Economic Benefits of Millstone Power Station

An Economic Impact Study by the Nuclear Energy Institute

NEI

NUCLEAR ENERGY INSTITUTE

Contents

Executive Summary

The Millstone nuclear power plant in Waterford, Conn., is an integral part of the New London County economy. The plant provides jobs and makes purchases that stimulate the local economy directly and indirectly. The benefits to the area come through jobs, taxes, economic output, labor income, contributions to the local community and other areas. And there are other intangible benefits to the region, such as clean air and low, stable electricity prices. Millstone's economic impact reaches beyond the local community to the state and even the national level.

The total economic impact of the Millstone plant on New London County for the year beginning April 1, 2001, and ending March 31, 2002, was $515.2 million. Millstone's total impact on the Connecticut economy for the same period was $584.8 million and $1.16 billion for the U.S. economy. The plant's total economic impact includes direct effects, which comprises the value of plant output, as well as indirect and induced effects, which are secondary effects resulting from plant operation.

The Millstone plant employs 1,464 people, roughly one of every 100 workers in the area. Seventy-three percent live in New London County, including an estimated 677 employees in Waterford and the adjoining towns of New London, Groton, East Lyme and Ledyard. In addition, these jobs pay salaries that are 50 percent higher than the average for New London County. Additionally, the economic activity generated by Millstone creates another 1,272 jobs in New London County. Given a combination of employees at the plant and secondary jobs created by Millstone's economic activity, the plant is responsible for 2,338 jobs in New London County.

The main expenditure of the Millstone plant in New London County is salaries. During the study period, Millstone paid $73.1 million in compensation to employees living in New London County and an additional $23.3 million to employees in Connecticut outside the county. Additionally, the economic activity created by the Millstone plant indirectly accounted for $45.2 million in labor income in New London County and an additional $33.2 million in other areas of the state. Together, the direct and indirect labor income from the plant accounts for $118.3 million in labor income in New London County and an additional $56.5 million in other areas of Connecticut.

The Millstone plant makes substantial purchases in New London County. In 2001, the plant made $248 million in purchases, $63 million of which was in Connecticut and $34 million in New London County. Economic activity generated by the Millstone plant also leads to $99.6 million in increased output in New London County and $69.5 million in the rest of Connecticut.

In 2001, the Millstone plant paid $17 million in state and local taxes; $12.3 million was to the town of Waterford in property taxes. This represented approximately one-quarter of all tax revenues in Waterford. Additionally, the economic activity generated by Millstone contributed to another $39 million in state and local taxes, through increased property, sales and income taxes. By combining the direct and indirect taxes, the Millstone plant accounts for $56 million in state and local tax payments.

In addition to the economic benefits provided by Millstone, the plant generated 15.5 billion kilowatt-hours (kWh) of electricity in 2001, approximately 15 percent of all of New England's electricity needs. This low-cost electricity helped keep energy prices in New England down. In 2000, the Millstone plant had a production cost of 1.92 cents/kWh, compared to an average production cost of 2.89 cents/kWh for New England. Millstone did all of this without producing airborne emissions typical of other generation sources.

Millstone also is an integral part of the local community, as seen in the charitable giving of the plant and its employees to the local community. In the year studied, the plant made more than $200,000 in contributions to the local community. In addition, the plant sponsored scholarships at the University of Connecticut and Three Rivers College worth $250,000.

Section 1: Introduction

This economic impact study by the Nuclear Energy Institute[1] (NEI) examines the economic, fiscal, community involvement and other benefits that a nuclear power plant provides for its communities.

The Millstone nuclear power plant, owned by Dominion Energy, was the first plant to participate in the project. This study estimates the economic and other benefits Millstone provides to Waterford—the town where the plant is located—as well as to New London County and to the United States. The study uses detailed data from the Millstone plant to assess the benefits that it provides to its community.

The primary focus of this study is on the benefits to the local community. However, state and national benefits also are calculated. These impacts include the direct impacts such as people employed by the plant, plant expenditures within the community and corporate tax payments, as well as indirect impacts, such as jobs created indirectly by plant expenditures in the local economy. The study also includes other benefits provided by the plant, such as stable, low-cost electricity, the benefits of a clean-air source of electricity and other plant contributions to the local community.

Dominion Energy, RTI International and NEI cooperated in developing this study. Dominion and Millstone provided data on employment, operating expenditures and tax payments used as inputs to the study. They also provided guidance as to particular details specific to New London County and their plant. RTI International, a nonprofit research organization in Research Triangle Park, N.C., applied a nationally recognized model to estimate the direct and indirect economic impacts of the nuclear power plant on local communities. They also were responsible for preparing the modeling sections of the report. NEI coordinated the project and prepared the non-modeling sections of the report.

The remainder of this report is presented in five sections. Section 2 provides background on the Millstone plant, including plant history, performance, cost, employment taxes and local area details, such as total employment and earnings and regional electricity prices. Section 3 examines the economic and fiscal impacts of Millstone on the local, state and national levels. Section 4 provides data on benefits not captured by the model, such as employee and corporate contributions to the community. Section 5 outlines recent trends in the nuclear energy industry and highlights cost, performance and safety. Section 6 discusses the methodology used to complete the study and Impact Analysis for Planning (IMPLAN), the economic modeling software employed as part of this effort.

[1] The Nuclear Energy Institute is the policy organization of the nuclear energy and technologies industry and participates in both the national and global policy-making process.

Section 2: The Millstone Plant

This section provides background information on the Millstone plant and New London County, Conn., in order to frame the results of subsequent sections. The section includes a brief history of the Millstone plant, as well as information on its performance, cost, employment and taxes. This section also includes information on local area details of Waterford, New London County and Connecticut, such as total employment, earnings, local tax collections and regional electricity costs.

2.1 History and Information

The Millstone nuclear power plant is located in southeastern Connecticut, on the north shore of Long Island Sound. The plant lies within Waterford, a town of 19,000 citizens. Waterford is part of New London County, which has a population of 260,000. The site sits on what had formerly been a quarry that provided granite for such famous structures as the Statue of Liberty, Grand Central Station and the United Nations building.

The Millstone Power Plants: At a Glance

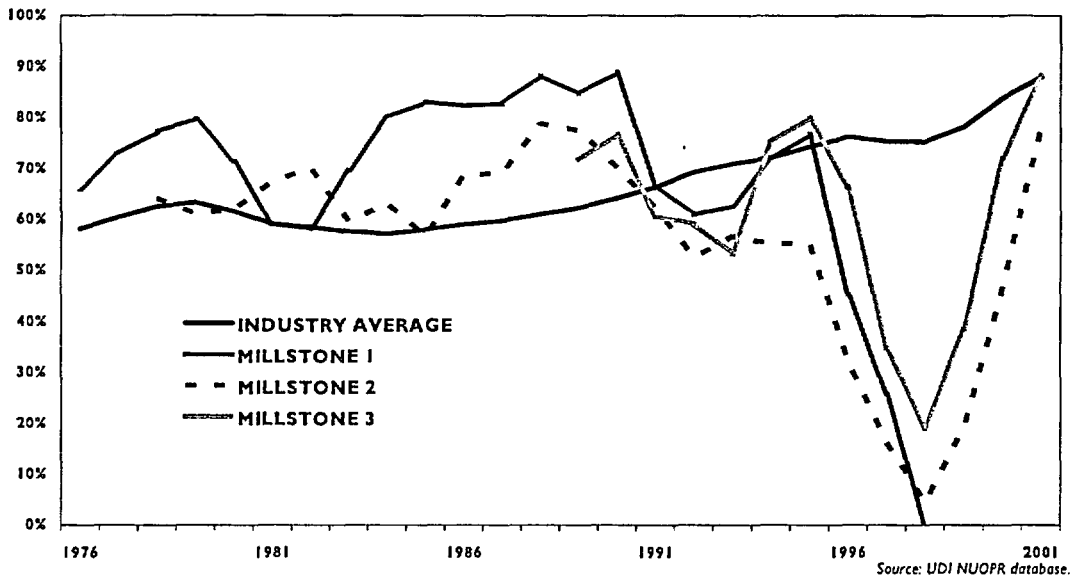
Unit	Capacity	Commercial Operation Year	License Expiration Year	Reactor Type
Unit 1	660 MW	1970	In Decommissioning	BWR
Unit 2	870 MW	1976	2015	PWR
Unit 3	1,150 MW	1986	2025	PWR

BWR = boiling water reactor; PWR = pressurized water reactor

Shortly after the Millstone quarry closed in the early 1960s, construction began on the first nuclear power plant at the Millstone site. In 1966, construction began on Millstone Unit 1, a 660-megawatt (MW) boiling water reactor (BWR). Millstone 1 was the first reactor at the site and the second nuclear reactor in Connecticut. The plant was built by a consortium of utilities comprising Connecticut Light and Power, Hartford Electric Light Co. and Western Massachusetts Electric Co. and was completed in 1970.

Two more reactors have since been added at the Millstone plant. Millstone 2, an 870-MW pressurized water reactor (PWR), began operation in 1976. Millstone 3, a 1,150-MW PWR, began operation in 1986. In 1998, Millstone 1 was shut down and is currently being decommissioned.

