is a hub of economic activity for New Hampshire and Massachusetts' counties, a major stimulus of economic activity for the states and a boost to the national economy in a variety of ways.

The following tables provide the multipliers and summarize the total effects for each region discussed.

Table 2.7 Multipliers for the Seabrook Nuclear Plant

Area	Output	Labor Income	Employment
Local Counties	1.34	1.77	3.28
Massachusetts	1.10	2.58	8.09
New Hampshire	1.39	1.79	3.75
United States	3.43	4.09	11.54

Table 2.8 Impact of the Seabrook Nuclear Plant on the Local, State and National Economies (dollars in millions)

Description	Direct	Secondary[a]	Total
Local Counties			
Output	$400.0	$135.3	$535.3
Labor Income	$78.9	$61.0	$139.8
Employment	548	1,251	1,799
Massachusetts			
Output	$400.0	$41.4	$441.4
Labor Income	$12.2	$19.2	$31.4
Employment	47	333	380
New Hampshire			
Output	$400.0	$157.5	$557.5
Labor Income	$88.3	$69.5	$157.8
Employment	528	1,453	1,981
United States			
Output	$400.0	$973.2	$1,373.2
Labor Income	$109.9	$339.3	$449.1
Employment	650	6,853	7,503

[a]*Secondary effects include indirect and induced impacts. Indirect impacts measure the effect of input suppliers on expenditures while induced impacts measure the effects produced by the change in household income resulting from expenditures.*

Economic Stimulus through Taxes

Seabrook contributed $23 million in direct state and local property taxes. Along the same lines as the secondary effects and output just discussed, the tax revenue contributed by the plant extends beyond the direct property tax revenue.

Spending from the plant has direct impacts on income and value creation, which in turn affects taxes paid on that income and value. Additionally, the plant expenditures we explored earlier increase economic activity, leading to additional income and value creation and therefore higher tax revenue.

When calculating the total tax impact (direct and secondary), the plant's operations resulted in $109 million in tax revenue, mostly from income and Social Security taxes.

Table 2.9 Total Tax Impacts[a] of Economic Activity Induced by the Seabrook Nuclear Plant (dollars in millions)

Government	Taxes Paid	Taxes Induced	Total Tax Impact[a]
Federal	-	$69.3	$69.3
State and Local	$23.4	$16.6	$40.0
Total Taxes	**$23.4**	**$85.9**	**$109.3**

[a]*The total tax impact includes taxes paid by Seabrook and other entities because of economic activity created by expenditures made by the plant.*

Summary

The Seabrook nuclear plant, owned and operated by NextEra Energy in New Hampshire, has substantial economic impacts on the local communities and states. When compared with their respective economies, those direct impacts are highest at the county level, next highest for Massachusetts and New Hampshire, and lowest for the United States.

Like other nuclear energy operators, NextEra Energy must buy many specialized products and services not available in local and state economies to operate its nuclear plants safely and efficiently. National and international markets typically provide these products and services.

The state and local economic effects of the plants are considerable because of the buying power created by the high wages, salaries and benefits paid by the plants to their employees. In turn, plant employees stimulate their economies by buying goods and services provided locally. This spending supports many small businesses in the area.

Section 3: Seabrook in the Community and the Environment

Seabrook is an active corporate leader in the local community. The plant is dedicated to educational progress, environmental support and community involvement.

Seabrook Encourages Education

Many of Seabrook's community activities focus on education. The site is home to the Science & Nature Center, a well-known destination for schools, civic groups and people who are interested in learning about electricity generation and the thriving ecosystem that surrounds the plant. The center offers:

- Free programs for students on electricity, nuclear energy and environmental stewardship
- A variety of interactive educational displays
- A marine "touch pool" where visitors can see and hold marine life
- Aquariums containing dramatic collections of local fish, and featuring exceptional specimens, including both blue and orange lobsters
- A nature trail featuring a boardwalk almost a mile long that winds throughout the plant's marsh and wooded areas

The interactive and educational displays in the Science & Nature Center also include a simulated journey 260 feet below sea level through granite bedrock in an elevator ride to Seabrook's cooling tunnels, exhibits that show how electricity is produced from a nuclear reactor, and hands-on demonstrations of how much energy it takes to use home appliances.

