



REPORT

Financial Assessment

Millstone Nuclear Power Plant

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Prepared by: Energyzt Advisors, LLC

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For additional information, please contact:

Tanya Bodell, Executive Director: tanya.bodell@energyzt.com

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EXECUTIVE SUMMARY

The Connecticut General Assembly is considering a bill to provide support to nuclear units via a five-year power purchase agreement that would guarantee a minimum price for electrical output.¹ Missing from the discussion is whether such support is financially required by the Millstone Nuclear Power Plant (“Millstone”). If Millstone has been and is projected to be profitable, such support is simply a wealth transfer from Connecticut ratepayers to Millstone’s equity holders that serves to subsidize other generation investments.²

Based on the financial analysis described in this report, Millstone has been very profitable, including the past five years when natural gas and energy prices have been at their lowest levels. Under a number of reasonable energy price outcomes for the next five years, Millstone is projected to continue to be profitable, generating positive cash flow under each scenario, including the unlikely scenario in which energy prices continue at 2016 “extraordinarily low” levels for the next five years. Locked-in capacity market prices for 2017 to 2021 effectively hedge the profitability of the plant. Therefore, there is no reason to anticipate that Millstone will face financial challenges or be at risk of retirement within the next five years or in the longer term. In contrast, contractual support will be an expensive proposition for ratepayers.

Out-of-market support to Millstone is not economically justified.

Millstone has been profitable

In 2001, Dominion Resources, Inc. (“Dominion”) purchased 100 percent of Millstone Unit 2 and 93.47 percent of Millstone Unit 3 for \$1,195 million plus \$105 million in pre-purchased fuel. Within five years, the original purchase price was repaid. The subsequent run-up in natural gas and electricity prices through 2008 created additional profits for Millstone equity holders due to: i) high capacity factors averaging around 90 percent; and ii) relatively low costs of production.

Not all plants in New England experienced the same level of profitability. Natural gas

¹ Committee Bill 106, *An Act Concerning the Diversity of Baseload Energy Supplies in the State and Achieving Connecticut’s Greenhouse Gas Emissions Mandated Levels*, January 2017 Session.

² Because Dominion shareholders receive after-tax flows to equity, a part of the transfer from Connecticut ratepayers also would be used to pay income taxes.

plants, for example, also experienced higher fuel costs associated with escalating natural gas prices, and lower capacity factors from generation build-out, offsetting higher energy prices. However, Millstone's unique position as a price-taker in the supply curve, combined with relatively fixed, long-term fuel contracts, resulted in significant profitability throughout the first eight years of Dominion's ownership.

Even after energy prices fell in 2009, Millstone remained profitable. This profitability was augmented by effective hedges that created around \$285 million in revenues between 2013 and 2016. As a result, Millstone has generated average annual returns to its equity investors of at least 25 percent since Dominion's purchase in 2001.

Millstone has been very profitable, even with lower energy prices.

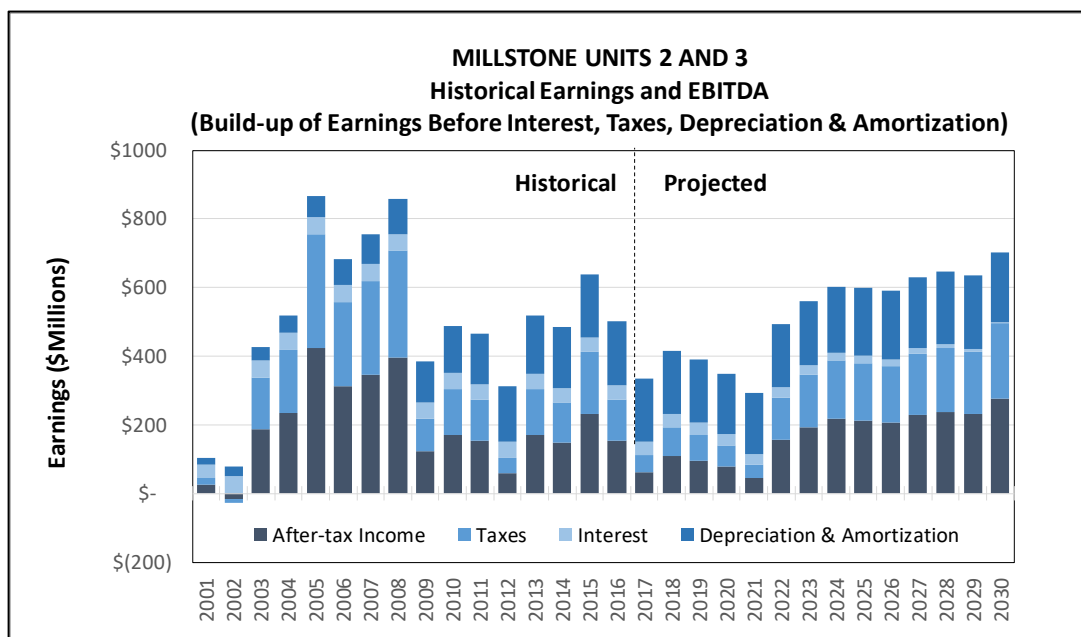
Millstone is projected to continue to be profitable

Extremely low energy prices in 2016 have challenged the economics of most competitive generators in New England. Millstone is an exception. As a result of hedges that were placed on 100 percent of the energy output and capacity, Millstone earned an estimated \$150 million in after tax income in 2016. Most of the output and capacity of the facility (i.e., a reported 85 percent of energy) continues to be hedged through 2017. Applying futures prices for energy, cleared prices for Millstone's committed capacity plus reported hedges, Millstone is projected to earn around \$60 million in after-tax income this year.

Going forward, energy hedges are scheduled to roll-off by 2018. However, higher capacity prices and Millstone's capacity supply obligation through mid-2021, offers revenue and operational certainty. Millstone's participation in New England's Forward Capacity Market ("FCM") ensures nearly \$800 million in revenues through 2021.

If Millstone were to hedge its energy price using the Chicago Mercantile Exchange ("CME") futures prices for MassHub, or something similar, the plant would continue to be extremely profitable, earning an average annual after-tax income of around \$75 million per year between 2018 and 2021, or around \$300 million dollars over a four-year period (Figure ES-1).

Figure ES-1: Millstone’s Historical and Projected Income



Source: Energyzt analysis

Under a number of other reasonable alternatives, Millstone is profitable. Even under the “Worst-case Scenario” which assumes 2016 energy prices continue and other very conservative assumptions, Millstone breaks even on after-tax income and generates close to \$45 million in after-tax cash flow from 2018 through 2021.

Given its capacity supply obligations, commitment to continue operations through at least May 2022, and projected profitability under expected and alternative conditions, Millstone is not at risk of retirement for financial reasons.

Millstone is not at risk of retirement in the next five years due to market prices.

Millstone Cannot Leave the Market

As is the case with any power plant in New England that participates in the regional FCM, Millstone does not have the unilateral ability to exit the market, even if economic challenges warranted such action. ISO-NE has a formal process that requires a power plant to submit a request to retire. ISO-NE requires that impacts of the plant retirement be vetted through a formal (tariff-based) review. If a plant seeking to retire is needed for reliability reasons, ISO-NE’s tariff provides means for the plant to be compensated and continue to operate.

Millstone is committed to remain operational through May 31, 2022. If Millstone wishes to leave the market (i.e. retire) the following year, the ISO-NE retirement process would have to be filed by the end of March 2017. However, Millstone did not take such action, effectively committing the plant to continue operating in the market through mid-2022. Therefore, Millstone will remain operational for the foreseeable future regardless of legislative support.

Connecticut Ratepayers Lose

Under expected conditions, as reflected in historic operating patterns and futures prices, any out-of-market support to Millstone will simply be a wealth transfer from Connecticut ratepayers to Millstone equity holders for no incremental benefit. While each residential customer would pay 15 to 20 percent above the current regulated rate for supply to cover a contract with Millstone, or over \$90 per year under continuance of 2016 supply rates, those payments have no impact on Millstone operations and simply add to Millstone's profitability, flowing straight to equity holders after taxes.

<p>The proposed legislation transfers money from Connecticut ratepayers directly to Millstone's equity investors.</p>
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Conclusion

Millstone has been profitable since Dominion purchased Units 2 and 3 in 2001; the purchase price was paid back within less than five years, and has generated strong returns to equity of at least 25 percent. Millstone was profitable in 2016 and futures prices indicate that Millstone will continue to be profitable. Even if 2016 energy prices were to continue for the next five years, which Dominion itself does not anticipate, higher capacity prices will help to cover its operating costs. In the long-term, Millstone is projected to earn significant revenue and positive income. Millstone is not at risk of retirement for financial reasons. Millstone has not initiated the process with ISO-NE to retire, and is committed to operate for at least the next five years.

All available evidence supports the conclusion that the proposed legislation is simply a wealth transfer from Connecticut ratepayers to Millstone's equity investors. Connecticut ratepayers will pay a hidden tax in above-market energy prices to fund that transfer and will receive no incremental benefits in return.

1. INTRODUCTION

The Connecticut General Assembly is considering a bill to provide support to nuclear units via a five-year contractual arrangement for existing generating units that would guarantee a minimum price for electrical output.¹ The proposal follows the example of a subset of other states that have considered providing out-of-market support to nuclear power plants in order to cover the operating costs of those units during low energy priced periods.² The concept has been addressed by the National Conference of State Legislatures in a report issued this past January titled, “State Options to Keep Nuclear in the Energy Mix” (“NCSL Report”).³ Missing from the NCSL Report, as well as discussion to date in Connecticut, is a formal assessment of whether specified nuclear power plants that would benefit from the proposed programs actually require such financial support to remain operational.

Energyzt was retained to focus on the Millstone Nuclear Power Plant (“Millstone”) in Connecticut and perform a financial assessment of historical and projected profitability. The objective is to discern whether state-based, out-of-market financial support is required for Millstone Units 2 and 3 to remain financially viable, as well as the costs of such support to ratepayers. Although there may be other policy reasons to compensate zero-emissions resources,⁴ the following analyses focus solely on the financial justification.

¹ Committee Bill 106, *An Act Concerning the Diversity of Baseload Energy Supplies in the State and Achieving Connecticut’s Greenhouse Gas Emissions Mandated Levels*, January 2017.

² Examples of other states with competitive electricity markets that initiated nuclear support programs include Illinois, New York and Wisconsin. In New England, Connecticut and Massachusetts have examined alternative approaches, and the New England Power Pool (“NEPOOL”) has sponsored a broader Integrating Markets and Public Policy (“IMAPP”) initiative to discuss alternative ways of implementing political and regulatory objectives into a competitive market construct that includes treatment of nuclear power plants.

³ Daniel Shea and Kristy Hartman, National Conference of State Legislatures, “State Options to Keep Nuclear in the Energy Mix,” January 2017, http://www.ncsl.org/Portals/1/Documents/energy/StateOptions_NuclearPower_f02_WEB.pdf

⁴ For example, economists have long argued that externalities associated with emissions are not properly priced in competitive markets leading to inefficient results. This argument would support a

This section provided an introduction. Section 2 provides a brief overview of Millstone. Section 3 assesses the historical financial performance of Millstone, and provides estimates of payback period and average returns to equity generated by Millstone under a conservative set of assumptions. Section 4 projects Millstone's near-term financial position under alternative energy price projections and long-term profitability under ISO-NE sponsored price projections. Section 5 calculates potential costs to Connecticut ratepayers under the proposed legislation and Connecticut load. Section 6 summarizes key insights from the analysis. The Appendices provide further information on assumptions, calculations and sources underlying the financial assessment.

2. MILLSTONE OVERVIEW

Millstone is located in Waterford, Connecticut (3.2 miles from New London) and consists of three units, two of which are operational. Millstone Unit 1 permanently closed on July 17, 1998; plant equipment other than that required to support the other units was de-energized and dismantled as part of the closure process.⁵ Millstone Unit 2 (870 MW) and Unit 3 (1,154 MW) utilize pressurized water reactor ("PWR") technology and received 40-year operating licenses in 1975 and 1986, respectively, both of which were extended for an incremental 20-year period in 2005. The current license extensions are set to expire in 2035 for Unit 2 and 2045 for Unit 3, but may be extended as part of a second license extension application.⁶

market-based solution that applies to the entire fleet and/or broader set of emitters to properly price the externality and ensure the external costs of pollution are properly incorporated into production costs, leading to a more efficient, market-based outcome.

⁵ United States Nuclear Regulatory Commission,
<https://www.nrc.gov/info-finder/decommissioning/power-reactor/millstone-unit-1.html>

⁶ Dominion already has announced that it intends to file an application with the Nuclear Regulatory Commission (NRC) to pursue a second license extension for its Surry Nuclear Power Plant located in Virginia. Surry is a multi-unit power plant of similar vintage and technology as Millstone, and set the stage for the initial Millstone license extension, preceding Millstone's application and approval by two years in 2003.

Millstone is the only nuclear power generating facility in Connecticut. In 2015, Millstone Units 2 and 3 produced an amount of energy equal to 46 percent of Connecticut's electrical load.⁷ Both units have experienced average capacity factors of around 90 percent over the past six years.⁸ Operating costs, including capital expenditures, have been maintained at or below industry averages since 2001 when Dominion Resources purchased the facility.⁹

Millstone offers a number of economic benefits to the State of Connecticut. The Nuclear Energy Institute ("NEI") recently reported that the value of direct benefits generated by the plant totals \$1.3 billion, consisting of \$873 from state operations and \$402 from lower energy prices.¹⁰

This financial assessment does not challenge those benefits, but concludes that those benefits will exist regardless of whether or not the proposed legislation is passed. If Millstone is financially sound in the absence of state support, the proposed legislation does not provide any incremental benefits to Connecticut ratepayers in exchange for higher utility bill costs. The following sections summarize the basis for the conclusion that Millstone is economically competitive and financially viable regardless of the contractual support offered by the state.

⁷ US EIA, <https://www.eia.gov/state/index.php?sid=CT>

⁸ Energyzt calculation based on EIA plant generating output reported in FERC Form-923 and ISO-NE qualified capacity reported in the Forward Capacity Market capacity supply obligation reports. The capacity factor of Unit 2 (89%) is slightly lower than Unit 3 (91%).

⁹ Kevin Hennessy, Director of State Policy in New England, Dominion, testified that Dominion has invested \$1.2 billion in Millstone since purchase. "Testimony before the Connecticut General Assembly's Energy & Technology Committee on Proposed Bill 106, *An Act Concerning Zero-Carbon Generation Facilities and Achieving Connecticut's Greenhouse Gas Emission Levels*," February 7, 2016, p.1.

The industry average capital expenditure would have been around \$1.8 billion, of which around \$1.5 billion of that would have been depreciated assuming a 7-year average straight-line depreciation schedule for each year's expenditure through 2016.