Three-Year Average Capacity Factors



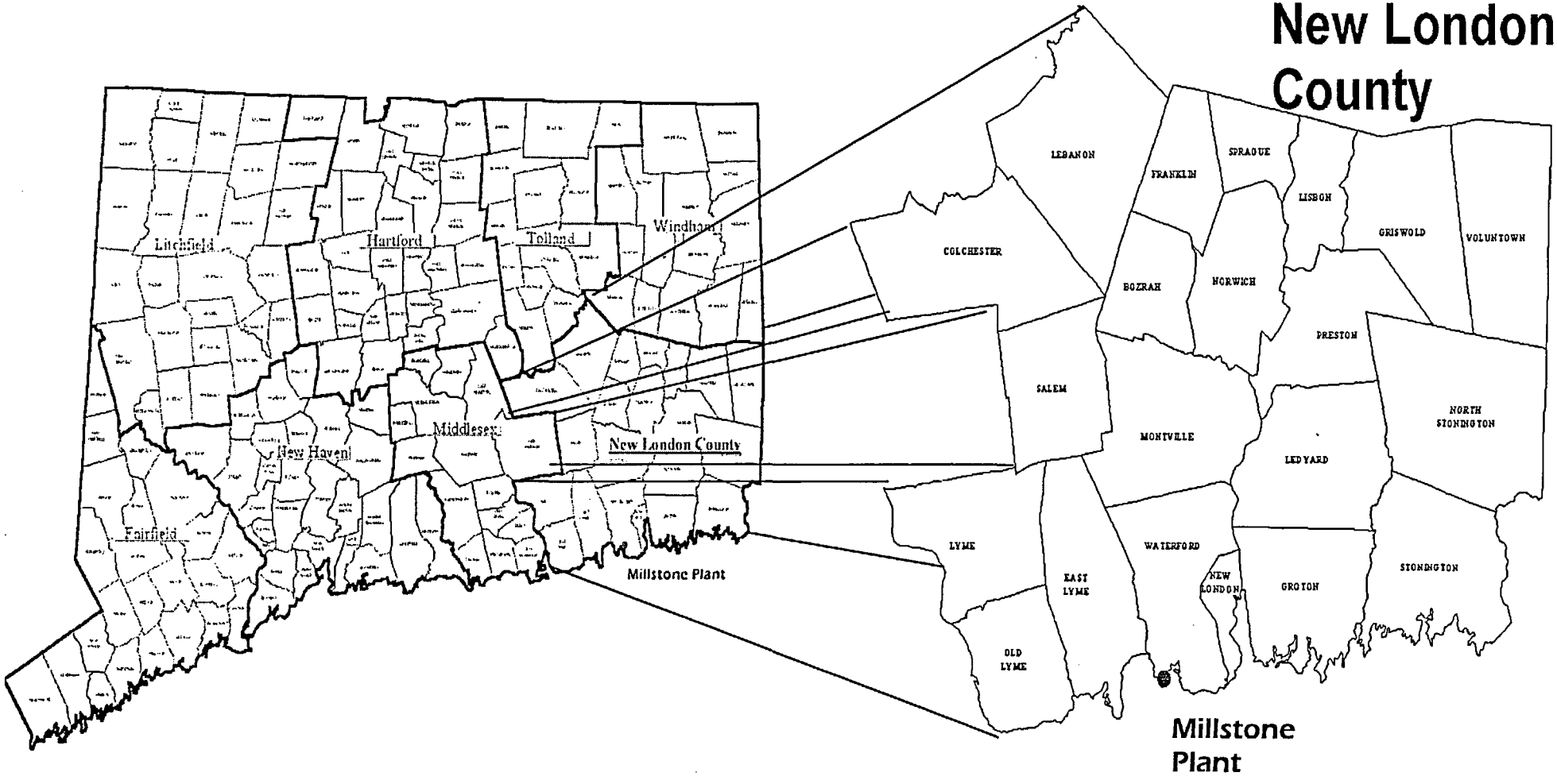
Source: UDI NUOPR database.

For most of its history, the Millstone plant has been a leader in the nuclear industry. Before the 1990s, each of the three reactors at Millstone maintained capacity factors at or above the industry average. However, in the mid-1990s, the plant came under scrutiny for not meeting certain Nuclear Regulatory Commission regulations. Failure to meet these regulations resulted in the plant's being placed on the NRC list of plants requiring additional regulatory oversight. The intense scrutiny led to the shutdown of all three reactors during 1997 and contributed to the early shutdown of Millstone 1.

Although this period of Millstone's history was costly from both an economic and a public perception perspective, it led to positive changes for the plant. Organizational restructuring and a review of Millstone's management has created a work force highly focused on excellence in operation. As part of getting the plants back on line, every process and procedure was analyzed and employees were retrained. Millstone initiated continuous improvement, self-assessment and corrective action plans that led to improved performance. In 2000, Millstone 3 had its best single year, with a capacity factor of 100 percent. Millstone 2 had its best year in 2001, with a capacity factor of 95 percent.

In April 2001, Dominion Energy purchased all three Millstone reactors for $1.3 billion and is integrating the plant into its six-reactor nuclear power plant system. Millstone 2 has a license that allows it to operate until 2015, and Millstone 3, until 2025. Dominion Energy recently announced that it will seek license renewals for both reactors and expects to submit formal applications to the NRC in 2004. The NRC has approved license renewals for 16 reactors as of May 2003, and most are expected to apply for license renewal.

Millstone benefits the people of New London County and Connecticut in several ways. It is a major source of inexpensive, reliable electricity for Connecticut and New England, and it provides hundreds of jobs and significant economic benefits to New London County.


New London County
Litchfield
Hartford
Tolland
Windham
Middlesex
New Haven
New London County
Fairfield
Millstone Plant
LEBANON
FRANKLIN
SPRAGUE
LISBON
GRISWOLD
VOLUNTOWN
COLCHESTER
BOZRAH
NORWICH
PRESTON
SALEM
MONTVILLE
LEDYARD
NORTH STONINGTON
LYME
EAST LYME
WATERFORD
NEW LONDON
GROTON
STONINGTON
OLD LYME
Millstone Plant

2.2 Generation

The Millstone plant generated 15.5 million megawatt hours (MWh) in 2001. This was about half the electricity generated in Connecticut and about 15 percent of the electricity generated in New England. Electricity production at the plant was driven by a high capacity factor for each unit. Capacity factor measures the amount of electricity produced versus the maximum amount achievable. In 2001, Millstone 2 operated at a 95 percent capacity factor in 2001; Millstone 3 had a capacity factor of 82 percent.

This outstanding performance has made the Millstone plant very cost-competitive in the New England region. For 2000, Millstone had an average electricity production cost of 1.92 cents/kWh. For comparison, average production costs for electricity generators in the New England Power Pool (NEPOOL) region (the region in which Millstone is located) averaged 2.89 cents/kWh in 2000.

New England Power Pool Production Cost and Generation (2000)

	Average Production Cost Cents/kWh	Generation Million MWh
Millstone	1.92	15.50
Coal	1.96	18.95
Natural Gas	4.03	17.95
Oil	4.94	12.83
NEPOOL Total	2.89	107.40

Source: Resource Data International

Millstone's low production costs help keep wholesale electricity prices affordable in New England. Although Millstone's specific contribution is hard to measure, it can be estimated by determining how much average production costs in the NEPOOL region would increase if Millstone were replaced by a combined cycle natural gas plant (the plant of choice for new generation). In 2000, production costs for combined cycle natural gas plants in the NEPOOL region averaged 3.83 cents/kWh. In 2000, substituting several natural gas plants for Millstone would have resulted in an increase in average electricity generation costs for the NEPOOL region from 2.89 cents/kWh to 3.21 cents/kWh.

2.3 Employment

In addition to providing inexpensive electricity to New England, Millstone also is a major source of employment for the residents of New London County. The Millstone plant employs 1,464 people, 1,066 who reside within the county. The Millstone plant employs 677 people from the town of Waterford and the five towns that border it, which represents about one of every 100 working people in the area.

The jobs provided by the Millstone plant also are typically higher paying than most jobs in the area. Employees in New London County working at the Millstone plant earned on average about $78,000 in 2001, including salary and overtime, well above the average earnings of workers in the county, about $52,000 a year.

Millstone is the largest private employer in Waterford and represents one-twelfth of the town's employment base. In addition to the jobs provided by Millstone, the plant also spends a large amount of money in the local community through purchases. In the one-year period of this study, the Millstone plant made $40.2 million worth of purchases in New London County.

	Millstone		City/County Total	
Location	**Employees**	**Average Earnings**	**Employed Work Force**	**Average Earnings**
Waterford	192	$78,560	10,253	$57,460
Waterford and Adjoining Towns*	677	$79,152	66,938	$52,278
New London County	1,066	$80,227	130,721	$52,124

**Waterford, New London, East Lyme, Groton and Ledyard. Sources: Millstone, Connecticut State Commerce Dept.*

2.4 Plant and Local Area Taxes

In addition to the benefits Millstone provides to the area in terms of employment and direct purchases, it also makes large tax payments. In 2001, Millstone made $3.4 million in federal income tax payments and approximately $17 million in local property taxes. Because of depreciation and other expenses, the Millstone plant did not make any state income tax payments in 2001. As is common for capital intensive entities that use accelerated depreciation, tax payments are usually small early in a plant's life and grow larger toward the end of the depreciation period. Hence, state income taxes are deferred until a later date.