Seabrook's Environmental Support

Seabrook is dedicated to protecting the environment while meeting the energy needs of New England. Seabrook's marsh and wooded areas are home to a wide variety of birds and other animals, many of which can be observed on the nature trail that winds through a portion of the site.

Seabrook is one of only a few nuclear power plants in this country that is ISO 14001-certified, an internationally recognized environmental management standard, recognizing the plant's leadership and excellence in environmental stewardship. Originally granted in 2002, Seabrook's ISO 14001 certification has been consistently renewed during the past 11 years.

Located on ecologically-sensitive marshlands adjacent to the Atlantic Ocean, Seabrook has played a key role in protection of the regional environment. Seabrook employees have "adopted" a portion of Seabrook beach for monthly cleanup, and for many years, the plant has supported the New Hampshire Estuary Project, an organization working to improve the water quality in the Hampton/Seabrook Estuary. One of these estuary improvement projects was rebuilding the decaying Brown's River Culvert, a major project that helped restore tidal water flow to revitalize the health and vitality of the marsh habitat near the plant.

Additionally, Seabrook recently provided financial support for two major environmental initiatives - the installation of the Hampton Harbor Tidal Gauge, which monitors water level to help planners prepare and respond to coastal storms and sea-level rise, and a project that is providing scientists ongoing estuary water quality monitoring.

All told, Seabrook's financial contributions to local environmental groups over the past decade have amounted to more than $1 million.

Seabrook as a Community Leader

Seabrook is a leading corporate citizen in New Hampshire and Massachusetts. Members of the plant's team serve their communities as elected town officials, volunteer firefighters and emergency medical technicians. They provide thousands of hours to more than 70 civic and community organizations and make significant contributions to United Way agencies each year. Here are some examples:

- **United Way: $180,000 annually**
  - Employee giving and event participation
  - Annual events, including 24-year sponsorship of the charity golf tournament that raises $30,000+ to jump-start the annual Seacoast United Way campaign
  - Employee participation in two major "Days of Caring" annually
- **Other Contributions:** Over the past decade, the plant has also contributed an average of $80,000 annually to various other charitable groups and nonprofit arts organizations throughout the region.

Section 4: Seabrook and the Future of the Nuclear Industry

As this study has empirically shown, Seabrook is a leader in producing clean, safe and affordable energy for decades. At a time when energy production throughout the U.S. is a point of debate, concern and enthusiasm for policymakers and citizens, it is worth discussing the general trends in nuclear energy and the important role it plays in meeting America's demand for affordable, reliable and sustainable energy.

In 2012, electricity production from U.S. nuclear power plants was almost 770 billion kilowatt-hours – nearly 20 percent of America's electricity production. In fact, in New Hampshire, nuclear power generated 40 percent of the state's power.

U.S. nuclear plants achieved an industry-leading performance capacity factor of 86 percent in 2012, while producing energy at one of the lowest costs of any baseload fuel source. As previously discussed, Seabrook has been operating at or above this industry average for generating capacity for many years.

Improvements in Industry Performance

Over the past 20 years, U.S. nuclear power plants have increased output and improved performance significantly. Since 1990, the industry has increased total output equivalent to that of 24 new, large plants, when in fact only five have come online.

Compared to the current capacity factor of 86 percent, the industry's capacity factor in the 1980s was 60 percent. One reason for the jump in productivity is improvements in refueling outage schedules.

Every 18 to 24 months, plants must shut down to refuel, which is one of the major determinants of nuclear plant availability. In 1990, it took 104 days to refuel. But in 2012, this number declined to an average of 45 days, with one refueling outage as short as 14.7 days (for a boiling water reactor).

