Economic Impact of Florida Power & Light Company's Nuclear Power Plants

An Analysis by the Nuclear Energy Institute

April 2015

NUCLEAR ENERGY INSTITUTE

www.nei.org

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March 2015

Recently, I was requested by NextEra Energy to perform an independent review of a report by the Nuclear Energy Institute (NEI) regarding the economic impact of Florida Power and Light Company's Nuclear Power Plants.

In summary, it's my view that the economic impact analysis conducted by NEI of FPL's nuclear power plants is a realistic and credible estimate of the economic impacts associated with the existing FPL nuclear power plants.

I've been employed as Director of the Florida State University Center for Economic Forecasting and Analysis (FSU CEFA) for about nine years*, and President of Economic Research Enterprises, since 2000. My current research area is directed towards the areas of natural resources/environment, energy, advanced technologies, economic development, and education economics, among others. I have extensive experience in the area of economic impact analysis and associated methodologies, and with various statistical and economic impacts modeling software (i.e., REMI and IMPLAN).

My role in the review of the NEI report is focused on the overall report's structure and economic impact methodology. As such, the review process did not include any financial or economic data validation.

Concerning the key findings, the economic impact results are presented and discussed according to standard reporting of results; i.e., in terms of direct and secondary (or indirect and induced) impacts relating to: output, employment and income (wages). One would expect additional economic activity generated on a state and national level, which is the case. In addition, it is reasonable to expect that given the higher average wages of the nuclear plant employees, wages would comprise a substantive portion of the local spending.

Regarding the economic methodology, the report provided a good overview of the IMPLAN model used, definition of economic impact terms, and an overview of the economic input/output methodology. The economic model represented the impacts under normal operating conditions, and didn't include additional capital outlay or investment costs associated with recent nuclear plant unit expansion or uprate efforts. The input data used for the model included expenditures based on: year 2013 purchase orders, compensation (salaries), and tax payments, and an estimate of revenues (or profit margin) from electricity sales from the nuclear plant to the wholesale market for year 2011.

There was very little discussion as to how the data was collected and what was included in the aforementioned expenditures categories line items. It's unclear whether there was any state, or public, investment in the analysis. However, one can assume that the NEI report authors captured all FPL expenditures (or revenue share) data for 2013. It's reasonable to assume that in addition to salaries, the highest costs associated with nuclear plant operations are fuel and maintenance and construction repair.

Sincerely,

Julie Harrington, Ph.D.
President, Economic Research Enterprises

**It should be noted that opinions expressed herein are my own and are not to be taken as representative of the opinions of the Florida State University.*

St. Lucie EDC

March 26, 2015

To Whom It May Concern:

The Florida Power & Light Company St. Lucie Nuclear Power Plant has been a staple of this community in many ways for many years. Regardless of the economic ups and downs that the Treasure Coast has experienced over the last four decades, one thing that has been as reliable as the electricity produced by the St. Lucie plant is the economic benefits that are delivered to our community.

Every year, the St. Lucie plant is responsible for the full-time employment of more than 600 people in our community, many of who are veterans. Nearly everyone who lives in the area knows someone who works at the plant or has a friend or family member who has some tie to it. In addition, there are hundreds of workers who come to the area during a refueling outage, which is an economic windfall for our businesses. Furthermore, hundreds of millions are spent right here in the Sunshine State to keep the plant modern and efficient, and we benefit from that too. Our schools and public infrastructure benefit from the significant tax revenues that the plant provides year in and year out.

Beyond the economic benefits, the St. Lucie plant generates enough electricity to power more than a million homes without creating any greenhouse gases. In an area that is so depending on our natural resources like the beaches, bays and ocean, it is great to have such an environmentally responsibly company. We reap benefits from the St. Lucie plant in a number of ways including wildlife programs such as annual turtle walks co-hosted with the Florida Fish & Wildlife Service and through the site's partnership with the Loggerhead Marine Life Center to rescue injured sea turtles.

