# Economic and Environmental Benefits to Massachusetts from the Operation of the Seabrook Nuclear Plant

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**Acknowledgments**

**About the Authors**

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**Introduction to Analysis Group**

Analysis Group is one of the largest international economics consulting firms, with more than 1,000 professionals across 14 offices in North America, Europe, and Asia. Since 1981, Analysis Group has provided expertise in economics, finance, health care analytics, and strategy to top law firms, Fortune Global 500 companies, government agencies, and other clients worldwide.

Analysis Group's Energy & Environment practice area is distinguished by expertise in economics, finance, market modeling and analysis, regulatory issues, and public policy, as well as deep experience in environmental economics and energy infrastructure development. We have worked for a wide variety of clients, including (among others) energy producers, suppliers and consumers, utilities, regulatory commissions and other federal and state agencies, tribal governments, power-system operators, foundations, financial institutions, and start-up companies.

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# I.  Key Takeaways

- The Seabrook nuclear power plant provides almost 8% of New England's power supply, lowers Massachusetts consumers' electricity and natural gas costs, reduces greenhouse gas (GHG) emissions and regional natural gas demand, and provides high-reliability, year-round power supply and capacity.

- A long-term power purchase agreement with Seabrook could save Massachusetts consumers $880 million to $2.61 billion over a ten-year period, ensure Massachusetts meets its GHG reduction objectives, and insure consumers against electricity and natural gas market price volatility.

- Seabrook's operation significantly contributes to Massachusetts' GHG emission reduction objectives, avoiding an estimated 49 million tons of regional carbon dioxide ($CO_2$) emissions over a ten-year period (2023–2032). The value of the avoided emissions is estimated at $611 million (equivalent to adding 2,500 MW of new offshore wind resources or the removal of nearly 1 million automobiles from roadways).

- Seabrook's operation replaces an equivalent amount of gas-fired capacity, roughly three 400 MW combined cycle facilities. In winter months—when power prices are highest—these resources' gas use corresponds to over 200 MCf/day, or roughly 20% of the daily natural gas supply consumed by power generators during winter cold snaps.

- Seabrook's operation reduces Massachusetts electricity consumer energy costs. Based on a wide range of New England natural gas price forecasts, Seabrook's operation reduces Massachusetts electricity costs an estimated $1.60 billion to $2.31 billion over the next ten years (2023–2032).

- Finally, Massachusetts consumers' savings from lower electricity costs translate into added value to the Massachusetts economy through increased economic activity and more jobs. When these often-overlooked benefits are included, Seabrook's operation provides an estimated total economic impact on Massachusetts of $2.00 billion to $2.91 billion and creates hundreds of jobs in Massachusetts.

# II. Executive Summary

Our analysis estimates the potential cost savings to Massachusetts consumers of a long-term power purchase contract with the Seabrook power plant and evaluates the economic and environmental impact of Seabrook's operation on Massachusetts. Seabrook's almost 1,250 MW of emission-free electric generation capacity provides approximately 8% of New England's power supply. Massachusetts—with electric energy consumption nearly half of New England's total—enjoys significant economic and environmental benefits due to Seabrook's operation. Seabrook's output lowers Massachusetts' power and natural gas prices and reduces energy cost for Massachusetts' residential, commercial, and industrial consumers. Reduced energy costs translate into broader regional economic benefits for Massachusetts—residential consumers have more money to spend and save, and commercial and industrial consumers enjoy lower costs and greater economic output. Yet if Massachusetts utilities were to contract directly for power produced by Seabrook, utility consumers could enjoy additional multi-year cost savings and reduced utility bill volatility. Finally, Seabrook's operation substantially reduces $CO_2$ emissions, keeps down Regional Greenhouse Gas Initiative (RGGI) emission allowance prices, and lowers other key air pollutant emissions.

Using commercially available power market and regional economic impact modeling software, we evaluate Seabrook's potential to lower Massachusetts consumers' electricity bills and Seabrook's economic and environmental impact on Massachusetts. We configure power market modeling software to evaluate the power market impacts by assessing power system performance over the ten-year period 2023–2032 under two cases—"with" and "without"—Seabrook under each of two pricing scenarios (described below). We use the modeling results to estimate potential cost savings of a long-term power purchase contract with Seabrook. We also estimate the benefits of Seabrook's continued operation by comparing the modeling results of the two cases and calculating the difference in power system prices, costs, emissions, and fossil fuel consumption due to Seabrook's operation. The power market modeling results are the basis for our findings.

We calculate Seabrook's potential to reduce Massachusetts consumers' electric utility bills and its impact on the regional power market and on Massachusetts' economy under two pricing scenarios. Our first scenario, the Base Case, uses recently reported New England natural gas forward prices. Our second scenario, an Alternative Future Fuel Prices scenario, assumes gas prices decline significantly from recent historically high levels. These two pricing scenarios provide "bookends" that allow us to account for the possibility of persistently high natural gas market prices in the United States and, in particular, in New England's regional natural gas market, which depends on liquefied natural gas during the winter. Moreover, we capture the impact of a prolonged Russian war in Ukraine or other international conflicts that can affect liquefied natural gas prices and influence New England's winter natural gas prices. We also account for the possibility that future regional gas prices decline in the next few years. We expect that the estimated benefits of a long-term power purchase contract to Massachusetts consumers and the associated cost reductions attributable to Seabrook's operations fall within the range of the results of our two scenarios.

First, **Table ES-1** shows that a long-term power purchase contract with Seabrook results in an estimated potential reduction in Massachusetts consumers' utility bills of $880 million to $2.61 billion over ten years.

We calculate this range of cost savings by first taking the difference between our market modeling electricity prices and assumed long-term power purchase contract electricity prices. For the assumed long-term contract prices, we used the Connecticut utilities' current Seabrook power purchase agreement as it was publicly available. We multiply the price difference by an assumed 1,000 MW Seabrook power sale quantity and report the cost difference over the ten-year modeling horizon. The two bookend fuel price trajectories used in the market modeling create the projected range of potential consumer cost savings. Current natural gas market prices result in higher cost savings, while potentially lower natural gas prices result in lower estimated cost savings.

**Table ES-1:  Estimated Massachusetts Consumer Utility Bill Cost Savings:  Seabrook Long-Term Power Purchase Power Contract**

| *Estimated Massachusetts Consumer Utility Bill Cost Savings:  Seabrook Long-Term Power Purchase Contract* | **10-Year Total (2023–2032)** |
|---|:---:|
| Base Case | $2.61 Billion |
| Alternative Future Fuel Prices | $880 Million |

Second, **Table ES-2** shows that, over the ten-year modeling horizon, Seabrook's operation avoids nearly 50 million short tons of $CO_2$ emissions from New England fossil-fuel-fired electric generation resources that would operate in the absence of Seabrook. These $CO_2$ emission reductions are equivalent to taking nearly 1 million automobiles off the road or adding approximately 2,500 MW of new offshore wind (OSW) electric generation capacity. Moreover, Seabrook's $CO_2$ emissions impact is essentially constant at a reduction of about 5 million short tons per year. Thus, as New England's reliance on renewable energy resources grows and total $CO_2$ emissions decline, Seabrook's operation becomes even more vital for Massachusetts representing an increasing percentage of New England's annual avoided $CO_2$ emissions (12–21%). Seabrook's operation is clearly critical for Massachusetts and other New England states' ability to reach their GHG reduction mandates and objectives.