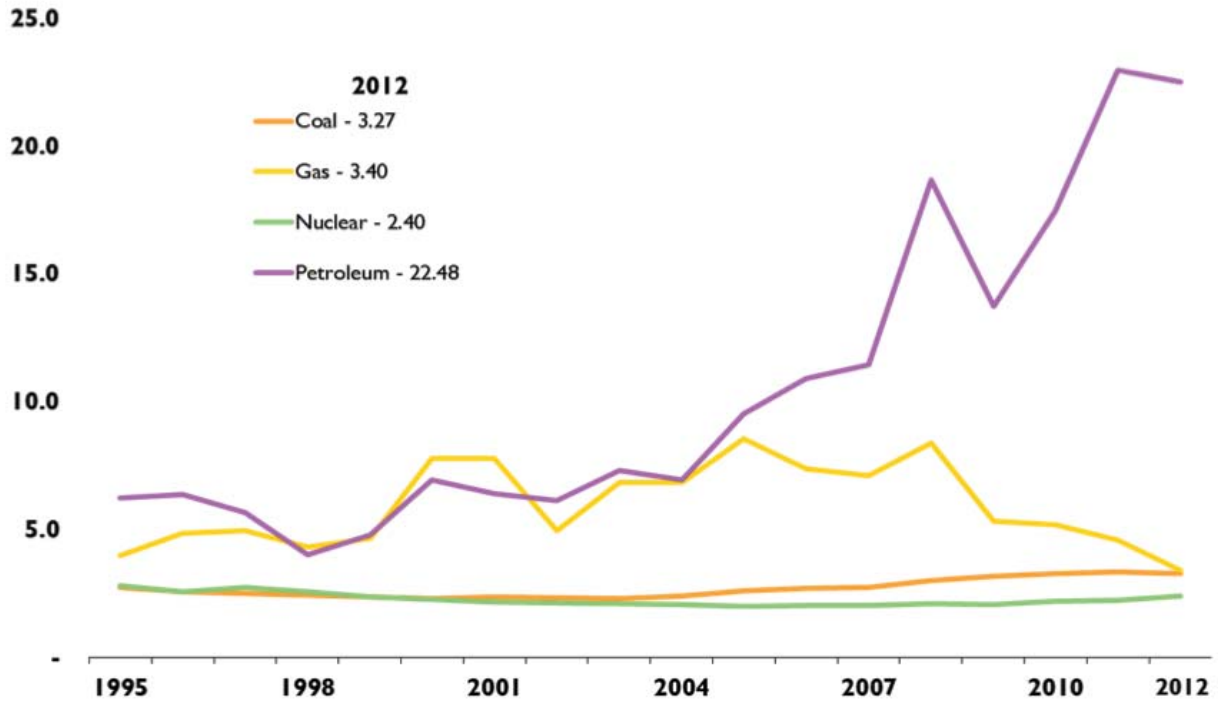
Affordable Energy for Consumers

In addition to increasing output, the U.S. nuclear industry has continued to become more cost-effective and affordable for consumers. In 2012, nuclear power had a production cost of 2.4 cents per kilowatt-hour.

Compared to fossil fuels – which are dependent on the price of fuel – nuclear plant fuel costs are stable, and therefore production is more economical on average.

U.S. nuclear plants achieved an industry-leading performance capacity factor of 86 percent in 2012, while producing energy at one of the lowest costs of any baseload fuel source.

Figure 4.0 U.S. Electricity Production Costs (1995-2012, in 2012 cents per kilowatt-hour)