When you step back and take a holistic look at the economic and environmental ways that the St. Lucie power plant has helped shaped this area and continues to deliver benefits, the more I realize that its substantial benefits should be recognized and appreciated.

Sincerely,

Peter J. Tesch
President

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SOUTH DADE
CHAMBER OF COMMERCE
The Voice of Business Since 1915

April 2015

As President of the South Dade Chamber of Commerce, I could not be more pleased to have Florida Power & Light Company's Turkey Point nuclear power plant in our backyard. For decades, Turkey Point has reliably produced clean, reliable electricity with no greenhouse gas emissions and contributes in many meaningful ways to our area's economic health.

I have seen firsthand how Turkey Point is a major economic catalyst for our businesses and neighborhoods. The hundreds of full-time, good paying jobs provided by the site have a significant positive ripple effect throughout our community. Beyond the jobs themselves, the employees live, eat, shop and inject money locally. Beyond those who live and work here on a permanent basis, there are thousands of specialized workers who routinely come to the plant from outside this area who stay in our hotels, eat in our restaurants and further strengthen our economy.

In addition to the existing plant, the construction of two new units would be one of the largest projects in the history of the State of Florida, creating an estimated 3,500 jobs during construction and 800 permanent jobs once the plant is operational. From materials to labor to the services needed to support the massive construction team, this project would benefit thousands of South Florida businesses. These investments in new nuclear power would do more than just create jobs; they also save all of us money. Since nuclear fuel prices tend to be low and stable compared to other fuels, FPL estimates that the new nuclear units would save FPL customers more than $170 billion in fossil fuel costs over a 60-year lifetime. This is a staggering dollar amount, and building the new nuclear plants would keep that money in our pockets and off our bills. This is good news for all of South Florida's families and local businesses, which power the economy of small towns like Homestead.

Regardless if measuring its positives today or in the decades to come, the Turkey Point plant is a vital part of this community, and I am very pleased with its current widespread benefits and optimistic for the many opportunities that expanding Turkey Point would bring to local entrepreneurs, job-seekers and our entire area.

Rosa Brito
President
South Dade Chamber of Commerce

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Executive Summary

For nearly a century, Florida Power & Light Company (FPL) has played an important role in the state's energy portfolio and economy. Today, FPL is the largest rate-regulated electric utility in Florida and serves approximately 4.7 million customers, the third-largest number of customers of any electric utility in the United States.

Since the 1970s, FPL's nuclear power plants have provided highly reliable, 100 percent carbon-free electricity to millions of Floridians. FPL now generates approximately 24 percent of its electricity, or enough to power approximately 2 million homes, from four nuclear reactors at two facilities: the St. Lucie Nuclear Power Plant, located on Hutchinson Island in St. Lucie County, and the Turkey Point Nuclear Power Plant, located near Homestead in Miami-Dade County. In addition, FPL's corporate nuclear staff supports these plants' operations from the its headquarters in Juno Beach, Fla.

FPL's nuclear operations generate approximately $1.4 billion of economic output in Florida and employ about 1,600 people full-time.

To help quantify the economic impact and job creation of these operations, the Nuclear Energy Institute (NEI) conducted an independent analysis of the company's ongoing economic, fiscal impact based on data provided by FPL.

Key Findings

FPL's nuclear operations have a significant impact on Florida's economy and the communities where its nuclear plants operate. In particular, during a non-refueling outage year, the study finds:

Large local impacts and statewide "ripple" effects. Every year, FPL's nuclear operations generate a combined $1.2 billion of economic activity in the counties around the Turkey Point and St. Lucie plants. In addition, FPL's nuclear operations generate an additional $200 million in economic activity for a statewide impact of $1.4 billion and $2.5 billion of economic activity across the United States.

This study finds that for every dollar spent by FPL's nuclear operations, the local county economies on average produce $1.27 and the state economy produces $1.50.