**Table ES-2:  Summary of Seabrook's Economic and Environmental Impact (2023–2032)**

| *Base Case* | 10-Year Total (2023–2032) |
|---|---|
| $CO_2$ Emissions Avoided | 48.9 Million Short Tons |
| Natural Gas Demand Reduction | 732 BCf |
| Massachusetts Electricity Cost Reduction | $2.31 Billion |
| Total Economic Benefit to Massachusetts Economy | $2.91 Billion |
| Increased Job-Years | 17,580 |
| | |
| *Alternative Future Fuel Prices* | |
| $CO_2$ Emissions Avoided | 47.9 Million Short Tons |
| Natural Gas Demand Reduction | 764 BCf |
| Massachusetts Electricity Cost Reduction | $1.60 Billion |
| Total Economic Benefit to Massachusetts Economy | $2.00 Billion |
| Increased Job-Years | 12,150 |

Third, reduced natural gas demand helps keep natural gas prices down and further supports Massachusetts' goals to reduce $CO_2$ emissions. Seabrook's operation reduces annual New England electric sector demand for natural gas by an estimated 73–76 BCf per year, for a total of 730–760 BCf over ten years. This reduction represents 18–30% of New England electric sector gas demand, with the percentage increasing over time as New England's reliance on renewable resources grows. Moreover, Seabrook's operation replaces an equivalent amount of gas-fired capacity, roughly three 400 MW combined cycle facilities. In winter months— when power prices are highest—these resources' gas use corresponds to over 200 MCf/day, or roughly 20% of the daily natural gas supply consumed by power generators during winter cold snaps. Seabrook's operation provides important regional benefits by reducing natural gas demand.

Fourth, under our Base Case scenario we find that Seabrook's operation reduces Massachusetts electricity costs by an estimated $2.31 billion over the next ten years. We then use economic modeling software to calculate the total economic impact on Massachusetts due to the reduced energy costs enabled by Seabrook's operation. In our Base Case, we find that the total ten-year residential savings benefit is approximately $1.56 billion, while the total ten-year benefit arising from commercial and industrial customer savings is approximately $1.34 billion. Overall, the combined benefit to the Massachusetts economy in the Base Case is approximately $2.91 billion.

In addition to economic benefits to Massachusetts, Seabrook's operation also drives the creation and support of jobs, measured in job-years (with one job-year equivalent to one person employed full-time for one year). We find in our Base Case scenario that the total created job-years includes 4,970 job-years from residential savings. In addition, commercial and industrial cost savings and associated reinvestment create an additional 12,610 job-years, for a total of 17,580 job-years.

Under the Alternative Future Fuel Prices scenario, electricity consumer costs attributable to Seabrook are somewhat lower starting in 2026, due to declining forecasted natural gas prices relative to the Base Case. As **Table ES-2** shows, under this alternative scenario we find that Seabrook reduces Massachusetts electricity costs by an estimated total of $1.60 billion over the next ten years. Economic impacts also decline, with a total residential savings benefit of approximately $1.08 billion, while the total benefit arising from commercial and industrial customer savings is approximately $924 million. Overall, the total benefit to the Massachusetts economy in the Alternative Future Fuel Prices scenario is approximately $2 billion.

We also find in our Alternative Future Fuel Prices scenario that total created job-years includes 3,440 job-years from residential savings. In addition, commercial and industrial cost savings and associated reinvestment create an additional 8,710 job-years, for a total of 12,150 job-years.

Finally, the economic and environmental benefits provided by Seabrook to Massachusetts are even greater when its contribution to power system reliability benefits and reduced emission of nitrogen oxides and carbon monoxide are considered. While we did not model these benefits, Seabrook provides 1,250 MW of reliable electric generation capacity almost year-round. In addition, Seabrook enables reduced operation of natural gas- and oil-fired electric generation facilities, which results in improved local and regional air quality in the area where the fossil-fuel-fired plants are located.

# III. Modeling Framework

Our modeling framework is composed of a ten-year (2023–2032) power market modeling analysis and a Massachusetts specific economic impact analysis. The power market modeling, which relies on Enelytix[1], was conducted employing two different pricing scenarios: a Base Case, and an Alternative Future Fuel Prices scenario. Each scenario includes two New England power sector analysis cases: one "with," and one "without," the Seabrook nuclear plant. Differences in the projected dispatch of generation resources under the "with" and "without" Seabrook cases provide a basis to estimate the impact of Seabrook's operations on the power and natural gas markets. The difference in the estimated electricity prices between the two cases provides inputs for each scenario's calculation of the impact on the Massachusetts economy. The economic impact analysis utilizes IMPLAN to estimate the magnitude of the economic benefits of Seabrook's power supply to Massachusetts consumers.

## A. Power Market Modeling

We model the New England power market using the Enelytix power market modeling software. The Enelytix software provides the platform for an hourly electricity system dispatch analysis. In the Enelytix model, we run ten-year, unconstrained hourly dispatch analyses of the ISO-New England (ISO-NE) power system for each case. Each Enelytix case is configured with the same core conditions, which include the following: power system infrastructure both in place and as it evolves over the modeling period based on known and possible resource retirements and planned renewable and other resource additions;[2] local and regional forecasts of electric energy and peak load by service territory over the modeling period (including consideration of transportation and building heating electrification); and projections of fuel prices and $CO_2$ allowance prices. The modeling results for each case provide the basis for estimating the impact of Seabrook's operations on New England's power system.

## B. Regional Economic Impact Modeling: Massachusetts

In the IMPLAN analysis, we start with economic relationships that exist among providers and users of goods and services in Massachusetts, and then introduce the revenue gains and losses to electricity consumers and power producers (from the Enelytix model). IMPLAN characterizes the impact of Seabrook's operation on Massachusetts electricity consumers both through the relationships between consumers and their electricity demand and through indirect and induced effects that "ripple" through the Massachusetts regional economy. Specifically, the model captures, and we report, employment impacts as well as "value-added"

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[1] Enelytix, Newton Energy Group LLC and Polaris Systems Optimization, Inc.

[2] We note that the Enelytix modeling software can be used to model capacity expansion, but we did not require this feature as our analyses include sufficient capacity to meet projected peak demand, including reserve requirements, with and without the Seabrook plant.

impacts from increased economic activity, which together represent the total economic value of the economy being modeled (i.e., gross state product in the case of Massachusetts).

We use the Enelytix results as inputs to the IMPLAN model. From a macroeconomic perspective, the changes in estimated consumer wholesale electricity costs and generator revenues result in (a) changes in the level of disposable income realized by residential consumers and reduced costs to commercial and industrial consumers due to Seabrook's impact on wholesale electricity prices, and (b) changes in economic conditions (i.e., revenue and operational cost differences) for Massachusetts power plant owners as electric generation resources' utilization changes in each scenario. The differences in the "with" and "without" Seabrook modeling results are the inputs to the Massachusetts IMPLAN regional economic model.

# IV.  Modeling Assumptions

## A.  Modeling Resource and Load Balance

**Table 1** presents the modeling resource and load balance for the ten-year modeling time horizon. **Table 1** is derived starting with the ISO-NE 2022 Capacity, Energy, Loads and Transmission (CELT) Report. We then use a combination of 2022 CELT Report data and projections, expected resource additions based on current New England state legislation and policies, ISO-NE interconnection queue, and ISO-NE forward capacity auction (FCA) results to project changes in the New England resource mixture over the next ten years.