¹⁰ NEI, "Economic Impacts of Millstone Power Station: An Analysis by the Nuclear Energy Institute," January 2017, <https://www.nei.org/CorporateSite/media/filefolder/Policy/Papers/MillstoneEconomicImpacts.pdf?ext=.pdf>

3. HISTORICAL FINANCIAL PERFORMANCE

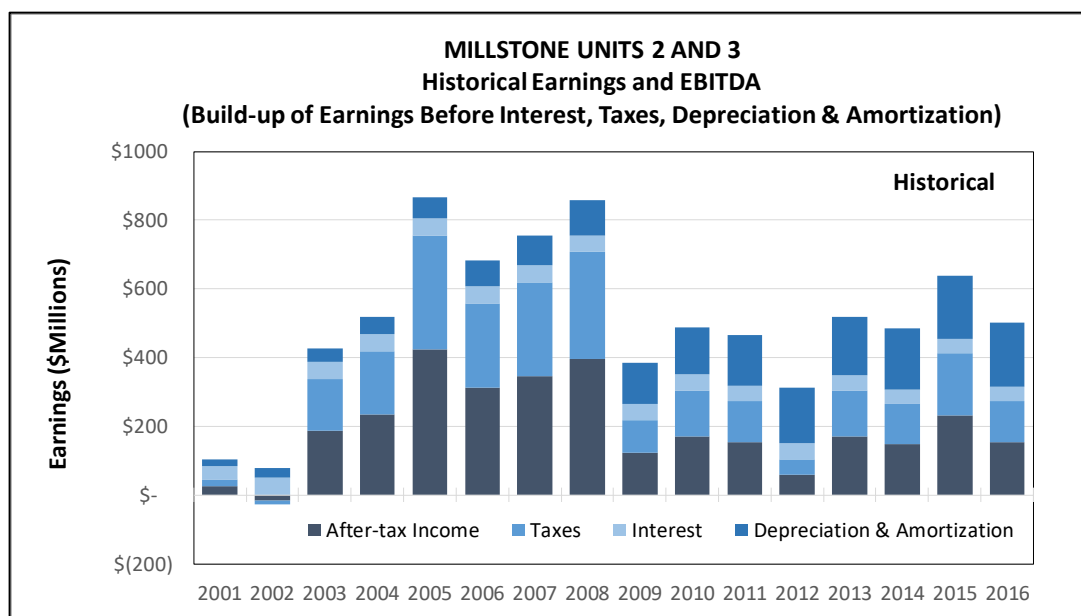
On March 31, 2001, Dominion Resources purchased the entirety of Millstone Unit 2 and 93.47% of Unit 3 from Northeast Utilities for \$1.3 billion, of which \$105 million was for a pre-purchase of nuclear fuel. The timing was opportune. Energy prices, tied to a rise in natural gas, started to climb, reaching historic heights in 2008 before the recession hit and energy prices reverted back to historical levels. With relatively low operating costs and high capacity factors, Millstone Units 2 and 3 were very profitable and appear to have paid back the initial investment in less than five years.

Even after energy prices fell during the recession in 2009, the Millstone units continued to be profitable. There have been two years since the recession began when energy prices were unusually low due to excess natural gas supply due to mild weather conditions. Yet even in those years, 2012 and 2016, Millstone still was profitable and generated tens of millions of dollars in after-tax cash flow.

In addition to energy and capacity payments that have more than covered costs and earned a substantial return on equity, an additional \$285 million in revenues has been generated by energy and capacity hedges entered into for Millstone during that same time period. In summary, Millstone has generated substantial returns on equity, earning an estimated \$2.5 billion in EBITDA¹¹ and around \$760 million in after tax income during the past five years alone (Figure 1).

¹¹ EBITDA is the acronym for earnings before interest, taxes, depreciation and amortization, and represents operating cash flows that can be used to cover capital investment and financial obligations.

Figure 1: Millstone Historical Earnings



Source: Energyzt analysis

Between energy sales, capacity payments and hedges, Millstone Units 2 and 3 have not experienced negative earnings since the initial transaction costs associated with Dominion's purchase in 2001. Furthermore, Dominion's timing benefited from the subsequent run-up in natural gas and electricity prices that occurred through 2008. The original purchase price of \$1,195 million appears to have been repaid by operating cash flows net of capital expenditures within less than five years and profited from the subsequent run-up in energy prices through 2008. As a result, the Millstone units have generated at least a 25% return on equity for Dominion's shareholders.¹²

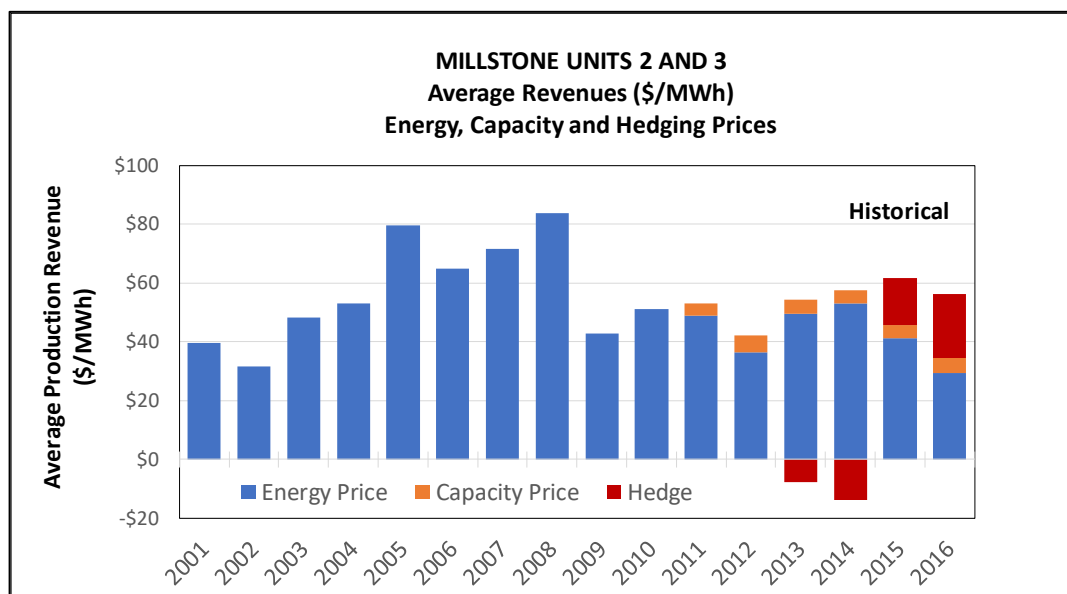
Key Insight 1

Since 2001, Millstone is estimated to have earned at least \$3 billion in profits and generated an average return on equity *above* 25 percent.

¹² Not all power plants in New England experienced these returns. Higher energy prices were associated with higher natural gas prices and lower capacity factors for natural gas-fired generating units which offset profits.

Even in 2016, when prices were “extraordinarily low” according to Dominion,¹³ a set of energy hedges that covered 100 percent of the output of the plant maintained profitability. As shown in Figure 2, such market-based approaches have been effective, and risk has been shifted from Millstone to sophisticated parties via competitive markets. Due to its hedging strategy, Millstone has been fairly immune to fluctuations in ISO-NE market prices, utilizing market-based tools to protect its revenues.

Figure 2: Average Energy, Capacity and Hedge Revenues (\$/MWh)



Source: Energyzt analysis

In contrast, the proposed legislation attempts to shift commodity risk away from Millstone onto Connecticut ratepayers who would be forced to bear significant out-of-market costs associated with accepting such commodity risk. Competitive markets are available to mitigate the risk of volatile energy and capacity prices, as the

¹³ In the February 1, 2017 earnings call, Mark F. McGettrick of Dominion stated, “The only thing we’ve factored into our growth rate and for 2018 is a very modest increase in power prices in the Northeast just because we think they’re extraordinarily low right now” (emphases added), Dominion Resources (D) Q4 2016 Results - Earnings Call Transcript. February 1, 2017, <http://seekingalpha.com/article/4041692-dominion-resources-d-q4-2016-results-earnings-call-transcript?page=7>

effectiveness of Millstone's hedges indicate. A legislative mandate is not required to protect Millstone from price volatility.

Key Insight 2

A legislative mandate is not required to protect Millstone.

It also is important to note that, assuming Millstone's hedges were futures versus call options, the hedges were "out-of-the-money" during 2013 and 2014 (i.e., lost money), when New England's winter prices were extraordinarily high as a result of extreme weather conditions, limited gas supplies and shortfalls in dual-fuel backup capability. This is the nature of hedging. By securing a fixed price for the plant's output, Dominion's hedges offset revenues when winter prices were high. Nonetheless, the plant was profitable in those years. Conversely, the hedges yielded positive values in 2015 and 2016 when weather normalized and system operations had addressed fuel adequacy issues. Although Millstone did not receive the full benefit of winter price spikes in 2013 and 2014, the "extraordinarily low" energy prices in 2016 did not harm Millstone as the plant's electrical energy output was fully hedged.

If the proposed Connecticut legislation is passed and ratepayer-based contracts are implemented, electric ratepayers effectively will have to bear the risk of entering into a long-term, fixed price contract that is "out-of-the-money." Ratepayers would be forced to accept risks associated with commodity derivatives, and at prices higher than Millstone could obtain from the marketplace or that utilities otherwise could purchase to hedge ratepayer commodity risk. Potential costs associated with such contracts are calculated in Section 5.

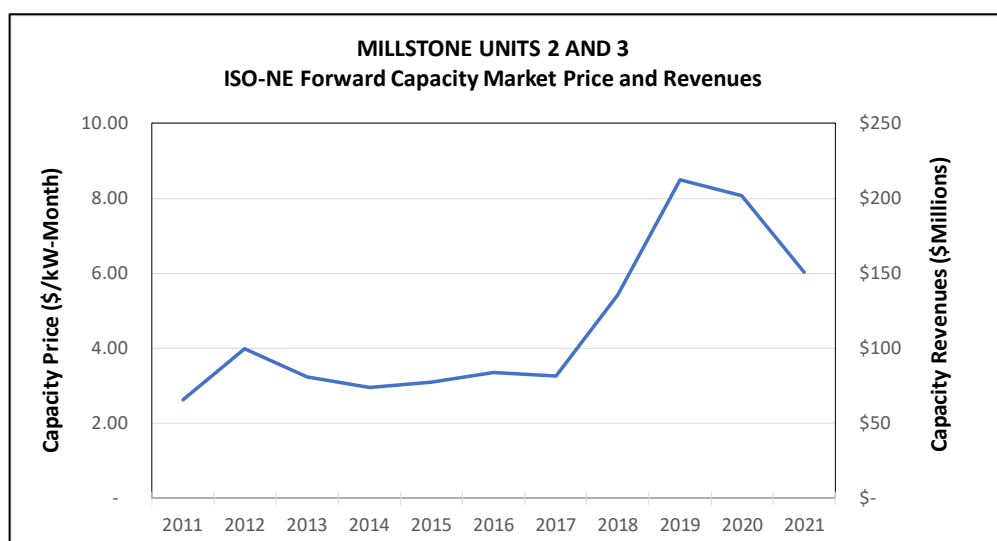
4. FINANCIAL PROJECTIONS

Millstone's profitability is not expected to end. Millstone's hedges through 2017, along with established capacity payments, effectively guarantees revenues close to \$1 billion over the next five years and after-tax income of around \$60 million in 2017, for

the most part regardless of energy prices.¹⁴ As Millstone’s hedges roll off, higher capacity prices associated with Millstone’s capacity supply obligation (“CSO”) that cleared ISO-NE’s Forward Capacity Market (“FCM”) three-years in advance, will replace the energy-based hedges to protect Millstone’s profitability.

For example, capacity price payments that had been less than \$4/kW-month for the previous six years increase to \$7.03/kW-month starting June 1, 2017 and again to \$9.55/kW-month for June 2018 through mid-2019, which translates into nearly \$800 million in guaranteed revenues (Figure 3). FCM prices and associated revenues are guaranteed, unless Millstone is unavailable, in which case it has outage insurance and reserves.¹⁵

Figure 3: Millstone Annualized Capacity Prices and Associated Revenues



Source: Energyzt analysis. The Capacity Commitment Period is from June to May. Prices in the chart reflect a weighted average of the prices that cleared in the FCM for that calendar year. Capacity revenues assume the amount of capacity that qualified and cleared.

¹⁴ This does not include any financial hedges that are entered into at the corporate level without allocation to specific generating assets. For purposes of incorporating hedges into the analysis, we rely upon Dominion’s analyst reports that specify Millstone hedges for both energy and capacity from 2013 through 2018. Prior to 2013, Dominion had a centralized trading group.

¹⁵ Dominion SEC Form 10-K for year ending December 31, 2016, p. 157.

Key Insight 3

**ISO-NE capacity markets serve as a hedge to Millstone,
locking in higher prices as soon as June 1, 2017.**

When future capacity prices in ISO-NE are combined with reasonable projections of energy prices for the next five years, it is clear that Millstone will continue to be profitable. As a base case, the Chicago Mercantile Exchange (“CME”) reports the price for energy futures for MassHub, a similar basis to the historically effective Millstone hedges¹⁶. CME futures are available to Millstone to serve as a hedge; they also provide a market-based view of forward prices. Although only liquidly-traded out a few years, monthly futures prices are reported out to 2022.¹⁷ Millstone could hedge its position with these forward contracts, if desired.

Base-case Scenario: CME Futures Energy Prices

In assessing the financial position of Dominion, base-case energy prices are established using CME monthly futures prices through 2021. After 2021, long-term energy prices are based on a recently-issued projection of energy prices submitted by ISO-NE as part of its Federal Energy Regulatory Commission (“FERC”) filing for FCM parameters.¹⁸ Under these base case projections, Millstone is anticipated to earn close to \$400 million in after-tax income over the next five years, or \$80 million

¹⁶ It is unclear from Dominion’s reports whether they hedged using MassHub or a Connecticut zone. For purposes of this analysis, MassHub prices are publicly available liquidly traded and were used for projected energy price values.

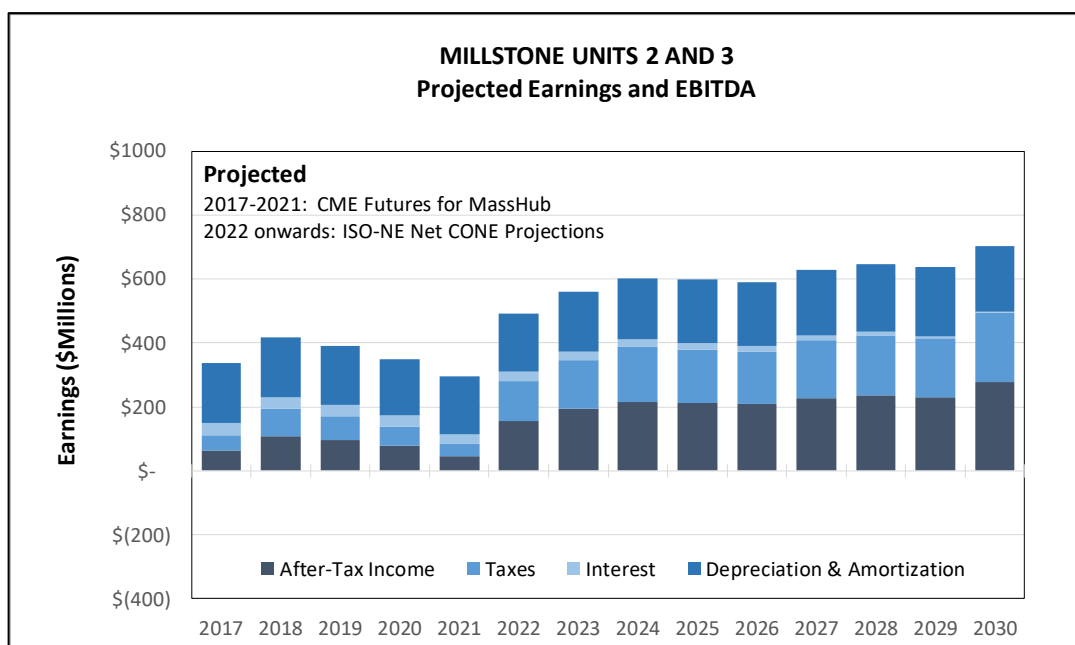
¹⁷ CME Group, <http://www.cmegroup.com/trading/energy/electricity/nepool-internal-hub-5-mw-off-peak-calendar-month-day-ahead-swap-futures.html>

¹⁸ For 2021 and after, energy and capacity prices are as projected and published by ISO-NE as part of the Net CONE proceedings. These longer-term prices are lower than the US EIA projections which assume a higher interim natural gas price.