Thousands of jobs at higher-than-average wages. Turkey Point and St. Lucie plants and nuclear corporate headquarters employ about 1,600 people. The average FPL nuclear plant employee's compensation is $97,500, or more than twice the average earnings of other workers in their respective counties ($37,800 near the St. Lucie plant and $43,250 near the Turkey Point plant). In addition to those people FPL employs directly, the company's nuclear operations indirectly support more than 4,200 other jobs (vendors, contractors, services) throughout Florida and 8,600 across the United States.

Reliable, clean energy. The St. Lucie and Turkey Point plants generate approximately 3,700 megawatts of emissions-free, around-the-clock electricity for Florida homes and businesses. Over the last 10 years, the facilities have operated at around 90 percent of capacity. Because of the plants' high reliability and the low, steady cost of nuclear fuel, FPL's nuclear plants help offset price fluctuations that can be associated with other fuel sources. The units also offer fuel diversity from fossil fuel power plants.

Moreover, since nuclear power plants do not release greenhouse gases, FPL's four nuclear units prevent the release of more than 15 million tons of carbon dioxide annually, the equivalent of taking nearly three million cars off the road every year.

Economic Highlights

	St. Lucie	Turkey Point	FPL Nuclear HQ	Total
Local economic output *(direct & secondary)*	$630 million	$543 million	$29 million	$1.2 billion
Local spending *(direct)*	$122 million	$147 million	$19 million	$288 million
Local jobs *(direct & secondary)*	1,515	2,405	203	4,123
State economic output *(direct & secondary)*	$765 million	$600 million	$60 million	$1.4 billion
State spending *(direct)*	$174 million	$167 million	$27 million	$368 million
State jobs *(direct & secondary)*	2,712	2,750	393	5,854

St. Lucie (Units 1 and 2)

Dates of commercial operation:
St. Lucie 1 - 1976 / St. Lucie 2 - 1983

Location: 1,130-acre site on Hutchinson Island about 8 miles southeast of Fort Pierce

NRC License Expiration Years:
2036 and 2043

Reactor Type: Pressurized water reactors

Total Electrical Capacity: 1,968 megawatts

Turkey Point (Units 3 and 4)

Dates of commercial operation:
Turkey Point 3 - 1972 / Turkey Point 4 - 1973

Location: 11,000-acre site on Biscayne Bay, 25 miles south of Miami and just east of the Homestead area

NRC License Expiration Years:
2032 and 2033

Reactor Type: Pressurized water reactors

Total Electrical Capacity: 1,632 megawatts

Section 1

Background and Generation History

FPL is the largest rate-regulated electric utility in Florida and serves approximately 4.7 million customers, the third-largest number of customers of any electric utility in the United States.

Reliable Electricity Generation

The St. Lucie and Turkey Point nuclear plants generate enough power each year for approximately 2 million homes and represent approximately 24 percent of FPL's total electricity generation.

One measure of a nuclear power plant's performance is "capacity factor." Capacity factor is its electricity production efficiency, the ratio of actual electricity generated to the maximum possible electric generation during the year. St. Lucie and Turkey Point nuclear power plants have operated at capacity factors consistent with the industry average of 90 percent. Because the cost of nuclear fuel is low and steady, and the St. Lucie and Turkey Point plants perform at high capacity factors, the power generated by these plants reduces the need for generation from other sources, including fossil fuels.

Local Jobs

St. Lucie and Turkey Point each employ approximately 700 full-time workers and have an average annual payroll of more than $100 million per plant. On average, FPL nuclear plant employees earn $97,500, or more than twice the average wage in the counties in which they reside ($37,800 near the St. Lucie plant and $43,250 near the Turkey Point plant).

In addition to full-time FPL employees, each plant also employs a significant number of contract workers at any given time and even greater numbers during refueling outage periods, which occur about every 18 months per unit. During a refueling outage, these facilities employ up to 1,500 additional workers mostly from outside the area due to the specialized skills required. These workers boost the economy by utilizing local hotels, stores and restaurants.