**Table 1: ISO-NE Modeling Resource and Load Balance (MW, 2023–2032)[3]**

| | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Capacity*** | | | | | | | | | | |
| Existing Derated Capacity (Excludes BTM PV) | 31,040 | 31,040 | 31,040 | 31,040 | 31,040 | 31,040 | 31,040 | 31,040 | 31,040 | 31,040 |
| Retirements | 147 | 1,571 | 1,859 | 2,349 | 2,780 | 3,580 | 3,580 | 3,580 | 3,580 | 3,580 |
| Existing Derated Capacity After Retirements | 30,892 | 29,468 | 29,181 | 28,691 | 28,260 | 27,460 | 27,460 | 27,460 | 27,460 | 27,460 |
| | | | | | | | | | | |
| Assumed Additions | | | | | | | | | | |
| Offshore Wind | 0 | 162 | 303 | 544 | 704 | 950 | 1,150 | 1,390 | 1,630 | 1,870 |
| Utility Scale Solar | 164 | 323 | 469 | 596 | 667 | 732 | 797 | 859 | 920 | 981 |
| Battery Storage | 200 | 400 | 600 | 700 | 800 | 950 | 1,100 | 1,250 | 1,400 | 1,550 |
| Installed Derated Capacity | 31,257 | 30,353 | 30,553 | 30,531 | 30,431 | 30,093 | 30,507 | 30,959 | 31,410 | 31,862 |
| | | | | | | | | | | |
| Imports | 1,115 | 1,115 | 2,205 | 2,205 | 2,205 | 2,205 | 2,205 | 2,205 | 2,205 | 2,205 |
| | | | | | | | | | | |
| Total Derated Capacity | 32,372 | 31,468 | 32,758 | 32,736 | 32,636 | 32,298 | 32,712 | 33,164 | 33,615 | 34,067 |
| Total Derated Capacity, without Seabrook | 31,126 | 30,222 | 31,512 | 31,490 | 31,390 | 31,052 | 31,466 | 31,918 | 32,369 | 32,821 |
| | | | | | | | | | | |
| ***Load*** | | | | | | | | | | |
| Load (50/50), Gross of EE and BTM PV | 27,855 | 27,983 | 28,130 | 28,330 | 28,524 | 28,740 | 28,979 | 29,239 | 29,519 | 29,723 |
| Behind the Meter PV | 935 | 961 | 994 | 1,031 | 1,060 | 1,084 | 1,100 | 1,110 | 1,115 | 1,141 |
| Energy Efficiency in Peak Hour | 2,288 | 2,423 | 2,557 | 2,706 | 2,833 | 2,935 | 3,010 | 3,058 | 3,082 | 3,207 |
| Net Load (50/50) | 24,632 | 24,599 | 24,579 | 24,593 | 24,631 | 24,721 | 24,869 | 25,071 | 25,322 | 25,375 |

As **Table 1** shows, state planned resource additions outpace resource retirements over the ten-year modeling time horizon. Existing generation resource mixture is based on ISO-NE's 2022 CELT Report, SNL Global Data, and ISO-NE Forward Capacity Market results. Assumptions regarding generation additions and retirements are based on a review of state policy GHG reduction policy objectives and ISO-NE FCA auction results and resource delist bidding frequency.[4] In the following points, we provide additional background on the development of the modeling resource and load balance.

### 1. Offshore Wind (OSW) Resource Additions

**Table 2** shows the OSW resource additions included in the modeling analysis. The OSW resource additions are based on: (1) OSW projects that have executed power supply contracts, and (2) state-legislated OSW resource procurement targets that are expected to be fulfilled over the next several years. The projected on-line dates are based on a mixture of OSW developer-reported commercial operation dates and dates that allow for resources to be in operation by the end of the modeling time horizon. We assume that the total quantity of resources that are envisioned under state policies will be able to interconnect to the ISO-NE transmission grid.

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[3] *See* Appendix for **Table 1** notes and sources.

[4] The resource mixture is the same for each "with" and "without" case other than Seabrook's removal in the "without" case.

**Table 2:  OSW Generation Resource Additions (2023–2032)[5]**

| Year | Projected OSW Additions (MW) | Cumulative OSW Additions (MW) | Notes |
|---|---|---|---|
| 2023 | 0 | 0 | |
| 2024 | 812 | 812 | Assumed Vineyard Wind I (800 MW) and New England Aqua Ventus I (12 MW) online year |
| 2025 | 704 | 1,516 | Assumed Revolution Wind (704 MW) online year |
| 2026 | 1,204 | 2,720 | Assumed Mayflower Wind (1,204 MW) online year |
| 2027 | 800 | 3,520 | Assumed Park City Wind (800 MW) online year |
| 2028 | 1,232 | 4,752 | Assumed Commonwealth Wind (1,232 MW) online year |
| 2029 | 1,000 | 5,752 | Assumed Rhode Island procurement (1,000 MW) online year |
| 2030 | 1,200 | 6,952 | Allocation of remaining 3,600 MW of MA and CT legislated procurements from 2030–2032 |
| 2031 | 1,200 | 8,152 | Allocation of remaining 3,600 MW of MA and CT legislated procurements from 2030–2032 |
| 2032 | 1,200 | 9,352 | Allocation of remaining 3,600 MW of MA and CT legislated procurements from 2030–2032 |

### 2.  Other Policy-Driven Resource Additions

We include in our resource mixture the addition of the currently contracted Hydro-Quebec imports in 2025 (New England Clean Energy Connect). We also include projected growth in photovoltaic (PV) solar resources (solar), energy efficiency (EE), and battery energy storage systems (BESS). For solar, EE, and BESS, we rely on ISO-NE's 2022 CELT Report, ISO-NE FCA results, and current state policies to guide these forecasted resource additions.[6]

### 3.  Resource Retirements

Generation resources that have already scheduled or announced retirement are retired based upon scheduled retirement dates. We assume New England's remaining coal-fired generating units and other thermal generating units that frequently submit ISO-NE FCA de-list capacity market offers retire between June 2026 and June 2028.

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[5] *See* Appendix for **Table 2** notes and sources. Note that the Commonwealth Wind project may be delayed based on recently revealed difficulties securing financing.

[6] *See also* Schatzki, Todd, et al., *Pathways Study: Evaluation of Pathways to a Future Grid*, April 2022, available at https://www.analysisgroup.com/globalassets/insights/publishing/2022_schatzki-et-al-pathways-final.pdf, Figure 11-2.

### 4. *Load and Intermittent Resource Output Forecasts*

We obtained forecasted monthly electricity loads for the ten-year modeling period from ISO-NE's 2022 CELT Report.[7] We align hourly load forecast shapes with forecasted intermittent resource output based on National Renewable Energy Lab 2012 wind and solar resource performance data.