See ISO New England Inc., Filing of CONE and ORTP Updates, Docket No. ER17-795-000, January 13, 2017, Attachment 1: Concentric Energy Advisors, ISO-NE CONE and ORTP Analysis, An evaluation of the entry cost parameters to be used in the Forward Capacity Auction to be held in February 2018 (“FCA-12”) and forward, January 13, 2017, Table A.52; see also backup spreadsheets that include energy price projections for SEMA: a_e_and_as_model_cc_technology_Revised.xlsx

per year (Figure 4).¹⁹ Thereafter, ISO-NE's sponsored price projection results in closer to \$200 million per year in after-tax income through 2030.

Figure 4: Millstone Projected Earnings using CME Futures Prices



Source: Energyzt analysis

Key Insight 4

Millstone could profitably hedge with futures over the next few years.

If Millstone or Dominion chose, they could enter into hedges using futures such as was done in the past. To date, it does not appear that Millstone has entered into such hedges, even though they would cover Millstone's costs. The only rational reason Millstone is not hedging through the futures markets would be if more valuable opportunities are available, either in the form of higher market prices or the proposed Connecticut legislation.

¹⁹ Energy prices for 2017 – 2021 are based on CME futures for MassHub using a weighted average of peak and off-peak prices. Capacity prices are as cleared in the forward capacity market.

Key Insight 5

Millstone has not hedged its profits over the next five years with futures, implying an expectation of higher market prices or a more lucrative state contract.

Alternative Scenarios

The financial analysis examines a number of alternative price scenarios to understand the impact on Millstone profitability, including a calculation of energy prices derived to set after-tax cash flows at break-even levels. In all cases other than the break-even scenario, total after-tax cash flows are positive over the five year period (Figure 5a and Figure 5b).

Figure 5a displays the alternative near-term price projections run as scenarios to understand the impact on Millstone financials. Prices vary from the “Worst-case Scenario” 2016 average of \$29 per MWh (red) to the average of 2012-2016 of \$46 per MWh (dark blue line). For comparison, the base case using CME futures is included as the black line. The light blue line along the bottom is the energy price back-calculated to result in zero after-tax cash flows; the dip in 2018-2020 reflects the higher capacity prices Millstone will be enjoying during those years under its FCM commitments.

Figure 5b displays the projected after-tax cash flows under each alternative price scenario. By design, the break-even energy price results in zero after-tax cash flow. Of greater interest, however, is the fact that all other scenarios result in positive after-tax cash flows. Other than the Worst-case Scenario (red), the alternative pricing scenarios generally result in greater than \$80 million in annual after-tax cash flows. In other words, Millstone is projected to cover its cost and generate reasonable returns to equity in the near-term.

Figure 5a: Alternative Price Projections in the Near-term

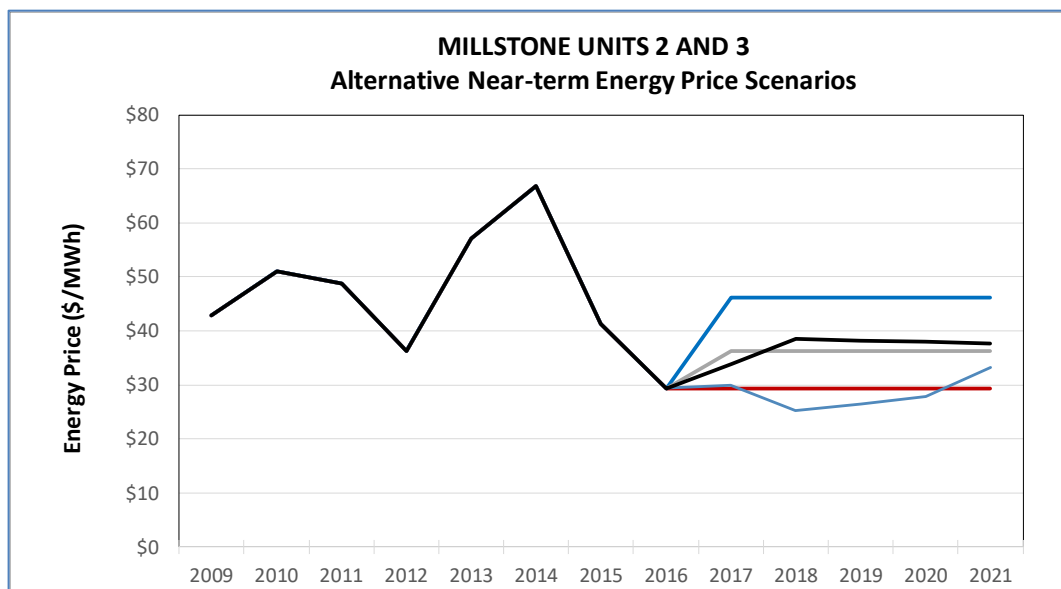
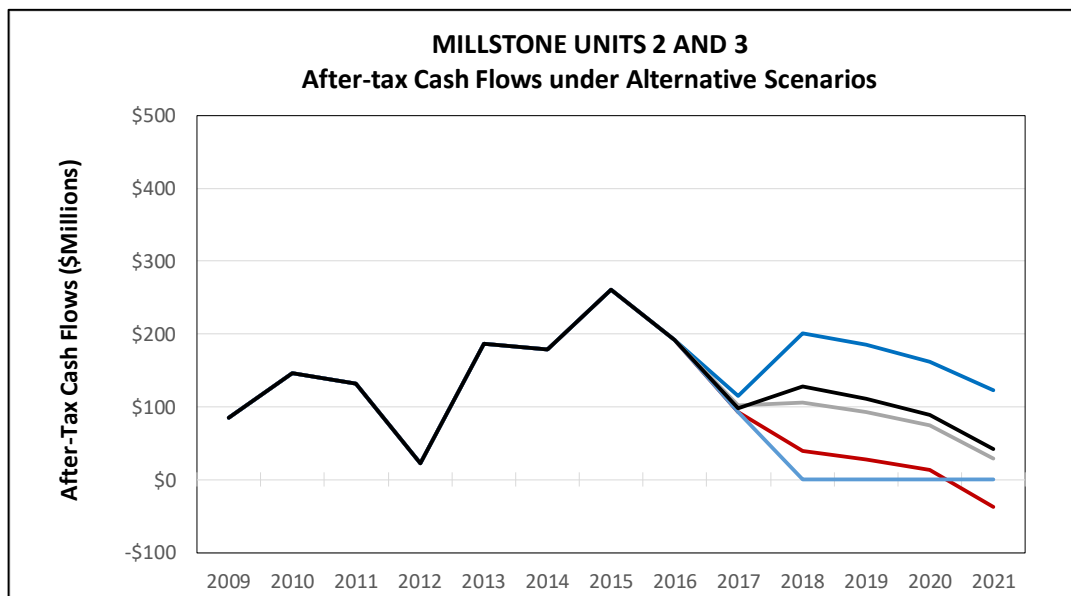


Figure 5b: Millstone Projected After-tax Cash Flows using Alternative Prices



2012-2016 Average Energy Price = \$46/MWh	CME Futures Energy Prices = \$34 - \$39 / MWh
2012 Average Energy Price = \$36/MWh	Break-even Energy Price = \$25 - \$33/MWh
2016 Average Energy Price = \$29/MWh	

Worst-case Scenario: 2016 Energy Prices

The “Worst-case Scenario” reflects an extreme case where energy prices stay at the “extraordinarily low” 2016 levels for the next five years. The unusually low energy prices in 2016 reflected a number of compounding events that even Dominion acknowledges are not expected to continue.²⁰ Therefore, assuming 2016 energy prices represents a floor that is unlikely to occur, but serves to bracket potential outcomes. This scenario is particularly conservative because it is in direct contravention of energy futures prices currently being traded and ISO-NE sponsored projections of energy prices starting in 2021.

Assuming 2016 prices continue through 2021, Millstone Units 2 and 3 still are expected to earn positive income the first four years, earn \$60 million in after-tax income over the five-year period,²¹ and generate at least \$135 million in after-tax cash flow to equity holders through 2021. Therefore, even under even the Worst-case Scenario, Millstone’s operating costs and debt payments are covered, on average, and every additional dollar earned as revenue would flow to Millstone equity holders (e.g., Dominion) as pre-tax profit.

Key Insight 6

**Under the worst-case scenario, all operating costs and debt payments are covered.
Every additional dollar flows to Millstone equity holders.**

²⁰ Dominion Resources, Dominion Resources (D) Q4 2016 Results - Earnings Call Transcript. February 1, 2017, <http://seekingalpha.com/article/4041692-dominion-resources-d-q4-2016-results-earnings-call-transcript?page=7>

²¹ Once the hedges expire, covers costs and debt payments on a cumulative basis over the next four years.

Long-term Prices

Over the longer-term, revenues from New England's competitive energy and capacity markets combined will need to approach the long-run marginal cost of a new entrant. With a large amount of baseload capacity projected to retire in New England, the new entrant is likely to be an advanced, natural gas-fired combined cycle power plant (see Appendix B, section B.7). As such technology has a higher all-in levelized cost of production than Millstone's fixed and variable costs of production, market prices will have to rise to a level that supports new entry and therefore Millstone will be profitable.

Estimated cost of new entry using a number of alternative sources ranges from \$55 to \$65 per MWh. Given the estimated break-even price for Millstone of between \$40 to \$45 per MWh required to cover costs and make debt payments, Millstone equity investors will continue to enjoy positive returns on an investment that has been profitable since Dominion acquired the plant. This conclusion is supported by three external sources of information:

- 1) **ISO-NE Price Projections:** ISO-NE price projections submitted by ISO-NE as part of its Net CONE submission to FERC Docket No. ER17-795-000 project combined energy and non-energy revenues in Southeastern Massachusetts ("SEMA") in 2021 to be around \$60 per MWh and rising thereafter.²²
- 2) **U.S. EIA 2016 Annual Energy Outlook:** EIA estimates of the levelized cost of new entry ("LCOE") for an advanced combined cycle unit coming online in 2022 is around \$58 per MWh in (\$2015), or \$64 per MWh (\$2022) assuming a 2 percent inflation rate.²³

²² ISO New England Inc., Docket No. ER17-795-000, January 13, 2017. SEMA and CT Zone prices tend to be nearly identical. If anything, Connecticut prices have been higher, making the use of SEMA projections a conservative assumption.

²³ U.S. Energy Information Administration, Annual Energy Outlook 2016, April 2016, DOE/EIA-0383(2016). The LCOE for an advanced combined cycle, weighted by region is \$55.8 per MWh (\$2015) for plants entering service in 2022. This value was escalated to 2022 dollars assuming 2% inflation. See

- 3) **NESCOE/LEI Study:** The New England States Committee on Electricity (“NESCOE”), a not-for-profit entity representing the six New England state governors, including Connecticut, recently sponsored a study, performed by London Economics, Inc., that concludes nuclear plants in New England will continue to cover costs and be profitable under a number of alternative scenarios, although equity returns may be impacted in the short-term.²⁴

Therefore, under a number of independent price projections, there is no reason for Millstone to retire due to market conditions, either in the short-run or in the long-run given its operational history and anticipated cost structure.²⁵

Key Insight 7

There is no reason for Millstone to retire.

Millstone Cannot Leave the Market

Perhaps even more important than prices is market reality. Given its position as a market participant in ISO-NE operated markets, Millstone is subject to certain operational requirements. Having committed its capacity into the FCM, Millstone does not have the unilateral ability to retire, even if economic challenges warranted such action. If Millstone did expect to retire, ISO-NE has a formal retirement process that requires a power plant to submit a request to retire. Review of the request assesses potential impacts through a formal (tariff-based) review, under which the affect plant must disclose its financial requirements. If a plant is found to be needed for reliability, ISO-NE’s tariff provides means for it to be compensated so that the plant can continue to operate. Millstone has not availed itself of this exit option. From a

also EIA, Annual Energy Outlook 2017, p. 11 that results in slightly higher estimates of LCOE, http://www.eia.gov/forecasts/aeo/pdf/electricity_generation.pdf

²⁴ LEI, “Study for NESCOE, Renewable and Clean Energy 2.0 Study, Phase I: Scenario Analysis,” Winter 2017.

²⁵ Even if Millstone did have a major operational outage, it has insurance to cover such an event. See Dominion, SEC 2016 Form 10-k.

Connecticut ratepayer perspective, a regional solution under a FERC-approved contract, will cost less than what would result from any state-specific process.

Millstone is committed to remain operational in accordance with its capacity supply obligations under the region's FCM through May 31, 2022. If Millstone wished to retire as of June 1, 2021, the ISO-NE retirement process would have had to be started by the end of March 2017. However, Millstone did not take such action, and the plant is effectively committed to continue operating in the market through mid-2022.

In contrast to retirement, Millstone actually may be preparing for a second license extension. In the early 2000s, Dominion applied for a license extension for its Surry nuclear power plant, which was followed by an application for a license extension for Millstone Units 2 and 3.²⁶ In November 2015, Dominion announced that it was going to apply for a second license extension for its Surry plant.²⁷ Given Millstone's profitability, it is likely that Dominion will repeat its previous approach and apply for a second license extension for Millstone shortly, regardless of whether the proposed Connecticut legislation is passed.

5. IMPACT ON CONNECTICUT RATEPAYERS

As already mentioned, Millstone provides benefits to the Connecticut economy in the form of lower energy costs, jobs, tax receipts, emissions and other economic impacts. Those benefits are only lost if Millstone shuts down. As the financial analysis above indicates, however, there is no economic basis for Millstone to retire. Therefore, these benefits are not at risk.

In contrast, there are very real, measurable costs to ratepayers, beyond the risks associated with entering into long-term contracts for financial derivatives. Such costs

²⁶ Millstone Power Station Unit 2, Application for Renewed Operating License, Technical and Administrative Information, 2005.

²⁷ Charlotte Business Journal, "As major power players queue up to extend nuclear plant licenses, Charlotte's Duke Energy mulls the same," September 19, 2016, <http://www.bizjournals.com/charlotte/news/2016/09/19/as-major-power-players-queue-up-to-extend-nuclear.html>

are directly measurable and can be translated into higher electricity bills since the proposed contracts are likely to be “out-of-the-money” from the start.

This section examines the impact on Connecticut ratepayers. As Millstone has no incentive or financial reason to retire, there are no off-setting benefits.