The largest taxes paid by the Millstone plant are property taxes to the city of Waterford. In 1999, the Millstone plant represented 64.2 percent of the assessed property value in Waterford and represented an equal proportion of the total property tax revenue. However, the assessed value of the plant fell considerably due to Connecticut's electricity deregulation. The difference in property taxes before and after deregulation is currently being made up by a systems benefits charge on Connecticut electricity consumers, but the tax assistance will be gradually phased out over the next 10 years. The amount paid to Waterford by the systems benefits charge is based on the differences between what Millstone would have paid as a regulated entity and what it pays as a deregulated entity. In the first year, the systems benefits charge made up 100 percent of this difference. In each subsequent year that difference will decrease by 10 percent until, after 10 years the charge ends.

Although Millstone's property value has declined, it remains the largest taxpayer in Waterford. Total town tax revenues for Waterford in 2001 were $52.4 million. In 2001, the year analyzed for this study, Millstone paid $12.3 million in property taxes to the city of Waterford, about one-quarter of all property taxes to the town. In addition, the systems benefits payments accounted for another $21.8 million in 2001. Consequently, revenue for Waterford from the plant totaled $34.1 million.

Because of the large tax base that the Millstone plant brings to the community, Waterford has been able to maintain a high level of local government services while keeping taxes on its citizens relatively low. Waterford has one of the lowest property tax rates (mill rates) in Connecticut. The town's equalized mill rate in 2001 was $11.06 per $1,000 of property—the median mill rate for all Connecticut towns was $17 per $1,000. Waterford's mill rate will no doubt increase over the next 10 years due to the decline in the plant value and the gradual phaseout of the transition assistance. However, the presence of the Millstone plant will likely continue to keep property taxes in Waterford below the state average, because few other towns have a single entity that pays such a large portion of local taxes.

2.5 Summary

The improved performance of the Millstone plant is mirrored by improving performance of the nuclear industry as a whole. Millstone's performance is expected to continue improving under Dominion Energy's ownership. Millstone provides low-cost electricity, high employment and a large tax base to Waterford, New London County and Connecticut. However, these are only the direct economic benefits of the plant. As illustrated in the next section, the secondary effects on the local and regional economies are as large as the direct benefits.

Section 3: Economic and Fiscal Impacts

The economic and fiscal effects of Millstone go well beyond what the plant spends on purchases, wages, salaries, employee benefits and taxes. They also reflect the strong stimulus that Millstone's large wage and salary payments provide to key measures of economic activity—the value of production (output), labor income, and employment—in the local and state economies.

Millstone's spending lifts economic activity throughout the local and state economies, as well as the tax payments that are related to economic activity. This multiplier effect is felt throughout the local and state economies—by the private sector in the form of increased sales and employment, and by the public sector through increased tax revenues to support the provision of public services.

Estimates of these effects were developed by applying the IMPLAN model to expenditure data provided by Dominion Energy, owner of the Millstone plant.

3.1 Plant Expenditures in New London County

Millstone expenditures for products and services (including labor) in New London County totaled $107.8 million for the year beginning April 1, 2001. This was the date when Dominion Nuclear Connecticut Inc. assumed full operational control from Northeast Utilities (NU). Dominion Energy purchased the plant from NU in April 2000, about one year prior. Spending within the county represents approximately 30 percent of Millstone's total spending of $357.1 million and approximately two-thirds of the $159 million of spending in Connecticut.

The expenditure totals for New London County were provided by Dominion Energy and are shown in Table 3-1. The 10 sectors receiving the largest amount of Millstone spending are listed in the table according to the amount spent in New London County. The categories are chosen from among the 528 IMPLAN sectors and are listed largely according to the IMPLAN description for each (*for more information on IMPLAN and related information, see Section 6*). Total compensation, which includes wages, salaries and benefits, is listed separately.

Similar expenditure totals for Connecticut and the United States are presented in Tables 3-2 and 3-3, respectively. Expenditure totals for New London County are included in the totals for Connecticut in Table 3-2, and for the United States in Table 3-3.

The next largest non-labor expenditures in New London County were for business services at $9.6 million, which represented approximately 9 percent of total Millstone spending in New London County. This sector includes vehicular and other equipment refueling services, radioactive waste monitoring services, and other specialized business services for nuclear plants.

Five of the sectors in Table 3-1 include miscellaneous expenditures. The prevalence of miscellaneous products and services sectors reflects the specialized nature of spending within the nuclear industry and differences in the structure of the U.S. and New London County economies. It also reflects, but to a lesser extent, the relatively high level of aggregation of U.S. and regional economic activity within the sectors.

Table 3-1. Millstone Expenditures in New London County

April 30, 2001, through March 31, 2002

IMPLAN Code	Expenditure Description	New London County Expenditures
56	Maintenance and Repair of Facilities	$16,458,364
470	Business Services	$9,602,326
474	Personnel Supply Services	$4,064,883
506	Engineering—Architectural Services	$3,103,153
475	Computer and Data Processing Services	$504,000
356	Switchgear and Switchboard Apparatus	$142,071
493	Medical and Health Services	$110,400
369	Lighting Fixtures and Equipment	$75,260
432	Manufacturing Industries	$69,521
360	Electrical Industrial Apparatus	$60,540
	Other	$523,377
	Subtotal	$34,713,895
	Total Compensation[a]	$73,111,708
	TOTAL	$107,825,603

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

Total compensation for labor services was $73.1 million and represents approximately two-thirds of Millstone expenditures in New London County. This reflects the fact that most of Millstone's expenditures for labor services (wages, salaries and employee benefits) stay "at home" in New London County. Naturally, this share for the county is much larger than that of Connecticut and the United States.

The largest non-labor expenditures in New London County totaled $16.5 million for the maintenance and repair of facilities, which represents approximately 15 percent of total Millstone spending in the county. This sector includes maintenance and repair services provided by general and specialized contractors serving the nuclear industry.

3.2 Plant Expenditures in Connecticut

Millstone expenditures for products and services (including labor) in Connecticut for the year beginning April 1, 2001, totaled $159.4 million. This total includes $107.8 million dispersed in New London County, plus expenditures of $51.6 million in seven other counties in Connecticut. Spending within the state represents approximately 45 percent of Millstone's total spending of $357.1 million.

Total spending in Connecticut is presented in Table 3-2. Total compensation is the largest category at $96.4 million and represents about 60 percent of the total. This is down slightly from the share of total compensation for spending in New London County, indicating relatively more spending on products and non-labor services in other Connecticut counties.

Table 3-2. Millstone Expenditures in Connecticut

April 30, 2001, through March 31, 2002

IMPLAN Code	Expenditure Description	Connecticut Expenditures
56	Maintenance and Repair of Facilities	$23,728,525
470	Business Services	$13,531,533
508	Management and Consulting Services	$6,103,600
474	Personnel Supply Services	$5,202,301
506	Engineering—Architectural Services	$5,100,903
446	Sanitary Services and Steam Supply	$1,114,532
473	Equipment Rental and Leasing	$898,200
475	Computer and Data Processing Services	$790,291
187	Industrial Gases	$679,837
303	Pipe, Valves, and Pipe Fittings	$489,636
	Other	$5,386,490
	Subtotal	$63,025,848
	Total Compensation[a]	$96,422,204
	TOTAL	$159,448,052

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

As in Table 3-1, maintenance and repair of facilities and business services were $23.7 million and $13.5 million, respectively, and were the largest non-labor expenditures. Their shares in total spending in Connecticut are very similar to those in New London County, at slightly under 15 percent and 9 percent, respectively.

Management and consulting services was the third-highest category in the Connecticut "top 10" list. Four other sectors—sanitary services and steam supply (which includes low-level radioactive waste transportation and disposal services), equipment rental and leasing, industrial gases, and pipe, valves and pipe fittings—appear in the Connecticut list and not in the New London County list.

3.3 Plant Expenditures in the United States

Millstone expenditures for products and services (including labor) purchased in the United States for the year ending March 31, 2002, totaled $357.1 million. Apart from expenditures of $159.4 million in Connecticut, $197.7 million was spent elsewhere in the United States. Much of this was for specialized products and services unique to the nuclear industry.

U.S. expenditures are detailed in Table 3-3. Total compensation ($108.6 million) is no longer the largest category and represents only 30 percent of the total. Total compensation as a share of the U.S. total is much lower because plant employees live mostly in Connecticut (and particularly in New London County), whereas spending on products and non-labor services is concentrated outside the state.

As in Tables 3-1 and 3-2, the largest spending for products and non-labor services was in maintenance and repair of facilities ($74.2 million). Its share increased from approximately 15 percent in the previous two tables to nearly 21 percent in the U.S. total. This result is not unique to Millstone, as specialized maintenance and repair spending is typically the largest component of spending at other nuclear plants, reflecting the strong emphasis on these activities at nuclear plants nationally to maintain them properly and ensure high availability rates and capacity factors.

Table 3-3. Millstone Expenditures in the United States

April 30, 2001, through March 31, 2002

IMPLAN Code	Expenditure Description	U.S. Expenditures
56	Maintenance and Repair of Facilities	$74,209,255
189	Inorganic Chemicals	$53,123,190
506	Engineering—Architectural Services	$22,639,557
470	Business Services	$21,693,518
474	Personnel Supply Services	$17,157,868
508	Management and Consulting Services	$15,407,312
445	Water Supply	$7,020,000
446	Sanitary Services and Steam Supply	$6,694,803
303	Pipe, Valves and Pipe Fittings	$3,262,952
475	Computer and Data Processing Services	$3,101,454
	Other	$24,221,819
	Subtotal	$248,531,727
	Total Compensation[a]	$108,560,813
	TOTAL	$357,092,540

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

The second largest non-labor spending category was inorganic chemicals. This sector is composed primarily of nuclear fuel processing expenditures that are made outside Connecticut. These expenditures totaled $53.1 million, about 15 percent of the U.S. total.

