

11.0 INTRODUCTION

Chapter 11 considers the economics of a decision to extend the operating license of Vermont Yankee (“VY”) an additional 20 years. The analysis presented herein represents a cost/benefit analysis of the value added to the state government, to the economy in general, and to the electric ratepayers through continued operation of the facility. If the operating license is not extended, these economic effects would be diminished until completion of the decommissioning, at which point they would cease entirely. However, the same decommissioning process would need to take place at the end of any license extension period. Chapter 6 of the report reviews decommissioning, including the decommissioning fund and the costs of decommissioning. Four components of the economic analysis are presented in Chapter 11.

- Tax Revenue/Burden Analysis – estimates government revenues generated by the facility versus additional burdens placed upon the government. The analysis is presented in Section 11.1.
- Economic Impact Analysis – estimates the impact on total value added, industrial output and employment associated with continued operation of Vermont Yankee, including impacts associated with Vermont Yankee operating expenditures and employee compensation spent on personal consumption in the state. An Input/Output model is developed to conduct this analysis, as described in Section 11.2.
- Revenue Sharing Arrangement – Entergy has agreed to share a portion of its revenues from Vermont Yankee that are in excess of a negotiated strike price. The shared revenue would be to the benefit of certain Vermont ratepayers. Section 11.3 describes the revenue sharing agreement and value.
- Potential for Reduced Power Cost – There exist the potential for Entergy to sell power to Vermont utilities from the Vermont Yankee facility at some unknown discounted rate. Section 11.4 estimates the value to ratepayers of a possible 5%, 15%, or 25% reduction from market prices.

11.0.1 *General Assumptions*

The following list outlines the general overall assumptions made in relation to the economic analysis.

- The study period is 2013 through 2032. The economic input/output model used for much of the analysis can only handle calendar year impacts. Therefore, although the extended operating license would be valid for March 2012 through March 2031, this analysis uses calendar years 2013 through 2032. The slight shift in timing would have a negligible impact on the results.
- For tax revenues and receipts, a discount rate of 4.9% is used to estimate total discounted impacts in 2012 dollars. The discount rate is equivalent to the bond

rate of a Vermont 20-year General Obligation bond. For the revenue-sharing analysis, a discount rate of 8.5% is used, which is the average utility cost of capital according to the Department of Public Service.

- The facility will have a net capacity of 620 MW in each year of the study period. Due to refueling outages every 18 months on average, capacity factors are estimated on three-year cycles. In 2013 and 2014, the net capacity factor is estimated to be 89%, and in 2015 it is estimated at 97%. This cycle is then repeated every three years. These estimates are based on refueling outages lasting 30 days.
- It is assumed that 50% of Vermont Yankee employees reside in Vermont.¹ It is assumed that this proportion will hold constant throughout the study period.
- The Input/Output model has several implicit assumptions associated with its use. Those assumptions are identified in detail in Section 11.2.1 below.

11.0.2 Summary Results of Analysis

Continued operation of the Vermont Yankee nuclear facility represents a substantial economic value to the state of Vermont and its citizens. With just over 500 employees, Vermont Yankee currently ranks among the 60 largest private and public employers in Vermont.² It plays a larger role in the Windham County area, where it ranks in the top 5 of employers according to the Brattleboro Area Chamber of Commerce. The cost/benefit analysis conducted in this study indicates that positive value is created for the local and state governments, the economy as a whole, and the electric ratepayers of the state if the plant continues to operate an additional 20 years. The total 20-year value is estimated to range from an extreme low potential of \$1.5 billion to an extreme high of \$5.1 billion, representing between 0.2% and 0.6% of estimated Gross State Product over the 20 years.³ The base case value is \$3.6 billion over 20 years. These results can be construed to represent the likely cost to the economy of shutting down Vermont Yankee in 2012 as opposed to extending its operating license. Although it could be argued that the decommissioning process would provide for mitigated economic activity beyond 2012, decommissioning would occur at the expiration of the extended license as well.

Table 11.0 summarizes the range of positive economic impacts associated with continued operation of VY for another 20 years. The base (or middle) case represents our best

¹ The prefiled testimony of Richard W. Heaps on behalf of Entergy (Public Service Board Docket No. 7440) indicated 50% of VY employment resided in state. Current information seems to indicate that 218 of 502 current employees, or 43%, reside in Vermont. This study uses the 50% figure since employee turnover and changes in states of residence may impact the percentage.

² Vermont Department of Labor.

³ Assumes Gross State Product grows by 4% per year through 2012 and then grows by a simple trend through 2032.

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expectation.⁴ Table 11.1 summarizes the basic assumptions for each of the range scenarios.

Table 11.0
Summary of Economic Impacts (\$Millions)

<i>20-Year Total of Nominal Values</i>			
Component	Extreme Low Case	Base Case	Extreme High Case
Govt Revenues Net of Burdens	\$173.4	\$237.8	\$282.1
Value Added – Econ. Activity	\$1,095.9	\$1,289.3	\$1,482.7
Revenue Sharing Agreement	\$259.5	\$938.8	\$1,441.1
Potential Electric Rate Discount	\$0.0	\$716.1	\$1,193.5
Value Added – Rate Discount	\$0.0	\$421.3	\$702.2
Total	\$1,528.8	\$3,603.3	\$5,101.6
Jobs Supported by Value Added*	21,298.0	30,079.4	36,884.2

<i>20-Year Net Present Value**</i>			
Component	Extreme Low Case	Base Case	Extreme High Case
Govt Revenues Net of Burdens	\$105.1	\$143.3	\$169.6
Value Added – Econ. Activity	\$642.1	\$755.5	\$868.8
Revenue Sharing Agreement	\$159.0	\$587.8	\$908.0
Potential Electric Rate Discount	\$0.0	\$178.2	\$296.9
Value Added – Rate Discount	\$0.0	\$231.0	\$385.0
Total	\$906.2	\$1,895.8	\$2,628.3
Jobs Supported by Value Added*	21,298.0	30,079.4	36,884.2

<i>Average Annual Value Over 20 Years</i>			
Component	Extreme Low Case	Base Case	Extreme High Case
Govt Revenues Net of Burdens	\$8.7	\$11.9	\$14.1
Value Added – Econ. Activity	\$54.8	\$64.5	\$74.1
Revenue Sharing Agreement	\$13.0	\$46.9	\$72.1
Potential Electric Rate Discount	\$0.0	\$35.8	\$59.7
Value Added – Rate Discount	\$0.0	\$21.1	\$35.1
Total	\$76.5	\$180.2	\$255.1
Jobs Supported by Value Added*	1,064.9	1,504.0	1,844.2

* – Measured in Full Time Equivalent (FTE) job-years. 1 job held for 20 years would equate to 20 job-years.

** – The discount rate for government revenues and burdens and value added is the general obligation bond rate of 4.9%. The discount rate for revenue sharing and rate discount is an average electric utility cost of capital of 8.5%.

⁴ In the case of “Potential Electric Rate Discount” the 15% reduction case does not actually represent an expectation, but is more simply the middle of the three scenarios run for that component of the analysis. Making any guess as to what contract might be negotiated between Entergy and Vermont utilities would be speculative.

**Table 11.1
Components of the Three Cases**

Component	Extreme Low Case	Base Case	Extreme High Case	More Details
Government Rev/Burden Analysis	<ol style="list-style-type: none"> 1. Low economic impact for taxes collected 2. 15% higher state & government burdens per capita 3. 75% of per capita state & local burdens assigned to out-of-state employees 	<ol style="list-style-type: none"> 1. 25% of per capita state and local burdens assigned to out-of-state employees 	<ol style="list-style-type: none"> 1. High economic impact for taxes collected 2. 15% lower state & government burdens per capita 3. 0% of per capita state & local burdens assigned to out-of-state employees 	11.1
Value Added Through Economic Impact	<ol style="list-style-type: none"> 1. Operating budget and salaries lower by 15% 	<ol style="list-style-type: none"> 1. Expected operating budget and salaries 	<ol style="list-style-type: none"> 1. Operating budget and salaries higher by 15% 	11.2
Revenue Sharing	<ol style="list-style-type: none"> 1. Market prices 20% lower than base case 2. Vermont Utilities with 55% share of revenue shared 	<ol style="list-style-type: none"> 1. Base case market price projections 2. Vermont Utilities with 92.5% share of revenue shared 	<ol style="list-style-type: none"> 1. Market prices 20% higher than base case 2. Vermont Utilities with 92.5% share of revenue shared 	11.3
Electric Rate Discount	<ol style="list-style-type: none"> 1. No discount from market 	<ol style="list-style-type: none"> 1. 15% discount from base case market prices 2. 45% of VY energy sold to Vermont utilities 	<ol style="list-style-type: none"> 1. 25% discount from base case market prices 2. 45% of VY energy sold to Vermont utilities 	11.4

Given that it is such a large employer in Windham County, the closure of VY would potentially have considerable negative impacts on the local town and county economies. If Entergy moved its employees after decommissioning, the local real estate market would likely see a depression in home values with a relatively high number of homes entering the market in a short period of time. That, in turn, might be enough to suppress new home construction for some time, having adverse impacts on the construction sector as well. According to the 2000 Census, construction jobs represented nearly 8% of all jobs in Windham County.⁵ Furthermore, the economy would lose the value of family members of VY employees that also worked in local jobs. If employees are not moved, it would create additional burdens on local governments and lead to a temporary increase in local unemployment rates. Although these ancillary impacts are important to consider, they were not quantified for this study.

⁵ U.S. Census Bureau.

11.1 GOVERNMENT REVENUE VS. BURDEN ANALYSIS

The revenue/burden analysis focuses on the economic impact to state and local governments. The analysis seeks to ascertain if the additional burdens placed on the government by the continuation of operations at Vermont Yankee are adequately covered by additional tax revenues generated. The key aspect of the analysis is to identify only revenues and burdens that would not otherwise arise without the plant in operation.

11.1.1 Revenues

There are four primary revenues quantified in this analysis – taxes associated with increased economic activity, state income taxes collected on salaries of full-time Vermont Yankee employees,⁶ continuation of the Electrical Energy Tax, and continuation of the Education Property Tax. The base case net present value, 20-year total, and average annual value of each of these components is presented in Table 10.1.

**Table 11.2
Base Case Summary of Revenues (\$2012, Millions)**

Revenues	20-Year Total	20-Year NPV	Annual Average
Taxes Through Economic Activity	\$148.8	\$87.3	\$7.4
Income Tax on Full-Time Salaries	\$67.8	\$40.3	\$3.4
Electrical Energy Tax	\$57.3	\$36.0	\$2.9
Education Property Tax	\$41.8	\$26.3	\$2.1
Total Quantified Revenue	\$315.7	\$189.9	\$15.8

Significant tax revenues are generated through the economic activities carried out in the state by Vermont Yankee and its employees. These taxes are estimated by the input/output impact model. The taxes collected by state and local government average about \$7.4 million per year, representing a 20-year total of \$148.8 million and a net present value of \$87.3 million. The impact analysis is described in more detail in section 11.2 below. The impact model estimates corporate profit, dividend, indirect business, personal and social insurance tax revenues for the state and local governments combined. Indirect business revenues include motor vehicle license taxes, business license fees, documentary and stamp taxes, property taxes, rent and royalties, special assessments, fines, settlements, donations, sales taxes, and severance taxes. Personal tax revenues include household estate tax, household personal income tax, household personal motor vehicle fees, fines, donations, hunting and fishing licenses, and property taxes. Social insurance revenues include employee and employer contributions to retirement plans, temporary disability insurance, and worker’s comp.