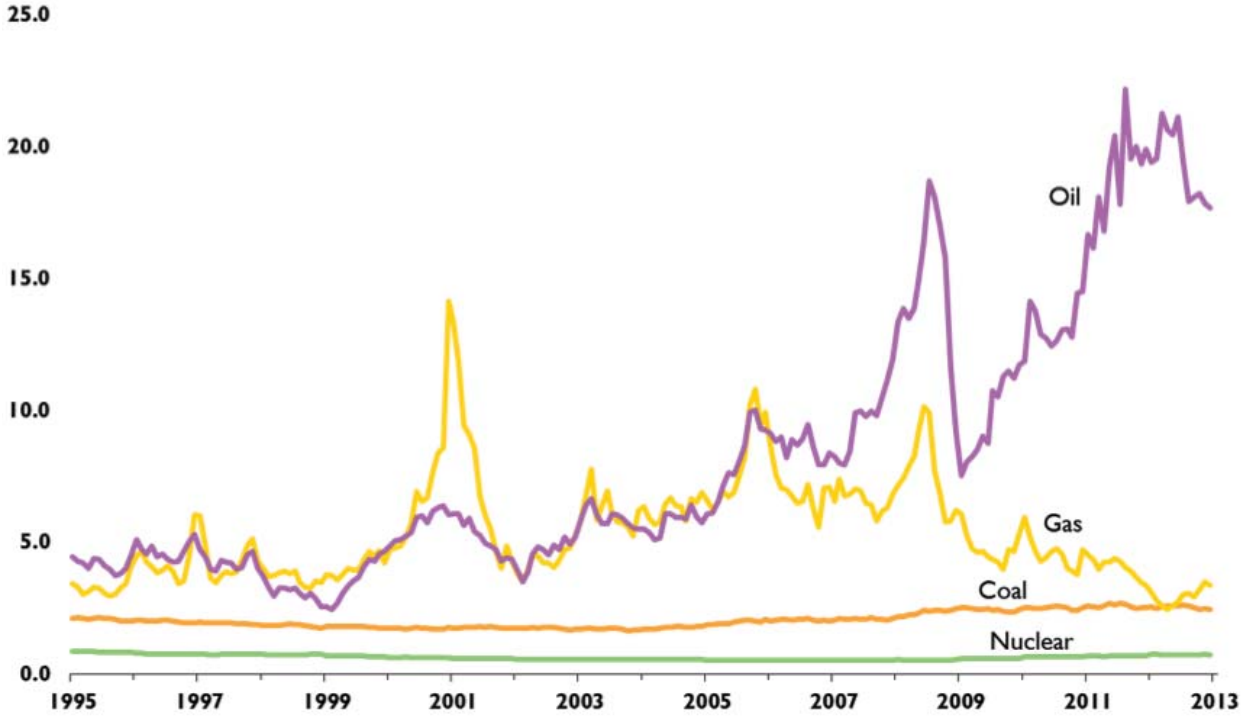
Source: Ventyx Velocity Suite

Nuclear plants are highly competitive in today's energy markets. They perform well against market prices, a true measure of competitiveness. The average 2012 production cost at the nation's 104 reactors of 2.4 cents per kilowatt-hour was lower than the average price in all regional markets. Future market prices for nuclear energy are just as competitive.

Nuclear plants provide a unique degree of price stability for two reasons. First, uranium fuel represents only 31 percent of the production cost of nuclear energy. Comparatively, fuel costs make up 78 percent to 88 percent of the cost of coal-fired and natural gas generation, respectively. Fuel markets tend to be volatile, so the production costs of generation sources tied to fuel expenses are highly volatile, as they swing with variations in the market.

Second, nuclear fuel prices are much more stable than those of fossil fuels, particularly natural gas and petroleum. Because of its stable, low production cost, nuclear energy can help mitigate large electricity price swings.

Figure 4.1 Monthly Fuel Cost to Electric Generators (1995-2012, in 2012 cents per kilowatt-hour)