The remaining sectors on the U.S. list are the same as in Table 3-2, with one exception—water supply. Purchases in this sector were primarily for pure water (free of minerals and ions) for use in the core cooling systems of pressurized water reactors such as Millstone 2 and 3. These services are typically provided by suppliers based outside Connecticut.

3.4 Taxes Paid and Accrued

A summary of taxes paid by Dominion Nuclear Connecticut Inc., on behalf of Millstone in 2001 is presented in Table 3-4. These tax payments were affected significantly by the sale of Millstone during this period, especially the subsequent revaluation of the plant for property tax purposes. The property tax value of the plant dropped by approximately one-half from the previous year because the sale price was lower than the book value of the plant.

Table 3-4. Taxes Paid by Millstone Nuclear Plant, 2001

Federal Government	
Payroll Tax[a]	$4,422,058
Other Federal Taxes	$3,557,900
Total Federal Taxes	$7,979,958
State and Local Government	
Property Tax	$16,982,197
Payroll Tax[a]	$72,023
Total State and Local Taxes	$17,054,220
Total Taxes Paid	$25,034,178

[a]*The division of payroll taxes between federal and state is based on the average distribution from IMPLAN data.*

Local taxes in this table refer to the towns in New London County. Property taxes paid in New London County ($17 million) represent approximately two-thirds of total taxes paid by the plant.

In addition to the taxes paid that are noted in Table 3-4, an additional $9.3 million in deferred income taxes was accrued by Millstone. Of this total, approximately one-fourth ($2.2 million) will be paid to the state of Connecticut.

Table 3-4 does not include assistance provided by the state to Waterford to help soften the impact of reduced property tax payments from Millstone. This assistance is being provided on a sliding-scale basis over a 10-year period. Initially, the state provided 100 percent of the difference between the tax payments that would have been made had the sale not occurred and the payments that are actually made. This percentage drops by 10 percent each year and will be eliminated after 10 years.

3.5 Economic Impacts by Geographic Area

Summary economic impacts for each of the three geographic areas—New London County, Connecticut and the United States—are presented in Table 3-5. The three economic impact variables are as follows:

- output—the value of production of goods and services, measured in 2001 dollars
- labor income—the earnings of labor, measured in 2001 dollars
- employment—measured in jobs provided.

Table 3-5. Impact of Millstone Nuclear Plant on Local, State, and National Economies

	Direct	Indirect[a]	Induced[b]	Total
New London County				
Output	$415,631,328	$41,935,265	$57,651,281	$515,217,874
Labor Income	$73,111,708	$22,567,855	$22,560,243	$118,239,806
Employment	1,066	541	731	2,338
Connecticut				
Output	$415,631,328	$79,323,036	$89,797,272	$584,751,636
Labor Income	$96,422,204	$41,523,196	$36,884,846	$174,830,246
Employment	1,406	861	979	3,247
United States				
Output	$415,631,328	$385,153,323	$360,968,646	$1,161,753,297
Labor Income	$108,560,813	$159,484,448	$127,027,812	$395,073,073
Employment	1,464	3,960	3,815	9,239

[a] *Indirect impacts are a measure of the effect on input suppliers of expenditures by Millstone.*

[b] *Induced impacts measure the effects produced by the change in household income that results from Millstone expenditures.*

These economic impacts are divided into their direct and secondary effects. The direct effects, or "first round" effects, reflect the industry sector and geographical distribution of Millstone spending without any subsequent spending effects. The secondary, or ripple, effects include these subsequent spending effects. Indirect effects reflect how Millstone spending patterns affect subsequent spending patterns among suppliers. Induced effects reflect how changes in labor income affect the final demand for goods and services, which then has an affect on all sectors producing basic, intermediate and final goods and services.

The direct effects in this table are based on the estimated value of Millstone revenues of $415.6 million for fiscal year 2001. These revenues are spent, distributed, invested or paid as taxes, and thereby reflect the total output of products and services associated directly with Millstone. This total includes the expenditures for products and services (including labor) itemized in Tables 3-1, 3-2 and 3-3. The direct employment (1,464 jobs) for the United States is the average Millstone employment level over this period. The majority of these jobs (73 percent) are filled by workers in New London County. Of the remaining 298 jobs, 240 are filled by residents of Connecticut outside New London County, and the other 58 are filled by residents of other states. The direct labor income entries reflect the geographic distribution pattern of Millstone employment.

As Table 3-5 indicates, direct effects typically are the largest contributor to total effects for each of the measures of economic impact and for New London County and Connecticut. Ripple effects are the largest contributor to total effects in the United States.

Within the ripple effects, induced effects are larger than indirect effects for New London County and Connecticut, both because the direct effects on labor income are large and because the final demand changes affect more sectors than are included in the indirect (supply chain) effects. Indirect effects are more important as a share of the total at the U.S. level.

A helpful way for measuring the ripple effects is by using multipliers. Multipliers show the ratio of the plant's "total economic impact" to its "direct economic impact" and can be measured for each geographic region. In terms of output, Millstone's direct impact for New London County is $415.6 million, whereas its total impact is $515.2 (see Table 3-5). Thus, the multiplier for Millstone's output for New London County is 1.24 (or $515.2 million divided by $415.6 million). This indicates that for every dollar of output from the Millstone plant, the New London County economy produces $1.24. Using the same formula, the output multiplier is 1.41 for Connecticut and 2.80 for the United States. This means that for every dollar of Millstone output, the Connecticut economy produces $1.41 and the U.S. economy produces $2.80. The multiplier is larger for the United States than for the smaller regions because Millstone spends less in the United States than it spends outside Connecticut and New London County.

3.6 Economic Impacts by Local Industry

Millstone's economic impacts are spread over virtually every sector of the economy. The direct effects are concentrated in a few sectors, but the ripple effects—and especially the induced effects—increase the dispersion of total effects across other sectors.

The sectors most impacted vary by geographic area. Table 3-6 presents the 10 sectors most affected by the plant in New London County, based on total output.

The sector that is most affected in terms of total output is the electric services sector because this includes electricity produced by the plant. Thus all direct effects are included in this sector. It is the largest sector based on total output in the Connecticut and U.S. economies, as shown in Tables 3-7 and 3-8, respectively.

The second most affected sector is the maintenance and repair of facilities sector. This sector received the largest share of Millstone spending on products and non-labor services at the New London County, Connecticut and U.S. levels. (See Tables 3-1, 3-2 and 3-3.) It includes industrial maintenance and repair, but excludes building maintenance, automotive repair and several other non-industrial maintenance and repair services. It is also the second-most affected sector based on total output in the Connecticut and U.S. economies.

The most affected sectors based on total output are not always the most affected sectors based on the other impact measures (i.e., labor income and employment). A striking example of this is the real estate values sector, also known as the owner-occupied dwellings sector. This is not a traditional business/ industry sector, and thus there are no impacts on labor income or employment. Instead, it is a special sector developed by the U.S. Department of Commerce's Bureau of Economic Analysis (BEA). It estimates what homeowners would pay in rent if they rented rather than owned their homes. In essence, it creates an industry for home ownership. The sole product (or output) of this industry is home ownership, purchased entirely by personal consumption expenditures out of household income. This sector in effect captures increases in housing values due to increased labor in the area resulting from the plant.

Table 3-6. Impact of Millstone on the Most Affected Industries in New London County (2001$)

IMPLAN Code	Industry Description	Output	Labor Income	Employment
443	Electric Services (Millstone)	$417,601,152	$73,625,620	1,072.5
56	Maintenance and Repair Services of Facilities	$17,283,242	$10,868,078	212.8
470	Business Services	$8,537,252	$3,277,446	90.9
461	Real Estate Values	$7,734,992	—	—
474	Personnel Supply Services	$4,255,820	$3,708,624	136.1
490	Doctors and Dentists	$3,882,637	$2,427,170	35.7
506	Engineering—Architectural Services	$3,860,664	$1,737,794	37.4
462	Real Estate	$3,739,821	$460,574	24.5
454	Eating and Drinking Establishments	$3,597,224	$1,381,985	95.9
492	Hospitals	$3,382,883	$2,194,208	44.7
	Other	$41,342,187	$18,558,307	587.1
	TOTAL	$515,217,874	$118,239,806	2,337.6

Table 3-7. Impact of Millstone Nuclear Plant on the Most Affected Industries in Connecticut (2001$)

IMPLAN Code	Industry Description	Output	Labor Income	Employment
443	Electric Services (Millstone)	$417,293,728	$96,856,420	1,411.5
56	Maintenance and Repair Services of Facilities	$25,388,340	$15,955,260	314.0
470	Business Services	$15,510,771	$6,131,832	115.2
461	Real Estate Values	$9,784,173	—	—
508	Management and Consulting Services	$7,448,452	$4,415,846	65.9
447	Wholesale Trade	$6,551,900	$2,529,977	37.1
506	Engineering—Architectural Services	$6,351,072	$2,832,083	62.3
474	Personnel Supply Services	$6,255,192	$5,450,196	190.0
490	Doctors and Dentists	$5,891,371	$3,708,980	52.5
492	Hospitals	$5,401,007	$3,536,587	69.1
	Other	$78,875,630	$33,413,065	928.9
	TOTAL	$584,751,636	$174,830,246	3,246.5

Table 3-8. Impact of Millstone Nuclear Plant on the Most Affected Industries in the U.S. (2001$)

IMPLAN Code	Industry Description	Output	Labor Income	Employment
443	Electric Services (Millstone)	$420,430,016	$109,814,149	1,479.8
56	Maintenance and Repair Services of Facilities	$78,696,552	$47,339,180	1,139.1
189/190	Industrial Inorganic Chemicals and Cyclic Crudes	$50,676,569	$9,401,764	87.3
461	Real Estate Values	$29,863,770	—	—
447	Wholesale Trade	$29,842,438	$11,523,124	235.2
470	Other Business Services	$29,629,738	$10,873,523	344.5
506	Engineering—Architectural Services	$27,793,106	$12,358,534	273.4
462	Real Estate	$24,842,974	$3,050,376	126.0
474	Personnel Supply Services	$21,497,200	$18,728,056	885.2
508	Management and Consulting Services	$20,960,098	$11,151,017	245.4
	Other	$427,520,836	$160,833,350	4,423.3
	TOTAL	$1,161,753,297	$395,073,073	9,239.2

3.7 Economic Impacts by State Industry

Table 3-7 is similar to Table 3-6, except that it is for the state of Connecticut. Again, electric services and maintenance and repair services of facilities are the most affected sectors in terms of total output.