⁶ As stated earlier, we assume that 50% of employees reside in Vermont. However, the state collects income taxes on all income earned in Vermont. Therefore, non-residing employees pay state income taxes as well as residing employees.

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Full-time salaries to Vermont Yankee employees are expected to average over \$100 million per year throughout the study period. Personal income taxes paid on those salaries represent a significant revenue source for Vermont. For this analysis, a 3% effective rate on gross wages is assumed.⁷ Note that the taxes through economic activity discussed in the preceding paragraph include personal income tax; however, these are not income taxes directly on the Vermont Yankee salaries but are income taxes collected based on the economic activity generated by VY. In order to avoid double-counting, the direct taxes on salaries are removed prior to running the input/output model that estimates the taxes due to economic activity (described further in Section 11.2). The state income taxes on full-time wages average \$3.4 million per year, totaling \$67.9 million over 20 years. Discounting the annual revenues at the state General Obligation bond rate of 4.9% per year yields a 2012 NPV of \$40.3 million.

In 1961, the state legislature approved an electric energy tax on electric generating plants with name-plate generating capacity of 200 MW or greater, effective July 1, 1965.⁸ Vermont Yankee was the only facility subject to the tax. Beginning in 1972, the tax was based on a percentage of the appraised value of the facility.⁹ In 2004, the tax was restructured to a tax based on net megawatt hours of generation produced by the facility.¹⁰ This tax is still in effect today. The structure of the current electric energy tax is shown in Table 10.2. It is assumed for the revenue/burden analysis that the taxes generated by this structure will approximate the taxes levied on energy production in the future should the operating permit be extended. Over three calendar years, the plant is projected to produce 4.86 GWh per year on average. The resultant electrical energy tax from that level of generation is \$2.9 million per year, \$57.3 million total over 20 years, or a net present value of \$36.0 million in 2012 dollars.

Table 11.3
Current Structure of Electrical Energy Tax

Average MWh Generated ¹	Electric Energy Tax
Less than 2,300,000	\$2.0 million
2,300,000 to 3,800,000	\$2.0 million plus \$0.40 per MWh in excess of 2,300,000
3,800,000 to 4,200,000	\$2.6 million
Over 4,200,000	\$2.6 million plus \$0.4 per MWh in excess of 4,200,000

1 Average of previous three calendar years.

⁷ The effective tax rate was provided by the Vermont Department of the Treasury and the Department of Public Service. Using a constant 3% effective rate is conservative as expected generally rising wages would put more earners into higher tax brackets and raise the effective rate in latter years.

⁸ The electrical energy tax in effect prior to 1961, which was repealed effective July 1, 1965, provided that “the emergency board finds by unanimous vote that an atomic generating plant of not less than 200,000 kilowatt capacity has been constructed in the State of Vermont and has been put into commercial operation” (Act No. 232 of 1961 and Act No. 188 of 1965).

⁹ Act No. 376 of 1967.

¹⁰ Act No. 50 of 2003.

Prior to 2000, a local school property tax was paid to the Town of Vernon by Vermont Yankee. This tax was replaced by the Electric Generating Plant Education Property Tax.¹¹ The local education tax was eliminated and a state tax was assessed as a percent of net book value, much like the Electrical Energy Tax at the time. When the Electrical Energy Tax was moved to a generation-based tax, the Education Property Tax was moved to the same basis. Table 10.3 shows the current structure of the tax. As with the Electrical Energy Tax, the current structure is used to estimate taxes collected into the future. With a 3-year average generation of 4.86 GWh per year, the tax revenues equal \$2.1 million per year, a 20-year total of \$41.8 million, or a net present value of \$26.3 million.

**Table 11.4
Current Structure of Electric Generating Plant Education Property Tax**

Average MWh Generated¹	Education Property Tax
Less than 2,300,000	\$1.465 million
2,300,000 to 3,800,000	\$1.465 million plus \$0.29 per MWh in excess of 2,300,000
3,800,000 to 4,200,000	\$1.900 million
Over 4,200,000	\$1.900 million plus \$0.29 per MWh in excess of 4,200,000

¹ Average of previous three calendar years.

11.1.2 Burdens

Specific burdens placed on the Vermont government due to operation of Vermont Yankee include the time of a nuclear engineer and support staff, and burdens placed on the Department of Public Service (public advocacy), the Department of Public Health, and the Agency of Natural Resources. It is important to note that the burdens measured are only the time specifically allotted to issues associated with the Vermont Yankee facility for these departments. Burdens were also estimated to show the impact on infrastructure and support services for both state and local governments. Police, transportation, fire, and other government functions are burdened by the additional 514 VY employees. The value of all of these burdens is summarized in Table 11.5.

¹¹ Act No. 60 in 1997.

Table 11.5
Base Case Summary of Burdens (\$2012, Millions)

Burdens	20-Year Total	20-Year NPV	Annual Average
Dept. of Public Service	\$7.4	\$4.3	\$0.40
Dept. of Public Health	\$1.3	\$0.8	\$0.06
Agency of Natural Resources	\$0.3	\$0.1	\$0.01
Other State Burdens	\$61.4	\$36.7	\$3.07
Other Local Burdens	\$7.5	\$4.5	\$0.38
Total Burden	\$77.9	\$46.4	\$3.92

The burdens place on the Department of Public Service include a nuclear engineer and his support staff, and public advocacy. The nuclear engineer and support staff burden is estimated at \$150,000 in total salary per year. The Department of Public Service estimates a burden of 25% of an average lawyer’s time per year, or a burden of \$25,000 per year, although at times the burden can expand greatly. The burden on the Department of Health is estimated at 25% of the year of an average \$85,000 salary, or \$21,250 per year, and support at 25% of \$38,000 per year (\$9,500). Finally, an estimate of the burden on the Agency of Natural Resources is 20 hours per month, or 240 hours per year (12% of hours) at an average salary of \$50,000 per year. All burdens are escalated at a rate of 5% per year to approximate average salary and benefits increases over time. These estimates were provided to the Department of Public Service from the various departments.

The existence of Vermont Yankee and its employees places a burden on government services and infrastructure in general. For instance, roads, schools, personal protection, nursing, and libraries are some services that are affected. In order to estimate the burden on both the state and local governments associated with the 257 VY employees residing in Vermont,¹² an average government expenditure per capita was estimated from the FY 2007 financial statements for the state of Vermont and the Town of Brattleboro. Brattleboro is a town located near the facility and financials were obtainable on the Internet; therefore, they were selected to represent local government expenditures.

The per capita government expenditure of interest needs to represent those costs that vary to a high extent with the population. For both the state and town budget, GDS identified line items that it felt were highly variable with respect to population and included those items in an average per capita expenditure. For the state of Vermont, 88% of the total budget was included in the calculation, and for the Town of Brattleboro 65% was included. The resultant rates were \$5,958 per person for the state and \$732 per person for the local government. These rates were then escalated at 3.2% per year, which is an average of the Employment Cost Index and the GDP-IPD. The escalated rates were then applied to 257 employees as a method to quantify the impacts on state and local governments to serve and protect the in-state employees. The non-resident employees also place some level of burden upon the government due to their transportation into and

¹² The 257 is 50% of 514 employees. Although current data from Entergy indicates 218 employees reside in Vermont, this analysis assumes 514 employees and a 50% level of employees living in state.

time spent in Vermont. Due to the difficulty of quantifying this aspect of the burden, GDS simply used 25% of the in-state resident rate in the base case analysis. The estimated burden on the state of VY employees is a 20-year total of \$61.4 million, or an average of \$3.1 million per year. Using the General Obligation bond rate of 4.9%, the discounted net present value total is \$36.7 million. Local burdens total \$7.5 million over 20-years, or an average of \$0.4 million per year. The net present value total is \$4.5 million.

11.1.3 Revenue/Burden Comparison

The revenue/burden analysis indicates that the revenues collected by Vermont and local governments exceed the burdens generated by the plant. Table 11.6 shows the annual revenues and burdens as estimated above and calculates a revenue-to-burden ratio. A ratio greater than 1.0 means that the revenue generated by Vermont Yankee exceeds the burden, providing additional value to the taxpayers. Under the base case, the revenues of Vermont Yankee consistently exceed the burdens by a ratio of \$3.80 to \$4.40 revenue generated for every \$1.00 of burden placed on state and local governments.

**Table 11.6
Base Case Revenue-To-Burden Ratio by Year**

Year	Total Revenues (\$ Millions)	Total Burdens (\$ Millions)	Revenue-To- Burden Ratio
2013	\$12.2	\$2.8	4.4
2014	\$12.5	\$2.8	4.3
2015	\$12.4	\$3.0	4.1
2016	\$13.1	\$3.1	4.3
2017	\$13.5	\$3.2	4.2
2018	\$13.3	\$3.3	4.1
2019	\$14.3	\$3.4	4.2
2020	\$14.7	\$3.5	4.2
2021	\$14.5	\$3.6	4.0
2022	\$15.4	\$3.8	4.1
2023	\$15.9	\$3.9	4.1
2024	\$15.7	\$4.0	3.9
2025	\$16.8	\$4.2	4.0
2026	\$17.3	\$4.3	4.0
2027	\$17.1	\$4.4	3.8
2028	\$18.4	\$4.6	4.0
2029	\$18.9	\$4.8	4.0
2030	\$18.7	\$4.9	3.8
2031	\$20.2	\$5.1	4.0
2032	\$20.8	\$5.3	4.0
Annual Avg	\$15.8	\$3.9	4.1
20-Year Tot	\$315.7	\$77.9	4.1
20-Year NPV	\$189.8	\$46.4	4.1

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The reader may note that in Table 11.6 above, the revenues in every third year decline slightly. This is due to the fact that contract labor for outages are not present in one out of every three years, thereby reducing the benefits of sales and other taxes collected from the temporary workers. The labor budget and treatment of contract workers is detailed further in Section 11.2.3.

Extreme Low Case Scenario

Three components of the revenue/burden analysis are modified to produce the extreme low case. First, the taxes collected through economic activity are based on the low economic activity case (VY operating budget 15% lower than base case, see Section 11.2). Since there is less economic activity generated under the low economic impact case, there is less tax collected through that activity. The per capita government expenditures are increased by 15% in the low case, thereby increasing the burdens placed on the government by VY employees. Finally, the portion of the per capita burdens for out-of-state employees is raised from 25% in the base case to 75% in the extreme low case. Revenues in the extreme low case average \$14.7 million per year for a 20-year total of \$293.4 million and a NPV of \$176.7 million. The burdens total \$6.0 million per year for a total of \$120.0 million over 20 years, or a NPV of \$71.6 million. The total revenue-to-burden ratio under the extreme low case is 2.4 to 1.0.

Extreme High Case Scenario

The high case scenario assumes the taxes generated through a high economic activity scenario (VY budget 15% higher than base case, see Section 11.2). Also, the per capita government expenditures are reduced by 15% and there is no burden assigned to employers residing outside of Vermont. High case revenues have a net present value of \$202.9 million. The 20-year total revenue is \$338.0 million, or an average of \$16.9 million per year. High case burdens are a NPV of \$33.2 million. The 20-year total burdens equal \$55.8 million, an average of \$2.8 million per year. The total revenue-to-burden ratio under the extreme high case is 6.1 to 1.0.