Environmental Benefits

Turkey Point and St. Lucie generate large amounts of electricity without emitting greenhouse gases. In 2013, St. Lucie's and Turkey Point's nuclear operations combined prevented more than 15 million metric tons of carbon dioxide[1] (8.9 million at St. Lucie and 6.2 million at Turkey Point), about the same amount released every year by nearly three million cars. The four units also prevented the emission of 12,200 tons of sulfur dioxide and more than 7,000 tons of nitrogen oxide, equivalent to that released by nearly 400,000 cars.

[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 Benefits for Local, State and National Economies

The economic benefits of FPL's nuclear operations extend well beyond local jobs and incomes. Although a significant portion of a nuclear power plant's expenditures benefit its own community, some specialized skills and services come from elsewhere in the state or country because of nuclear plants' highly technical nature. This creates additional, significant economic impacts well beyond the local community.

NEI used the Impact Analysis for Planning (IMPLAN) model to analyze expenditure data provided by FPL and to develop estimates of these effects (more information on IMPLAN can be found in Section 5).

Economic Impact: The economic impact of FPL's nuclear operations consists of direct and secondary effects. The main variables used to analyze these effects are:

- **Output**: the value of production of goods and services—e.g., sales
- **Labor income**: workers' earnings
- **Employment**: jobs provided

Direct Effects: The direct effects are the estimated value of power produced by FPL's nuclear plants and the spending from FPL's nuclear headquarters which, combined at the local, state and national levels, totaled nearly $1 billion in 2013. The direct effects include purchases, salaries, earnings and taxes. It does not include subsequent spending effects.

Secondary Effects: The secondary effects measure how FPL's nuclear spending alters subsequent spending among suppliers and how those employed at the facilities influence the demand for goods and services within their communities.

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

Local Impact

In 2013, St. Lucie spent $122 million in its local counties (St. Lucie, Martin, Indian River and Okeechobee); Turkey Point spent $147 million in its local counties (Miami-Dade, Broward and Monroe); and the nuclear corporate headquarters spent approximately $19 million in Palm Beach County.

As expected, a significant amount of local impact is seen in employee wages and benefits at the two plants and headquarters. In fact, about 80 percent of the $288 million of local spending goes to labor. Much of this stays "home" within the respective counties, as employees and contractors spend for services at hospitals, doctor's offices, dentists, insurance brokers, realtors, restaurants and other businesses.

For every dollar of output from FPL's nuclear operations, the local counties produced $1.27 and the Florida economy produced $1.50.

Spending by FPL's nuclear operation has a multiplier effect within the counties across nearly every sector of the economy. The total output value to the counties where the power plants and headquarters operate was $1.2 billion. That puts the output multiplier at 1.27; in other words, for every dollar of output from FPL's nuclear operations, the local economies produced $1.27. Specifically, for every dollar of output at St. Lucie, its local economy produced $1.16, and for every dollar of output at Turkey Point, its local economy produced $1.43.

The study also finds a large impact on a sector called "imputed rental activity," which is what the U.S. Department of Commerce estimates homeowners would have to pay in rent if they did not own their homes. It measures the benefit of increased home values caused by increased labor from the plant's operation.

Florida Statewide Impact

FPL's nuclear power plant spending also has a significant economic impact statewide. In 2013, FPL's nuclear operations spent $368 million for products and services (including labor) locally and throughout Florida, with St. Lucie spending $174 million, Turkey Point spending $167 million and the headquarters spending $27 million.

The study finds that FPL's nuclear operations stimulate the Florida economy in an even broader way than at the local level. In fact, this study found that the total economic impact for the state was $1.4 billion. For every dollar of output from FPL's nuclear operations, the state economy produced $1.50.

National (U.S.) Impact

In 2013, total expenditures for products and services (including labor) by FPL's nuclear operations totaled $707 million across the United States—mainly in procuring specialized labor, services and materials unique to the nuclear industry. This includes $368 million of spending in Florida and $339 million throughout the United States, largely for specialized products and services.