Source: Ventyx Velocity Suite

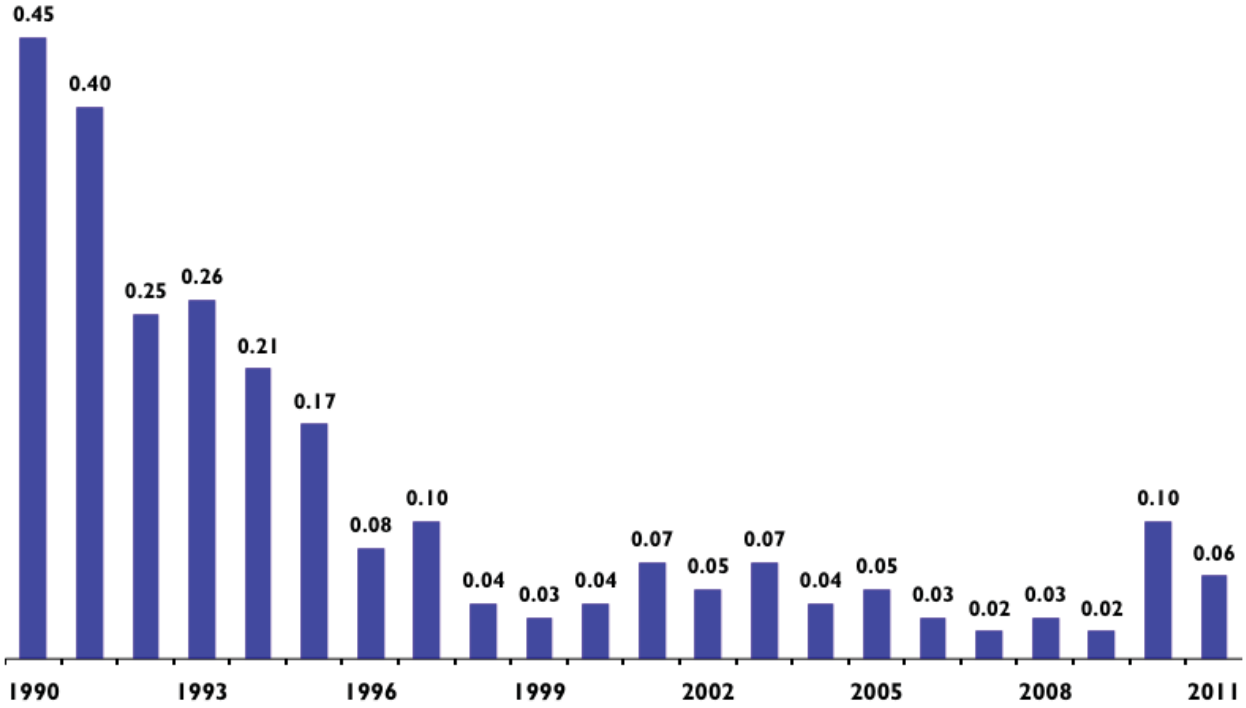
Emphasis on Industry Safety

Safety continues to be the highest priority for the nuclear industry. In 2012, the nuclear energy industry was close (95 percent) to meeting all safety goals set by the Institute of Nuclear Power Operations (INPO) and the World Association of Nuclear Operators (WANO). These entities track safety and performance data in nine important areas.

One key indicator tracked by INPO and WANO is the number of unplanned automatic plant shutdowns. The U.S. industry has maintained a low rate in the number of unplanned automatic shutdowns, reversing a six-year trend and making 2012 tied for the best year ever for the lowest number of unplanned shutdowns.

The U.S. Nuclear Regulatory Commission (NRC) 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 2011, again illustrating the emphasis on safety throughout the nuclear industry.

Figure 4.2 Significant Events: Annual Industry Average (Number of events per reactor, 1990-2011)