Table 11.7
Summary of Revenue/Burden Scenarios, 20-Year Totals (\$Millions)

Case	Revenues	Burdens	Rev Net of Burdens	Rev/Burden Ratio
Extreme Low	\$293.4	\$120.0	\$173.4	2.4
Base	\$315.7	\$77.9	\$237.8	4.1
Extreme High	\$338.0	\$55.8	\$282.2	6.1

Table 11.8
Summary of Revenue/Burden Scenarios, 20-Year NPV (\$Millions)

Case	Revenues	Burdens	Rev Net of Burdens	Rev/Burden Ratio
Extreme Low	\$176.8	\$71.6	\$195.2	2.5
Base	\$189.8	\$46.4	\$143.4	4.1

Extreme High	\$202.9	\$33.2	\$169.7	6.1
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11.1.4 Net Present Value Revenues and Burdens

In order to get the discounted net present values for revenues and burdens displayed in Table 11.6, a discount rate of 4.9% is applied to the annual cash flows. This discount rate is the current rate for a state General Obligation bond, according to the Vermont Department of Treasury. For the base case, the 20-year net present value of revenues is \$189.8 million and the net present value of burdens is \$46.4 million, resulting in a net positive impact on the government of \$143.4 million. A way to interpret the significance of this net increase in government revenue is that if the government wanted to match the value of the Vermont Yankee stream of net revenues, it would have to invest \$143.4 million dollars in 2012 and earn 4.9% interest on it for 20 years. The extreme low case revenues net of burdens in net present value terms is \$105.1 million and the extreme high case is \$169.7 million.

11.2 ECONOMIC IMPACT ANALYSIS

The chief aim of an economic impact analysis is to determine the multiplicative effects of a direct change in demand within an industry in the local economy. Continuing operation of the Vermont Yankee facility another twenty years will create stimulus in the economy to the extent that money is spent in-state and employment is drawn from the Vermont labor force. When the plant spends a dollar, that dollar has multiplicative impacts on the economy as it is cycled through various industries as they purchase goods and services. An economic input/output model quantifies the multiplicative effects of such spending within a study area. A description of the model methodology, inputs and assumptions, and results follows.

11.2.1 *Input/Output Modeling*

Input/output (“I/O”) analysis is a means of examining relationships within an economy, both among businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. The resulting mathematical formulas allow for examination of effects of a change in one or several economic activities on an entire economy. There are two components of an I/O model – the descriptive model and the predictive model.

Descriptive Model

The descriptive model is a set of tables that describe a local economy in terms of the flow of dollars from purchasers to producers within a region. Trade flows are also a part of the model. They describe the movement of goods and services within a region and the outside world (regional imports and exports). Social Accounting data is also included in the descriptive model. This data describes non-industrial transactions, such as payment of taxes by businesses and households.

Predictive Model

The regional economic accounts developed in the descriptive model are used to construct local level multipliers. Multipliers describe the response of the economy to a stimulus (change in demand or production). The set of multipliers comprise a predictive model. The predictive model can be used to determine the impact on the local economy caused by a one dollar change in final demand for any given industry. Industries providing goods and services for consumption purchase goods and services from other producers. These other producers, in turn, purchase goods and services. These are called indirect effects of the change in demand in the original industry. They continue until leakages from the region (imports, wages, profits, etc.) stop the cycle. Furthermore, a predictive model can determine the induced effects in an input-output analysis. Induced effects are the impacts associated with increased household consumption associated with the economic activity generated by the stimulus.

Key Assumptions

There are five key implicit assumptions associated with an input/output model.

- Constant Returns to Scale – An industry’s list of expenditures, called its production function, is considered linear. If additional output is required, constant returns to scale assumes all inputs increase proportionately.
- No Supply Constraints – Supplies are assumed to be unlimited. An industry has unlimited access to raw materials and its output is only limited by demand.
- Fixed Commodity Input Structure – This assumption requires that changes in the economy will affect the industry’s output, but not the mix of commodities and services it requires for production. In other words, this structure implies that price changes will not force a producer to use a substitute good.
- Homogenous Sector Output – Some industries produce multiple commodities. Homogenous sector output means that the proportions of all commodities produced by an industry remain the same, regardless of total output. An industry will not increase the output of one product without proportionately increasing the output of all its other products.
- Industry Technology Assumption – This assumption is that an industry uses the same technology to produce all of its products. An industry is assumed to have a main or primary product and all other products are byproducts of the primary production. This assumption comes into play in the development of a descriptive model when data is collected on an industry-by-commodity basis and is converted to industry-by-industry matrices.

11.2.2 IMPLAN Software

The software used by GDS Associates in conducting I/O analysis is IMPLAN Professional Version 2.0. The software was developed by the Minnesota IMPLAN Group (MIG, Inc.). A database of data required to develop a descriptive model for the state of Vermont was purchased from MIG. The data is derived from several federal sources including the Bureau of Economic Analysis, the Bureau of Labor Statistics, and the U.S. Census Bureau. For this analysis, Vermont data for 2006 was the most recent database available.

The IMPLAN software develops the descriptive and predictive models. It then allows the user to conduct impact analyses with the resultant multipliers. IMPLAN has an industry sectoring scheme that roughly tracks both the North American Industrial Classification System (NAICS) and the Bureau of Economic Analysis (BEA) 1997 commodity classifications. To perform an impact analysis, the user would input an impact to a selected industrial sector and analyze the multiplier effects of that change. IMPLAN produces resultant direct, indirect, and induced impacts for value-added, employment, and output. Value-added is a composite of employee compensation, proprietor income,

other property income, and indirect business tax (described earlier). Output is the value of production for a given period.

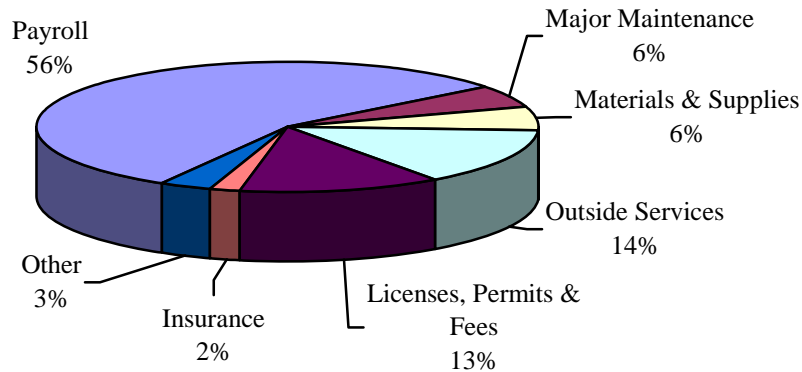
11.2.3 Inputs and Assumptions

There are two ways in which operation of Vermont Yankee will stimulate the Vermont economy – annual operating expenses spent in-state and the personal consumption behavior of the in-state employees.¹³ Therefore, GDS had to estimate operating expenses for the plant and what proportion of those expenses would be spent in-state. Those values then become direct changes in demand in the IMPLAN I/O model.

Projected Operating Budget

Fuel is sourced from outside of Vermont; therefore, the operating budget prepared by GDS is net of fuel costs. Entergy did not provide operating expense information in response to data requests, other than salaries. Therefore, we had to estimate expenses based on the salary level and our experience in working with other nuclear facilities. We used a budget breakdown from a similar nuclear facility as displayed in Figure 11.1 to generate a budget for 2008. The payroll budget was escalated using the Employment Cost Index (3.71%) and other operating and maintenance categories were inflated using the GDP-IPD (2.69%).

Figure 11.1
Breakdown of Operations Budget Net of Fuel



According to Entergy, the payroll in 2007 was approximately \$56 million for 454 employees, and that, in the long-run, the plant will employ 514 employees. Our analysis assumes that Entergy actually hires the additional 60 employees per its expectations. Therefore, grossing up for additional employees and inflation, the 2008 payroll excluding contract outage labor is \$64 million. Contract outages are expected to require an

¹³ Out-of-state employees would have some positive impact on the state economy due to their expenditures in state while commuting and working at the facility (for example, buying lunches or gasoline). It would be highly speculative to quantify how much the 50% of out-of-state employees might spend in a year in Vermont, so excluding their benefits is being conservative.

additional 800 staff for 30 days at a 2008 per diem of \$113.¹⁴ For the purposes of economic analysis, the contract outage is expected two out of every three years, adding \$2.7 - \$6.5 million per year with an outage in payroll expenses over the next 20 years. Based on the breakdown above and these payroll figures, the estimated 2008 operating budget net of fuel is \$120.9 million. The budget is projected to reach \$263.0 million by 2032, an average annual increase of 3.3% per year.

Estimating In-State Expenditures

Having the total operating budget in place, the next step in the development of I/O inputs is to estimate what percentage of the expenditures will be spent in-state. Typically, the percentages are based on estimates since defining in- and out-of-state expenditures at a detailed level is costly and time-consuming and provides only marginal improvement in the results.

Payroll – It is assumed that all of the per diem for contract outage labor is spent in Vermont while the crews are working at the nuclear facility. The effects of permanent payroll are estimated using household personal consumption patterns provided by IMPLAN. These patterns include historical Regional Purchase Coefficients that estimate the amount of consumption spent out-of-state. However, income taxes and savings are not removed, so GDS has to estimate the amount of total salary that goes toward federal and state income taxes and into savings. Data available from the U.S. Bureau of Labor Statistics (BLS) was used to estimate the savings and tax rate. BLS data for the Northeast region of the United States for 2004 and 2005¹⁵ indicate that average income before taxes was \$62,059. Personal consumption in the region averaged \$47,017, leading to an average rate of 24.2% of income spent on income taxes and put into savings. Therefore, for the 2013 full-time salary of in-state employees of \$39.2 million, \$9.5 million is expected to go toward taxes and savings, leaving \$29.7 million spent on personal consumption both in and out of the state. According to the IMPLAN model, every \$1 spent in personal consumption by a VY employee produces a benefit of \$0.37 in direct total value added and an additional indirect and induced effect of \$0.16 for a total of \$0.43 in total value added. Multipliers are shown in a single table later in the chapter.

Non-Labor O&M Expenditures - The in-state allocations of spending for all non-payroll and non-fuel operating budgetary items are shown in Table 11.8. It is assumed that major maintenance, waste and ash disposal, dues and subscriptions, travel and meals, fees, and other expenses will be completely sourced out-of-state. Given the assumptions shown in Table 10.8, 32.2% of the non-payroll budget will be spent in-state.

¹⁴ The IRS-approved per diem rate in 2007 is \$109 and was provided by Entergy as an estimate for contract labor cost. The 2008 figure is escalated at the Employment Cost Index to reach \$113.

¹⁵ At the time this report was drafted, these were the two most-recent years available for this data.