Wholesale trade and management and consulting services are sectors that appear in Table 3-7, but not in Table 3-6. They receive large amounts of spending by Millstone in the rest of Connecticut rather than in New London County. These two sectors have displaced the real estate and eating and drinking sectors that appear in Table 3-6. The other eight sectors of economic impact are consistent in New London County and the entire state.

3.8 Economic Impacts by U.S. Industry

The electric services and maintenance and repair services of facilities are the most affected sectors in terms of total output for the United States.

The 10 most affected sectors (on the basis of output) in the United States are similar to the 10 most affected sectors in New London County and Connecticut. The main difference is the appearance of a combined industrial inorganic chemicals and cyclic crudes sector in Table 3-8. This sector includes some inorganic and organic chemicals used at Millstone. It is important in this study because it includes nuclear fuel processing services. The industrial inorganic chemicals and cyclic crudes sector and the real estate sector have replaced the doctors and dentists and hospital sectors on the Connecticut list in Table 3-7. Impacts on the latter two sectors are more concentrated locally than nationally, as expected.

3.9 Tax Impacts

Millstone spending has effects on tax payments that go beyond the taxes paid directly on the plant. This spending has direct impacts on income and value creation, which affects taxes paid on that income and value. Similarly, the ripple effects of Millstone spending on other spending and economic activity leads to additional income and value creation, which leads to additional taxes paid.

These additional or "induced" effects on tax payments are much larger than the taxes paid directly. These results are presented in Table 3-9.

The taxes paid by Millstone shown in this table do not include accrued taxes or state assistance to the town of Waterford to soften the effect of loss in property tax revenues in the aftermath of the Millstone sale by Northeast Utilities to Dominion Energy. The taxes paid by Millstone reflect taxes only (not outside assistance) and actual taxes paid (not accruals) in 2001.

These results can be used to compute tax multipliers, but not for each line item. Line-item tax multipliers cannot be computed because some taxes are not paid by Millstone and the table does not include taxes accrued by Millstone.

Table 3-9. Tax Impacts of Economic Activity Induced by Millstone

	Taxes Paid by Millstone	Taxes Induced by Millstone Expenditures	Total Tax Impact[a]
Federal Government			
Payroll Tax[b]	$4,422,058	$35,744,803	$40,166,861
Personal Taxes	—	$38,310,546	$38,310,546
Other Federal Taxes	$3,557,900	$13,473,257	$17,031,157
Total Federal Government	$7,979,958	$87,528,606	$95,508,564
State and Local Government			
Payroll Tax[b]	$72,023	$585,106	$657,129
Personal Taxes	—	$10,612,351	$10,612,351
Other State and Local Taxes	$16,982,197	$28,506,189	$45,488,386
Total State and Local Government	$17,054,220	$39,703,646	$56,757,866
Total Taxes	$25,034,178	$127,232,252	$152,266,430

[a]*The total tax impact includes both the taxes directly paid by Millstone and the taxes paid by other entities as a result of the economic activity created by Millstone expenditures.*

[b]*Payroll taxes for Millstone were divided into federal and state components using the average allocation based on IMPLAN data.*

3.10 Summary

There are substantial economic and fiscal impacts from the Millstone nuclear power plant. When compared with the respective economies, the relative impacts of Millstone are highest for New London County, next highest for Connecticut and lowest for the United States. The Millstone job creation impact (direct and indirect) of 2,338 jobs in New London County represents almost 2 percent of the employed work force of 130,721 in the county. This is a significant number of jobs deriving from a single establishment.

These impacts are greater in absolute terms at the national level than at the state level, and also are greater at the state level than at the county level. As is the case with other nuclear plants, Millstone buys many specialized products and services not available in local and state economies. It typically buys from national and international markets. The state and local economic and fiscal effects are great, in large part because of the buying power that is created by Millstone's high wages, salaries and benefits, which are spent on goods and services provided locally and in nearby areas.

Section 4: Additional Benefits Provided by Millstone

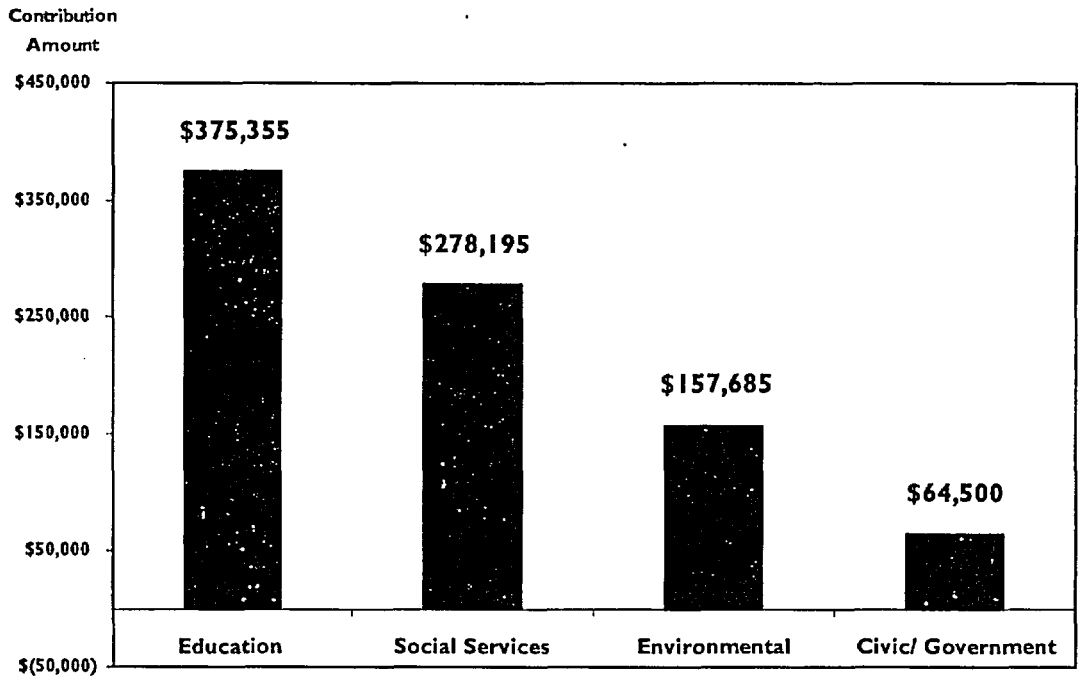
The Millstone plant also contributes to the social services, education, environment, economic development and civic life of New London County. In addition to the economic benefits that the Millstone plant contributes to the New London County area through jobs, incomes and taxes, the Millstone plant also contributes to the local community in important ways that are difficult to quantify. Nuclear plants hire large numbers of well-educated people who are involved in their communities in a variety of ways.

4.1 Introduction

Millstone Station has a long tradition of community involvement. This tradition is manifested in the strong management commitment to the sharing of financial and intellectual talent in Southeastern Connecticut. Company leaders support volunteerism. Policies include a paid time-off policy for employees who perform community-based volunteer service; a corporate matching giving program that includes a match of $3 for every $1 donated for employees who serve on the board of directors of a nonprofit organization and $2 for every $1 donated to all other nonprofit organizations. Also, Dominion Energy funds a corporate contributions program to not-for-profit organizations through the Employee Contributions Committee and the Dominion Foundation.

During 2001, Millstone contributed $875,735 through direct contributions and through its matching gift program. The beneficiaries included educational institutions, social services agencies, and environmental, civic and governmental organizations. The company contributes to scholarships to the University of Connecticut and Three Rivers Community College, and provides funds to the American Heart Association, the United Way and its regional food bank, Hospice of Southeastern Connecticut, and the Women's Center, just to name a few. These company donations provide valuable educational and health benefits to the residents of Southeastern Connecticut. In addition to the company donations to the United Way, the employees of Millstone also donated $326,000 to the United Way of Southeastern Connecticut.

Figure 4-1. Annual Contributions by Millstone to Local Organizations



4.2 Social Services

The Millstone plant makes contributions to improve social services in New London County and Connecticut. In 2001, the Millstone plant's contributions totaled more than $278,000 in the area of social service improvement.