The terms of the proposed legislation would allow Millstone to enter into a competitive bidding process (wherein it would be the only eligible bidder of nuclear energy) and be awarded a five-year contract so long as its bid is lower than competing renewable resources. The current draft of the legislation establishes the maximum annual amount of energy that can be purchased from nuclear units at 8,326,750 MWh, or roughly half of Millstone’s average annual output.²⁸

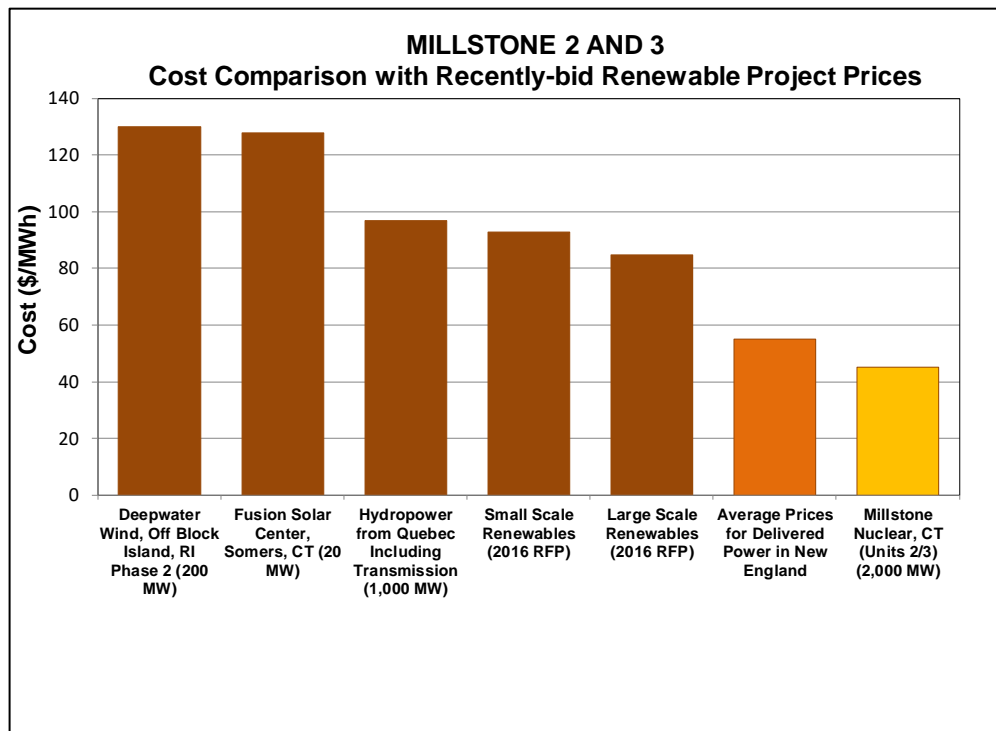
Figure 6 illustrates the relative all-in revenue requirements of Millstone compared to a number of other renewable alternatives, including the average system-wide price in New England of around \$55 per MWh. The most recent tri-state solicitations resulted in prices of around \$85 per MWh for large-scale renewables and \$93 per MWh for smaller renewable resources.²⁹

It is clear that, in response to any state-based request for proposal (“RFP”), Millstone would be competing against significantly higher cost alternatives. The RFP that would be required by the pending legislation, therefore, would not be competitive (especially in light of the bill’s effort to ensure other nuclear plants in New England are precluded from bidding). Millstone would be able to simply bid up to the cost of the next highest option.

²⁸ Committee Bill 106/LCO5352, p. 4, lines 107 – 111.

²⁹ CT DEEP, “Energy and Technology Committee Informational Meeting Cheaper, Cleaner, More Reliable Energy,” January 24, 2017, p. 8.

Figure 6: Comparison of Millstone to Alternative Energy Options



Sources:

- (1) "Deepwater gets OK for full throttle at Block Island Wind Farm," Providence Business Journal, Dec 12, 2016
- (2) "Deepwater Wind CEO Jeffrey Grybowski says offshore wind power cheaper than solar power in R.I.," Politifact, August 31, 2013
- (3) "Wind Farm, Solar Project Chosen For State Clean Energy Push" (Fusion Solar Center, Somers, CT,) Hartford Courant, September 30, 2013
- (4) Sue Tierney, "Proposed Senate Bill No. 1965: An Act Relative to Energy Sector Compliance with the Global Warming Solutions , Analysis Group, September 2015, p.5.
- (5) CT DEEP, "Energy and Technology Committee Informational Meeting Cheaper, Cleaner, More Reliable Energy," January 24, 2017, p. 8.
- (6) Ibid.
- (7) Sue Tierney, p. 6.
- (8) Energyzt Advisors analysis, March 7, 2017

Given that ratepayers are currently benefitting from historically low wholesale power prices, the only outcome such an RFP can produce is that ratepayers will be left paying a higher price than should be required in a truly competitive procurement process or market-based approach. Under the terms of the legislation, such a high price conceptually could be measured as being to the benefit of ratepayers, even though it is significantly higher than 1) ISO-NE market prices; 2) futures prices; and 3)

the price Millstone requires to cover its costs, including a reasonable return on equity. Ratepayers will be left paying a higher price than should be required.

The impact on Connecticut ratepayers can be easily assessed. An average residential consumer uses 0.7 MWh per month. Assuming a contract price of \$85 per MWh (i.e., the contractual cost of large scale renewable contracts in 2016) versus the \$45 break-even price, the legislated contracts would transfer an average of \$330 million per year to Millstone over a five-year contract term (i.e., \$1.65 billion versus the initial investment of \$1.195 billion) from Connecticut ratepayers to Millstone equity holders.

Dividing this total amount by Connecticut's total projected load of approximately 31 GWh results in an average increase in energy supply by around \$11 per MWh per year. When compared to the 2016 standard offer supply rate published by Eversource of \$66 per MWh, that would be an increase of 17 percent.

Multiply that incremental cost times 0.700 MWh per month, and the average residential customer will be paying \$7.70 per month more than otherwise would be required, or over \$90 per year. Commercial, industrial and governmental customers would see a significantly greater impact. Indeed, an important secondary effect of higher rates on municipal entities such as town buildings, schools, and local utilities (e.g., water and sewer) is that those entities will incur higher expenditures associated with their electric bills, forcing either a reduction in services, higher prices for municipal services, or increases in local taxes to fund these higher costs, thereby placing an even greater burden on household incomes.

Key Insight 8

If prices stayed at 2016 levels, Connecticut residential ratepayers could pay an additional 15% to 20% in supply costs, or over \$90 per year in extra payments to Millstone, with commercial, industrial and municipal customers paying significantly more.

What would be the benefit to ratepayers in exchange for paying the higher rate?

Based on the financial assessments above, nothing.

- **No change in operations:** Millstone will continue to operate, as it would have in the absence of the contracts.
- **No change in emissions:** There would be no incremental impact on the environment as Millstone's capacity factor will be the same with or without the contract. If anything, the additional money used to support Millstone will reduce the state's financial ability to invest in new renewable resources and alternative policy approaches which would otherwise displace higher polluting existing fossil fuel units.
- **No benefit of the bargain:** At the expense of ratepayers, Millstone would receive \$1.6 billion above market prices under the contract, enough to cover the entire purchase price, and more than the total capital expenditure invested since 2001.
- **No equity for ratepayers:** Every incremental dollar will simply go to Millstone's equity holders (i.e., Dominion) and further increase Millstone's profitability, while decreasing ratepayer's free cash.
- **No choice:** Additional risk will be placed on Connecticut ratepayers tied to the long-term commitment of a fixed price based on more expensive alternatives, with no ability to escape the recovery of contractual costs incurred by the utility.

In other words, Connecticut ratepayers receive no incremental value for their higher utility bills.

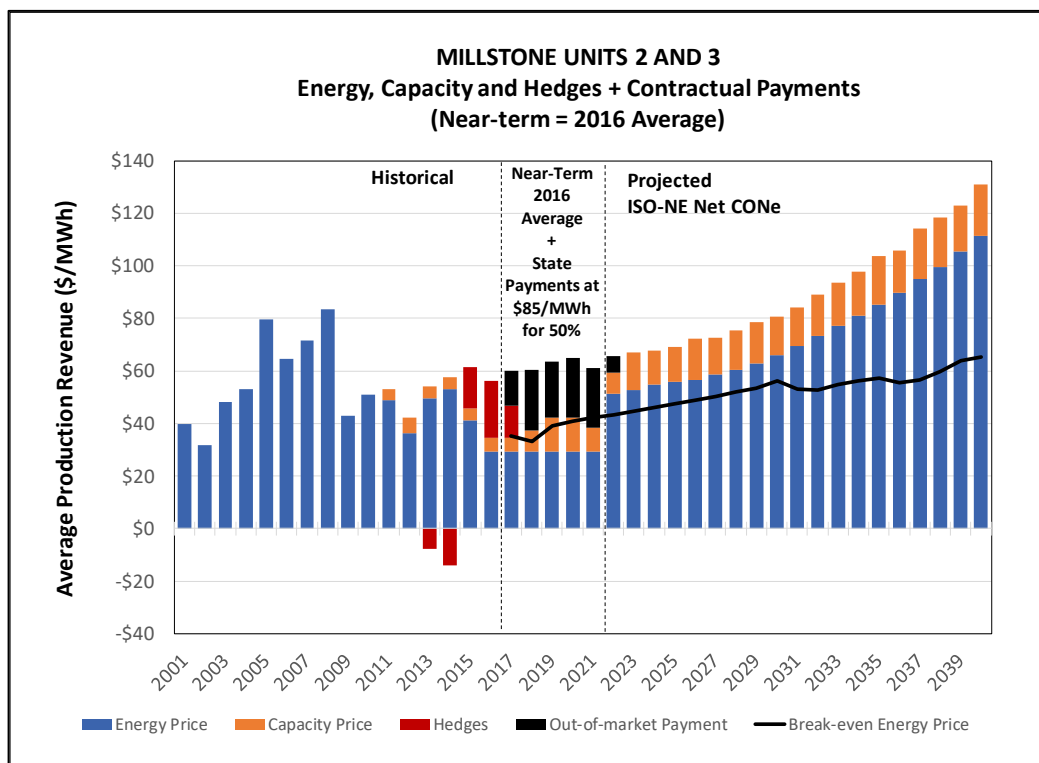
Key Insight 9

Connecticut ratepayers are being asked to pay money for no incremental benefit.
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In contrast, Figure 7 illustrates why Millstone would benefit from the proposed

legislative contracts. Not only would the fixed price be higher than current futures prices, they would raise even the Worst-case Scenario up to extremely profitable levels. In this scenario, contractual payments would be for a five-year period beginning in the second half of 2017 and extending through the first half of 2022.

Figure 7: Projected Pay-out to Millstone with Legislated Contracts



Source: Energyzt analysis

Although the price support is meant to serve as a financial “bridge” if low prices occur during the next five years, and arguably would be less “out-of-the-money” if energy prices reflect the futures markets, ratepayers would not be able to escape the fact that they are paying a higher price for energy under the Millstone contracts than they would under either spot market prices or a hedge entered into based on futures prices currently trading on the CME.

In contrast, Millstone would continue to enjoy excess profits. In effect, the out-of-market state contracts would replace the value of the competitive market hedges that

Millstone has employed, without the risk and at a price-level well-above what is currently available.

Given that Millstone is not projected to lose money under reasonable scenarios, the proposed legislation is simply a wealth transfer from Connecticut ratepayers to Millstone equity investors (e.g., Dominion). It would be even less needed following 2021 when multiple price forecasts project prices rising to the long-run marginal costs of a new entrant.

Key Insight 10

The proposed legislation is simply a wealth transfer from Connecticut ratepayers to Millstone equity investors.

6. CONCLUSION

Since 2001, Millstone is estimated to have been very profitable for Dominion. A legislative mandate is not required to protect Millstone, the plant is committed to operate through 2021 and has not made any indication that it intends to retire.

ISO-NE capacity markets serve as a hedge to Millstone, locking in higher prices through 2021. Although Millstone has hedged its energy output in the past and could profitably hedge with futures over the next five years, it has chosen not to do so, indicating either an expectation of market prices higher than the forward markets or proposed legislation that would be more lucrative (i.e., an out-of-market contract).

There is no economic reason for Millstone to retire. Projected prices are more than enough to continue Millstone's profitable history. Even if energy prices stayed at 2016 levels, Millstone would cover its operating costs, investment costs and debt payments plus some return on equity.

In contrast, Connecticut residential ratepayers would pay an additional 15% to 20% in supply costs, or over \$90 per year on average. Connecticut ratepayers are being asked to pay more money for no incremental benefit. Although the proposed legislation

intends to use ratepayer dollars, rather than tax dollars, to support local economic development, the reality is that Millstone jobs will remain regardless of the legislation. The proposed legislation is simply a wealth transfer from Connecticut ratepayers to Millstone equity investors and their tax authorities.

APPENDIX A

Revenues: Data and Sources

This appendix provides detail underlying assumptions related to the historical assessment of revenues and revenue projections.

A.1 ENERGY REVENUES

Calculating energy revenues requires an estimate of both the energy to be generated by the power plant and the price at which the plant sells that energy. Fortunately, historical values for both are publicly available and provide a verifiable estimate of energy revenues that were earned by Millstone within a few years of Dominion's purchase. Each data source or estimation methodology is described in more detail below.

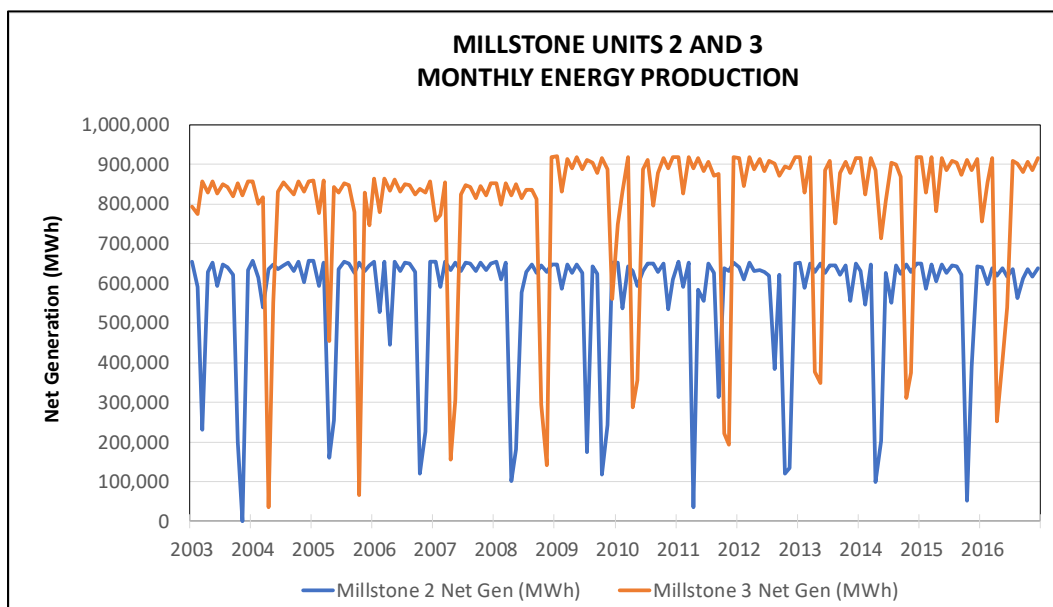
A.1.1 Output

Net generation (MWh) is readily available for large generation plants from FERC 923 data. This information is available by unit for nuclear power plants, allowing for differentiation between Millstone Unit 2 and Unit 3.