Table 11.9
Estimated In-State Spending – Non-Payroll Budget Items

Expense Item	Percent of Budget	Est. Percent Spent In-State	Percent of Budget Spent In-State
Outside Services	14.14%	40%	5.66%
Fees	7.07%	0%	0.00%
Licenses & Permits	6.09%	50%	3.05%
Materials & Supplies	5.70%	75%	4.28%
Major Maintenance	5.56%	0%	0.00%
Insurance	1.95%	50%	0.98%
Dues & Subscriptions	1.88%	0%	0.00%
Travel & Meals	0.85%	0%	0.00%
Waste & Ash Disposal	0.30%	0%	0.00%
Rent & Lease	0.17%	50%	0.09%
Other Expenses	0.05%	0%	0.00%
Utilities	0.02%	100%	0.02%
Subtotal – Non-Payroll	43.78%	32.2%	14.08%

Assignment of In-State Expenses to Industry Impacts

In order to complete an I/O impact assessment, a direct impact must be assigned to a specific industry. The IMPLAN model then estimates the multiplicative effects of that direct impact on the state economy. The IMPLAN software has a rich set of industries in which impacts can be assigned, roughly corresponding to the North American Industry Classification System¹⁶ (NAICS) categories. Still, making assignments is an approximation as perfect matches are not always obvious.

The IMPLAN software contains personal consumption spending patterns for different income-level homes. These patterns apportion personal consumption across all industries relative to historical patterns obtained from Census Bureau and Bureau of Economic Analysis databases. For measuring the effect associated with consumption by full-time employees, GDS used the consumption patterns for homes with incomes between \$75,000 and \$100,000. For contract labor, the payroll expenses are divided among food services, hotels and motels, and gasoline station industries. Utilities are assigned to natural gas, water/wastewater, and telecommunications. It is assumed that materials and supplies will be sourced from both wholesale and retail sources, with the retail sources including building material and garden supply stores (i.e., Home Depot and Lowes) and general merchandise stores. Outside services expenses are allocated to legal, accounting, engineering, computer services, and environmental consulting. Rent and lease expenses are assigned to the real estate industry and licenses and permits are assigned to state and local government, non-educational. Finally, insurance is split between insurance carriers and insurance agencies and brokerages. Table 11.9 uses 2014 (outage year) and 2015

¹⁶ NAICS is the industry classification system adopted by the United States Office of Management and Budget in 1997. Prior to the use of NAICS, the Standard Industrial Classification (SIC) system was in place.

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(non-outage year) in-state expenditures to demonstrate the relative proportions of the operating budget assigned to each industry as a direct impact.

Table 11.10
Industry Assignment of In-State Expenditures – 2014 and 2015

Industry	2014 Dollars	2014 Percent	2015 Dollars	2015 Percent
Personal Consumption Pattern*	\$30,756,832	56.9%	\$31,896,644	60.9%
State & Local Govt. – Non Edu.	\$4,318,530	8.0%	\$4,434,839	8.5%
Legal Services	\$2,807,541	5.2%	\$2,883,155	5.5%
Hotels and Motels	\$2,477,152	4.6%	\$0	0.0%
Wholesale Trade	\$2,020,987	3.7%	\$2,075,417	4.0%
Building Mat. & Garden Supply	\$2,020,987	3.7%	\$2,075,417	4.0%
General Merchandise Stores	\$2,020,987	3.7%	\$2,075,418	4.0%
Arch./Engineering Services	\$2,005,387	3.7%	\$2,059,397	3.9%
Accounting & Bookkeeping	\$1,203,232	2.2%	\$1,235,638	2.4%
Environmental Consulting	\$1,203,231	2.2%	\$1,235,637	2.4%
Computer Related Services	\$802,155	1.5%	\$823,759	1.6%
Insurance Carriers	\$691,391	1.3%	\$710,012	1.4%
Insurance Agencies/Brokerages	\$691,390	1.3%	\$710,011	1.4%
Food Services & Drinking	\$619,288	1.1%	\$0	0.0%
Gasoline Stations	\$278,680	0.5%	\$0	0.0%
Real Estate	\$120,550	0.2%	\$123,797	0.2%
Natural Gas Distribution	\$9,455	>0.1%	\$9,709	>0.1%
Water and Sewer	\$9,455	>0.1%	\$9,709	>0.1%
Telecommunications	\$9,454	>0.1%	\$9,710	>0.1%
TOTAL DIRECT IMPACTS	\$54,066,684	100.0%	\$52,368,269	100.0%

* – Salaries of employees residing in Vermont (50% of all employees)

Extreme Low and High Cases

The operating budgets and salaries described above were allowed to vary by +/-15% in order to establish the extreme cases. The extreme low case has budgets 15% below the base case. The extreme high case has budgets 15% above the base case. A higher budget will leader to greater economic activity and therefore larger value added impacts.

11.2.4 Impact Analysis Results

An Input/Output predictive model uses direct impacts on an industry and runs it through the set of multipliers to calculate the additional value associated with increased economic activity. There are three impacts measured in the I/O output.

- Direct Demand Effects – The impacts that directly impact an assigned industry. In the Vermont Yankee analysis, these are the in-state operating and personal consumption expenditures (the values in Table 10.9 are direct effects).

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- Indirect Effects – The impacts caused by the iteration of industries purchasing from industries resulting from direct demand changes.
- Induced Effects – The impacts on all local industries caused by the expenditures of new household income generated by the direct and indirect effects.

The total economic impact is the sum of the direct plus indirect and induced effects.

The levels of indirect and induced effects for a demand change in a given industry are described by the multipliers developed during the descriptive modeling stage of an I/O analysis. As an example, a \$1 direct input into the Wholesale Trade industry will produce \$0.20 in indirect effects and \$0.31 in induced effects based on Vermont multipliers. A table of multipliers for impacts on the economy specific to VY operations is exhibited in Section 11.2.6. In order to measure the true economic impact of operations of the Vermont Yankee facility an additional twenty years, the direct effects described in Table 11.9 are input into IMPLAN and the indirect and induced effects are observed.

Three key output variables were measured for the impact analysis.

- Total Value Added – Value added is a measure of a single industry's contribution to Gross State Product (GSP). It is the difference between total output and the cost of intermediate inputs. Value added can be broken down into employment compensation, proprietary income, other property type income, and indirect business taxes.
- Employment – The equivalent average number of full time jobs supported by the industry output each year. Employment figures are therefore best understood in terms of job-years. One full-time worker working twenty years would equate to 20 job-years. Employment includes salary employees as well as self-employed jobs.
- Taxes and Other Government Revenues – All government collections from the normal operation of business and through personal consumption. This output is used in the revenue/burden analysis presented in section 11.1 of the report.

Value-Added

On average, the annual economic impact of continued operation of Vermont Yankee on the state economy is \$64.5 million in total value added, comprised of \$44.8 million (69%) in direct impacts and \$19.7 million (31%) in indirect and induced effects. Using an estimated Gross State Product of \$30 billion in 2012,¹⁷ Vermont Yankee's impact represents 0.22% of GSP (value-added) in Vermont per year. Over the timeframe of 2012 to 2032, the total direct value added is \$896.5 million and the indirect multiplier

¹⁷ The Bureau of Economic Analysis reports 2007 GSP at \$24.5 billion. Growth of 4% per year would yield a GSP of nearly \$30 billion by 2012. GSP growth averaged 4.5% per year over the most recent 5 years and averaged 4.0% per year over the most recent three years.

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effects are \$392.8 million, for a total 20-year value added of \$1.3 billion. Using the General Obligation bond rate of 4.9% to discount the annual cash flows yields a base case total value added NPV of \$755.5 million in 2012 dollars. Table 11.10 shows the base case value added associated with 20 additional years of Vermont Yankee operations.

Table 11.11
Base Case Summary of Total Value Added (\$Millions)

Year	Direct Effects	Indirect & Induced Effects	Total Value Added	Direct Effect % of Total	Indirect % of Total
2013	\$28.6	\$13.8	\$42.4	67.5%	32.5%
2014	\$29.8	\$14.3	\$44.1	67.6%	32.4%
2015	\$29.0	\$13.7	\$42.7	67.9%	32.1%
2016	\$32.5	\$15.3	\$47.8	68.0%	32.0%
2017	\$34.0	\$15.9	\$49.9	68.1%	31.9%
2018	\$33.2	\$15.2	\$48.4	68.6%	31.4%
2019	\$37.3	\$17.1	\$54.4	68.6%	31.4%
2020	\$39.1	\$17.8	\$56.9	68.7%	31.3%
2021	\$38.3	\$17.1	\$55.4	69.1%	30.9%
2022	\$42.9	\$19.2	\$62.1	69.1%	30.9%
2023	\$44.9	\$19.9	\$64.8	69.3%	30.7%
2024	\$44.1	\$19.2	\$63.3	69.7%	30.3%
2025	\$49.3	\$21.5	\$70.8	69.6%	30.4%
2026	\$51.7	\$22.3	\$74.0	69.9%	30.1%
2027	\$51.0	\$21.5	\$72.5	70.3%	29.7%
2028	\$56.9	\$24.2	\$81.1	70.2%	29.8%
2029	\$59.8	\$25.1	\$84.9	70.4%	29.6%
2030	\$59.1	\$24.3	\$83.4	70.9%	29.1%
2031	\$65.9	\$27.2	\$93.1	70.8%	29.2%
2032	\$69.2	\$28.3	\$97.5	71.0%	29.0%
Average	\$44.8	\$19.6	\$64.4	69.6%	30.4%
20-Yr Total	\$896.5	\$392.8	\$1,289.3	69.5%	30.5%
20-Yr NPV	\$523.1	\$232.4	\$755.5	69.2%	30.8%

Under the low case scenario with budgets 15% lower than the base case, the 20-year total value added equals \$1.1 billion, an average of \$54.8 million per year. The net present value under the low case is \$642.1 million. Budgets 15% greater than the base case produce an annual average total value added of \$74.1 million per year, totaling to \$1.5 billion over 20 years. The NPV with a 4.9% discount rate equals \$868.8 million. Table 11.12 summarizes value added for the three scenarios.

Table 11.12
Summary of Value Added Scenarios (\$Millions)

Case	20-Year Total	20-Year NPV
Extreme Low	\$1,095.9	\$642.1
Base	\$1,289.3	\$755.5
Extreme High	\$1,482.7	\$868.8

Employment

According to the IMPLAN model, the economic activity associated with and spurred by Vermont Yankee operations would support 1,208 full-time equivalent jobs per year on average. As of August 2008, total employment in Vermont was approximately 306,500,¹⁸ meaning Vermont Yankee’s employment contribution equals 0.4% of current state employment levels. Of the total annual number of jobs, 257 (21%) jobs are from Vermont Yankee itself (514 total employees, with half living in Vermont), 631 (52%) jobs are from direct economic effects, and 319 (27%) jobs are from indirect and induced economic effects. Over twenty years, the economic activity would support a total of 24,150 job-years. The value added in the extreme low scenario would support a 20-year total of 21,300 job-years. The extreme high case value added would sustain a 20-year total of 27,000 job-years. Table 11.13 shows the base case annual job-year impacts from continued operation of Vermont Yankee and Figure 11.2 shows the totals for the three scenarios.

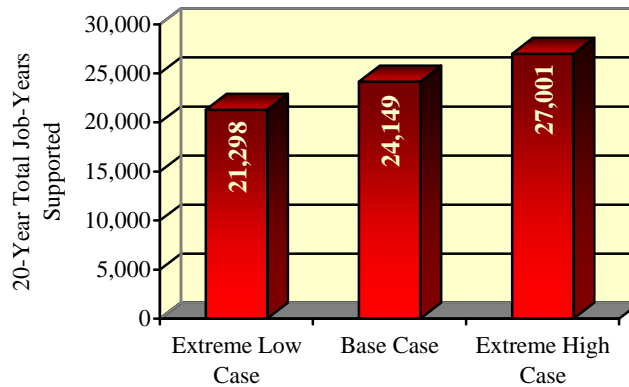
¹⁸ Bureau of Labor Statistics, seasonally adjusted, preliminary non-farm employment. Data extracted from <http://data.bls.gov/cgi-bin/surveymost> on October 6, 2008.