The largest of these donations was to the United Way food bank. In 2001, Dominion Energy and Millstone donated $100,000 to replace the roof on the food bank, which serves as a distribution center for the donation of food to New London County citizens.

In addition to the food bank, Millstone also regularly donates to several other social services-related charities such as the American Heart Association ($12,000), Hospice of Southeastern Connecticut ($4,000) and the Women's Center of Southeastern Connecticut ($2,500). These donations provide valuable health benefits to New London County and southeastern Connecticut residents.

Millstone's employees also actively participate in a variety of social services that benefit the people of New London County. One program undertaken by Millstone employees is the Save the Kid Fund. The program is funded through employee payroll deductions and funds raised during plant refueling outages by selling T-shirts. The fund donates money and time to community children in need who are recommended to the fund by Millstone employees.

Many Millstone employees also participate in the Adopt a Family program. Employees donate money and time to help a family in need during the holidays.

4.3 Education

Because of the science and engineering expertise in the nuclear industry, Millstone has a strong interest in promoting education. Aside from the contribution that Dominion Energy makes to the local education system through property taxes, the Millstone plant also makes direct expenditures that foster educational achievement in New London County and throughout Connecticut.

In 2001, Millstone made donations of $375,000 to educational groups. Millstone provides $50,000 for engineering scholarships to the University of Connecticut. These are competitive scholarships given to engineering students from Connecticut. Millstone also provided $208,000 to sponsor students at Three Rivers Community College. These students learn skills that they can use at the Millstone plant. In addition to these programs, Millstone sponsors student interns at the plant, allowing these students to get hands-on experience applying what they have learned in college.

Millstone also donates employees' time and financial resources to primary and secondary education in New London County. One program run by Millstone sponsors is a robot-building contest. Employees at Millstone assist local students in building robots with supplies provided by the plant. Millstone donates $100,000 and time from plant engineers to two high schools to help them participate in the FIRST (For Inspiration and Recognition of Science and Technology) robotics contest.

Dominion Energy also sponsors mentoring programs in which Millstone employees help children with their studies. The plant allows employees to take off one hour per week to interact one-on-one with students in local classrooms. In 2002, 56 employees served as mentors, and an additional 40 employees have been trained as mentors and await placement.

In addition, the Millstone plant provides opportunities for hands-on research. The plant has two state-of-the-art testing facilities that provide opportunities for the collection of data on the environment. One program is the "ring monitoring" system, which is a ring of meteorological and environmental data collection stations that were installed in regional schools surrounding the plant and that allow students to monitor the environment. The program is run independently by Three Rivers Community College and receives all its funding from Millstone. Also, the plant's water testing laboratory collects data used by local colleges and labs as part of the testing conducted by Millstone to ensure a pollution-free water supply. These data are used to access the environmental and ecological condition of the surrounding water systems.

4.4 Environment

Millstone's principal contribution to improving the environment in Connecticut is through the generation of electricity without emitting any air pollutants. Nuclear plants do not emit any air pollution as part of their operations, and all of a plant's solid wastes are contained and constantly monitored. If a coal-fired plant had been built at the Millstone site instead of a nuclear plant, the state of Connecticut would have had 43,000 tons more nitrogen oxide (NOx) emissions, 89,000 tons more sulfur dioxide (SO_2) emissions and 15 million tons more carbon dioxide (CO_2) emissions in 2000 alone.

The Millstone plant also makes many contributions to the local economy with a focus on improving the quality of the environment in southeastern Connecticut, as indicated in Figure 4.1. In fact, the state of Connecticut awarded Millstone its Green Circle Award for environmental stewardship. In addition to the significant number of Millstone employees that serve on local

boards and agencies, Dominion Energy contributed to environmental organizations through a tree planting program in the town of Groton, an annual environmental day off with pay for approximately 65 employees to restore nature trails at the Dennison Pequot Nature Center in Mystic, Conn., and financial support for the Save the River/Save the Hills water testing program.

Additionally, Millstone has also initiated programs to encourage the ecological growth of the area surrounding the plant. One program encourages growth of the osprey population around Millstone Point. In the 1950s and 1960s, before the plant was built, the osprey population was reduced as a result of pesticides. Since 1967, Millstone lab staff have built nesting platforms around the plant and monitored increases in the number of osprey near the plant. Today, many active osprey nests are maintained along the Connecticut coast.

4.5 Civic/Government

The Millstone plant and its employees are very involved in the civic life of New London County. In 2001, the Millstone plant donated $64,500 to civic causes in the local community. The contributions of time and money were concentrated in the areas of community activities, athletics and the arts.

One of the most significant contributions that Millstone employees make to the New London County area is through programs promoting the arts. In 2001, Millstone donated $12,500 to fund a summer music special event that brings in nationally acclaimed performers to the local area. Millstone also supports a series of acoustic guitar concerts at Connecticut College and donated $12,000 to sponsor a concert by the Eastern Connecticut Symphony Orchestra.

In addition, Millstone makes annual contributions to the Lyman Alan Arts Museum, the Children's Museum of Southeastern Connecticut and the nationally recognized Eugene O'Neill Theater Center.

Millstone contributes to many other community activities in New London County. It provided $5,000 to sponsor the Waterford Bicentennial celebration. Millstone also sponsored the Fourth of July fireworks in East Lyme, receptions for the USS Caron and provided funding for Main Street America New London and East Lyme.

Millstone also supports youth and amateur athletics in New London County. In 2001, Millstone made donations to Colchester youth soccer, Waterford Little League, Connecticut Cyclones fast pitch softball, Westerly Women's softball, Waterford Softball Union, Easter Seals volleyball team, Fitch Senior High girls cross country team, the Waterford High School football program, and the Waterford Youth Football League.

In addition to supporting these activities, the Millstone plant also donated the use of ballparks to the town of Waterford through a license agreement. The ballparks are about 30 acres with an approximate value of $300,000.

Section 5: Nuclear Industry Trends

U.S. nuclear power plant performance reached an all-time high in 2002, the fifth consecutive record-setting year. The nuclear energy industry has steadily improved performance and cost, while also improving safety at the plants. The nuclear energy industry is a model of industrial safety. Power plant performance is commonly measured by capacity factor, which expresses the amount of electricity actually produced by a plant compared with the maximum achievable. U.S. nuclear power plants achieved a capacity factor of 91.9 percent in 2002. Total electricity production for U.S. nuclear power plants reached new heights in 2002. At the same time, production costs for U.S. nuclear power plants have been among the lowest of any baseload fuel source.

5.1 Nuclear Industry Performance

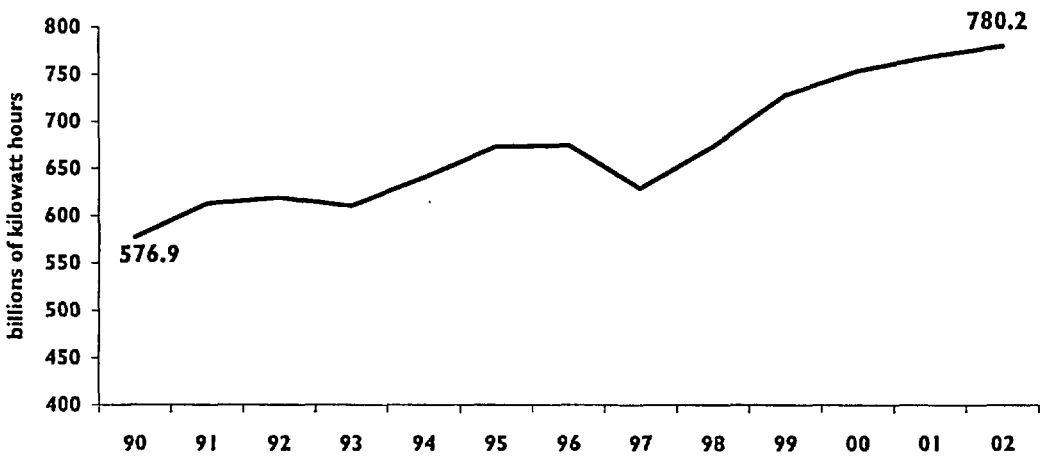
U.S. nuclear power plants have increased their output and improved their performance significantly over the past 10 years. Nuclear energy represents about 20 percent of all electricity generated in the United States. In 2002, nuclear power generated 780 billion kWh of electricity. Since 1990, the industry has increased total output equivalent to 25 new, large nuclear plants. The increase in output has been accomplished without building any new nuclear plants.

In 2002, U.S. nuclear plants operated at an average capacity factor of 91.9 percent. In fact, overall capacity factors for the U.S. nuclear power plants increased dramatically over the past decade. By contrast, in the late 1980s the average industry capacity factor was 60 percent.

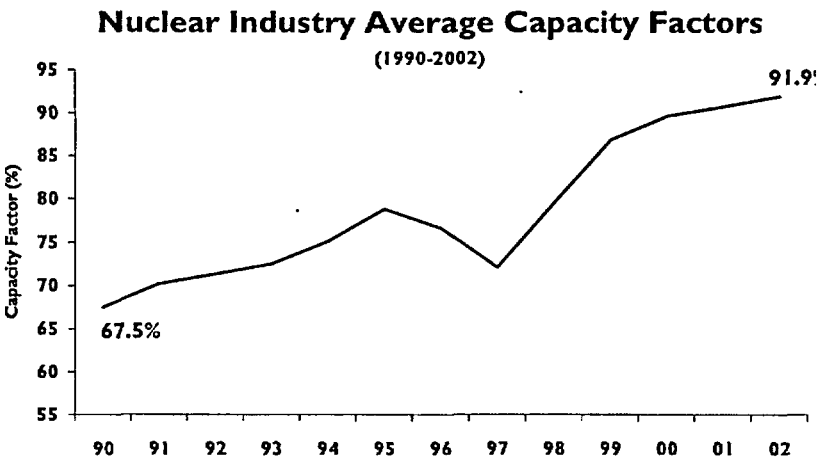
One of the key reasons for these increased capacity factors has been the shortening of refueling outage times.