As shown in Figure A.1, Millstone's operating history has been fairly consistent, reflecting an 18-month maintenance schedule that occurs during the shoulder months (i.e., spring and fall). The result is an off-year once every three years where output is maximized for that unit. Major maintenance schedules for Millstone Unit 2 and Unit 3 are coordinated so that they occur six months apart, allowing for total plant output impacts to be mitigated. Millstone Unit 3 has a higher capacity and therefore higher output than Millstone Unit 2. The data reflects higher output from Millstone Unit 3 of around 7 percent following its license amendment to uprate in August 2008.³²

³² Letter from John G. Lamb, Senior Project Manager Plant Licensing Branch I-2 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation to Mr. David A. Christian President and Chief Nuclear Officer Virginia Electric and Power Company re: Millstone Power Station, Unit No. 3 – Issuance

Figure A.1: Historical Net Generation Output



Source: FERC Form 923 data: <https://www.eia.gov/electricity/data/eia923/>

Net generation data is available by unit starting in 2003; for 2001 and 2002, it is available on the plant level. For those years, an allocation of monthly net generation output was allocated to each unit in accordance with their relative proportion of capacity.

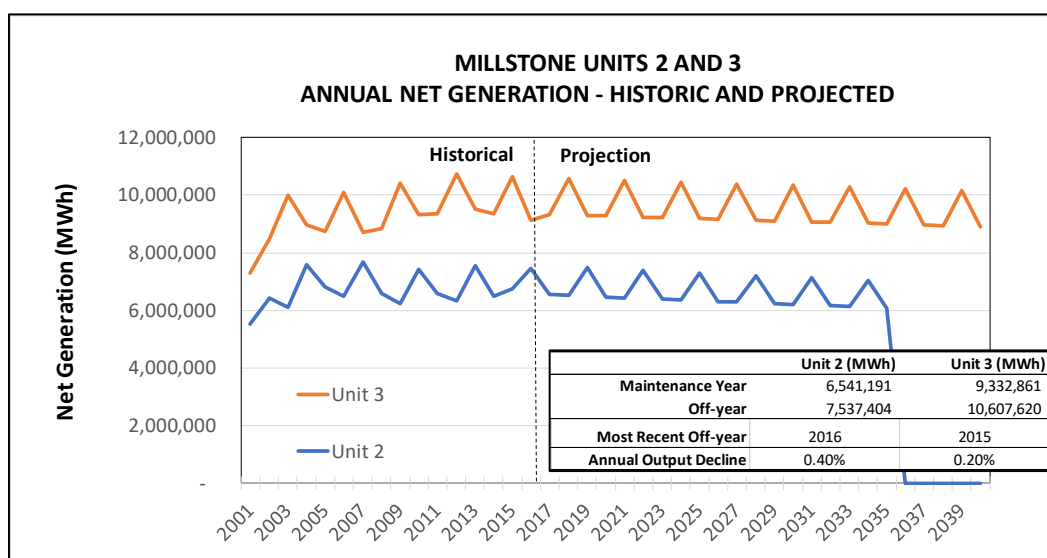
For purposes of projecting future net energy production, Energyzt took the average of all maintenance years back to 2004 for Unit 2 and back to 2009 for Unit 3 to reflect the uprate. The average output during maintenance and off years was used as the 2017 starting point.

To the base net generation output in 2017, a degradation factor was applied to reflect potential output declines due to aging, although the most recent history does not indicate that such declines are occurring. For Unit 2, which is 10-years older, a degradation factor of -0.4% was applied each year to the base output value. For Unit 3, a degradation factor of -0.2% was applied for each year going forward. The net impact is a slightly declining output that begins to accelerate with compounding in the out-years.

Although Dominion may be considering applying for a second license extension for Millstone, the analysis does not assume a second license extension. As a result, Unit 2 is assumed to cease operations in 2035.

The basis for the projected net generation output is presented in Figure A.2.

Figure A.2: Projected Net Generation Output Assumptions and Output



Source: Energyzt analysis.

A small degradation estimate is included to be conservative. However, contemplation of a second license extension would indicate that such degradation associated with aged plants may not be likely to be noticeable through 2030.

A.1.2 Energy Prices

As with historical output, historical energy prices are readily available from ISO-NE. ISO-NE also recently sponsored an energy price projection as part of its FCM proceedings to calculate a Net CONE. The analyses make use of these price projections as well as alternative scenarios for the near term.

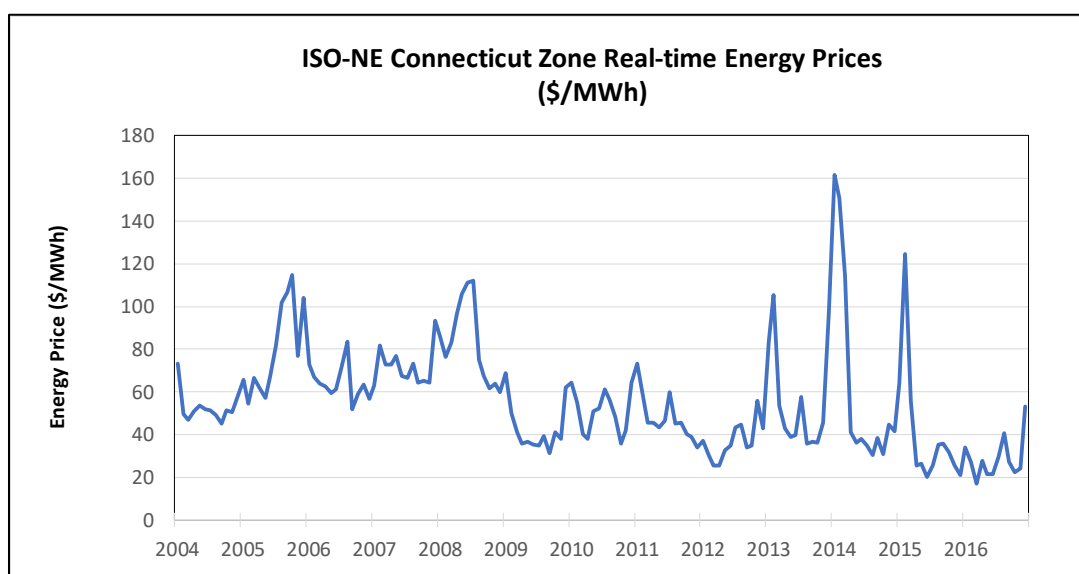
Historical Energy Prices

Although hourly locational marginal prices are available at the Millstone interconnection point, the associated output is only available on a monthly basis. To reflect the same level of granularity as the output, monthly historical prices for the Connecticut zone were used.

Monthly prices for the Connecticut zone are available back to March 2003. In order to backcast prices to 2001, 2002, and 2003, the ratio of the annual average natural gas prices to generators in earlier years versus 2004 was applied to the 2004 average annual price.

Figure A.3 provides historical energy prices at Connecticut zone on a real-time basis.

Figure A.3: Historical Monthly Real Time Energy Prices (\$/MWh)



Source: ISO-NE, <https://www.iso-ne.com/isoexpress/web/reports/pricing/-/tree/zone-info>

Monthly zonal prices for Connecticut were applied to the monthly output from Millstone Units 2 and 3, as reported in Form 923, to derive total revenues generated by energy sales and an annual weighted average annual price.

Short-term Energy Price Projections (2017-2021)

Energy prices were projected under alternative scenarios. In the case of CME futures, and the longer-term ISO-NE price projections, prices were obtained for peak and off-peak hours on a monthly basis and weighted according to the relative proportion of hours in each month to obtain a monthly average.

To calculate the annual projected energy price, a straight average of the monthly futures was calculated. This approach is **conservative** as maintenance outages are scheduled

during shoulder months when energy prices are lower compared to winter peak natural gas pricing periods or New England's summer peak load periods.

For purposes of the short-term alternative energy price scenarios, the annual average was based on historic weighted average prices earned by Millstone, and implicitly assume a monthly weighting consistent with Millstone's historic operations. See Figure 5a in the body of the report for a comparison of alternative prices.

Long-term Energy Price Projection

The focus of the analysis is on near-term pricing during the period in which a 5-year contract arguably would be most needed and implemented. For the longer-term (i.e., after 2021), a publicly-available price projection from an independent third party was required to show longer-term expectations. Two such projections are publicly-available:

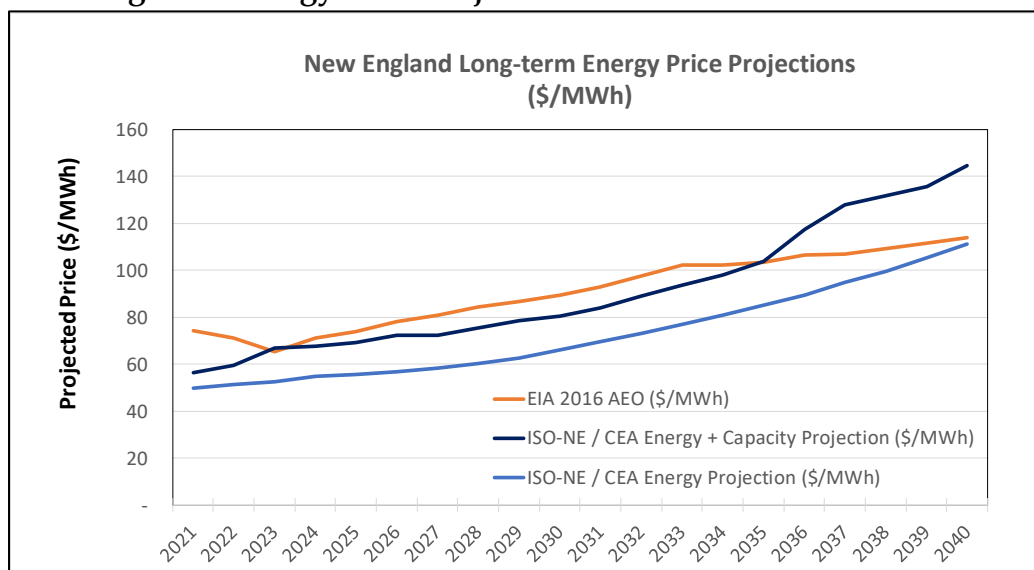
- 1) **ISO-NE:** ISO=NE sponsored energy prices projected by Concentric Energy Advisors using AURORAxmp, a fundamental market model with assumptions submitted as part of the Net CONE submission to FERC.
- 2) **U.S. EIA:** Long-term energy price projections produced by the United States Energy Information Agency as part of its 2016 Annual Energy Outlook. The projections are performed with and without the Clean Power Plan.

A comparison of the two projections is provided below in Figure A.4. The lighter blue line on the bottom represents ISO-NE's energy price projection. The dark blue line represents ISO-NE's energy price projection plus non-energy revenues (e.g., energy and capacity values). The orange line represents the 2016 AEO projection of generation supply prices for New England which represents both energy and capacity values plus uplift for spinning reserves.

For purposes of this analysis, the ISO-NE price projections were adopted as they are lower in the short-term until 2035 compared to the EIA projections (without the Clean Power Plan) and therefore are more **conservative**.³³

³³ The EIA projections for New England reflect prices for both energy and capacity value. Even if the ISO-NE price projections were increased to reflect projected non-energy revenue payments, the EIA values would still be higher.

Figure A.4: Long-term Energy Price Projections



Source: ISO-NE, Filing of CONE and ORTP Updates, Docket No. ER17-795-000, January 13, 2017, Attachment 1 and supporting spreadsheets; U.S. EIA, Annual Energy Outlook Bench Mark Electricity Prices for New England, DOE, Release Date: May 17, 2016, http://www.eia.gov/forecasts/aeo/data/browser/#/?id=62-AEO2016&cases=ref2016~ref_no_cpp&sourcekey=0

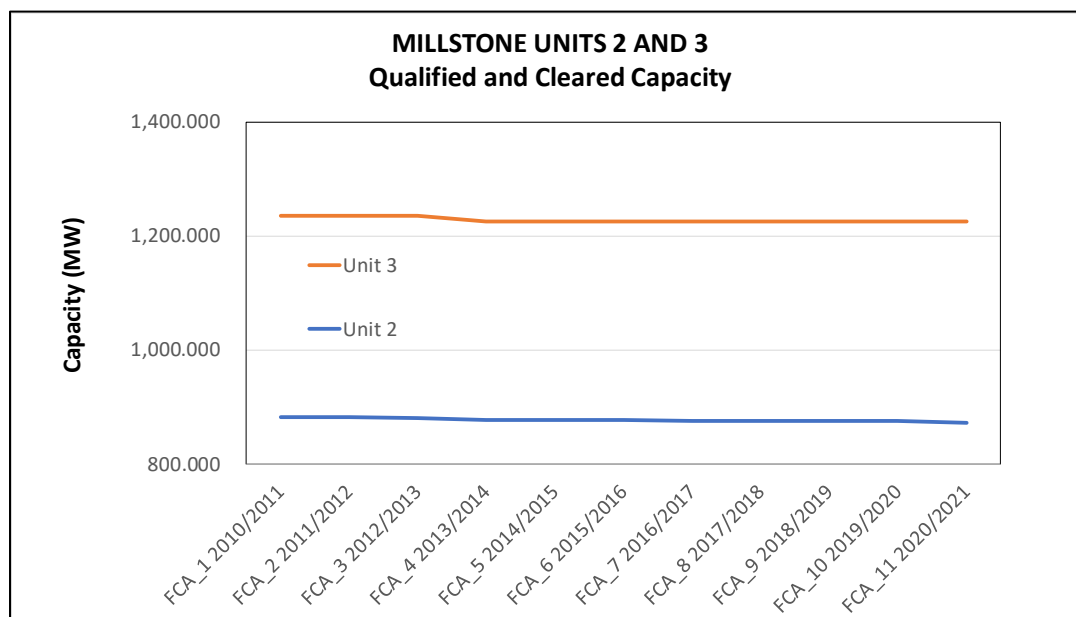
A.2 CAPACITY REVENUES

New England also has competitive capacity markets that provide year-to-year contracts for existing generators. As part of the Forward Capacity Market (“FCM”), prices are set three years in advance through competitively-bid Forward Capacity Auctions (“FCA”). The most recent FCA_11 established capacity prices for the June 2020 to May 2021 period. The first forward capacity auction established capacity market prices for June 2010 to May 2011. Millstone has qualified for and cleared each FCA, locking in capacity prices three years in advance. Therefore, there is certainty associated with the FCM prices that Millstone will receive through May 2021.

A.2.1 Qualified Capacity

Before a generator can bid into the FCM, ISO-NE must qualify the capacity that can be committed. Bidders then bid into the auction and the lowest priced resources clear. ISO-NE publicly reports the resources and their capacity that cleared as forward capacity supply obligations (“CSOs”). Millstone has cleared each auction, providing a history of qualified and cleared capacity (Figure A.5).

Figure A.5: Millstone Qualified and Cleared Capacity by Unit



Source: ISO-NE, CCP Forward Capacity Supply Obligations,
<https://www.iso-ne.com/isoexpress/web/reports/auctions/-/tree/fca-results>

Although there has been some variation in the qualified capacity over time, it has been fairly consistent. For the most recent auction, FCA_11, ISO-N qualified and cleared Millstone at the following:

	<u>Qualified Capacity</u>	<u>Nameplate Rating</u>
Millstone Unit 2:	872.258 MW	870 MW
Millstone Unit 3:	1,225.000 MW	1,150 MW

For comparison, the nameplate capacity is provided. The nameplate capacity rating is around the same for Millstone Unit 2, but is lower than Millstone Unit 3 given the 2008 stretch power uprate license.