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**Table 11.13
Base Case Summary of Employment Supported by Economic Activity (Job-Years)**

Year	VY Jobs	Direct Effects	Indirect & Induced Effects	Total Add'l Emp.	VY % of Total	Direct % of Total	Indirect % of Total
2013	257.0	576.3	286.7	1,120.0	22.9%	51.5%	25.6%
2014	257.0	581.5	289.4	1,127.9	22.8%	51.6%	25.7%
2015	257.0	546.5	277.5	1,081.0	23.8%	50.6%	25.7%
2016	257.0	593.2	296.0	1,146.2	22.4%	51.8%	25.8%
2017	257.0	599.6	299.2	1,155.8	22.2%	51.9%	25.9%
2018	257.0	564.2	287.6	1,108.8	23.2%	50.9%	25.9%
2019	257.0	613.7	307.2	1,177.9	21.8%	52.1%	26.1%
2020	257.0	621.3	311.5	1,189.8	21.6%	52.2%	26.2%
2021	257.0	585.4	299.5	1,141.9	22.5%	51.3%	26.2%
2022	257.0	636.0	319.7	1,212.7	21.2%	52.4%	26.4%
2023	257.0	643.9	324.0	1,224.9	21.0%	52.6%	26.5%
2024	257.0	607.9	312.1	1,177.0	21.8%	51.6%	26.5%
2025	257.0	660.4	333.2	1,250.6	20.6%	52.8%	26.6%
2026	257.0	669.1	338.0	1,264.1	20.3%	52.9%	26.7%
2027	257.0	632.8	326.1	1,215.9	21.1%	52.0%	26.8%
2028	257.0	687.5	348.2	1,292.7	19.9%	53.2%	26.9%
2029	257.0	697.2	353.5	1,307.7	19.7%	53.3%	27.0%
2030	257.0	660.5	341.6	1,259.1	20.4%	52.5%	27.1%
2031	257.0	717.6	364.8	1,339.4	19.2%	53.6%	27.2%
2032	257.0	728.3	370.8	1,356.1	19.0%	53.7%	27.3%
Average	257.0	631.2	319.3	1,207.5	21.3%	52.3%	26.4%
20-Yr Total	5,140.0	12,622.9	6,386.6	24,149.5	21.3%	52.3%	26.4%

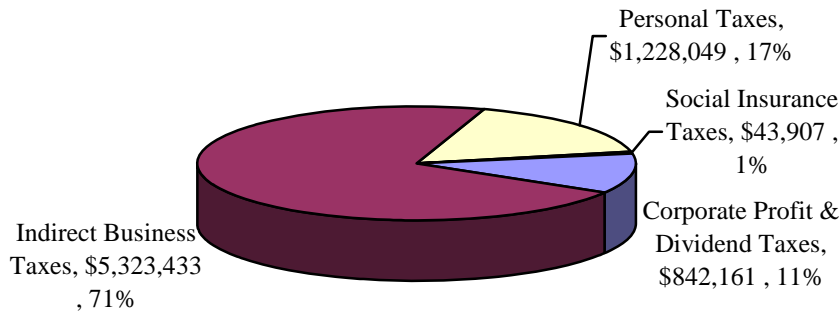
**Figure 11.2
Summary of Employment Scenarios**



Taxes Generated by Economic Activity

The tax impacts associated with Vermont Yankee operations were discussed in Section 10.1 in regards to their use in a government revenue/burden analysis. The IMPLAN model estimated that taxes generated by the operations of the facility and the consumption of its employees would average \$7.4 million per year. The breakdown of those taxes is displayed in Figure 11.3.

**Figure 11.3
Breakdown of Taxes Generated from Economic Activity
(Based on Average Annual Tax Impact, 2013-2032)**



11.2.5 Other Considerations from the Impact Analysis

The IMPLAN impact analysis results presented in the prior section estimate the impact on the state economy of continuing operations of Vermont Yankee. If the operating license of Vermont Yankee is not extended, once decommissioning is complete and the facility is completely off line, several impacts may arise that are not quantified in this analysis. For instance, if Entergy moved all or a large percentage of the employees out of Vermont, the impact on the local housing market could be severe as a high number of houses hit the market concurrently. This concern was expressed by the Windham County real estate community at public meetings held by the Department of Public Service as part of preparation of an Economic Study the DPS conducted in January 1999:

Members of the Windham County real estate community expressed concern at public meetings that a sudden closing of Vermont Yankee would have a severe impact on real estate values in Windham County. It was stated that Brattleboro, Putney and Vernon would be the most impacted towns and that it could take many years to absorb the houses which would be put on the market in the event of such a closing. In addition, if the supply of houses for sale in the market increased enough, new housing starts would be severely reduced impacting the construction trades.¹⁹

¹⁹ Vermont Yankee Economic Study, January 1999. Technical Report No. 43. Department of Public Service.

According to the 2000 Census, construction jobs made up 8% of all jobs in 2000. Along with the negative effect on the housing sector would be collateral impacts on the economy through lost value from spouses and other family members of VY employees who work in Vermont. If Entergy does not move the employees, then the unemployment rate would increase in the short-term and stay high until the economy was able to absorb the influx of jobless citizens. That, in turn, would increase the burdens on the government. As with the housing market, these impacts would be severely felt in and around Windham County, where Vermont Yankee is one of the top 5 employers in the area.²⁰ According to the Bureau of Labor Statistics, employment in Windham County in 2007 was 22,512. According to Entergy, 45% of VY employees live in the county. That means just over 1% of jobs in Windham County are sourced from Vermont Yankee.

Another negative consequence of losing Entergy's presence in Vermont is the loss of charitable contributions made by Entergy. Entergy VY has been a contributor to local charities and expects to continue to do so. VY estimates based on historical experience that it will donate an average of \$380,000 per year, or \$7.6 million total over 20 years. The Department of Public Service has verified that VY is a significant benefactor of several local charities including United Way. Although Entergy has estimated an amount of charitable donation that might be lost if the VY license is not renewed, GDS Associates and the DPS believe the true amount is unknown at this time and has not added such impacts into the quantified analysis of this report.

11.2.6 Impact Analysis Multipliers

The multipliers that are used by the IMPLAN model to estimate direct, indirect, and induced effects are provided below. These multipliers can be used to determine the various impacts measured in the I/O analysis for a \$1 change in VY operating activity. Each industry sector has its own set of multipliers, developed from historical state databases. However, given the large number of industries, this report contains only the combined effects of Vermont Yankee activity across the various industries impacted by VY. There are two different sets of multipliers provided. Table 11.14 shows the multipliers to use to measure the impact of the VY operating budget (net of fuel and full time salaries) and full-time salaries if the dollar input is not known to be in-state (i.e., a simple change in the overall operating budget). Table 11.15 displays the multipliers to use to measure the impact of in-state operating budget or in-state personal consumption.

²⁰ *Vermont Yankee Economic Study*, January 1999, and Brattleboro Area Chamber of Commerce, 2008.

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**Table 11.14
Impact Analysis Multipliers for Change in Overall Operating Budget**

Variable	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total Value Added*	0.2471	0.0431	0.0902	0.3804
Employment**	4.6040	0.8252	1.5398	6.9690
Taxes***				0.0413

Impact Analysis Multipliers for Change in Overall Full-Time Salary

Variable	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total Value Added*	0.4344	0.0663	0.0876	0.5883
Employment**	5.5126	1.2729	1.4957	8.2812
Taxes***				0.0717

* – Per \$1 change in total operating budget or total full-time salary.

** – Per \$1,000,000 change in total operating budget or total full time salary.

*** – Tax Effects are estimated by IMPLAN for combined direct, indirect, and induced effects. Full-time salary component excludes state income taxes, which would be an additional 0.0400 per dollar.

**Table 11.15
Impact Analysis Multipliers for Change in In-State Operating Expenses**

Variable	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total Value Added*	0.7092	0.1237	0.2590	1.0919
Employment**	13.2169	2.3690	4.4203	20.0062
Taxes***				0.1184

Impact Analysis Multipliers for Change in In-State Personal Consumption

Variable	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total Value Added*	0.5734	0.0875	0.1156	0.7766
Employment**	7.2765	1.6801	1.9734	10.9300
Taxes***				0.0946

* – Per \$1 change in in-state operating expenses or personal consumption.

** – Per \$1,000,000 change in operating expenses or personal consumption.

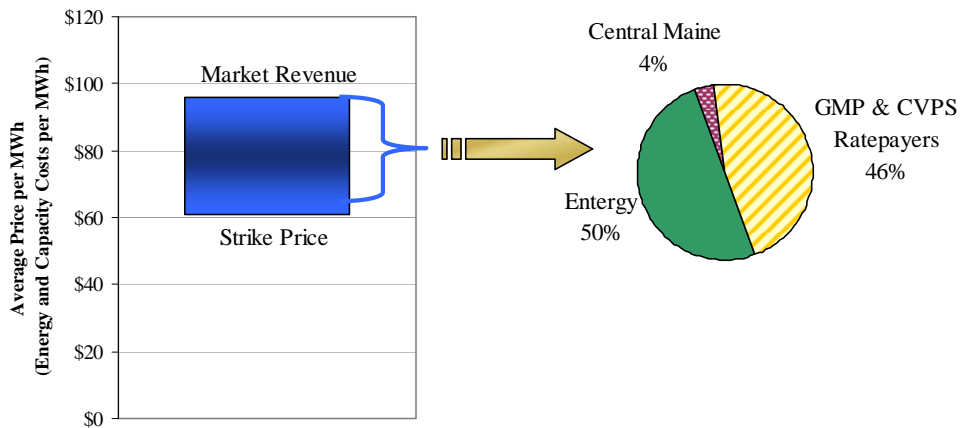
*** – Tax Effects are estimated by IMPLAN for combined direct, indirect, and induced effects.

11.3 REVENUE SHARING ARRANGEMENT WITH ENTERGY

The Memorandum of Understanding in Docket No. 6545 states that Entergy will share revenues generated by Vermont Yankee when the all-in (capacity and energy) revenue of market sales is above a strike price. In the agreement, 50% of the revenue in-excess of the strike would be shared with the ownership of Vermont Yankee Nuclear Power Corp (VYNPC). Presently, VYNPC is owned by Central Vermont Public Service (CVPS), Green Mountain Power (GMP), and Central Maine Power (CMP). The sharing agreement lasts for ten years beyond 2012.

Ultimately, the ratepayers of the VYNPC owners will benefit from the revenue sharing agreement. The utilities must return these funds to the ratepayers, reducing revenue requirements and therefore electricity rates. Therefore, it is appropriate to estimate the revenue generated from the agreement if the Vermont Yankee license is extended and assign that value to the ratepayers of Vermont. Central Vermont Public Service and Green Mountain Power have a combined 92.5% ownership share of VYNPC and would receive that proportion of the funds generated under the sharing agreement if the revenues are shared under the current ownership structure. Central Maine Power would receive the remaining 7.5%. The expected case scenario is based on this current ownership structure of VYNPC and seems the fair and correct way to divide the revenue sharing. However, another scenario was prepared in which the in-state utilities receive only 55% of the shared revenue. The low case scenario is presented later in Section 11.3.