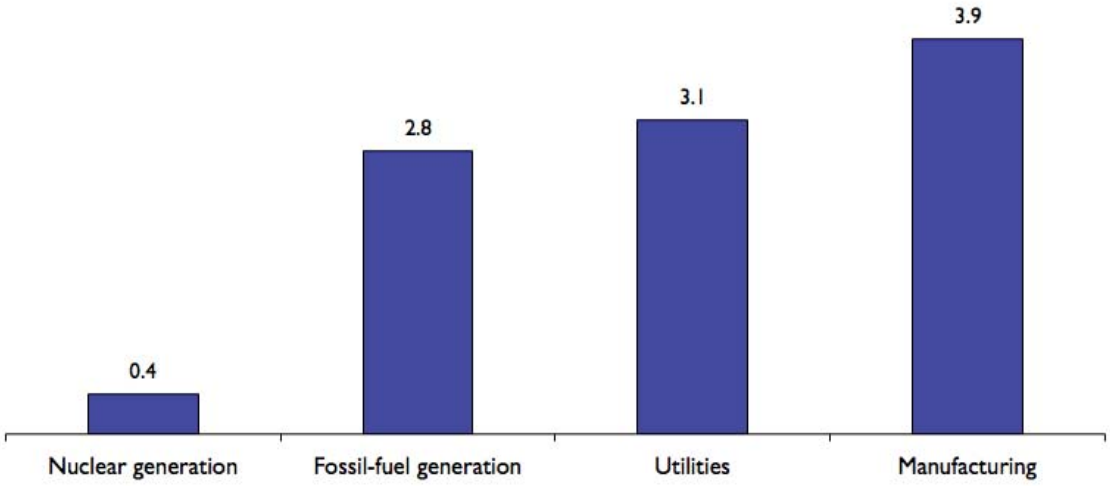


Source: U.S. Nuclear Regulatory Commission

In addition to safe operations, U.S. nuclear plants continue to emphasize the critical nature of worker safety. According to NRC data, radiation exposure to workers (measured in rems) decreased from an average of about 1 rem per year in 1973 to 0.11 rem per year in 2011. Both the historical and current radiation doses per employee are far below the U.S. regulatory limit of five rem per year.

General worker safety also is excellent at U.S. nuclear power plants—far safer than in the U.S. manufacturing sector. The U.S. Bureau of Labor Statistics provides information on the industrial safety incidence rate. This statistic measures the number of injuries and illnesses per 200,000 worker-hours. The nuclear industry in 2011 achieved an incidence rate of 0.4, compared to 2.8 for fossil-fuel generation, 3.1 for utilities and 3.9 for the manufacturing industry.

Figure 4.3 Nuclear's Superior Worker Safety Record (2011 U.S. Industrial Safety Incidence Rates Compared to Other Industries)



Source: U.S. Bureau of Labor Statistics
Incidence rates are the number of injuries and illnesses per 200,000 worker hours.

Current Industry Trends

The excellent economic and safety performance of U.S. nuclear plants has demonstrated the value of nuclear energy to the electric utility 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 plants can operate safely for longer periods. The NRC granted the first 20-year license renewal to the Calvert Cliffs plant in Maryland in 2000. As of October 2013, 73 reactors have received license extensions and 30 reactors either have submitted applications or formally announced that they will seek to renew their licenses. 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 current plants, energy companies are building new nuclear plants. The NRC voted in February 2012 to grant a combined construction and operating license for two reactors at Southern Co. subsidiary Georgia Power's Plant Vogtle, near Waynesboro, Ga. It is the first combined license ever approved for a U.S. nuclear energy facility, which will become the nation's first new nuclear units built in 30 years. On March 30, 2012, the NRC issued combined construction and operating licenses to South Carolina Electric & Gas Co. for two reactors near Jenkinsville, S.C. All four projects are proceeding through the construction stage, hiring more than 5,000 workers between them. Also, Tennesee Valley Authority is completing construction on the Watts Bar 2 reactor in Tennesee. Some 18 companies and consortia are studying, licensing or building more than 30 nuclear power reactors.

Section 5: Economic Impact Analysis Methodology

The methodology used to estimate the economic and fiscal impacts of the NextEra Energy plant is commonly referred to as an input/output analysis. Several operational input/output models are available in the marketplace. The market leaders are Impact Analysis for Planning (IMPLAN), Regional Economic Models Inc. and Regional Input-Output Modeling System II. The study's authors selected the IMPLAN model for use in this study, primarily because of the availability of the model and data sets. Other important factors were its relevance to the particular application as well as its transparency and ease of use.

This section presents typical applications of input/output analysis and explains the methodology and its underpinnings. It also describes how NextEra's data and the IMPLAN model were used to estimate local, state and national economic and fiscal impacts of the plant's operations.

Use of Input/Output Models

Input/output models capture input and output, or demand and supply, that represent interrelationships for detailed business, industry and government sectors in a geographic region. They also capture the consumption of goods and services for final demand by these sectors and by the household sector.

The basic geographic region is a county, but model results can be developed at the multi-county, state, multi-state and national levels. These results are particularly useful in examining the total effects of an economic activity or a change in the level of that activity.