U.S. Nuclear Industry Net Electricity Generation

(35% increase from 1990 to 2002)



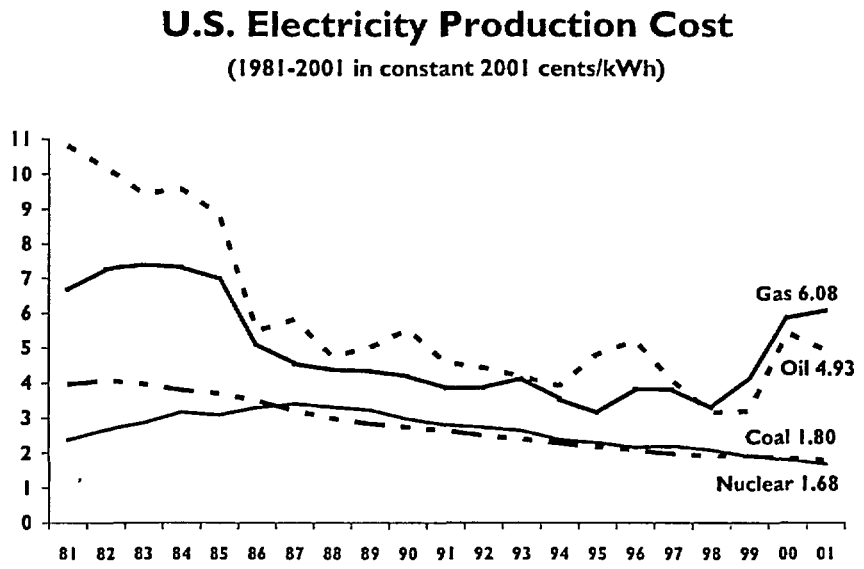
Source: Energy Information Administration



Nuclear plants need to shut down to refuel approximately every 18 to 24 months. Refueling represents one of the major determinants of nuclear plant availability. In the past 10 years, the durations of refueling outages have been declining. In 1990, the average refueling outage took 105 days to complete. By 2001, this number declined to an average of 37 days, and companies continue to apply best practices to reduce this average length of refueling. The record for the shortest refueling outage is 14.67 days for boiling water reactors and 15.67 days for pressurized water reactors.

5.2 Cost Competitiveness

Along with increasing output, the U.S. nuclear industry has continued to decrease the cost of its operations. In 2001, nuclear power had a production cost of 1.68 cents/kWh. This was significantly lower than the production costs of electricity generated by oil and natural gas and slightly lower than coal. In the past decade, nuclear production costs have dropped by about one-third, as a result of the increased capacity factor of the U.S. plants. Since most of a nuclear plant's costs are fixed, greater electricity production creates lower cost. However, nuclear plants have also taken steps to reduce their total cost through improved work processes.



Source: Pre-1995: UDI, Post-1995: RDI Modeled Production Cost

Wholesale Electricity Prices by Region (cents/kWh)

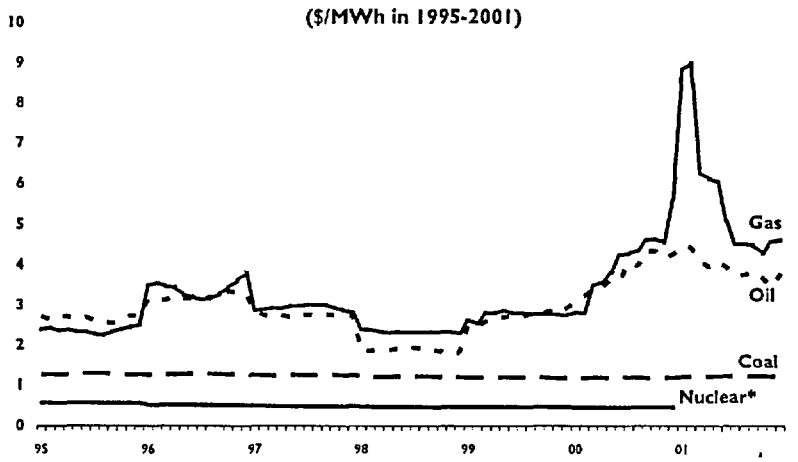
Region	2001 Average On-Peak Prices	2003 On-Peak Futures Prices
New England	4.99	3.58
New York	4.97	4.38
Mid-Atlantic	3.93	3.63
Tennessee Valley	3.58	3.03
Gulf States	3.60	3.05
Midwest	3.39	3.00
Texas	3.46	3.30
Northwest	13.00	3.48
Southwest	11.30	3.73

Because of low production costs and excellent safety performance, today's nuclear plants are well-positioned to compete in today's energy markets. Ultimately, the primary test of nuclear power's competitiveness is how well it performs against market prices. In this respect, nuclear power is highly competitive. Average production costs at 103 reactors were 1.68 cents/kWh in 2001, lower than the average price in all regional markets. Nuclear power is also competitive with futures market prices, one of the best ways to judge what prices will be in the year ahead.

Nuclear plants also provide a unique degree of price stability not seen by other fuel sources for two reasons. First, production costs for nuclear plants are comprised of costs not associated with fuel. Fuel markets tend to be very volatile, so the production costs of generation sources tied to fuel expenses are highly volatile, as they swing with variations in fuel markets. Fuel represents only 20 percent of the production cost of nuclear power, but it makes up between 60 percent and 80 percent of the cost of natural gas, coal and petroleum-fired generation. Second, nuclear fuel prices are much more stable than that of fossil fuels, particularly natural gas and petroleum. Because of its stable, low production cost, nuclear power can help mitigate large electricity price swings.

Monthly Fuel Cost to Electric Generators

($/MWh in 1995-2001)



Source: RDI and UDI.

* Nuclear data is annual instead of monthly since fuel is only loaded once every 18-24 months. Data are only available through 2000.