Figure 11.4
Schematic of Revenue Sharing Agreement – Base Case



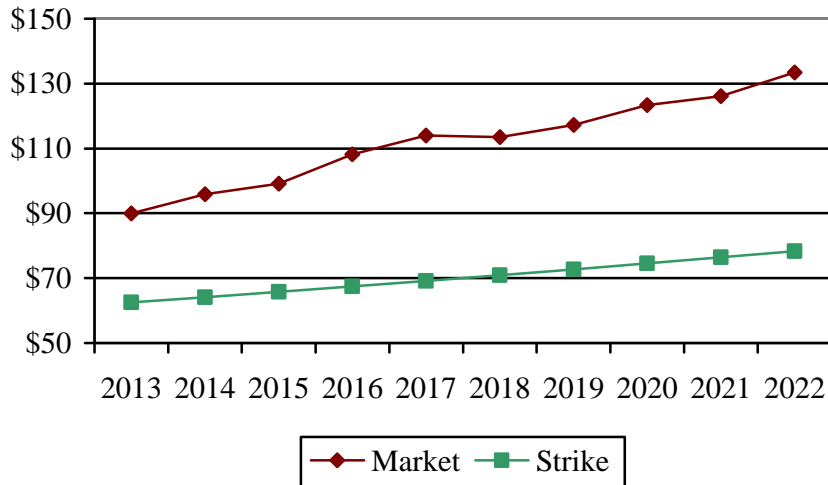
In order to estimate the value of the revenue sharing agreement, GDS needed a prediction of market prices for 2013-2022. Projections of market energy and capacity prices were obtained from the AESC 2007 forecast, provided by the Department of Public Service. Energy prices are projected to grow from \$77.82 per MWh in 2013 to \$108.51 per MWh by 2022, an average compound growth of 3.8% per year. Capacity prices are projected to

grow at a much higher rate, 8.3% per year. The projected capacity price is \$92.41 per kW-year in 2013 and \$189.65 per kW-year in 2022. Assuming net generation of 4.7 million to 5.1 million MWh per year, depending on refueling outages, and a capacity of 620 MW, the sum of energy and capacity market price per MWh is projected to grow from \$89.96 to \$133.44 from 2013 to 2022. The strike price is set at \$61 per MWh beginning in 2012. An escalator composed of a weighted average of an employment cost index, GDP – IPD, and a nuclear fuel market index is applied to estimate the strike price in years beyond 2012. The escalation rate used for the strike price is 3.38% per year.

Table 11.16
Estimate of Strike Price Escalation Factor²¹

Item	Weight	Escalation Rate
Employment Cost Index	60%	3.71%
GDP-IDP	25%	2.69%
Nuclear Fuel Market Index	15%	3.20%
Weighted Average		3.38%

Figure 11.5
Projected Market and Strike Prices
 (Prices are energy and capacity prices per MWh)

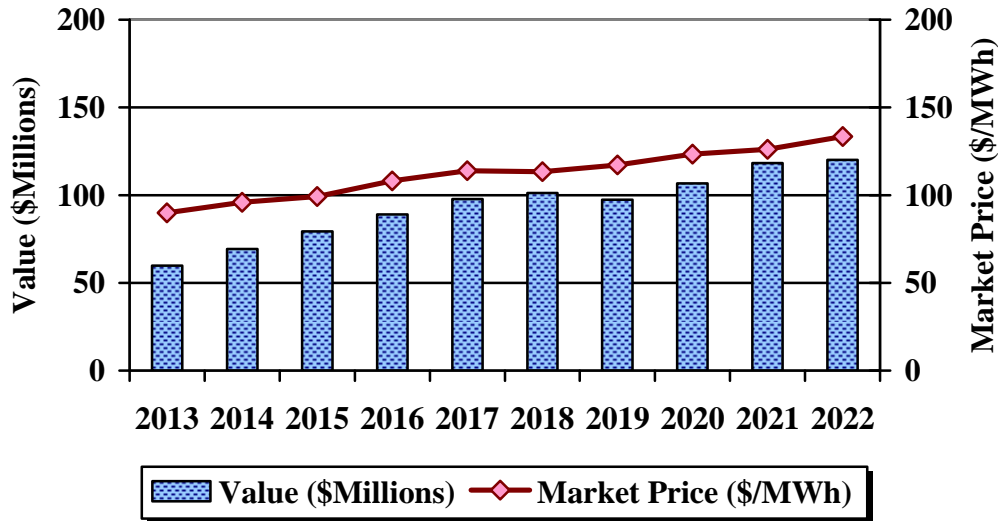


Under these base case projected market prices, total revenue in excess of the strike would average \$203.0 million per year for 10 years, 50% or \$101.5 million of which Entergy will share with VYNPC. GMP and CVPS get a 92.5% share of that amount in the base case, resulting in an average value to Vermont ratepayers of \$93.9 million per year. The ten-year total value to Vermont ratepayers is \$938.8 million given projected market prices. Discounting at the average utility cost of capital in Vermont of 8.5%, the net

²¹ The indices and weights were provided by the Department of Public Service to use as an escalator for market prices.

present value of the revenue sharing to in-state utilities is \$587.8 million (in 2012 dollars).

Figure 11.6
Estimated Value of Base Case Revenue Sharing Arrangement



In 2007, GMP and CVPS combined sold 4,292,094 MWh. If energy sales are projected to grow at 3% per year, the savings per MWh sold would average \$16 per MWh, or 1.6¢ per kWh. That means every kWh sold by these two utilities would be 1.6¢ lower than it otherwise would have been due to the revenue sharing offsetting utility revenue requirements. If the total value of revenue sharing remains unchanged and growth in energy sales by the utilities varies from 2% to 4% per year, the value of the reduction ranges from 1.44¢ per kWh to 1.77¢ per kWh.²²

11.3.1 Market Price Sensitivity

Given the high level of volatility in energy markets in recent years, the potential benefit of revenue sharing is very uncertain. The value will fluctuate with the markets, increasing and decreasing directly with the energy market prices. A sensitivity analysis was conducted to show a range of values for market prices ranging higher and lower than the base case projections by 20%. If projected market prices are allowed to fluctuate by +/-20%, the average annual value to GMP and CVPS ranges from \$43.7 million to \$144.1 million per year, or 0.7¢ to 2.5¢ per kWh sold (under the 3% growth in energy sales scenario). Figures 11.7 through 11.9 show the potential ranges associated with market prices.

²² The current DPS projection of energy net of Demand Side Management is for no growth over the next ten years. However, allowing for some growth as in this analysis provides a more conservative value of the revenue sharing on a per kWh basis.

Figure 11.7
Sensitivity Market Prices of Revenue Sharing Value

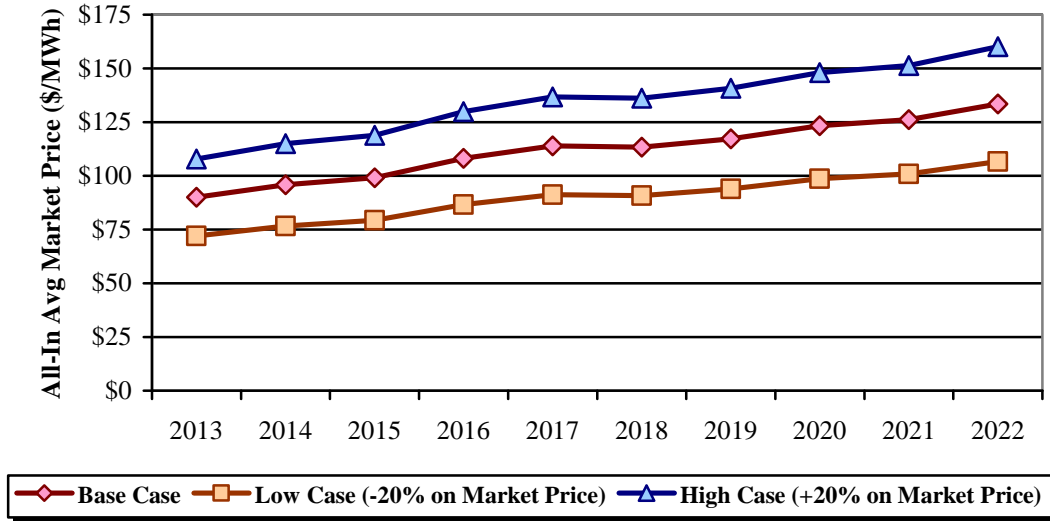


Figure 11.8
Estimated Value to GMP & CVPS Ratepayers of Revenue Sharing Arrangement
Low Market Price Case (20% Below Base Case)

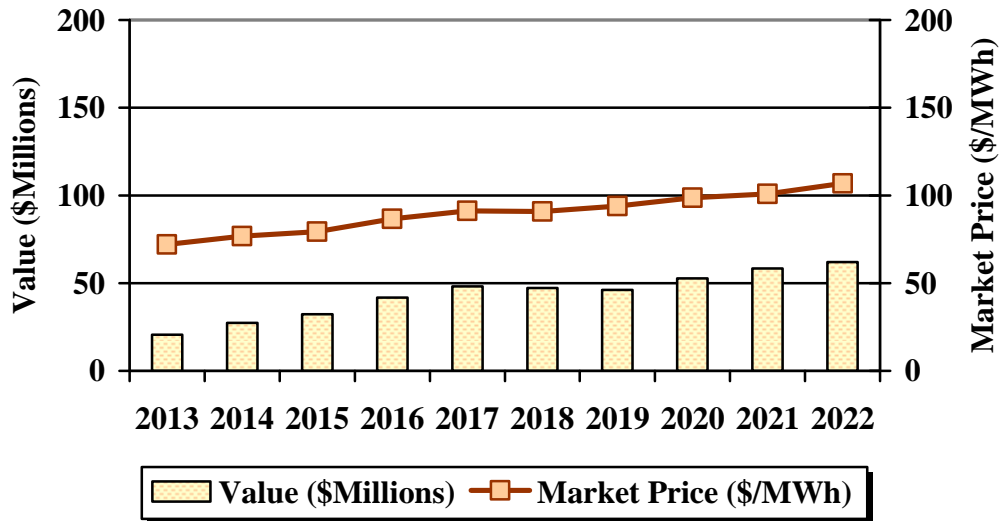
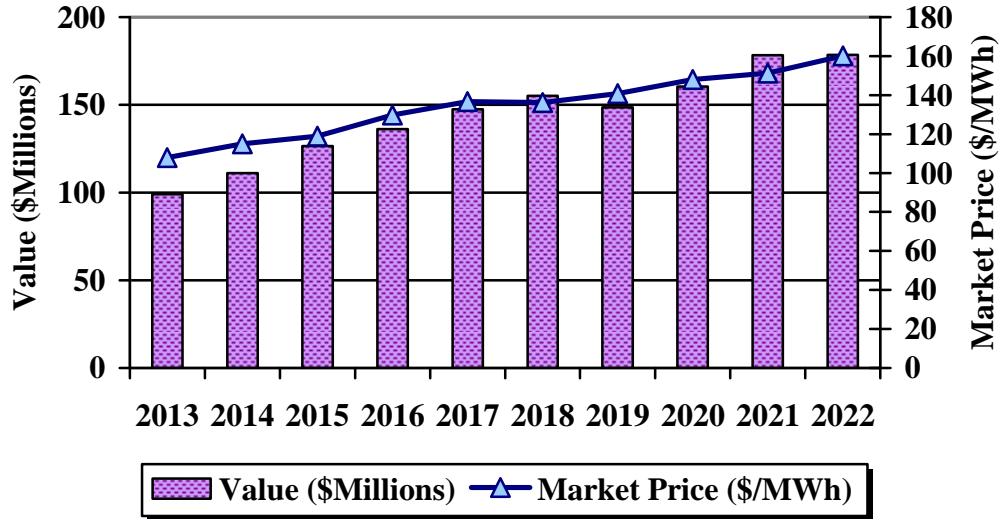