## B. Modeling Scenarios and Generation Resource Fuel Price Forecasts

We completed two modeling scenarios in our analysis. These two scenarios allow us to evaluate the impact of natural gas price projections on the results of the analyses. In our Base Case scenario, fuel prices capture the current market expectations for natural gas prices in New England. Current natural gas market prices, however, are at historically high levels and capture the ongoing impact of the global commodity markets and the Russian war against Ukraine. Thus, we also evaluated an Alternative Future Fuel Prices scenario in which we assume that New England natural gas prices decline in 2026 to levels that align with the US Energy Administration's 2022 Annual Energy Outlook. By analyzing a range of possible natural gas prices, we are likely to capture the differences in the impact of Seabrook's operation on New England's power markets.

We conservatively do not estimate the impact of the absence of Seabrook's operation on New England natural gas market prices. Instead, by using a range, we first capture market conditions where forecasted elevated gas prices increase reliance on fuel oil in cold winter months (Base Case scenario). We then contrast the Base Case results with a forecast of falling gas prices (Alternative Future Fuel Prices scenario) in which natural gas prices moderate compared with current market conditions. That is, we implicitly assume gas demand in the region declines as more renewable resources are added to the system and heating electrification grows. The reduction in New England's power market prices due to Seabrook's operations is nearly certain to fall into the range between current market conditions and a longer-term forecast that does not include the impact of the Ukrainian war in three years.

### 1. *Current Fuel Futures Prices (Base Case Scenario)*

In our Base Case scenario, we use recently reported Algonquin City Gates forward prices and New York Harbor No. 2 distillate fuel oil (ultra-low sulfur heating oil) and residual fuel oil (1% sulfur) futures prices. The natural gas forward prices are obtained from S&P Global Market Intelligence.[8] Fuel oil futures prices are also

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[7] We use CELT Report net-loads, which are reduced for projected behind-the-meter PV and energy efficiency. For the year 2032, we use 2031 forecasted values adjusted based on prior year's load growth. *See* ISO-NE 2022 CELT Report, available at https://www.iso-ne.com/static-assets/documents/2022/04/2022_celt_report.xlsx.

[8] *See* S&P Global Market Intelligence, "Natural Gas Forwards & Futures (Data)," as of 11/7/2022. The S&P Global Market Intelligence MI forward price series is available through 2032. Fuel oil futures are only available through 2026. After 2026, we escalate fuel oil prices based on projected fuel oil price changes in EIA's 2022 Annual Energy Outlook.

obtained from S&P Global Market Intelligence. In our Base Case, annualized Algonquin City Gates natural gas prices start at $10.62/MMBTU in 2023 and decline to $8.66/MMBTU in 2032.

### 2. *Alternative Future Fuel Prices Scenario*

Because recent fuel price futures are significantly impacted by Russia's war with Ukraine, we model a scenario in which we assume natural gas prices decline beginning in 2025 are adjusted to levels that align with the Energy Information Administration's 2022 Annual Energy Outlook.[9] **Figure 1** contains monthly natural gas prices for each of the two scenarios. In our Alternative Future Fuel Prices scenario, annualized Algonquin City Gates natural gas prices start at $10.62/MMBTU and decline to $4.71/MMBTU.

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[9] *See* US Energy Information Administration, "Annual Energy Outlook 2022," Table 3.1. New England, available at https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&region=1-1&cases=ref2022. Specifically, we assume prices from 2026–2032 correspond to the EIA AEO annual estimates for natural gas for electric power use in New England. We assume prices for 2023–2024 are identical to the Base Case fuel prices, and we calculate prices for 2025 by taking the average of the 2024 Base Case prices and 2026 EIA AEO prices.

**Figure 1:  Monthly Natural Gas Prices—Base Case and Alternative Future Fuel Prices Scenarios (2023–2032)**
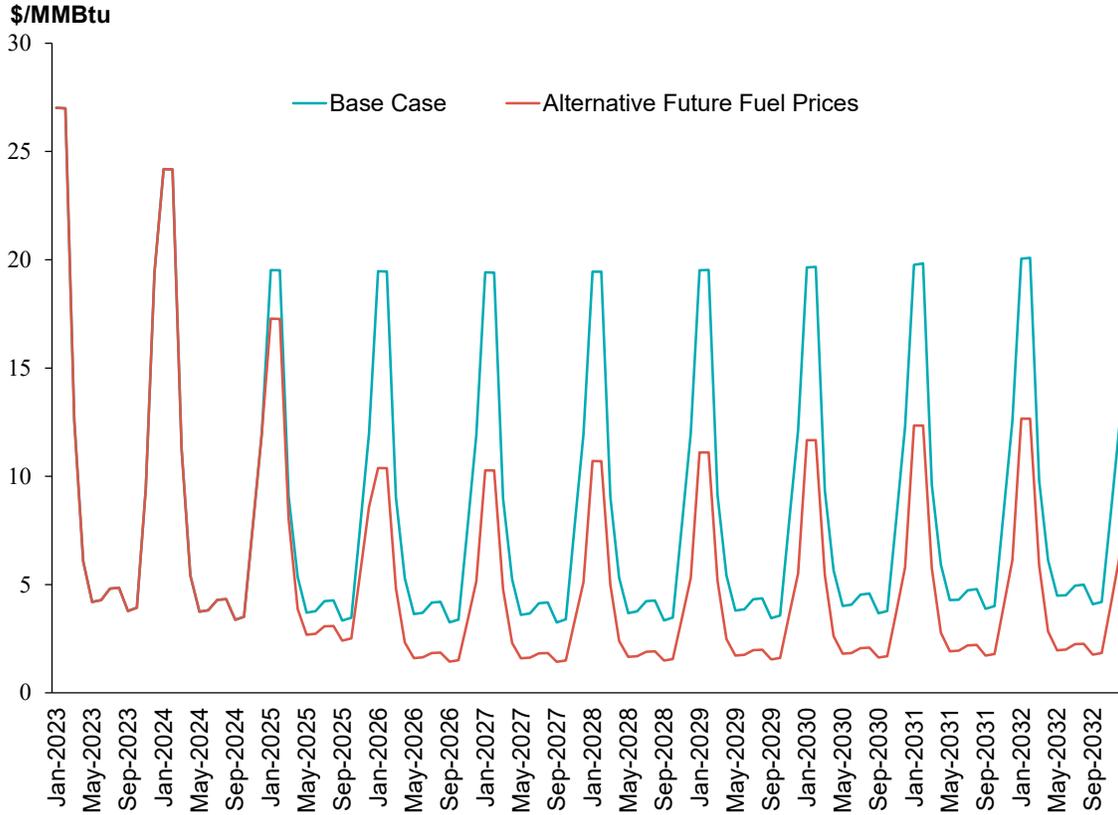


# V. Results

The modeling results include projected electricity prices, $CO_2$ emissions, and resource fossil fuel consumption. We first use our modeling results to estimate the potential Massachusetts consumer cost reduction that a long-term power purchase contract with Seabrook could provide. Then, for each scenario, we calculate the changes in estimated annual wholesale electricity costs and prices, $CO_2$ emissions, and electric generator natural gas consumption. Next, we trace the dollar differences in each scenario's two Enelytix runs ("with" and "without" Seabrook) through the macroeconomic IMPLAN model to capture the impact of the operation of Seabrook on the Massachusetts economy. Finally, we note the expected reliability benefits for New England associated with Seabrook's operation.