- **Fuel**: The largest non-labor spending category at the national level was for nuclear fuel, which historically has been low and steady in cost, and related services. In 2013, St. Lucie spent about $105 million and Turkey Point spent approximately $87 million for nuclear fuel.

- **Maintenance and construction repair**: The second largest spending category is for maintenance and construction repair, which includes payments to specialized contractors for highly specialized services.

The total effect of FPL's nuclear operations on the U.S. economy was $2.5 billion. Given that the direct output from its operations was $955 million at the two plants and headquarters, the U.S. economy reaped $2.59 for every dollar of output.

Table A.0 in the Appendix illustrates the variety of industries that benefited from FPL's local, state and national spending. Table 2.0 below displays the top sectors in spending by each of the facilities in each region. Table 2.1 on the following page provides an overview of the impacts of FPL's spending.

Table 2.0
Top Sector Spending in Each Region
(Following Wages and Compensation)

Facility	Region	Top Sector	$ Millions
Turkey Point	Miami-Dade, Monroe, Broward Counties	Investigation and security services	$23.5
	Florida Total	Investigation and security services	$23.6
	U.S. Total	Nuclear fuel	$87.3
St. Lucie	St. Lucie, Martin, Indian River, Okeechobee Counties	Professional, scientific, and technical services	$6.6
	Florida Total	Investigation and security services	$19.5
	U.S. Total	Nuclear fuel	$104.9
Nuclear Corporate Headquarters	Palm Beach County	State and local governments	$97K
	Florida Total	Professional, scientific, and technical services	$2.5
	U.S. Total	Professional, scientific, and technical services	$3.3

Economic Stimulus Through Taxes

FPL's nuclear operations resulted in a total tax impact of $196 million to local, state and federal governments combined. St. Lucie and Turkey Point nuclear plants paid more than $70 million in state and local taxes in 2013. This is the direct impact. There are also secondary impacts, because plant expenditures increase economic activity, leading to additional income and value creation and, therefore, to higher tax revenue. Table 2.2 below provides more tax detail.

Table 2.1
Impact of FPL's Florida Nuclear Operations on the Local, State and National Economies *(dollars in millions)*

Description	Direct	Secondary	Total
Counties			
Output	$943.0	$258.4	$1,201.4
Labor Income	$228.5	$97.3	$325.8
Employment	1,630	2,493	4,123
Florida			
Output	$950.9	$473.3	$1,424.2
Labor Income	$229.7	$182.1	$411.8
Employment	1,642	4,212	5,854
United States			
Output	$954.9	$1,517.9	$2,472.7
Labor Income	$230.1	$482.1	$712.3
Employment	1,647	8,593	10,241

Table 2.2
Total Tax Impacts of FPL's Economic Activity in 2013
(dollars in millions)

Government	Taxes Paid	Taxes Induced	Total Tax Impact
Federal	–	102.8	102.8
State and Local	70.2	22.9	93.1
Total Taxes	**70.2**	**125.6**	**195.7**

Section 3

Environmental Protection

One of the reasons that the Florida Power & Light Company can deliver low customer bills is, in part, because of the way it operates and has invested in its four nuclear units. To ensure that clean, reliable nuclear power continues to remain a significant part of FPL's energy mix, the company regularly makes significant investments in plant equipment and systems, new designs, safety features and training programs. All of these activities take place in alignment with FPL's commitment to environmental stewardship.

In fact, more than $3 billion was invested into the St. Lucie and Turkey Point sites during the Extended Power Uprate project, which was completed in 2013. This project added approximately 500 megawatts of clean power generation without expanding the physical footprint of the existing plants. This capacity is equivalent to adding the power production of a mid-sized power plant to the FPL fleet.

Land/Wildlife Conservation

In addition to emitting zero greenhouse gases, the physical power plant facilities at St. Lucie and Turkey Point make up a relatively small percentage of the property on which they are located. Because the majority of FPL's land around the plants is free of development or human activity, it has become wildlife habitat.