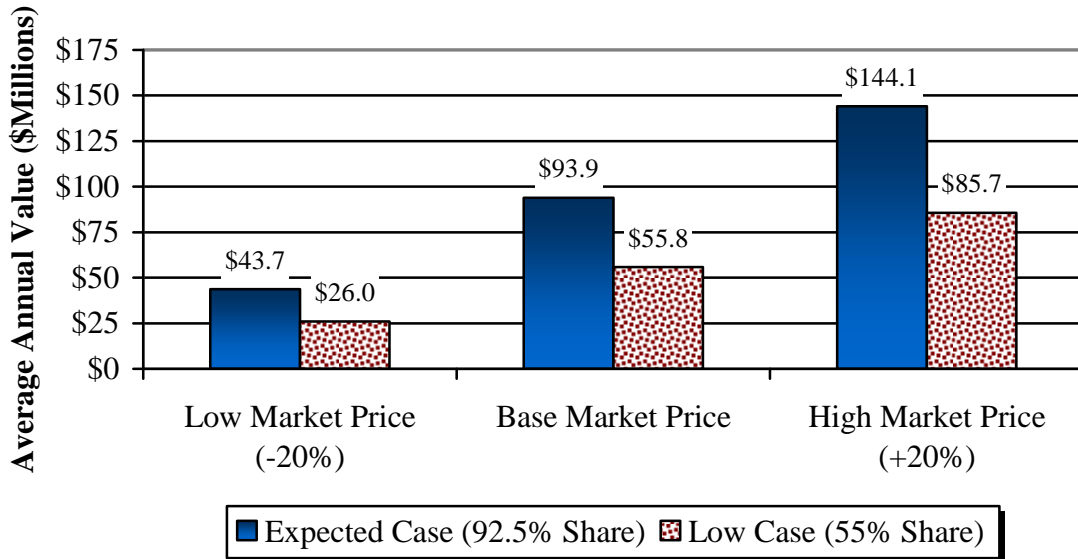
Figure 11.9
Estimated Value to GMP & CVPS Ratepayers of Revenue Sharing Arrangement
High Market Price Case (20% Above Base Case)



11.3.2 Scenario with 55% Share for Vermont Utilities

In the event other out-of-state entities are allocated some of the revenues shared by Entergy with VYNPC, a low case was run showing GMP and CVPS receiving only 55% of the shared revenue (as opposed to 92.5%). Under the base case market energy and capacity projections, this low scenario would still result in \$55.8 million per year of benefit to GMP and CVPS ratepayers over 10 years, or a total of \$558.2 million (a net present value of \$349.5 million). Figure 11.10 compares the expected and low case scenarios.

Figure 11.10
Expected and Low Case Revenue Sharing Scenarios
Average Annual Value (\$Millions)



11.3.3 Extreme Low and High Cases

For the revenue sharing arrangement, the extreme low case includes market prices 20% below the base case projections and assumes GMP and CVPS will only get a 55% portion of the revenues shared by Entergy. The lower market prices reduce the amount of revenue shared with VYNPC. The extreme low case results in an average value over 20 years of \$13.0 million per year, or a 20-year total of \$259.5 million. The net present value benefit to GMP and CVPS ratepayers under the extreme low case is \$159.0 million.

The extreme high case assumes market prices are 20% higher than the base case projections and assumes the current ownership structure of VYNPC will split the revenues shared by Entergy (GMP and CVPS get 92.5% of the shared revenues in that scenario). The extreme high case results in an average value over 20 years of \$72.1 million per year, or a 20-year total of \$1.4 billion. The net present value benefit to GMP and CVPS ratepayers under the extreme high case is \$908.0 million.

Table 11.17
Summary of Revenue Scenarios (\$Millions)

Case	20-Year Total	20-Year NPV
Extreme Low	\$259.5	\$159.0
Base	\$938.8	\$587.8

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Extreme High	\$1,441.1	\$908.0
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11.4 POTENTIAL FOR REDUCED POWER COST IN VERMONT

The potential exists for power contracts between Vermont Yankee and Vermont's distribution utilities that could result in power being sold to those utilities below market rates. The resultant discount from market would be a benefit to ratepayers in addition to the firm revenue sharing agreement. The discounted price would generate savings relative to the market, but those savings would be reduced by the impact the discounted market price would have on the revenue sharing arrangement. The average energy and capacity wholesale sharing price used to compare to the strike price for that portion of the plant output would be the discounted price. Due to the uncertainty of the amount of discount, if any, that might be agreed to by Entergy and the Vermont utilities, GDS Associates has run three scenarios to provide indications of the additional value that might be created for ratepayers. The three scenarios are 5%, 15%, and 25% below market prices.²³ The market price forecasts are the same as used in the revenue sharing analysis, the AESC 2007 Forecast. Approximately 45% of Vermont Yankee net generation is presently purchased for Vermont consumption, meaning 2.1 to 2.3 GWh would be subject to the reduced price in the expected case analysis. A second scenario estimates the value if only 20% of VY energy is purchased in-state.

11.4.1 *Base Case – 45% of VY Energy In Vermont*

A 5% discount from the market over 20 years for the in-state generation would save a net present value of \$85.3 million (discounted at the average utility cost of capital of 8.5%). However, \$25.9 million of the revenue sharing arrangement would be eroded due to the discounted price. Therefore, the net value to ratepayers of a 5% discount would be approximately \$59.4 million. A 15% discount would have a NPV savings of \$255.9 million from market, less \$77.7 million lost in the revenue sharing for a net value of \$178.2 million to ratepayers. Finally, a 25% discount would have a net value of \$297.0 million to ratepayers, \$426.5 million in value due to the discount offset by a \$129.5 million erosion in the revenue sharing. Tables 11.18 through 11.20 summarize the potential benefit to ratepayers of a negotiated discount rate for Vermont Yankee energy. It should be noted that the value of the discount is achieved for 20 years while the erosion in the revenue sharing would impact only 10 years.²⁴

²³ The results of the analysis are subject to change depending on the actual terms of any future contract.

²⁴ Although the conclusion of the revenue sharing arrangement creates additional benefits under the price discount analysis, it represents the end of a substantial positive benefit as described in Section 11.3.

Table 11.18
Summary of 20-Year Value To Ratepayers of Discounted Power
5% Discount, 45% of Energy Sold in Vermont
(All Dollars in Millions)

Year	In-State MWh	Value of Discount	Erosion of Revenue Sharing	Net Value	Value per MWh
2013	2,122,570	\$9.5	(\$4.8)	\$4.7	\$2.21
2014	2,122,570	\$10.2	(\$5.1)	\$5.1	\$2.40
2015	2,313,363	\$11.5	(\$5.7)	\$5.8	\$2.51
2016	2,122,570	\$11.5	(\$5.7)	\$5.8	\$2.73
2017	2,122,570	\$12.1	(\$6.0)	\$6.1	\$2.87
2018	2,313,363	\$13.1	(\$6.6)	\$6.5	\$2.81
2019	2,122,570	\$12.4	(\$6.2)	\$6.2	\$2.92
2020	2,122,570	\$13.1	(\$6.5)	\$6.6	\$3.11
2021	2,313,363	\$14.6	(\$7.3)	\$7.3	\$3.16
2022	2,122,570	\$14.2	(\$7.1)	\$7.1	\$3.35
2023	2,122,570	\$14.7		\$14.7	\$6.93
2024	2,313,363	\$16.4		\$16.4	\$7.09
2025	2,122,570	\$15.8		\$15.8	\$7.44
2026	2,122,570	\$16.4		\$16.4	\$7.73
2027	2,313,363	\$18.3		\$18.3	\$7.91
2028	2,122,570	\$17.6		\$17.6	\$8.29
2029	2,122,570	\$18.3		\$18.3	\$8.62
2030	2,313,363	\$20.4		\$20.4	\$8.82
2031	2,122,570	\$19.6		\$19.6	\$9.23
2032	2,122,570	\$20.2		\$20.2	\$9.52
Average	2,179,808	\$15.0	(\$3.0)	\$11.9	\$5.46
20-Yr Total	43,596,155	\$299.9	(\$59.8)	\$238.9	\$5.48
20-Yr NPV		\$85.3	(\$25.42)	\$59.4	\$1.36

Table 11.19
Summary of 20-Year Value To Ratepayers of Discounted Power
15% Discount, 45% of Energy Sold in Vermont
(All Dollars in Millions)

Year	In-State MWh	Value of Discount	Erosion of Revenue Sharing	Net Value	Value per MWh
2013	2,122,570	\$28.6	(\$14.3)	\$14.3	\$6.74
2014	2,122,570	\$30.5	(\$15.3)	\$15.2	\$7.16
2015	2,313,363	\$34.4	(\$17.2)	\$17.2	\$7.44
2016	2,122,570	\$34.4	(\$17.2)	\$17.2	\$8.10
2017	2,122,570	\$36.3	(\$18.1)	\$18.2	\$8.57
2018	2,313,363	\$39.4	(\$19.7)	\$19.7	\$8.52
2019	2,122,570	\$37.3	(\$18.7)	\$18.6	\$8.76
2020	2,122,570	\$39.3	(\$19.6)	\$19.7	\$9.28
2021	2,313,363	\$43.8	(\$21.9)	\$21.9	\$9.47
2022	2,122,570	\$42.5	(\$21.2)	\$21.3	\$10.04
2023	2,122,570	\$44.1		\$44.1	\$20.78
2024	2,313,363	\$49.1		\$49.1	\$21.22
2025	2,122,570	\$47.4		\$47.4	\$22.33
2026	2,122,570	\$49.2		\$49.2	\$23.18
2027	2,313,363	\$54.8		\$54.8	\$23.69
2028	2,122,570	\$52.9		\$52.9	\$24.92
2029	2,122,570	\$54.9		\$54.9	\$25.86
2030	2,313,363	\$61.1		\$61.1	\$26.41
2031	2,122,570	\$58.8		\$58.8	\$27.70
2032	2,122,570	\$60.7		\$60.7	\$28.60
Average	2,179,808	\$45.0	(\$9.0)	\$35.8	\$16.42
20-Yr Total	43,596,155	\$899.5	(\$179.4)	\$716.3	\$16.43
20-Yr NPV		\$255.9	(\$77.7)	\$178.2	\$4.09