## A. Power Market Modeling

### 1. Benefits of a Seabrook Long-Term Power Purchase Agreement

**Table 3** shows the estimated Massachusetts electricity customer bill savings under an assumed ten-year power purchase contract with Seabrook. In this analysis, we assume that 1,000 MW of Seabrook's energy output (~80% of rated hourly output) is contracted on behalf of Massachusetts utility customers over ten years. To estimate customer savings, we multiply the price difference of the Base Case (or Alternative Futures Fuel Price scenario) and an assumed contract generation price[10] by the assumed annual contract generation quantity. Over ten years, the estimated Massachusetts customer utility bill reductions range from $880 million to $2.61 billion.

In addition, a long-term power purchase contract can provide Massachusetts consumers with insurance against potential ISO-NE capacity cost increases. Several oil- and natural gas-fired power generators in New England are aging and unlikely to be repaired if they sustain a major equipment failure. Moreover, ISO-NE capacity market accreditation protocols are expected to reduce the estimated contributions of intermittent renewable resources and gas-fired resources that do not have firm natural gas transportation. Reduced capacity market supply can be expected to drive up future capacity market prices. A long-term commitment to purchase Seabrook's proven, reliable generation capacity provides Massachusetts consumers with a hedge against potential capacity price increases.

Finally, Seabrook's operation will help Massachusetts meet its clean energy standard if there are delays bringing offshore wind resources into operation. Massachusetts' clean energy standard calls for 60% of Massachusetts' electricity supply to be generated by clean energy resources by 2030 (including imported nuclear electricity).[11] Massachusetts also requires significant growth in OSW resources to meet its renewable portfolio standards.[12] Because both OSW wind and nuclear resources are qualified to meet Massachusetts' clean energy standard, Seabrook will help reduce the costs of clean energy standard compliance, especially if planned offshore wind resource additions are delayed.[13]

**Table 3: Estimated Massachusetts Electric Utility Customer Bill Cost Savings—Seabrook Long-Term Power Purchase Contract (2023—2032)**

| Estimated Massachusetts Consumer Utility Bill Cost Savings: Seabrook Long-Term Power Purchase Contract | 10-Year Total (2023–2032) |
|---|---|
| Base Case | $2.61 Billion |
| Alternative Future Fuel Prices | $880 Million |

### 2. Seabrook's Impact on New England's Power Market

**Table 4** presents the estimated energy cost reductions realized by New England and Massachusetts due to the operation of Seabrook for the Base Case and Alternative Future Fuel Prices scenarios.[14] In our Base

Case scenario, the annual electric energy cost reduction from Seabrook's operation in New England ranges between $284 million and $971 million over the next ten years. For Massachusetts, the annual energy cost reduction ranges from $133 million to $455 million. In the Base Case, estimated wholesale energy price reductions range from $2.1/MWh to $6.9/MWh. In our Alternative Future Fuel Prices scenario, the estimated cost savings decline, but remain significant. For New England, the annual energy cost reduction ranges between $160 million and $636 million, while in Massachusetts the annual energy cost reductions range from $75 million to $295 million. In the Alternative Future Fuel Prices scenario, estimated wholesale energy price reductions range from $1.2/MWh to $4.9/MWh.

In both scenarios, the annual cost reductions are highest at the beginning and the end of the modeling time horizon. In the beginning of the modeling time horizon, current natural gas prices drive the higher energy cost reductions. In the later years of the modeling time horizon, the energy cost reductions attributable to Seabrook's operation rise again. In these later years, Seabrook's operation, combined with growing OSW generation resources, pushes wholesale prices to very low levels in more and more hours. However, without Seabrook in the resource mix, some of these very low-priced hours are replaced by higher-priced hours where gas- or oil-fired resources are the marginal resource setting prices. The "with" and "without" Seabrook price difference grows in these hours in later years, driving up the energy cost reductions attributable to Seabrook's operation.

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[10] For our analysis, we base the assumed power purchase contract prices on Connecticut utilities' current long-term Seabrook power purchase contracts.

[11] Massachusetts 310 CMR: Department of Environmental Protection, 7.75: Clean Energy Standard.

[12] See, for example, Knight, Pat, et al., An Analysis of the Massachusetts Renewable Portfolio Standard, Prepared for NECEC in Partnership with Mass Energy, May 2017 at 6.

[13] The clean energy standard alternative compliance penalty (ACP) is set at 50% of the RPS ACP, which is currently $40/MWh (https://www.mass.gov/service-details/program-summaries).

[14] Our analysis conservatively does not evaluate the potential costs of transmission upgrades that may be necessary to maintain reliability in the absence of Seabrook or the impact of Seabrook's operation on ISO-NE's capacity market price or performance penalties.

**Table 4: Electric Energy Cost Reductions Attributable to Seabrook (2023–2032)[15]**

| *Base Case* | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Energy Cost Reduction in New England ($ millions) | $636 | $523 | $346 | $330 | $284 | $403 | $370 | $453 | $629 | $971 | $4,945 |
| Energy Cost Redcution in Massachusetts ($ millions) | $295 | $243 | $162 | $154 | $133 | $188 | $173 | $212 | $295 | $455 | $2,312 |
| Wholesale Energy Price Reduction ($/MWh) | 4.9 | 4.0 | 2.6 | 2.5 | 2.1 | 3.0 | 2.7 | 3.3 | 4.4 | 6.9 | |
| *Alternative Future Fuel Prices* | | | | | | | | | | | |
| Energy Cost Reduction in New England ($ millions) | $636 | $520 | $310 | $195 | $160 | $171 | $232 | $269 | $369 | $566 | $3,427 |
| Energy Cost Redcution in Massachusetts ($ millions) | $295 | $242 | $145 | $91 | $75 | $80 | $109 | $125 | $173 | $265 | $1,601 |
| Wholesale Energy Price Reduction ($/MWh) | 4.9 | 4.0 | 2.3 | 1.5 | 1.2 | 1.3 | 1.7 | 1.9 | 2.6 | 4.0 | |

**Figure 2** shows the impact of Seabrook's operation on electric sector annual $CO_2$ emissions for New England and Massachusetts. Seabrook's operation avoids annual $CO_2$ emissions of nearly 5 million short tons (equivalent to taking over 1 million automobiles off the road or adding ~2,500 MW of new OSW generation capacity) from New England fossil-fuel-fired electric generation resources that would operate in the absence of Seabrook.[16] As **Figure 2** shows, as New England's reliance on renewable energy resources grows and $CO_2$ emissions decline, Seabrook's annual impact is essentially constant at roughly 5 million short tons. Thus, as New England's $CO_2$ emissions decline due to expected renewable resource additions, Seabrook's operation accounts for a growing percentage of New England's annual avoided $CO_2$ emissions (12%–21%). Seabrook's operation is clearly critical for the New England states to reach their GHG reduction mandates and objectives.

In addition, in Massachusetts Seabrook's operation avoids estimated average annual emissions of 1.81 million tons of $CO_2$ in the Base Case, representing 37% of the estimated New England-wide $CO_2$ emission reduction (and 22–42% of the projected electric sector $CO_2$ emissions in Massachusetts). However, because Massachusetts imports almost half of its electricity from other New England states, Seabrook's operation's reduction of $CO_2$ emissions associated with serving Massachusetts consumers is even greater. Seabrook's operation is critical for Massachusetts to achieve its legislatively mandated GHG reductions. Moreover,

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[15] Massachusetts consumer energy cost savings are calculated using the forecasted electricity demand served by ISO-NE in Massachusetts.