- **The St. Lucie plant is situated on 1,130 acres**: At the St. Lucie plant, the power plant and associated buildings cover only one quarter of the property. St. Lucie's unused land plays an important role in the research and protection of the endangered sea turtle. Each year since 1971, turtle hatchling nesting surveys have been conducted along the beach on the St. Lucie property. This data has been valuable to identifying long-term nesting trends on one of Florida's highest-density nesting beaches. In addition, FPL works with the Loggerhead Marinelife Center in Juno Beach to rehabilitate injured sea turtles.

- **The Turkey Point plant is situated on 11,000 acres**: Turkey Point started an American Crocodile monitoring program in 1978 after plant workers discovered a crocodile nest on the site. Shortly after, Turkey Point partnered with the U.S. Fish & Wildlife Service to develop a monitoring and species recovery plan with the ultimate goal of preventing the extinction of the American Crocodile in the United States. As a result of these efforts, in 2007, the U.S. Fish & Wildlife Service announced that the crocodile was removed from Florida's endangered species list.

Section 4

FPL and the U.S. Nuclear Energy Industry

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 2013, generation from the St. Lucie and Turkey Point plants made up approximately 24 percent of FPL's total generation.

U.S. nuclear power plants achieved an industry-leading performance capacity factor of approximately 90 percent in 2013, while producing electricity at one of the lowest costs of any fuel source used to generate electricity.

Over the past 20 years, America's nuclear power plants have increased their output and improved their performance significantly through projects like power uprates. Since 1990, the industry has increased its total output equivalent to 26 large power plants, when in fact only five new reactors have come online. FPL completed uprates on all four units in 2013, adding approximately 500 megawatts of clean, reliable electricity to its generation fleet.

Affordable Energy for Consumers

In addition to increasing electricity production at existing nuclear energy facilities, power from these facilities is affordable for consumers. 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.

Emphasis on Safety

Safety is the highest priority for the nuclear energy industry. Based on more than 50 years of experience, the industry provides one of the country's safest industrial working environments. Through rigorous training of plant workers and close communication and cooperation between nuclear plants and federal, state and local regulators, the industry is keeping the nation's 99 nuclear plants safe for their communities and the environment.

General worker safety at nuclear power plants is also excellent—far safer than in the manufacturing sector. The U.S. Bureau of Labor Statistics showed 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.

In 2013, FPL's nuclear plants' worker safety was in the top decile within the entire nuclear industry. This accomplishment was recognized by the Southeastern Electric Exchange, which presented the FPL nuclear plants with its 2013 Safety Performance Award.

New Nuclear Units

FPL is in the licensing phase for two, advanced reactors at the existing Turkey Point site. If approved, the new units would provide 2,200 megawatts of clean energy, or enough to power approximately 1.3 million homes, and create a substantial economic stimulus during construction and operation as a result of payroll, property taxes, local service contracts, and purchases worth billions of dollars.

Turkey Point 6 & 7 would allow Miami-Dade County to meet approximately half of its water reuse goals with one single, cost-effective project.

On May 13, 2014, Florida's state siting board approved the Turkey Point 6 & 7 project and associated transmission routes. The federal license application is still under review.

Current estimates indicate that the new power reactors at Turkey Point would save customers approximately $570 million in fuel costs in their first full year of operation and more than $100 billion over a 60-year life span.

In addition, the new units would prevent the emission of 481 million tons of carbon dioxide over 60 years of operation, which is equivalent to removing more than 91 million cars from the road, and would use up to 60 million gallons of reclaimed water per day from Miami-Dade County. This water, which the county now disposes in deep well injection and into the ocean, would be piped to the site and purified for use as cooling water. This project would also allow Miami-Dade County to meet approximately half of its water reuse goals with one single, cost-effective project.

Section 5

Economic Impact Analysis Methodology

The methodology used to estimate the economic and fiscal impacts of FPL's nuclear power stations 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 FPL'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, or demand, and output, or supply, 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 of 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 activity 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" also can 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. FPL's wage and salary expenditures at its plants also create induced effects, primarily in the plants' 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 would likely 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 the FPL Nuclear Power Plants

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 the following functions: data retrieval, data reduction, model development and impact analyses.