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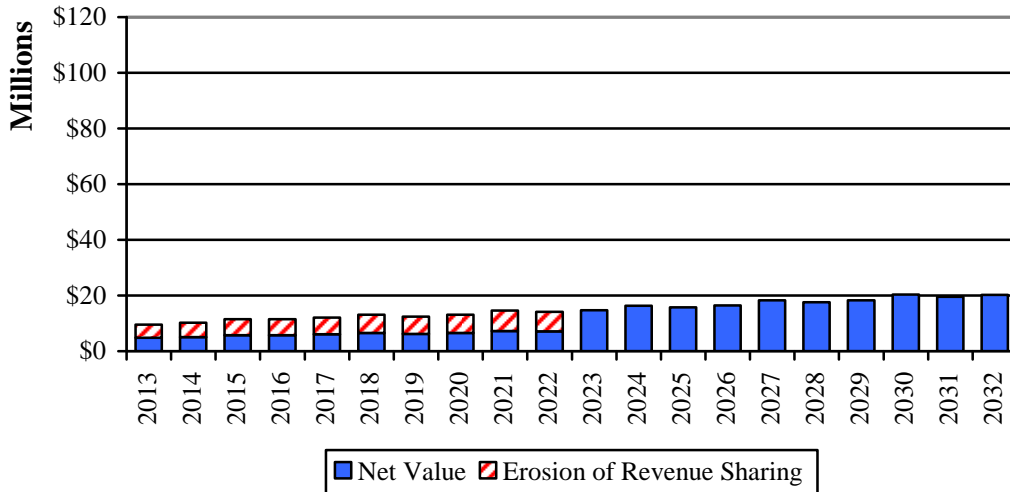
Table 11.20
Summary of 20-Year Value To Ratepayers of Discounted Power
25% Discount, 45% of Energy Sold in Vermont
(All Dollars in Millions)

Year	In-State MWh	Value of Discount	Erosion of Revenue Sharing	Net Value	Value per MWh
2013	2,122,570	\$47.7	(\$23.9)	\$23.8	\$11.21
2014	2,122,570	\$50.9	(\$25.4)	\$25.5	\$12.01
2015	2,313,363	\$57.3	(\$28.7)	\$28.6	\$12.36
2016	2,122,570	\$57.4	(\$28.7)	\$28.7	\$13.52
2017	2,122,570	\$60.5	(\$30.2)	\$30.3	\$14.28
2018	2,313,363	\$65.6	(\$32.8)	\$32.8	\$14.18
2019	2,122,570	\$62.2	(\$31.1)	\$31.1	\$14.65
2020	2,122,570	\$65.5	(\$32.7)	\$32.8	\$15.45
2021	2,313,363	\$73.0	(\$36.5)	\$36.5	\$15.78
2022	2,122,570	\$70.8	(\$35.4)	\$35.4	\$16.68
2023	2,122,570	\$73.4		\$73.4	\$34.58
2024	2,313,363	\$81.8		\$81.8	\$35.36
2025	2,122,570	\$79.0		\$79.0	\$37.22
2026	2,122,570	\$81.9		\$81.9	\$38.59
2027	2,313,363	\$91.3		\$91.3	\$39.47
2028	2,122,570	\$88.1		\$88.1	\$41.51
2029	2,122,570	\$91.4		\$91.4	\$43.06
2030	2,313,363	\$101.9		\$101.9	\$44.05
2031	2,122,570	\$98.0		\$98.0	\$46.17
2032	2,122,570	\$101.2		\$101.2	\$47.68
Average	2,179,808	\$74.9	(\$15.3)	\$59.7	\$27.39
20-Yr Total	43,596,155	\$1,498.9	(\$305.4)	\$1,193.5	\$27.38
20-Yr NPV		\$426.5	(\$129.5)	\$297.0	\$6.81

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The three figures below show the annual values of the discount for each case. In each figure, the sum of the two components of the bar represents the total value of the discount. The striped bar is then the reduction in value due to the impact on revenue sharing. The resultant solid bar is the net value of the discount.

**Figure 11.11
Value of a 5% Discount on Vermont Energy**



**Figure 11.12
Value of a 15% Discount on Vermont Energy**

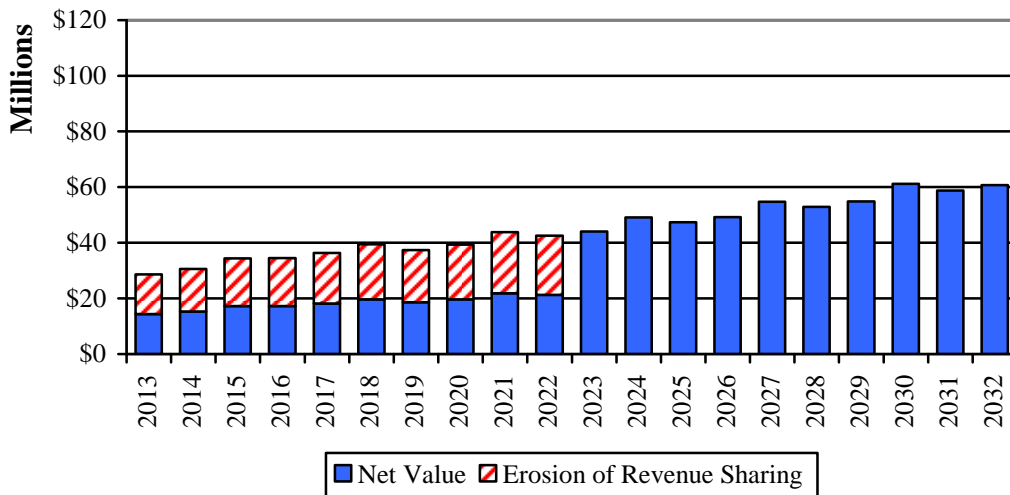
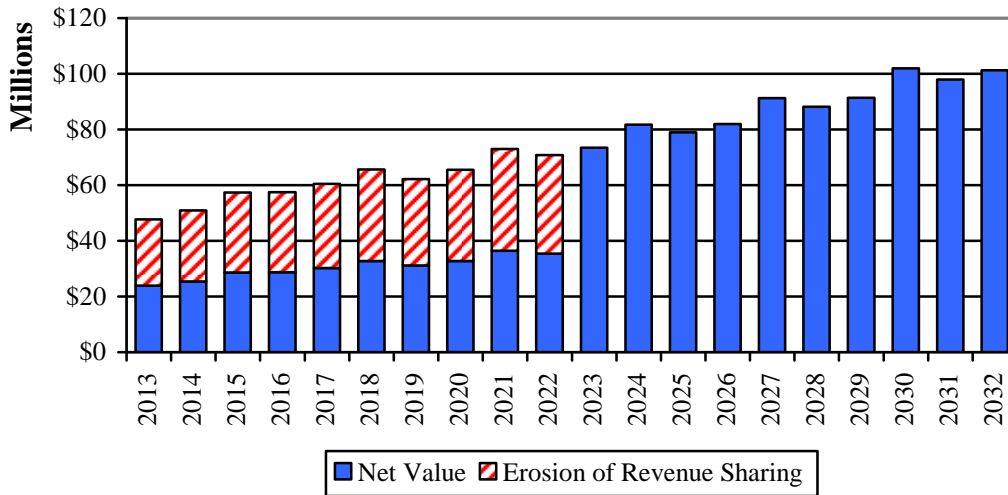


Figure 11.13
Value of a 25% Discount on Vermont Energy



The discounted rate of power leads to lower power costs for Vermont electricity consumers. The savings in power costs can therefore be used for other expenditures. This increased economic activity due to personal consumption can be quantified using the personal consumption multipliers from the Input/Output analysis. The multipliers indicate that \$1 in personal consumption would generate \$0.5883 in total value added and that every \$1 million of personal consumption would support 8.2812 additional jobs. The additional value added and job impacts from the power cost savings are shown in the table below.

Table 11.21
Economic Impacts of Power Cost Savings Used on Personal Consumption
(Value Added in \$Millions, Jobs in FTE Job-Years)

Scenario	Avg. Annual Value Added	20-Year Total Value Added	Avg. Annual Job Impact	20-Year Total Job Impact
5% Price Discount	\$7.0	\$140.4	99	1,977
15% Price Discount	\$21.1	\$421.3	297	5,930
25% Price Discount	\$35.1	\$702.2	494	9,883

11.4.2 Sensitivity Case – 20% of VY Energy In Vermont

The expected case analysis assumes the current level of VY generation being sold to in-state utilities. A sensitivity case was run to show the impacts if only 20% of the generation stays in Vermont. The results of that scenario are show in the tables below.

**Table 11.22
Summary of 20-Year Value To Ratepayers of Discounted Power
If 20% of Power Stays In State
(All Dollars in Millions)**

Scenario	20-Year Total MWh	Average Annual	20-Year Total	20-Year NPV
5% Price Discount	19,376,069	\$5.3	\$106.1	\$26.4
15% Price Discount	19,376,069	\$15.9	\$318.3	\$79.2
25% Price Discount	19,376,069	\$26.5	\$530.5	\$132.0

**Table 11.23
Economic Impacts of Power Cost Savings Used on Personal Consumption
(Value Added in \$Millions, Jobs in FTE Job-Years)**

Scenario	Avg. Annual Value Added	20-Year Total Value Added	Avg. Annual Job Impact	20-Year Total Job Impact
5% Price Discount	\$3.1	\$62.4	44	879
15% Price Discount	\$9.4	\$187.3	132	2,636
25% Price Discount	\$15.6	\$312.1	220	4,393

11.4.3 Extreme Low and High Cases

It is not known with any certainty the amount, if any, of a potential discount from market prices that might be negotiated by Entergy and Vermont utilities. Therefore, three general points were selected. The 15% scenario was chosen as the “base” case in this instance primarily because it was the middle of the three points.

The extreme low case provides for no discount form market prices. Therefore, there are no economic impacts associated with a price discount in the extreme low case.

The extreme high case includes a 25% discount from market and assumes 45% of VY generation would be sold to Vermont utilities. This scenario produces a NPV of \$297.0 million when discounted at the utility cost of capital of 8.5%. The average annual savings under the extreme high case are \$59.7 million, which total to \$1.2 billion over 20-years.

11.5 CONCLUSION

In this analysis, GDS Associates has endeavored to quantify the economic impacts conservatively but as accurately as possible. Based on the study, it is obvious that continued operation of Vermont Yankee an additional 20 years would provide a significant boost to the state economy across a range of potential scenarios. The 20-year total value to citizens of Vermont is estimated to range from \$1.5 billion to \$5.1 billion. Although closure of VY would have some impact on the state, it would have a much greater impact on the Windham county and local town economies, where Vermont Yankee is one of the top 5 employers.

Table 11.24
Summary of 20-Year Total Impacts by Scenario

<i>20-Year Total of Nominal Values</i>			
Component	Extreme Low Case	Base Case	Extreme High Case
Govt Revenues Net of Burdens	\$173.4	\$237.8	\$282.1
Value Added – Econ. Activity	\$1,095.9	\$1,289.3	\$1,482.7
Revenue Sharing Agreement	\$259.5	\$938.8	\$1,441.1
Potential Electric Rate Discount	\$0.0	\$716.1	\$1,193.5
Value Added – Rate Discount	\$0.0	\$421.3	\$702.2
Total	\$1,528.8	\$3,603.3	\$5,101.6
Jobs Supported by Value Added*	21,298.0	30,079.4	36,884.2