The historical analysis assumes the actual qualified capacity that cleared. The forward projection analysis assumes the same amount of qualified capacity going forward that cleared in the most recent auction, FCA_11.

A.2.2 Capacity Prices

Cleared capacity prices are published by ISO-NE almost immediately after the auction. For historical capacity auctions that cleared prices through May 2021, the actual clearing prices from the FCA are assumed for the capacity commitment period (“CCP”).

After 2021, the ISO-NE sponsored energy price projection included in the Net CONE submission also included a “missing money” calculation. This “missing money” calculation is performed by the AURORA model capacity planning module and estimates the additional value that a new entrant (i.e., an advanced combined cycle) requires to meet its cost of entry above and beyond the AURORA projected energy prices. These values were provided by ISO-NE as part of the backup calculation spreadsheets.³⁴

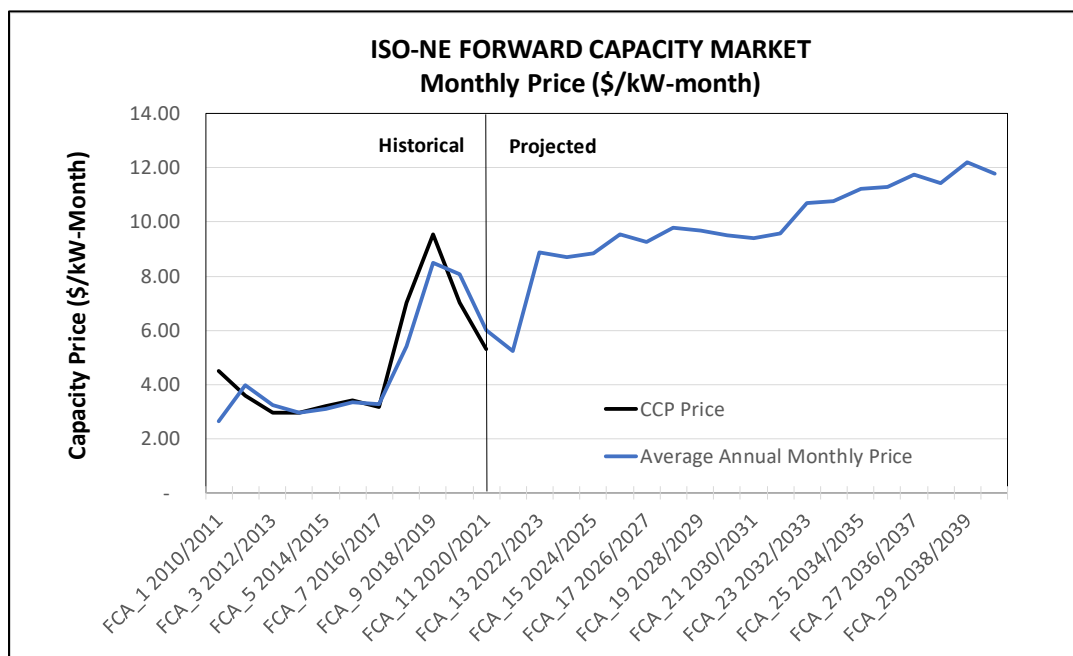
The forward-looking analysis includes the “missing money” values as projected capacity values that are consistent with the projected energy prices, market representation and underlying assumptions.

Figure A.6 shows the historic versus projected capacity prices on a \$ per kW-month basis. The CCP price reflects the price that actually cleared; the average annual monthly price is a weighted average of the cleared prices for the 5 months of the preceding FCA and 7 months of the cleared FCA for the year to obtain an average monthly price for the calendar year.

The higher level reflects the model’s balancing function which targets all-in prices to the cost of a new entrant. This is consistent with FCA_7 and FCA_8 prices that reflect the price for capacity required to attract new entrants.

³⁴ ISO-NE, Back-up spreadsheets to Concentric’s Report, a4_net_cone_supporting_data_part_1_revision_2.xlsx

Figure A.6: Historical and Projected Capacity Market Prices



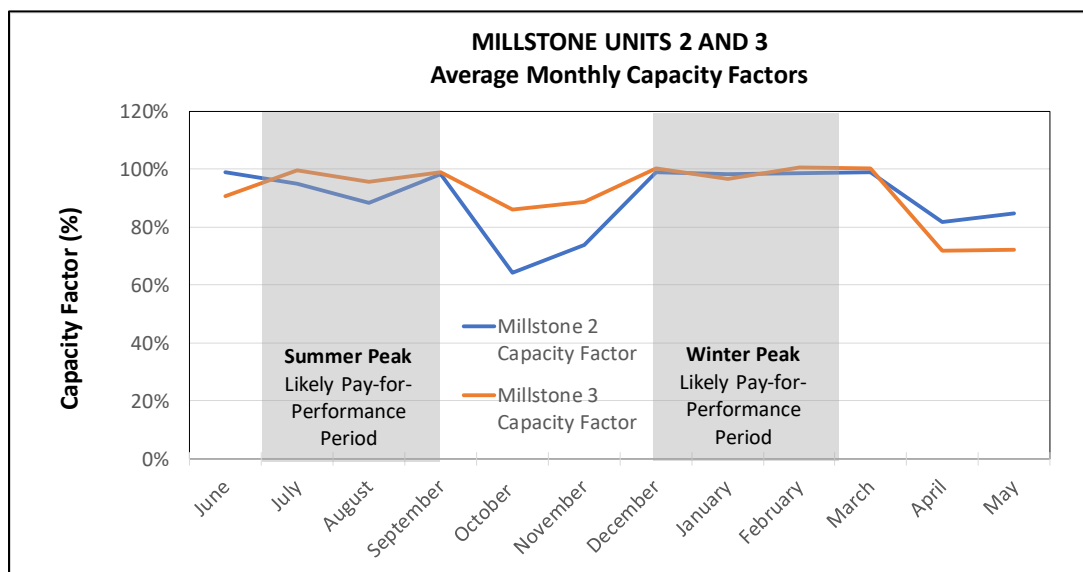
Source: Historical: ISO-NE, FCA Results for each auction,
<https://www.iso-ne.com/isoexpress/web/reports/auctions/-/tree/fca-results>
 Projected: ISO-NE, a4_net_cone_supporting_data_part_1_revision_2.xlsx

A.2.3 Pay-for-Performance Penalties

ISO-NE recently received FERC approval for a pay-for-performance penalty program to be implemented in 2018. Under this program, generators that fail to provide their capacity supply obligations when called are assessed penalties which are then used to reward those generating units that did meet their capacity supply obligations.

The Millstone units have experienced very high capacity factors, and modified their qualified capacity since FCA_1 to reflect their expected availability. Maintenance outages are scheduled for the shoulder months, when pay-for-performance penalties are not likely to occur. Taking the average monthly capacity factors for the past five years (2012-2016) indicates that Millstone has had and can be expected to have superior performance in meeting its capacity supply obligations going forward (Figure A.7).

Figure A.7: Monthly Average Capacity Factors by Unit (2012-2016)



Source: Energyzt analysis of Form 923 data and qualified capacity factors.

To the extent one of the units has a short-fall (e.g., Unit 2), the other (e.g., Unit 3 with the higher capacity) is likely to be available, more than covering the pay-for-performance payments. If anything, one would expect Millstone to receive net positive pay-for-performance during peak periods as a result of its higher historic capacity factors that have been close to 100 percent during peak months when capacity supply obligations are likely to be called.

The analysis does not include pay-for-performance payments, making it a **conservative** assessment of Millstone's projected revenues from ISO-NE's pay-for-performance program.

A.3 HEDGES

Millstone has hedged both its energy and capacity revenues that have been quite lucrative. Although holding companies may hedge at the corporate level and engage in speculative trading around its asset footprint, in this case, the hedges are explicitly attributed to Millstone in Dominion's analyst reports. The direct allocation to Millstone requires incorporation into the financial assessment.

A.3.1 Source Materials

The basis for incorporating hedges into the financial analysis are clearly laid out in materials presented by Dominion to equity analysts going back to 2013.³⁵ Although hedging information may be available further back, accessibility to such information is limited and a review of Dominion's SEC filings do not readily provide the detailed information required to perform the analysis. An example from the most recent earnings release is provided below.

Figure A.8: Example of Hedging Information Provided by Dominion

Hedging				
Power, Capacity and NGL Hedge Positions		As of January 26th, 2017		
Merchant Generation Power & Fuel	Net Summer Capacity (MW)	2016	2017	2018
Hedge Positions ¹				
Millstone	2,001	100%	85%	0%
Manchester	461	100%	36%	0%
Fairless	1,196	100%	17%	0%
Total Merchant Generation ²	3,658	100%	55%	0%
Power Pricing				
NEPOOL Baseload - Average Hedge Price (\$/MWh) ³		\$51.51	\$40.09	-
Merchant Generation Capacity (EFOR Adjusted)		2016	2017	2018
Millstone & Manchester (MW)		2,469	2,467	2,467
Average Capacity Hedge Price (\$/KW - month)		\$3.08	\$5.29	\$8.72
Fairless (MW)		1,191	1,193	1,193
Average Capacity Hedge Price (\$/KW - month)		\$4.46	\$4.39	\$5.92
NGL		2016	2017	2018
Estimated annual NGL sales (in million gallons) ⁴		85	90 - 110	90 - 110
Amount hedged (in million gallons)		79.1	39.5	8.0
Average hedge price per gallon ⁵		\$0.67	\$0.72	\$0.76

Source: Dominion, 4th Quarter 2016 Earnings Release Kit, February 28, 2017, p. 26.

A.3.2 Hedging Assumptions

All Millstone hedges were assumed to be futures with a fixed strike price as opposed to call options, which only have value if market prices are above the strike. The following

³⁵ Dominion's 4th Quarter Earnings Release Kits for 2015 and 2016.

information was compiled and incorporated into the analysis, with the market clearing price for 2017 established by the associated capacity prices and short-term energy price scenario.

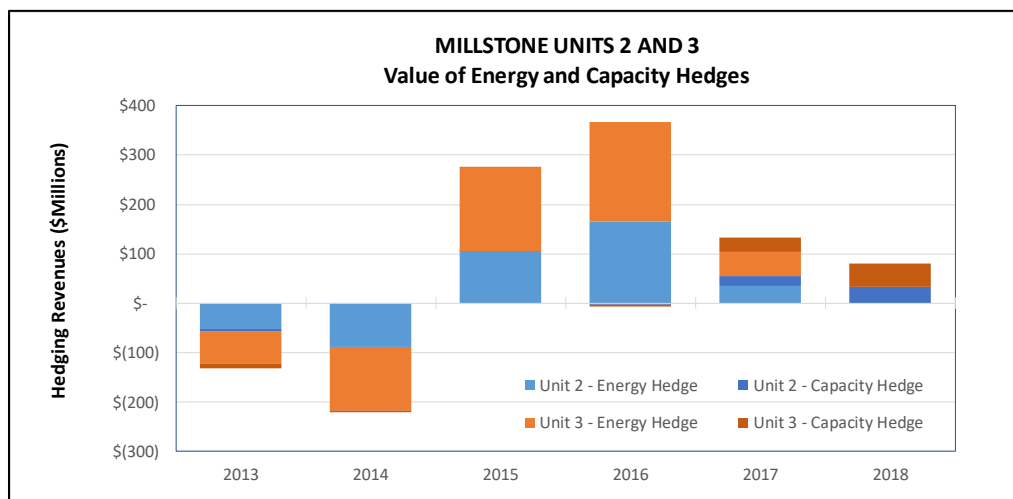
Figure A.9: Millstone Hedging Information Incorporated into the Analysis

Year	2013	2014	2015	2016	2017	2018
Power (2,001 MW)	82%	92%	100%	100%	85%	0%
\$/MWh	\$48.83	\$52.03	\$56.97	\$51.51	\$40.09	--
Capacity (MW)						
(Manchester and Millstone)	2,473	2,467	2,469	2,469	2,467	2,467
<u>Manchester</u>	<u>461</u>	<u>461</u>	<u>461</u>	<u>461</u>	<u>461</u>	<u>461</u>
Millstone (MW)	2,012	2,006	2,008	2,008	2,006	2,006
\$/kW - month	\$2.61	\$2.75	\$3.14	\$3.08	\$5.29	\$8.72

Source: Dominion 4th Quarter Earnings Release Kits for 2013-2016 for years 2013, 2014, 2015, 2016, and 2017, with zero for 2018; NEPOOL Baseload Average Hedge Price includes all on-peak, off-peak, all-hour, and seasonal hedges for Millstone

Incorporating this information into the analysis results in the following hedge values under historical prices and projected CME futures.

Figure A.10: Millstone Hedging Value



Source: Energyzt analysis of Millstone hedges, cleared FCA capacity prices and CME futures

These hedging values are incorporated directly into the analysis as a separate revenue line item and flow through to after-tax cash flows and earnings.

APPENDIX B

Cost Assumptions: Data and Sources

Properly estimating costs is key to the financial assessment of any generating facility, but especially a nuclear power plant where extraordinary costs tied to efficiency, reliability and safety issues can lead to uneconomic operation and retirement. Fortunately, costs for nuclear power plants are publicly reported and extensively analyzed in the public domain.

This section describes key cost components and the assumptions underlying the analysis. Wherever possible, conservative choices were made to reflect likely costs to Millstone, but err on the side of higher expenses so as to assess the likelihood of financial distress or future retirement as a result of costs.

Details underlying the cost calculations are provided below. On a high level, however, the all-in costs of Millstone's operations, including production costs, capital expenditures and debt payments, is estimated to be around \$40 per MWh in 2018, rising to \$45 per MWh by 2024. So long as the combined revenues from energy and capacity markets exceeds this target, Millstone will be profitable and equity investors will earn returns. This threshold is important to understand in the short-term as well as over the long-term when analyzing Millstone's financial viability.