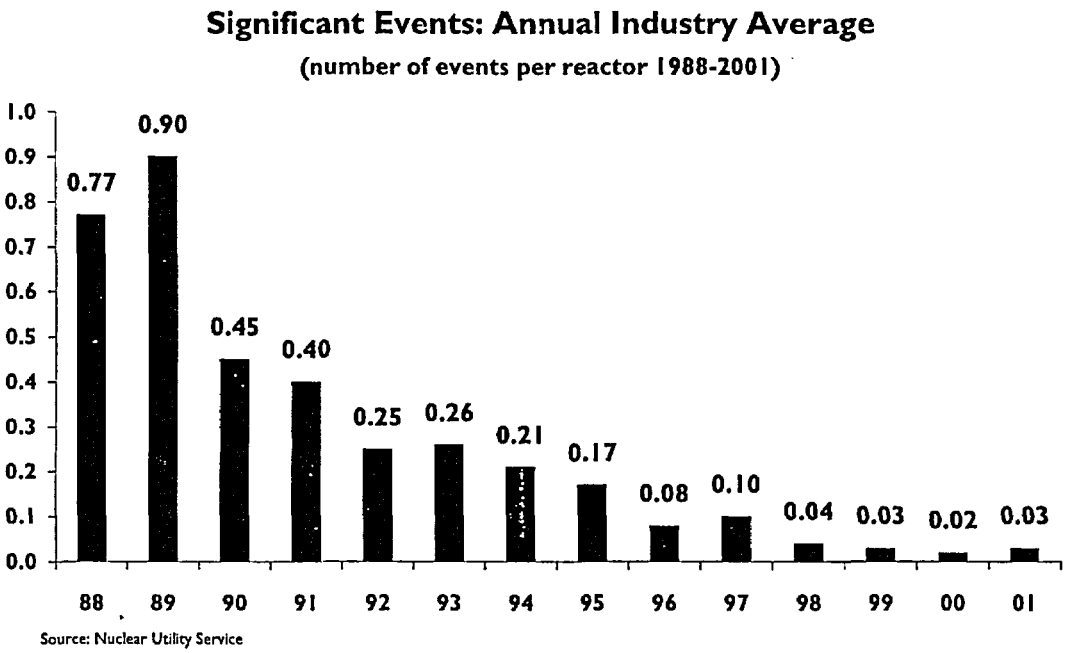
5.3 Industry Safety

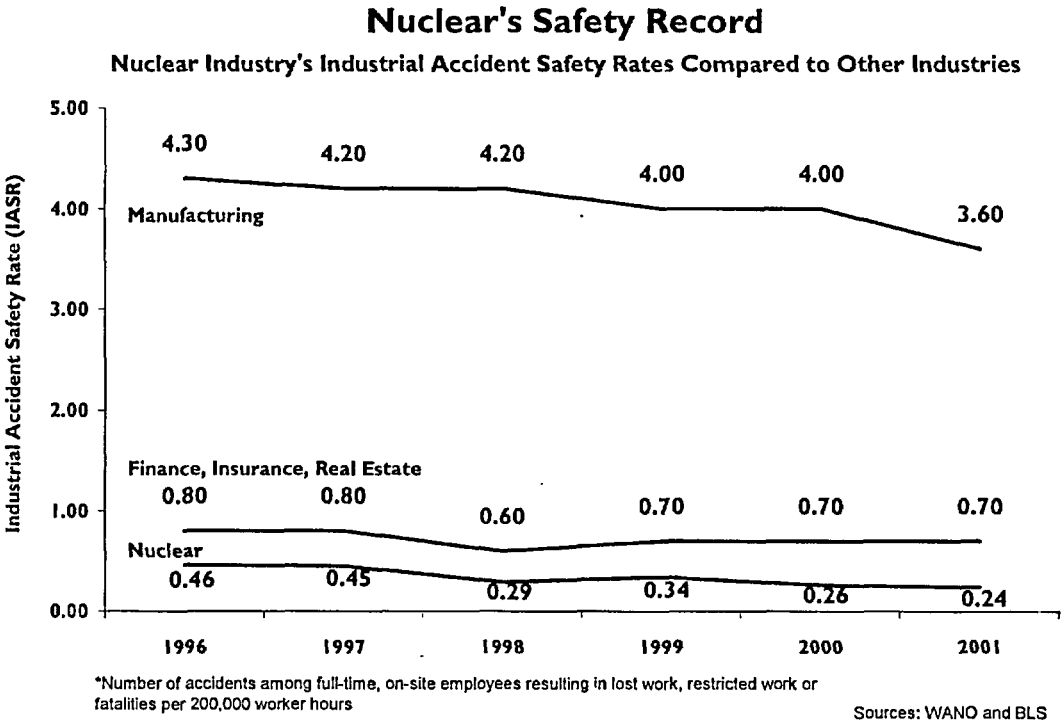
The nuclear industry's recent performance and cost achievements have been accomplished in an era of outstanding safety at U.S. nuclear plants. In 2002, the nuclear power industry met or exceeded all safety goals set by the Institute of Nuclear Power Operations (INPO) and the World Association of Nuclear Operators (WANO). These entities track safety and performance data in 10 key areas.

One key indicator tracked by INPO and WANO is the number of unplanned automatic plant shutdowns, or "scrams." The U.S. industry has made dramatic improvements in the number of unplanned automatic shutdowns. In 1980, the U.S. nuclear industry had a median of 7.3 shutdowns per reactor. Since 1997, the median has been zero scrams per reactor.

Other safety and performance indicators tracked by the Nuclear Regulatory Commission (NRC) confirm the improved safety performance of U.S. nuclear plants. The NRC tracks data on the number of "significant events" at each nuclear plant. (A significant event is broadly defined as any occurrence that challenges a plant safety system.) The average number of significant events per reactor has declined from 0.77 per year in 1988 to 0.03 in 2001.

In addition to safe operations, U.S. nuclear plants are continuing to improve the already high levels of worker safety. According to NRC data, radiation exposure (measured in rems) to workers decreased from an average of about 1 rem per year in 1973 to 0.16 rem per year in 2001. Both the historical and current doses per employee are far below the regulatory limit of 5 rems per year.





General worker safety also is excellent at U.S. nuclear power plants—far safer than the U.S. manufacturing sector. WANO and the Bureau of Labor Statistics (BLS) provide information on the industrial accident safety rate. This statistic measures the lost workday accidents or fatalities per 200,000 worker hours. The nuclear industry has improved its industrial accident safety rate from 0.46 in 1996 to 0.24 in 2001. By comparison, the U.S. manufacturing industry had an industrial accident safety rate of 3.6 in 2001 and the U.S. finance, insurance and real estate industries had an industrial accident safety rate of 0.7—both higher than the nuclear industry.

5.4 Current Industry Events

The excellent economic and safety performance of the U.S. nuclear power plants has increased interest in nuclear power by the electric utility industry, the financial community and policymakers. This is evidenced by the increasing number of plants seeking license renewals from the NRC. Nuclear plants were originally licensed to operate for 40 years but can safely operate for longer periods of time. The NRC granted the first 20-year license renewal to the Calvert Cliffs plant in Maryland in 2000. As of May 2003, 16 plants have received license extensions, and 38 units have either submitted an application 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 power's low production costs and the return on investment for license renewal.

In addition to relicensing current plants, interest has recently increased in building new nuclear plants. Several companies are exploring building new plants, and the Department of Energy is engaged in steps necessary to build new plants. In addition, President Bush included construction of new nuclear plants as an essential part of the National Energy Strategy announced in May 2001.

Section 6: Economic Impact Analysis Methodology

The methodology used to estimate the economic and fiscal impacts of the Millstone power plant is commonly referred to as input/output methodology. Several operational input/output models are available in the marketplace—the market leaders are IMPLAN, REMI and RIMS-II. The IMPLAN (Impact Analysis for Planning) model was selected for use in this study, primarily because the model and many of the data sets were already on hand, the relevance of IMPLAN to the particular application, and for its transparency and ease of use.

This report section presents typical applications of input/output methodology and provides an overview of the methodology and its underpinnings. It also describes how Millstone data and the IMPLAN model were used to estimate local, state and national economic and fiscal impacts of plant operation.

6.1 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, and model results can be developed at the county, multi-county, state, multi-state and national levels. They 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 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 are also 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, closings
- transport or other public infrastructure investments
- industrial recruitment and relocation
- tourism.

6.2 Overview of the Input/Output Methodology

Input/output models link various sectors of the economy—e.g., agriculture, construction, manufacturing, trade, services, government and households—through their respective spending flows in a reference year. These linkages 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 subsequent, 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 income, spending, production and employment) that are triggered by this 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 industry output, earned income, total income (which includes the effect of transfers between institutions) and employment.

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, the state in which the county is located, because some of the 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 economy is more diversified and if the economic activity being modeled is a good "fit" within that economic base.

Ripple effects include two components—indirect and induced effects—that are separately modeled within input/output models. Indirect or "upstream" effects are the effects on the supply chain that feeds into the business/industry sector in which the economic activity is located. For example, when Millstone buys a hammer for $5, it contributes directly to the economy by this purchase, but the company that makes the hammer also has to increase its purchases of steel and wood to maintain its inventory, and this will increase output in the steel and wood industries. The steel and wood industries will then 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 by Millstone for the hammer.

Induced effects are the effects on all sectors that result from changes in final demand of commodities and services that are associated with changes in income from the economic activity. They are primarily associated with changes in household spending on goods and services for final demand. These changes are the result of changes in labor income. To illustrate, when Millstone 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. There will also be a contribution from the effect of this purchase on labor income in the wood and steel industries, and the household spending on goods and services that results. Millstone's own wage and salary expenditures create induced effects too, and they occur primarily in the New London County economy.

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.

Input/output models assume 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 weren't 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 isn't large relative to the rest of the sectors.

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 there likely would be diseconomies of scale. 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 isn't large relative to the rest of the sectors.

Homogeneity is also a key simplifying assumption. Basically, firms within sectors and technologies within sectors are characterized as very similar. There is some ability to edit sector files to characterize specialized firms, but there is no ability to reflect full diversity of firms within sectors.

6.3 The IMPLAN Model and Its Application to Millstone

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.

There are two components of the IMPLAN system: 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 three functions:

- data retrieval
- data reduction and model development
- impact analyses.

The IMPLAN database consists of two major parts:

- national level 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 IMPLAN 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, provide a high degree of flexibility both in terms of geographic coverage and model formulation.

In applying the IMPLAN model to Millstone, three basic types of data were provided by Dominion Energy:

- purchase order expenditures by Millstone purchase order code
- employee compensation expenditures
- tax payment data.

Purchase order expenditures were provided for a full year after the sale of Millstone by Northeast Utilities to Dominion Energy became effective on April 1, 2001. Employee compensation (salary data and an estimate of the value of benefits) were provided for the same time period, with a small gap at the end of 2001, when data were not available. Tax payment data were provided for calendar year 2001.

The purchase order data were mapped to IMPLAN sector codes (528 sectors) by comparing the descriptions of the purchase order codes provided by Dominion Energy with the Standard Industrial Classification (SIC) codes within IMPLAN sector codes. For certain purchase order codes with large dollar amounts where it appeared that the codes could be mapped to several IMPLAN codes, Dominion Energy provided the names of key vendors to facilitate the mapping process. These vendor names could be compared with vendor names listed by SIC code to provide "one-to-one" mapping of Dominion Energy purchase order codes to IMPLAN codes.

The purchase order and compensation data were then augmented by an estimate of revenues from Millstone sales into the wholesale market over this period. This augmentation was necessary because purchase orders and compensation do not reflect all Millstone expenditures, and total expenditures (approximated by total revenues) better reflect the full economic impacts of Millstone. However, Millstone revenues are not public, because Millstone is now a merchant power plant. Therefore, Millstone revenues were estimated based on kilowatt hours sold and prices paid by the New England Power Pool during this time period. The estimated revenues were slightly above the expenditure data provided by Millstone, indicating a modest margin that was then incorporated into IMPLAN as profits associated with Millstone operation.

In tailoring the model to Millstone, the underlying datasets provided by IMPLAN were reviewed to see if any of the IMPLAN coefficients could be edited to better reflect local conditions. IMPLAN coefficients are based on national relationships, and in some cases may not reflect local conditions. In this report, the coefficients within the electric services sector (code 443) were edited to more accurately reflect a nuclear power plant rather than a "national average power plant of all types." This constituted the majority of the coefficient editing.

IMPLAN was then used to develop the economic and impact estimates.

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