These models are typically used when the following key questions need to be addressed:

- How much spending does an economic activity (such as a power plant) bring to a region or local area?
- How much of this spending results in sales growth by local businesses?
- How much income is generated for local businesses and households?
- How many jobs does this activity support?
- How much tax revenue is generated by this activity?

These models also are useful in addressing related questions, such as the geographic and industry distribution of economic and fiscal impacts. Typical applications of these models include facility or military base openings and closings, transport or other public infrastructure investments, industrial recruitment, relocation and tourism.

Overview of the Input/Output Methodology

Input/output models link various sectors of the economy—e.g., agriculture, construction, government, households, manufacturing, services and trade—through their respective spending flows in a reference year. These include geographic linkages, primarily at national, state and county levels.

As a result of these linkages, the impact of an economic activity in any sector or geographic area on other sectors and areas can be modeled. These impacts can extend well beyond the sector and area in which the original economic activity is located. They include not only the direct, or initial, effects of the economic activity, but also the secondary, or "ripple," effects that flow from this activity. Direct effects are analogous to the initial "splash" made by the economic activity, and ripple effects are analogous to the subsequent "waves" of economic activity (new employment, income, production and spending) triggered by the splash. A full accounting of the effect of the splash must include the waves as well as the splash itself.

The sum of the direct and ripple effects is called the total effect, and the ratio of the total effect to the direct effect is called the "total effect multiplier," or simply the multiplier effect. Multipliers can be developed for any of the model outputs, such as earned income, employment, industry output and total income, which includes the effect of transfers between institutions.

"Multipliers" can also be developed for any industry/business sector or geographic area in the model. Multipliers for a county are smaller than for a larger area, such as the state in which the county is located, because some spending associated with an economic activity migrates from the small area into the larger area. At the local area level, multipliers are larger if the local area tends to produce the types of goods and services that the plant requires.

Secondary effects include two components—indirect and induced effects—modeled separately within input/output models. Indirect effects are those influencing the supply chain that feeds into the business/industry sector in which the economic activity is located. For example, when a nuclear plant buys a hammer for $5, it contributes directly to the economy.

Consequently, the company that makes the hammer also has to increase its purchases of steel and wood to maintain its inventory, increasing output in the steel and wood industries. The steel and wood industries then will have to purchase more inputs for their production processes, and so on. The result will be an economic impact that is greater than the $5 initially spent for the hammer.

The increased income of plant employees and other regional workers leads to higher spending at the household level. That increased spending is called the induced effect. To illustrate, when a nuclear plant pays $5 for a hammer, a portion of the $5 goes to pay wages of employees at the company that makes the hammer. This portion contributes to labor income, which provides an additional contribution to the economy through its effects on household spending for goods and services.

This purchase also will affect labor income in the wood and steel industries, and the resulting household spending on goods and services. Seabrook's wage and salary expenditures at the plant creates induced effects as well, primarily in the plant's host and surrounding counties.

As with any model, input/output models incorporate some simplifying assumptions to make them tractable. There are several key simplifying assumptions in input/output models, including the assumption of a fixed commodity input structure. In essence, the "recipe" for producing a product or service is fixed, and there is no

substitution of inputs, either of new inputs (which were not in the mix before) for old inputs, or among inputs within the mix.

Input substitution does not occur if technical improvements in some inputs make them relatively more productive. Nor does input substitution occur if there are relative price changes among inputs. Were any of these types of substitutions to be allowed, they might dampen the multiplier effects, especially for larger geographic areas.

Another key simplifying assumption is constant returns to scale. A doubling of commodity or service output requires a doubling of inputs, and a halving of commodity or service output requires a halving of inputs. There is no opportunity for input use relative to commodity or service production levels to change, as those levels expand or contract, so there are no opportunities for either economies or diseconomies of scale. This will not dramatically alter the overall results as long as the economic activity whose effects are being modeled is not large relative to the rest of the sectors.

In other words, the models assume that for every dollar of output, the same dollar amount is required for the various input categories. Returning to the hammer example, if a $5 hammer requires $3 of steel, then two hammers would require $6 of steel.