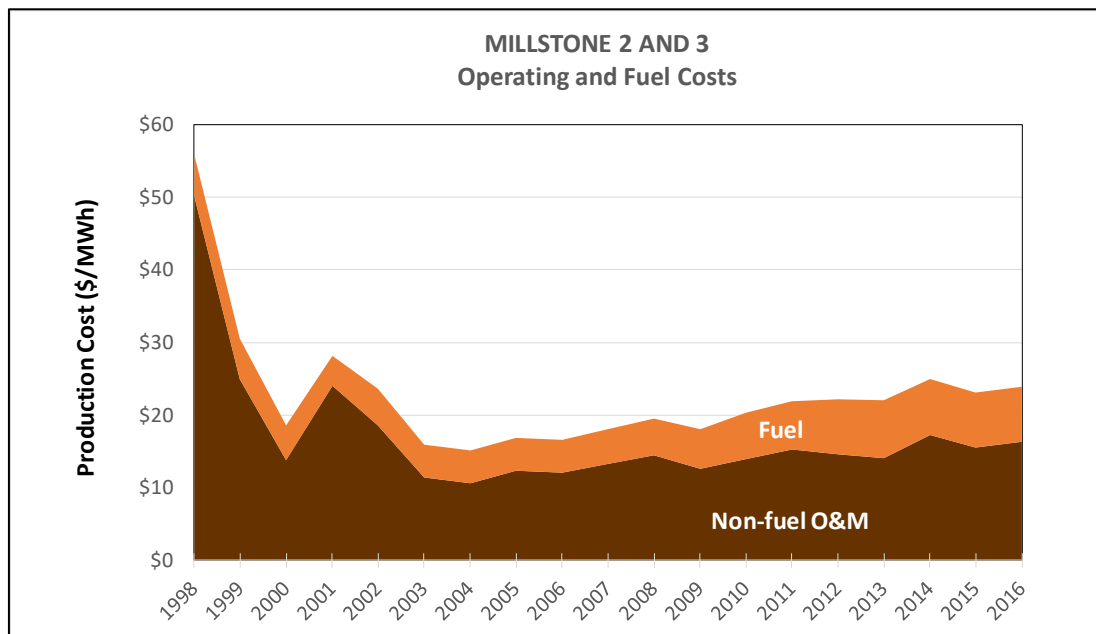
This appendix is organized as follows:

- Production Costs (i.e., fuel and non-fuel O&M)
 - Capital Expenditures
 - Property Taxes
 - Debt Costs
 - Depreciation and Amortization
 - Estimated Return on Equity
 - Estimated Levelized Costs for New Generation Units
 - Decommissioning Fees
-

B.1 PRODUCTION COSTS

FERC Form 1 submissions include production costs (O&M and Fuel only) for nuclear power plants owned and operated by regulated utilities. Information for Millstone was submitted until the plant became a competitive generator with Dominion's purchase in 2001. This original data, combined with information submitted by regulated utilities for their nuclear power plants, can be used to estimate Millstone's cost of production. Specifically, the Nuclear Energy Institute ("NEI") takes these values and modeled data for power plants and years for which the data is not available. These historical costs provide the basis for understanding Millstone operations and to project costs going forward.

Figure B.1: Millstone Operating Costs



Source: NEI compilation of data submitted to EUCG, based on FERC Form 1, EIA-412, RUS-12, EIA-906/923, and ABB Primary Research; Modeled costs by ABB Velocity Suite if information isn't provided directly. Based only on regulated entities. Does not include indirect costs or capital expenditures.

Figure B.1 illustrates Millstone's historical operations from 1998 to the present. Since the relatively high costs incurred during the late 1990s and early 2000s, production costs in the industry in general have settled down to stable levels that have been fairly consistent,

albeit rising at a steady rate close to inflation.

The data indicates that fuel costs experienced a brief uptick in 2008, 2011 and 2014, but have leveled off in recent years. This relatively small increase is in direct contrast to the volatility associated with the price of uranium, particularly for 2008 when uranium prices reached historic highs. This is consistent with Dominion's reported strategy of engaging in long-term purchases of fuel, illustrated by the \$105 million pre-purchase of fuel as part of the purchase price and confirmed by Dominion's most recent annual report.³⁶

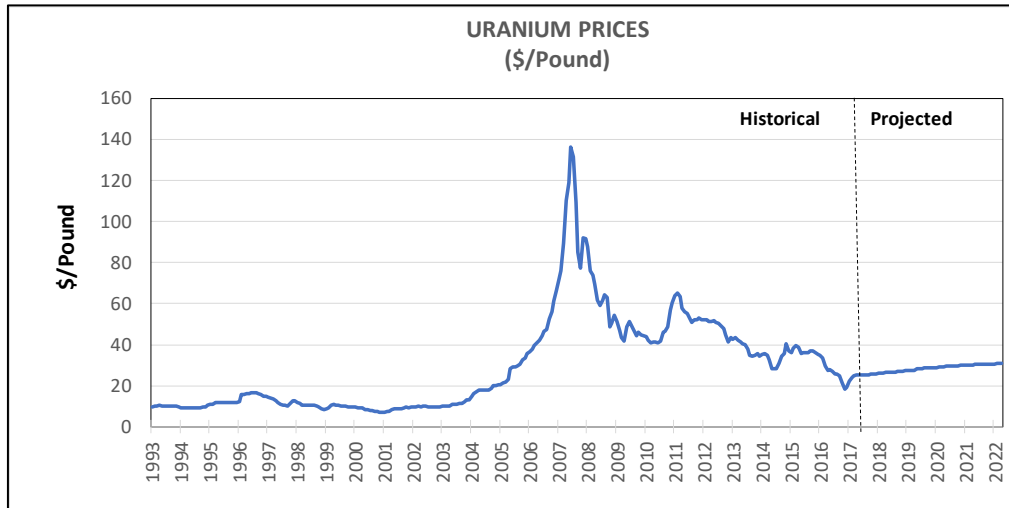
FERC Form-1s have been submitted through 2015. Therefore, the analysis uses the following estimates for 2015 Millstone costs as the bases for future projections:

- Fuel costs = \$7.50/MWh
- O&M Costs = \$15.54/MWh

The projected fuel price assumes that long-term fuel purchases continue, and that fuel cost increases will correspond to the gradual incline of futures (Figure B.2), adjusted downwards for lower delivery cost escalation. The analysis assumes 3 percent escalation, consistent with historic escalation of estimated fuel costs since 2010.

³⁶ "Dominion Generation primarily utilizes long-term contracts to support its nuclear fuel requirements" SEC Form 10-k, p. 14.

Figure B.2: Uranium Prices – Historical and Futures

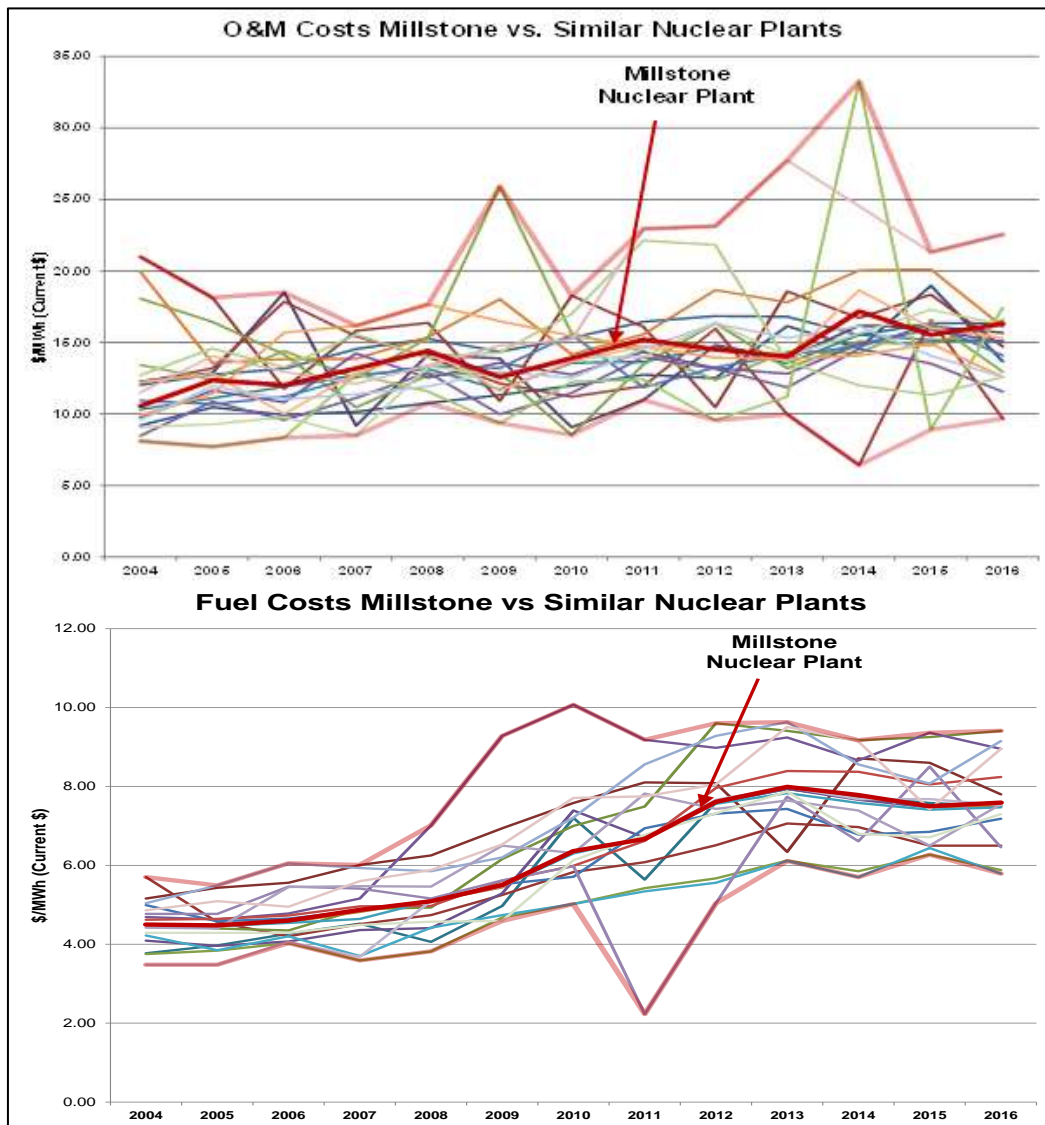


Source: Historical prices from Index Mundi,
<http://www.indexmundi.com/commodities/?commodity=uranium&months=300>
Futures from CME Group, <http://www.cmegroup.com/trading/metals/other/uranium.html>

A comparison of Millstone production costs to other similar units (e.g., PWR reactors with commercial operating dates of 1975-1987) for when FERC Form-1 information was submitted indicates that Millstone's costs were close to average for the industry. This is consistent with the modeled costs for Millstone (Figure B.3), which appear squarely in the midst of operating costs for other PWR units.

Plant operating costs and safety issues are critical factors that can drive retirement of nuclear power plants. If Millstone's costs are significantly above average, however, subsidizing poor performance creates an unfair disadvantage in the market place and rewards inefficiency. Therefore, in order to evaluate Millstone's financial position, the analysis assumes the fuel and non-fuel operating costs as modeled and reported by the NRC.

Figure B.3: Millstone Operating Costs Compared to Peers



Sources: Energyzt Advisors based on analysis of NRC data, which compiles FERC Form 1, EIA-412, RUS-12, EIA-906/923, and ABB Primary Research, Modeled costs by ABB Velocity Suite if information isn't provided directly. Based only on regulated entities.
<https://www.nrc.gov/reading-rm/doc-collections/datasets/>

Based on a sample of 22 nuclear plants (36 individual reactors) of similar design and age in the US (PWR, Commercial operating date - 1975 – 1987), estimated production costs for

Millstone generally follows general industry cost trends. Historic escalation at Millstone's estimated production costs has averaged around 3 percent per year. This escalation rate is assumed going forward.

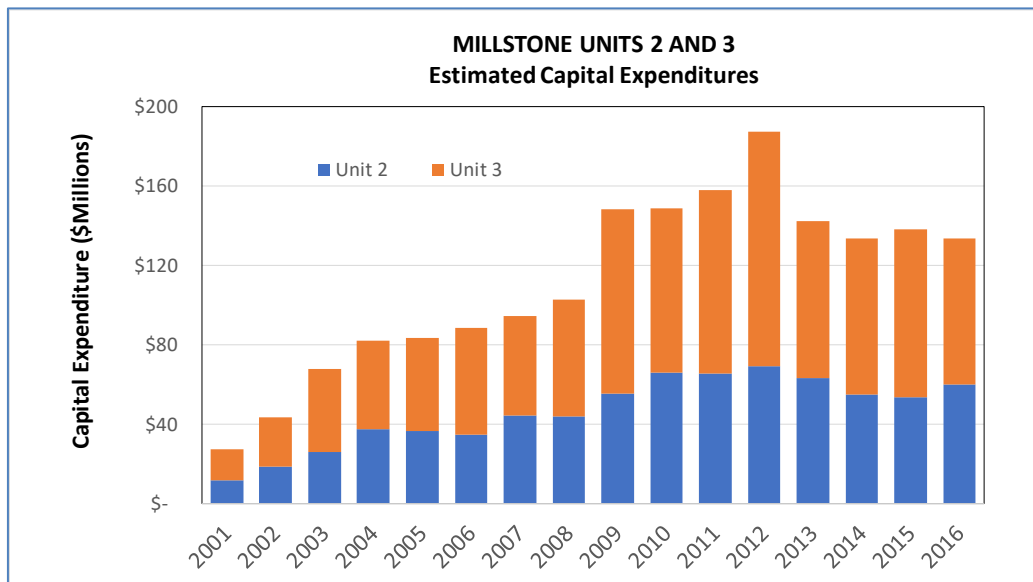
B.2 CAPITAL EXPENDITURES

Plant-specific capital expenditures are not available for Millstone directly. Instead, an estimate was derived based on industry averages for similarly situated nuclear power plants. Capital expenditures are assumed to reflect average costs in the industry.

There are two pools of comparable plants with aggregated information on capital expenditures: 1) PWRs; and 2) multi-unit facilities. Three-quarters of U.S. nuclear power plants had three operating units until 1998, of which one has shut down. Costs for these facilities tend to be lower than single unit plants as a result of cost-sharing and higher total output. To estimate Millstone's historical capital expenditures, this analysis uses the average of the annual capital expenditures for PWR plants (Figure B.6).

For purposes of the financial assessment, capital costs are incorporated into the cash flow statement as investment cash flows. However, capital expenditures generally are depreciated for income tax purposes. For purposes of depreciation, the analysis assumes a seven-year average depreciation rate of the total capital investment. Expenditures and undepreciated investment prior to Dominion's purchase in 2001 are assumed to have been claimed by the seller against the purchase price. Thus, depreciation starts with capital expenditures incurred starting in 2001.

Figure B.6: Estimated Capital Expenditures by Unit



Source: Energyzt analysis based on industry averages and data from Nuclear Energy Institute (NEI);
Report: *Nuclear Costs in Context*, April 2016; Energyzt Advisors analysis

When the values are run through the analysis, it is clear that the methodology used to estimate capital expenditures is **conservative**. Kevin Hennessy testified on behalf of Dominion that they have invested an additional \$1.2 billion in capital since purchasing Millstone.³⁷

Dominion purchased the Millstone Power Station in 2001 for \$1.3 billion via a state-sanctioned auction. Since then, Dominion has invested more than \$1.2 billion in capital toward safety, environmental, efficiency and reliability upgrades.

Applying the methodology described above results in an estimated \$1.8 billion in capital expenditure, of which \$1.5 billion has been depreciated.

³⁷Hennessy, Kevin, Director of State Policy in New England, Dominion, "Testimony before the Connecticut General assembly's Energy & Technology Committee on Proposed Bill 106, *An Act Concerning Zero-Carbon Generation Facilities and Achieving Connecticut's Greenhouse Gas Emission Levels*," February 7, 2016, p.1.

B.3 PROPERTY TAXES

Power plants such as Millstone generally contribute to the local economy in the form of property taxes which can be equal to tens of millions of dollars. In order to estimate historical property taxes and project future taxes, taxes assessed for 2016 were obtained from the Assessor's Office in Watertown, Connecticut, where Millstone is located. The combination of personal taxes and real property taxes, allocated by unit and owner, is presented in Figure B.5.