[16] The EPA estimates that a typical passenger vehicle emits 4.6 metric tons, or 5.1 short tons, of $CO_2$. *See* US Environmental Protection Agency, "Greenhouse Gas Emissions from a Typical Passenger Vehicle," available at https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle.

based on $CO_2$ emission allowance prices used in our modeling, Seabrook's operation reduces $CO_2$ emission allowance costs by $611 million over the ten-year modeling period.[17]

Finally, Seabrook's operation also reduces the emissions of nitrogen oxides and carbon monoxide at all electric generation units that would need to operate in the absence of Seabrook. While we have not quantified the impact of these other pollutant reductions, communities that host the power generation units that operate less realize improvements in local air quality.

**Figure 2: Carbon Dioxide Emissions with and without Seabrook**
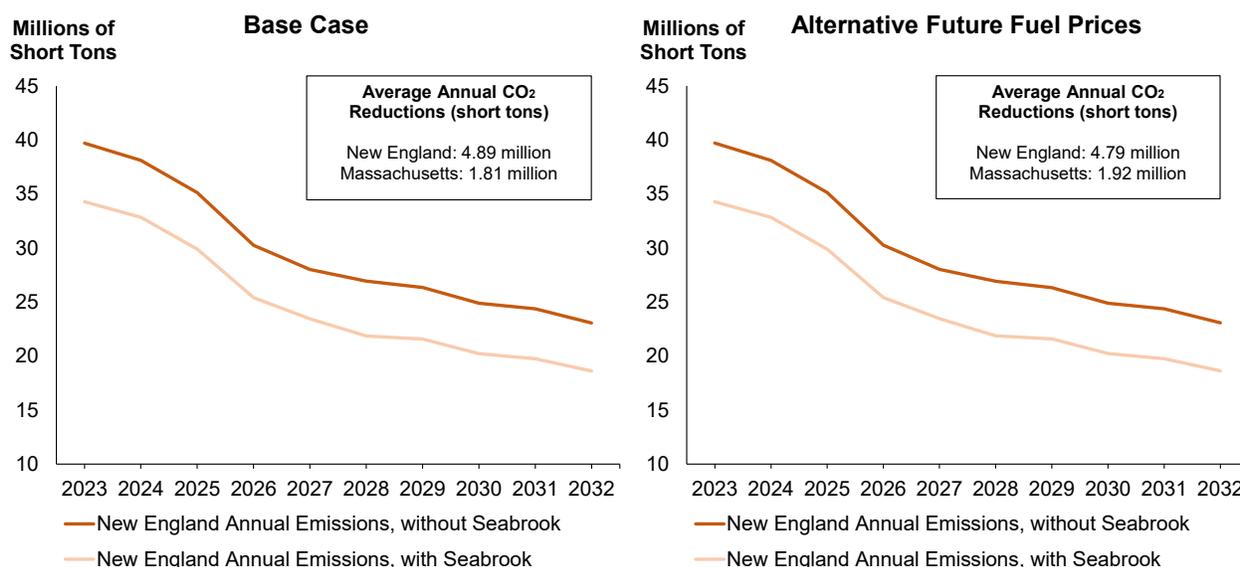


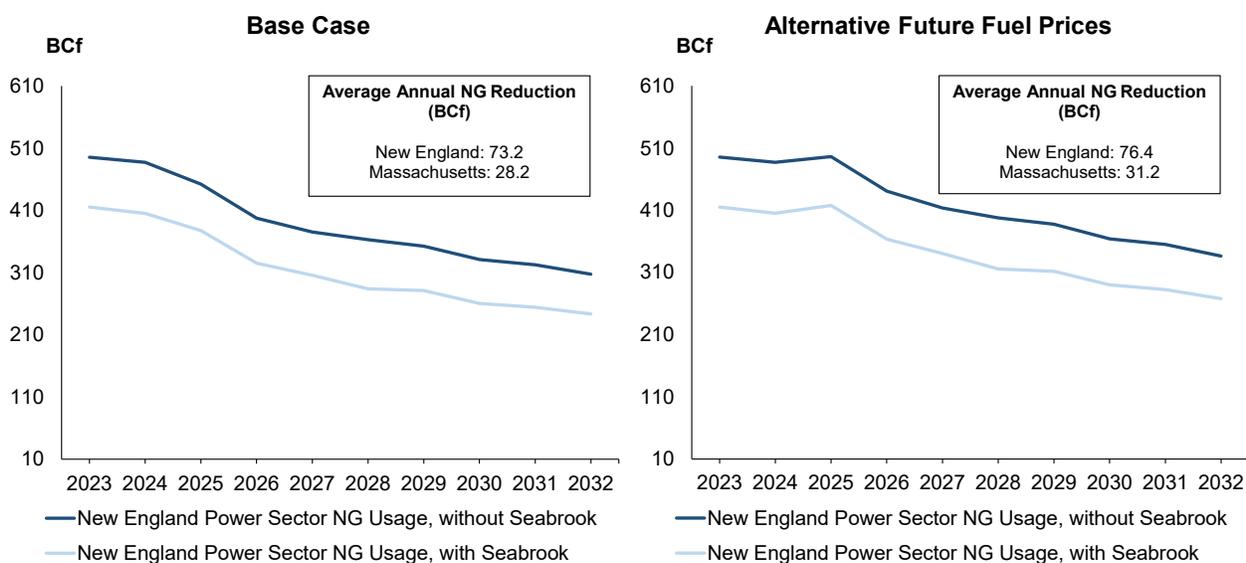### 3. *Seabrook's Impact on New England's Natural Gas Market*

The results of our analysis also show that Seabrook's operation significantly reduces the natural gas demand that would otherwise need to be met to provide fuel to natural gas-fired electric generators. In particular, Seabrook's operation reduces annual New England gas demand for electricity production by an amount equivalent to 18%–30% of projected New England gas demand for electricity production, with the percentage increasing over time as New England's reliance on renewable resources grows. Moreover, Seabrook's operation replaces an equivalent amount of gas-fired capacity, roughly three 400 MW combined cycle facilities. In winter months—when power prices are highest—these resources' gas use corresponds to over

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[17] We estimate these costs by multiplying forecast annual RGGI prices by annual avoided $CO_2$ emissions for each year in the study period.

200 MCF/day, or approximately 15–20% of the daily natural gas supply consumed by power generators during winter cold snaps.[18]

Finally, without Seabrook, the cost of gas rises for consumers as demand increases, especially during the cold winter months when New England's gas demand peaks. Reduced reliance on natural gas helps moderate natural gas prices.

**Figure 3:  Natural Gas (NG) Demand Reduction Attributable to Seabrook's Operation (Billion Cubic feet (BCf) 2023–2032)**



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[18] *See* ISO New England, "Post Winter 2017/18 Review," May 11, 2018, available at https://www.iso-ne.com/static-assets/documents/2018/05/2018-05-11-egoc-a2.1-iso-ne-post-winter-1718-review.pdf, p. 31 (indicating daily winter natural gas use by power generators of approximately 1,000 MCF).