Although that works for steel and hammers, some inputs do not vary directly with output. For instance, if an oil refinery's efficiency and output increases, a corresponding increase in personnel operating the plant is unlikely. The constant-return-to-scale assumption considers such differences and is necessary for modeling.

Input/output models assume no input supply or commodity/service production capability constraints. This simplifying assumption is related in part to the constant-returns-to-scale assumption, for if there were supply constraints, diseconomies of scale likely would result. As in the case of the constant-returns-to-scale assumption, this "no supply constraints" assumption is not a major concern as long as the economic activity of interest is not large relative to the rest of the sectors.

To illustrate, the assumption presupposes that a hammer manufacturer would purchase all the steel for the same price. If not, doubling the number of hammers sold could mean that the dollar value of the steel might more than double if the manufacturer had to buy more steel at a higher price. This would violate the constant-returns-to-scale assumption, which simplifies modeling.

Homogeneity, another key simplifying assumption, characterizes firms and technologies within sectors as very similar. Although the model allows some editing of its sector files to characterize specialized firms, there is no ability to reflect full diversity of firms within sectors.

The IMPLAN Model and Its Application to Seabrook

IMPLAN was originally developed by the U.S. Department of Agriculture's Forest Service in cooperation with the Federal Emergency Management Agency and the U.S. Department of the Interior's Bureau of Land Management to assist in land and resource management planning. IMPLAN has been used since 1979 and is supported by the Minnesota IMPLAN Group Inc.

The IMPLAN system consists of two components: the software and the database. The software performs the necessary calculations, using the study area data, to create the models. It also provides an interface for the user to change the region's economic description, create impact scenarios and introduce changes into the local model. The software is described in a user's guide provided by the Minnesota IMPLAN Group.

The IMPLAN software was designed to serve four functions: data retrieval, data reduction, model development and impact analyses. The IMPLAN database consists of two major parts:

- national technology matrices
- estimates of regional data for institutional demand and transfers, value added, industry output and employment for each county in the United States as well as state and national totals.

The model's data and account structure closely follow the accounting conventions used in the input/output studies of the U.S. economy by the Department of Commerce's Bureau of Economic Analysis. The comprehensive and detailed data coverage of the entire United States by county, and the ability to incorporate user-supplied data at each stage of the model-building process, provides a high degree of flexibility in terms of both geographic coverage and model formulation.

In applying the IMPLAN model to the plant, NextEra Energy provided three basic types of data: purchase order expenditures by purchase order code, employee compensation expenditures and tax payment data for 2011.

The purchase order data mapped IMPLAN's 440 sector codes by identifying the spending at each geographic level and assigning them an industrial classification code within IMPLAN sector codes. The purchase order and compensation data then were augmented by an estimate of revenues from electricity sales from the nuclear plant into the wholesale market in 2011. This augmentation was necessary because purchase orders and compensation do not reflect all the economic value of the nuclear plant, while total output (approximated by total revenues) better reflects the full economic impacts of the plant.

The estimated revenues were above the expenditure data provided by the nuclear plant, indicating a nuclear generation profit margin that was incorporated into IMPLAN as profits associated with the operation of the plant.

These data then were incorporated into the IMPLAN model, which combined specifics of the local economy with data on economic activity of the nuclear plants to provide estimates of the plant's total impacts. IMPLAN then developed the economic and fiscal impact estimates for this report.

Conclusion

As we have seen in the course of this study, the Seabrook Station is a leader economically, fiscally, environmentally and socially within New Hampshire and the nation.

The total economic impact (direct and secondary) of Seabrook to the country was $1.4 billion in 2011. The operation of the Seabrook Station and its secondary effects accounted for nearly 2,000 jobs in New Hampshire, and an additional 5,500 jobs throughout the country. These jobs resulted in $449 million created in earnings to American workers.

Economy aside, the plant generated more than eight billion kilowatt-hours of electricity in 2012, enough to serve the yearly needs for 1.2 million homes. This low-cost electricity helped keep energy prices affordable in New Hampshire. The plant also supports community initiatives through educational support, environmentally-friendly practices and charitable giving. As a leader in corporate responsibility throughout the region, Seabrook will continue to support the community in the coming years.

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