The IMPLAN database consists of two major parts:

- national technology matrices, and
- 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 plants and nuclear headquarters, FPL provided three basic types of data: purchase order expenditures by purchase order code, employee compensation expenditures and tax payment data for 2013.

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 facilities' full economic impacts.

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 were then 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

FPL's nuclear operations play an important role in the health of Florida's economy. The economic benefits these operations generate directly – through wages and the purchase of goods and other services – are considerable. These benefits are felt strongly by municipalities and businesses locally, throughout the region and the state.

This report details that in 2013 alone, FPL's nuclear operations generated a total of $1.2 billion of economic output in the counties around the Turkey Point and St. Lucie power plants, $1.4 billion of economic output statewide, and $2.5 billion of economic output across the United States.

FPL's nuclear operations directly employ approximately 1,600 people and support an additional 4,200 jobs throughout Florida. Of the direct jobs, the wages at the plant sites are on average more than twice those of others in those areas. During refueling outages, which take place approximately every 18 months at each reactor, about 1,500 skilled contractors are on site. They boost the local economies by utilizing hotels, restaurants and stores.

In addition to its current operations, FPL is pursuing licensing to create the option to build two new nuclear units at Turkey Point. FPL estimates indicate that the new power reactors at Turkey Point would save customers more than $100 billion in fuel costs over a 60-year life span.

Beyond the economic benefits, FPL's nuclear units also operate in harmony with the environment on small portions of the land on which they are located. The sites help to protect local wildlife and avoid the emission of more than 15 million tons of carbon-dioxide.

In summary, FPL's nuclear operations provide significant and positive benefits to Florida's economy, energy sector and environment.

Appendix

Table A.0 FPL's Direct Expenditures by Region and Location — Top Five Economic Sectors *(2013 dollars)*

Local Counties		State		U.S.	
Sector	**$K**	**Sector**	**$K**	**Sector**	**$M**
FPL Nuclear Headquarters (Juno Beach, Fla.)					
State and local government enterprises	97	Professional, scientific, and technical services	2,523	Professional, scientific, and technical services	3.3
Software publishers	75	Business support services	1,601	Business support services	2.9
Business support services	27	Travel arrangement and reservation services	878	Other state and local government enterprises	0.9
Civic, social, and professional organizations	21	Insurance agencies and related activities	760	Travel arrangement and reservation services	0.9
Telecommunications	19	Other electronic component manufacturing	641	Other electronic component manufacturing	0.8
Other	30		1,554		3.0
Subtotal	269		7,956		11.9
Compensation	18,847		19,052		19.1
Total	**19,116**		**27,008**		**31.0**
St. Lucie Nuclear Plant					
Professional, scientific, and technical services	6,628	Investigation and security services	19,502	Inorganic chemical manufacturing	104.9
Insurance agencies and related activities	1,264	Professional, scientific, and technical services	14,114	Federal Government enterprises	42.0
Pump and pumping equipment manufacturing	1,220	Other electronic component manufacturing	13,969	Maintenance and repair construction	27.8
Motor and generator manufacturing	1,203	Maintenance and repair construction	2,799	Professional, scientific, and technical services	24.9
Truck transportation	638	Architectural, engineering, and related services	2,172	Investigation and security services	20.1
Other	2,518		11,724		40.9
Subtotal	13,471		64,820		260.7
Compensation	108,754		109,265		109.4
Total	**122,225**		**173,545**		**370.1**
Turkey Point Nuclear Plant					
Investigation and security services	23,475	Investigation and security services	23,606	Inorganic chemical manufacturing	87.3
Other electronic component manufacturing	10,803	Other electronic component manufacturing	11,010	Investigation and security services	23.9
Architectural, engineering, and related services	6,184	Architectural, engineering, and related services	8,739	Maintenance and repair construction	18.5
Professional, scientific, and technical services	1,451	Professional, scientific, and technical services	4,639	Professional, scientific, and technical services	16.1
Maintenance and repair construction	1,175	Motor and generator manufacturing	3,070	Other electronic component manufacturing	11.9
Other	3,031		14,826		47.1
Subtotal	46,120		65,889		204.7
Compensation	100,885		101,396		101.6
Total	**147,005**		**167,284**		**306.3**