## B. Impact on the Massachusetts Economy

In this section, we report the economic impact of Seabrook's operation on the Massachusetts electricity sector and regional economy using the IMPLAN model.[19] As noted above, we use the changes in estimated wholesale electricity costs and generator revenues as inputs to the IMPLAN model. IMPLAN provides the analytical platform to characterize the impact of the Seabrook power station's operation on the Massachusetts electricity sector both through the relationships between consumers and their demand for electricity and through indirect and induced effects that "ripple" through the Massachusetts regional economy. Specifically, the model captures, and we report, employment impacts as well as "value-added" impacts, which represent the total economic value of the economy being modeled (i.e., gross state product in the case of Massachusetts).

Our IMPLAN analysis starts with Seabrook's impact on Massachusetts' wholesale electric energy costs and assesses the additional economic impacts resulting from the reduced energy costs. We use Enelytix hourly energy price results and Massachusetts' hourly electricity loads to calculate the annual energy cost reduction for the "with" and "without" Seabrook cases in each of the two pricing scenarios. We then allocate the cost reductions to Massachusetts residential electricity customer and commercial and industrial electricity customer segments based on the most recent three full years' average annual percentage share of these segments to total load. Next, we account for the impact of the change in generator revenues (i.e., margins) on the generation resources that are owned by companies based in Massachusetts. We input these cost and margin differences into IMPLAN to calculate the total estimated economic value-added to the Massachusetts economy.

From a macroeconomic perspective, the IMPLAN model captures the changes in the level of disposable income realized by residential consumers due to Seabrook's operation's reduction of Massachusetts' wholesale electricity costs. These savings, in turn, affect residential consumer spending and saving, and that spending "induces" additional favorable economic impacts for Massachusetts. At the same time, cost savings for the commercial and industrial sectors result in greater economic output from these sectors, as we assume that each business reinvests its electric cost savings to generate incremental sales, with the resulting economic benefits accruing to the Massachusetts economy. We report the combined economic value-added of lower wholesale energy costs and the additional economic benefits calculated in the IMPLAN analysis in **Table 5**.[20]

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[19] See Appendix for additional detail on the structure of the IMPLAN model.

[20] Economic value-added reflects the total economic value added to the Massachusetts economy, which reflects the gross economic output of the region less the cost of the inputs.

**Table 5:  Average Annual Economic Value-Added to Massachusetts Economy Due to Operation of Seabrook ($ millions)**

| | **Base Case** | | | **Alternative Future Fuel Prices** | |
|---|---|---|---|---|---|
| | Residential Savings | Commercial & Industrial Savings | | Residential Savings | Commercial & Industrial Savings |
| Direct Effects | $92.9 | $66.0 | Direct Effects | $64.4 | $45.4 |
| Indirect Effects | $0.0 | $34.4 | Indirect Effects | $0.0 | $23.7 |
| Induced Effects | $63.5 | $33.8 | Induced Effects | $44.0 | $23.3 |
| **Total** | **$156.5** | **$134.2** | **Total** | **$108.4** | **$92.4** |

**Table 5** presents the Base Case scenario estimated average annual benefits to the Massachusetts economy attributable to Seabrook's operations. **Table 5** shows the average annual benefit from residential savings is approximately $156 million, while the average annual benefit arising from commercial and industrial customer savings is approximately $134 million. In total, the average annual benefit to the Massachusetts economy in the Base Case is approximately $291 million, with a total of $2.91 billion over ten years.

Consistent with the power market modeling results shown in **Table 4**, the projected benefits are high in early years given current natural gas prices, decline as OSW resources are added and gas prices moderate, and increase as Seabrook's operation helps reduce energy prices as more OSW resources commence operations. As a result, in the Base Case, the range of annual macroeconomic benefits over the modeling time horizon is $162 million to $585 million. The low end of benefits occurs in 2027, when residential benefits are $90 million and commercial and industrial benefits are $72 million, for a total of $162 million. The largest benefits come in 2032, when the value of residential economic benefits increases to $307 million and commercial and industrial savings rise to $278 million, for a total of $585 million in benefits to the Massachusetts economy.

Under the Alternative Future Fuel Prices scenario, consumer cost reductions attributable to Seabrook decrease in 2026 as future natural gas prices decline. As **Table 5** shows, the average annual benefit from residential savings is approximately $108 million, while the average annual benefit arising from commercial and industrial customer savings is approximately $92 million. In total, the average annual benefit to the Massachusetts economy in the Alternative Future Fuel Prices scenario is approximately $200 million, for a total of $2 billion over ten years.

As with the Base Case, the Alternative Future Fuel Prices scenario also has a range of annual macroeconomic benefits over the modeling time horizon. The low end of benefits occurs in 2027, when residential benefits are $50 million and commercial and industrial benefits are $40 million, for a total of $90 million. The largest benefits come in 2032, when the value of residential economic benefits increases to $179 million and commercial and industrial savings rise to $163 million, for a total of $342 million in benefits to the Massachusetts economy.

In addition to economic benefits to Massachusetts, Seabrook's operation also drives the creation and support of jobs, measured in "job-years."[21] These jobs-years are created directly and indirectly through commercial and industrial activities. Additional job-years are also induced through the injection of money back into the economy from both the residential and commercial/industrial sectors. **Table 6** shows the job-years resulting from Seabrook's operation under the Base Case and Alternative Future Fuel Prices scenarios. For the Base Case, the yearly average for job-years created includes 497 job-years from residential savings. Increases in commercial and industrial production lead to an additional 736 directly created job-years, 258 indirectly created job-years, and 267 induced job-years. This results in a total annual average of 1,758 job-years, and a total of 17,580 job-years over ten years.[22]

**Table 6:  Average Annual Job-Years Added to Massachusetts Economy Due to Operation of Seabrook**

| | **Base Case** | | | **Alternative Future Fuel Prices** | |
| | Residential Savings | Commercial & Industrial Savings | | Residential Savings | Commercial & Industrial Savings |
|---|---|---|---|---|---|
| Direct Effects | 0 | 736 | Direct Effects | 0 | 509 |
| Indirect Effects | 0 | 258 | Indirect Effects | 0 | 178 |
| Induced Effects | 497 | 267 | Induced Effects | 344 | 184 |
| **Total** | **497** | **1,261** | **Total** | **344** | **871** |

Under the Alternative Future Fuel Prices scenario, as with the financial benefits to the Massachusetts economy, the job-year values created from energy savings are reduced by lower projected natural gas prices. As shown in **Table 6**, under the Alternative Future Fuel Prices scenario, the yearly average created job-years resulting from Seabrook's operation includes 344 induced job-years from residential savings. In addition, increases in commercial and industrial production lead to an additional 509 directly created job-years, 178 indirectly created job-years, and 184 induced job-years. This results in a total annual average of 1,215 job-years, and a total of 12,150 job-years over ten years.

## C.  Impact on ISO-New England System Reliability

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[21]  Seabrook also provides high-paying jobs to numerous plant employees that live in Massachusetts. These jobs are not accounted for in the figures reported.

[22] Commercial and industrial savings are assumed to be reinvested as business owners take electricity cost savings and generate incremental sales. These incremental sales are reflected in the reported direct, indirect, and induced values.

As our modeling results show, in Seabrook's absence, much of its electricity output would be replaced by natural gas. ISO-NE, however, has warned that a prolonged cold spell in the winter could deplete natural gas supplies available for electricity generation to the extent that rolling blackouts would become necessary.[23] Without Seabrook, grid reliability in the winter would be further threatened.[24] Seabrook's operation helps avoid winter operational challenges, as Seabrook's power generation technology can be expected to produce electricity during the most challenging operational conditions that ISO-NE faces. Seabrook's generation technology provides nearly the highest availability (and lowest forced outage rate) of all generation technologies currently operating in New England.[25] Seabrook's nuclear generation technology can be expected to be available and operating almost all hours of the year.