Table A.1 Direct and Secondary Effects on the Most-Affected Industries in each Region — Top Five Economic Sectors *(in 2013 dollars, except for employment)*

Sector	Output ($K)	Labor Income ($K)	Employment
Local Regions			
FPL Nuclear Headquarters (Juno Beach, Fla.)			
Electric power	19,239	18,865	124
Imputed rental activity	1,358	-	-
Real estate establishments	779	108	5
Offices of health practitioners	681	441	5
Food services and drinking places	627	276	10
Other	6,244	2,950	59
Total	28,930	22,640	203
St. Lucie Nuclear Plant			
Electric power	545,839	109,004	786
Imputed rental activity	10,963	-	-
Professional, scientific, and technical services	6,849	1,681	38
Offices of health practitioners	5,168	3,196	44
Food services and drinking places	4,763	1,755	81
Other	56,176	20,901	566
Total	629,759	136,538	1,515
Turkey Point Nuclear Plant			
Electric power	382,002	101,132	724
Investigation and security services	23,797	15,201	639
Imputed rental activity	11,526	-	-
Other electronic component manufacturing	10,812	2,252	54
Real estate establishments	7,599	886	48
Other	106,989	47,187	941
Total	542,726	166,658	2,405
Florida			
FPL Nuclear Headquarters (Juno Beach, Fla.)			
Electric power	27.5	19.1	126
Professional, scientific, and technical services	2.6	0.9	13
Imputed rental activity	2.4	-	-
Business support services	1.7	1.0	30
Real estate establishments	1.6	0.2	10
Other	23.8	10.1	214
Total	59.6	31.3	393
St. Lucie Nuclear Plant			
Electric power	547.2	109.6	792
Investigation and security services	19.9	13.4	479
Professional, scientific, and technical services	14.9	5.1	72
Imputed rental activity	14.8	-	-
Other electronic component manufacturing	14.0	3.8	65
Other	153.8	60.9	1,304
Total	764.6	192.9	2,712

Table A.1, continued

Florida, continued			
Sector	**Output ($M)**	**Labor Income ($M)**	**Employment**
Turkey Point Nuclear Plant			
Electric power	383.0	101.8	730
Investigation and security services	24.0	16.2	578
Imputed rental activity	14.4	-	-
Other electronic component manufacturing	11.1	3.0	51
Architectural, engineering, and related services	9.6	5.7	86
Other	158.0	61.0	1,305
Total	600.0	187.6	2,750
United States			
FPL Headquarters (Juno Beach, Fla.)			
Electric power	31.7	19.3	128
Professional, scientific, and technical services	3.5	1.5	14
Business support services	3.1	1.9	48
Imputed rental activity	3.0	-	-
Real estate establishments	2.0	0.2	12
Other	42.7	16.4	303
Total	85.9	39.2	506
St. Lucie Nuclear Plant			
Electric power	558.7	111.9	807
Basic inorganic chemical manufacturing	106.7	14.9	115
Federal Government enterprises	42.3	15.4	254
Maintenance and repair of nonresidential structures	34.8	15.0	241
Professional, scientific, and technical services	28.0	12.1	114
Other	569.1	190.1	3,654
Total	1,339.6	359.4	5,184
Turkey Point Nuclear Plant			
Electric power	392.3	103.7	743
Basic inorganic chemical manufacturing	88.8	12.4	96
Investigation and security services	24.7	17.1	549
Maintenance and repair of nonresidential structures	24.7	10.6	171
Imputed rental activity	23.8	-	-
Other	493.1	169.9	2,992
Total	1,047.3	313.6	4,551

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