Moreover, our modeling results show, if gas prices are sufficiently high or supply sufficiently low, some of Seabrook's power would be replaced by oil generation, which is more polluting. Oil-fired generation resources can emit as much as twice the amount of $CO_2$ on a per kWh basis than natural gas units.[26] Again, the Seabrook facility significantly contributes to helping New England's power sector reduce emissions and maintain system reliability.

# VI. Appendix

## A. Additional Technical Description: IMPLAN Macroeconomic Model

We estimate the economic impacts of the Seabrook plant by inputting to the IMPLAN model the change in electricity prices from the "with" and "without" Seabrook for each scenario. IMPLAN calculates macroeconomic impacts based on the economic relationships that exist among providers and users of goods and services in the economy. IMPLAN is a social accounting/input-output model that attempts to replicate the structure and functioning of a specific economy (e.g., a state or a country), and is widely used in public and private sector economic impact analyses. It estimates the effects on a regional economy of a change in economic activity by using baseline information capturing the relationships among businesses and consumers in the economy based on historical economic survey data. IMPLAN tracks dollars spent in the

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[23] See Blunt, Katherine and Benoit Morenne, "New England Risks Winter Blackouts as Gas Supplies Tighten," *Wall Street Journal*, available at https://www.wsj.com/articles/new-england-risks-winter-blackouts-as-gas-supplies-tighten-11665999002.

[24] Recent ISO New England economic studies also highlight the value of nuclear power even in a world with substantial renewable resource additions. *See*, *e.g.*, ISO New England, "2021 Economic Study: Future Grid Reliability Study Phase 1," July 29, 2022, available at https://www.iso-ne.com/static-assets/documents/2022/07/2021_economic_study_future_grid_reliability_study_phase_1_report.pdf, pp. 1 and 47.

[25] See, for example, North American Electric Reliability Standards, Generating Unit Statistical Brochures, Generating Unit Statistical Brochure 4 2017- 2021 - All Units Reporting, available at https://www.nerc.com/pa/RAPA/gads/Pages/Reports.aspx

[26] U.S. Energy Information Administration, "How much carbon dioxide is produced per kilowatthour of U.S. electricity generation," available at https://www.eia.gov/tools/faqs/faq.php?id=74&t=11#:~:text=In%202020%2C%20total%20U.S.%20electricity ,CO2%20emissions%20per%20kWh.

geography of interest (in this case, the Commonwealth of Massachusetts), including dollars that circulate within it (e.g., transfers of dollars from consumers to producers), dollars that flow into it (e.g., purchases of goods and services from outside the local economy), and dollars that flow outside of it (e.g., payments to the federal government). The model thus examines inflows, outflows, and interactions within the economy under study.

The IMPLAN model allows one to investigate interactions in the economy, and to calculate various economic impacts when a new or different activity (such as new infrastructure construction or expected consumer/business cost savings) involves changes in money flows around the economy. Specifically, the model captures various impacts, including:

- Employment impacts (the total number of jobs created or lost); and
- "Value-added" impacts (the total economic value added to the economy, which reflects the gross economic output of the area less the cost of the inputs).[27]

We report employment impacts and the "value-added" impacts produced by the model, reflecting the combination of the following economic effects of the change in money flow associated with operation of the Seabrook plant.

**Direct effects**: the initial set of inputs that are being introduced in the economy.  In our study, these include the direct effects of energy cost savings to consumers that result in increased purchases of goods and services in the economy. In addition, direct effects include the reduced energy costs to commercial and industrial businesses that result in greater productivity.

**Indirect effects**: the new demand for local goods, services, and jobs that result from the growth in output of businesses whose energy costs are reduced.

**Induced effects**: the economic impacts of the increased spending of workers resulting from income earned from direct and indirect economic activity.

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[27] IMPLAN also captures tax impacts, which we do not evaluate in our analysis.

## B. Table Notes and Sources

**Table 1:**

**Notes:**

[1] Wind capacity and solar capacity is derated to 20% and 32% of nameplate capacity, respectively.

[2] Cumulative retirements from 2023 – 2025 rely on the ISO New England Retirement Tracker (See [A]). New England's remaining coal generating units and generating units that frequently submit ISO-NE FCA de-list capacity market offers are assumed to retire beginning in June 2026.

[3] See Table 2 for assumed offshore wind additions.

[4] Battery storage estimates assumes 50% of the 3,000 MW of stand-alone battery storage in the ISO New England Generation Interconnection Queue as of March 17, 2021 becomes operational. (See [E])

[5] Increase in import capacity in 2025 reflects assumed online date of New England Clean Energy Connect Hydro project.

**Sources:**

[A] ISO New England Retirement Tracker, available at https://www.iso-ne.com/static-assets/documents/2016/08/retirement_tracker_external.xlsx

[B] ISO New England, "Power Plant Retirements," available at https://www.iso-ne.com/about/what-we-do/in-depth/power-plant-retirements

[C] U.S. Department of Energy, Offshore Wind Report, available at https://www.energy.gov/sites/default/files/2022-09/offshore-wind-market-report-2022-v2.pdf; See also Table 2.

[D] ISO New England 2022 CELT Report, available at https://www.iso-ne.com/static-assets/documents/2022/04/2022_celt_report.xlsx.

[E] ISO New England, "Energy Storage in Transmission Planning Studies," March 17, 2021, available at https://www.iso-ne.com/static-assets/documents/2021/03/a6_energy_storage_in_transmission_planning_studies.pdf

**Table 2:**

**Sources:**

[1] U.S. Department of Energy, "2022 Offshore Wind Market Report," August 2022, available at https://www.energy.gov/sites/default/files/2022-08/offshore_wind_market_report_2022.pdf

[2] "About Revolution Wind - Project at a glance," available at https://revolution-wind.com/about-revolution-wind.

[3] Park City Wind, "AVANGRID, Town of Barnstable Enter into Host Community Agreement to Advance Park City Wind Project," available at https://www.parkcitywind.com/press-releases/avangrid-renewables-town-of-barnstable-enter-into-hca-to-advance-park-city-wind-project.

[4] Young, Colin A., "Mass. Offshore wind project 'no longer viable' without changes to power contract, company says," *WBUR*, October 28, 2022, available at https://www.wbur.org/news/2022/10/28/commonwealth-wind-offshore-avangrid-ppa.

[5] "AVANGRID Statement On Progress Of Clean Energy Investments In Massachusetts," December 16, 2022, available at https://www.avangrid.com/w/avangrid-statement-on-progress-of-clean-energy-investments-in-massachusetts

**Table 3:**

**Notes:**
[1] Assumed Contract Generation reflects 80% of Seabrook's modeled generation (*i.e.*, assuming a contracted capacity of 1,000 MW).
[2] For 2023-2029, Assumed Contract Generation Price is based on Seabrook's contract price with Connecticut utilities for those years. For 2030-2032, we escalate the price based on the contract's annual escalation rate of 2%.

**Table 4:**

**Note:**
[1] Massachusetts consumer energy cost savings are calculated using the forecasted electricity demand served by ISO-NE in Massachusetts.