Figure B.5: Millstone 2016 Property Taxes in Watertown, CT

Tax Component	Tax Payer	\$ Millions	Unit 1	Unit 2	Unit 3
Personal Property Taxes (Reactors and All Equipment)					
MP#1	Dominion Nuclear	\$ 0.09	\$ 0.09		
MP#2	Dominion Nuclear	\$ 8.12		\$ 8.12	
MP#3	Dominion Nuclear	\$ 7.15			\$ 7.15
Not Unit Specific	Dominion Nuclear	\$ 1.72		\$ 0.86	\$ 0.86
ISFSI	Dominion Nuclear	\$ 1.27		\$ 0.64	\$ 0.64
Not Unit Specific	Mass Municipal	\$ 0.37			\$ 0.37
Not Unit Specific	Green Mountain	\$ 0.12			\$ 0.12
Subtotal		\$ 18.84	\$ 0.09	\$ 9.62	\$ 9.14
Real Estate (Physical Land)					
MP#1	Dominion Nuclear	\$ 0.02	\$ 0.02		
MP#2	Dominion Nuclear	\$ 4.12		\$ 4.12	
MP#3	Dominion Nuclear	\$ 7.14			\$ 7.14
Not Unit Specific	Dominion Nuclear	\$ 2.25		\$ 1.13	\$ 1.13
Not Unit Specific	Mass Municipal	\$ 0.37			\$ 0.37
Not Unit Specific	Green Mountain	\$ 0.13			\$ 0.13
Subtotal		\$ 14.02	\$ 0.02	\$ 5.25	\$ 8.76
TOTAL		\$ 32.87	\$ 0.11	\$ 14.86	\$ 17.90

Source: Town of Waterford, CT, Assessors Office (3/1/2017),
<https://www.mytaxbill.org/inet/bill/home.do?town=waterford>

Property taxes for Unit 1 were ignored for purposes of this analysis, as Unit 1 is decommissioned and subject to post-closure cost requirements.

In order to estimate historical property taxes, the subtotal for personal and real estate was allocated to Unit 2 and Unit 3 for all owners in 2016. Prior years were estimated by deescalating the 2016 costs at an assumed inflation rate of 2 percent, and projected by escalating the 2016 value at a 2 percent escalation rate.

B.4 DEBT COSTS

In order to calculate free cash flows and after-tax income, it is crucial to estimate debt payments, including a break-out of interest and principal payments. Normally, debt would only be included if explicitly tied to the asset. However, Dominion does not appear to have financed the purchase of Millstone as a non-recourse financing secured by the cash flows of a single asset. Instead, Dominion appeared to have financed the purchase using balance sheet financing.

According to press releases at the time, Dominion purchased Millstone with cash. However, review of Dominion's SEC filings indicate that \$250 million of debt initially was issued specifically with the intention of purchasing the Millstone units at an interest rate of 8.4 percent.³⁸ Additional leverage was anticipated to be placed at the corporate level according to specific language in Dominion's financial statements at that time.

The other owners already had purchased the plant and financed it as part of the original purchase. Much of that debt already may have been paid down. To be conservative, an adjustment was made to the purchase price to reflect the total market value to the other owners, and the same level of debt under the same terms and conditions was applied to that portion of the ownership share of Millstone.

The higher the debt, the lower the cost of capital and higher the tax shields, thereby lowering taxes resulting in higher the after-tax cash flows and returns to equity. The analysis conservatively assumed a 50-50 debt-equity ratio, consistent with regulated utilities. This is conservative because at that time, Dominion had around 66 percent debt,

³⁸ Dominion Resources, Inc., SEC Filing Form 10-k for year ending December 31, 2001 and December 31, 2002.

or a 2:1 debt to equity ratio. The term of the loan was assumed to be 30 years.

The assumed 50-50 debt/equity split for a fixed payment, 30-year debt instrument and assumed interest rate of 8.4 percent, results in a very **conservative** assumption regarding debt levels, interest deductions, and cash flow to equity holders. In reality, Dominion and Millstone's other owners may have assumed a greater amount of debt associated with the Millstone purchase and a shorter term, which would front-load payments. Furthermore, the lower interest rate period following the 2009 recession may have allowed for refinancing at a lower rate, which would have decreased tax shields, but increased after-tax cash flows as a result of lower payments.

The underlying debt assumptions are presented in Figure B.6.

Figure B.6: Debt Assumptions

Purchase Date:	4/1/2001
Purchase Price:	\$ 1,300,000,000
Fuel Purchase:	\$ 105,000,000
Net Purchase Price:	\$ 1,195,000,000
Adjusted for Other Owners:	\$ 1,242,386,443
Debt Percentage:	50%
Loan:	\$ 621,193,222
Term:	30 Years
Annual Interest Rate:	8.40% Dominion Rate in 2001
Loan Fees:	1%
Depreciable Amount:	\$ 530,126,295 42.67%
Equity:	\$ 621,193,222

Source: Energyzt analysis

B.5 DEPRECIATION AND AMORTIZATION

The purchase price paid for equipment and land (i.e., personal and real property). Only the personal property can be depreciated; land is not depreciable for purposes of taxes.

The assumed base for purposes of depreciation was calculated using the ratio of personal property taxes to total property taxes in 2016, which is equal to 42.67 percent of the total purchase price, less pre-purchased fuel (i.e., \$530 million – see section B.4). A 30-year straight-line depreciation schedule was applied to this amount.³⁹ This combination of assumptions is **conservative** and underestimates the amount of depreciation incurred through December 2016. Per Dominion's 2016 Annual Report, Millstone has an accumulated depreciation of \$349 million for Unit 3,⁴⁰ whereas the analysis calculates \$280 million in accumulated total plant depreciation through 2016.

Depreciation assumptions for capital expenditures were described in Section B.2.

Loan fees were assumed to be 1 percent of the total loan, and were amortized in a straight-line over the 30-year period.

Although Dominion amortizes its long-term contractual commitments to purchase fuel costs, the financial assessment expenses fuel costs as incurred.

B.6 ESTIMATED RETURN ON EQUITY

Calculating the average return on equity is the equivalent of finding the internal rate of return. In other words, the discount rate that results in a zero-net present value of after-tax cash flows is the average rate of return on investment realized by equity investors.

In the case of Millstone, the estimated return on equity was calculated with the after-tax cash flows compared to the up-front purchase costs incurred by equity investors. Consistent with the leverage assumption, the equity portion of the asset purchase price was assumed to be 50 percent of the initial investment cost less the up-front fuel purchase of \$105 million, adjusted for partial ownership of Millstone Unit 3, or \$621.2 million.

The equity purchase price was assumed to be incurred on April 1, 2001. The up-front fuel

³⁹ Dominion's SEC Form 10-k for year ending December 31, 2016 indicates a straight-line depreciation schedule of 44 years. The difference is negligible (i.e., less than \$7 million per year) for purposes of the analysis.

⁴⁰ Dominion, SEC Form 10-k, 2016, p. 119.

purchase cost of \$105 million also was incurred at the time of purchase in 2001 as inventory, and added to the upfront costs. Lastly, debt financing fees that are amortized for purposes of income were included as an up-front cost.

The average annual rate of return is the discount rate that discounts future cash flows such that they exactly equal the up-front purchase price. Using a mid-year convention, the calculation indicates that Dominion earned more than a 25 percent return on equity.⁴¹

Is this consistent with market conditions? Yes. Natural gas and electricity prices in New England experienced a significant run-up between 2001 and 2008. Any infra-marginal price-taking asset, such as Millstone, would benefit. Indeed, the run-up was so significant that the initial investment was estimated to have been paid back within five years, and twice over by 2008.

B.7 ESTIMATED LEVELIZED COSTS FOR NEW GENERATION UNITS

Economic theory of competitive markets prices the long-run equilibrium at the long-run marginal cost of a new entrant. If prices are higher than this cost, new entry will occur. If lower, exit will occur, raising the price until new entry is economically supported. Although real-world markets are not perfect, the long-run marginal cost reflects an expectation regarding long-run average prices, and provides a high-level check regarding the potential profitability of an existing power plant in the long run.

In an energy-only market, expected energy prices will need to rise to at least the LCOE in order to encourage new entry. As enough new entrants enter into the market, the LCOE will decline. As with any capital-intensive industry, there will be boom and bust cycles. However, the LCOE represents a projected average around which those business cycles will revert.

In markets, such as New England, which have separate competitive capacity markets, a portion of the new entrant's costs will be hedged. The LCOE still provides a target for the long-run marginal cost, but will be covered by both capacity and energy revenues. To the

⁴¹ The actual calculation is around 31 percent, but is reported as above 25 percent to be conservative; anything over 25 percent is a stellar return on equity.

extent ancillary services supplies a significant portion of revenues, those also will be incorporated into the equation. Regardless of the source of revenues that will cover the LCOE of a new entrant, it provides a proxy for the anticipated revenues that an existing generating unit, such as Millstone, may receive over the long-term.

B.7.1 U.S. EIA Estimates of LCOE

The US Department of Energy's Energy Information Administration provides updates of estimated Levelized Costs of Electricity (LCOE) by technology as part of its Annual Energy Outlook report each year. The LCOE represents the cost of new entry and therefore, under economic theory, the long-run marginal cost of electricity. In its 2016 Annual Energy Outlook, the U.S. EIA provided LCOE estimates for a number of different technologies (Figure B.7).

Figure B.7: U.S. EIA Estimated Levelized Costs of New Entry with In-service Date 2022

U.S. Capacity-Weighted ² Average LCOE (2015 \$/MWh) for Plants Entering Service in 2022								
Plant Type	Capacity Factor (%)	Levelized Capital Cost	Fixed O&M	Variable O&M (including fuel)	Transmission Investment	Total System LCOE	Levelized Tax Credit	Total LCOE including Tax Credit ²
Dispatchable Technologies								
Advanced Coal with CCS ²	N/B							
Natural Gas-fired								
Conventional Combined Cycle	87	12.8	1.4	41.2	1.0	56.4	N/A	56.4
Advanced Combined Cycle	87	15.4	1.3	38.1	1.1	55.8	N/A	55.8
Advanced CC with CCS	N/B							
Conventional Combustion Turbine	30	37.1	6.5	58.9	2.9	105.4	N/A	105.4
Advanced Combustion Turbine	30	25.9	2.5	61.9	3.3	93.6	N/A	93.6
Advanced Nuclear	90	75.0	12.4	11.3	1.0	99.7	N/A	99.7
Geothermal	91	27.8	13.1	0.0	1.4	42.3	-2.8	39.5
Biomass	N/B							
Non-Dispatchable Technologies								
Wind	42	43.3	12.5	0.0	2.7	58.5	-7.6	50.9
Wind – Offshore	N/B							
Solar PV ⁴	26	61.2	9.5	0.0	3.5	74.2	-15.9	58.2
Solar Thermal	N/B							
Hydroelectric ⁵	60	54.1	3.1	5.0	1.5	63.7	N/A	63.7

Source: U.S. EIA, 2016 Annual Energy Outlook, Table 1a.,
http://www.eia.gov/forecasts/aeo/pdf/electricity_generation.pdf

The levelized cost of an advanced Combined Cycle of \$55.8 / MWh (2015\$) equates to a price of \$64/MWh (\$2022) assuming a 2% inflation rate. Therefore, the long-run marginal cost of production according to the U.S. EIA is above \$60/MWh, which would generate significant profits for Millstone.

B.7.2 ISO-NE Estimates of CONE

Every three years, ISO-NE engages in an exercise to estimate the Cost of New Entry (CONE) in order to establish key parameters for the FCM. ISO-NE recently completed this analysis and submitted for approval by FERC.

Relying on the analysis performed by its consultants, ISO-NE presented its consultant's analysis of Gross CONE and Net CONE estimates for alternative technologies:

Figure B.8: Estimates of Gross CONE for Alternative Technologies

Reference Technology	Installed Capacity (MW)	Installed Cost (000\$)	Installed Cost (\$/kW)	ATWACC (%)	Fixed O&M (\$/kW-mo)	Gross CONE (\$/kW-mo)	Revenue Offsets (\$/kW-mo)	Net CONE (\$/kW-mo)
1x1 7HA.02 (CC)	533	\$598,958	\$1,124	8.1	\$5.01	\$15.62	\$5.62	\$ 10.00
1x0 7HA.02 (CT)	338	\$304,179	\$900	8.1	\$3.21	\$11.35	\$3.31	\$ 8.04
2x0 LM6000 PF+ (Aero)	94	\$198,363	\$2,110	8.1	\$6.96	\$25.98	\$3.63	\$ 22.35
1x0 LMS100PA (Advanced Aero)	103	\$174,644	\$1,696	8.1	\$5.75	\$21.03	\$3.67	\$ 17.36

Source: Concentric Report, p. 7.

Under this calculation, the capital costs of construction would require around \$15.62 / kW-month for a new Combined Cycle. Staying consistent with the Concentric analysis, construction costs for a new combined cycle unit can be converted into dollars per MWh assuming an 84% capacity factor for a cost of \$25/MWh to cover the construction costs alone. Conservatively ignoring O&M, and assuming a heat rate of 6,500 kWh/Btu, gas prices would have to be consistently below \$3/MMBtu in order for Millstone to be unable to cover its operating costs and debt of around \$45/MWh. As most long-term projections

assume natural gas prices will rise above this level, it is clear that Millstone will be profitable over the long-run.

In fact, the associated electricity price projection that supports its Net CONE analysis projects electricity prices to be close to \$50/MWh in 2021, not including a separate estimate of a required “missing money” of around \$5/kW-month required for new builds of advanced combined cycles to occur. All in, the fundamental energy market model underlying ISO-NE’s Net CONE analysis balances to a long-run marginal cost of production in 2022 close to \$58/MWh, projecting significant profits for Millstone in the long-run.

B.8 DECOMMISSIONING FEES

Decommissioning a nuclear power plant can be expensive and the industry requires nuclear power plant owners to maintain a reserve for that purpose. Estimated decommissioning costs are calculated and reserves are assessed against that value.

Dominion already has reserves in excess of estimated decommissioning costs (Figure B.9).

Figure B.9: Dominion Resources Nuclear Decommissioning Reserves

	NRC license expiration year	Most recent cost estimate (2016 dollars)(1)	Funds in trusts at December 31, 2016	2016 contributions to trusts
(dollars in millions)				
Surry				
Unit 1	2032	\$ 600	\$ 597	\$ 0.6
Unit 2	2033	620	588	0.6
North Anna				
Unit 1(2)	2038	513	475	0.4
Unit 2(2)	2040	525	446	0.3
Total (Virginia Power)		2,258	2,106	1.9
Millstone				
Unit 1(3)	N/A	373	474	—
Unit 2	2035	563	614	—
Unit 3(4)	2045	684	604	—
Kewaunee				
Unit 1(5)	N/A	467	686	—
Total (Dominion)		\$ 4,345	\$ 4,484	\$ 1.9

Source: Dominion SEC Form 10-k, 2016

As reported in Dominion's 2016 10-k,

Dominion believes that the amounts currently available in the decommissioning trusts and their expected earnings will be sufficient to cover expected decommissioning costs for the Millstone and Kewaunee units. Dominion will continue to monitor these trusts to ensure they meet the NRC minimum financial assurance requirements, which may include, if needed, the use of parent company guarantees, surety bonding or other financial instruments recognized by the NRC.

Therefore, for purposes of this analysis, decommissioning fees outside of standard O&M and industry capital expenditures were not included as a deduction to projected cash flows.

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Underlying backup spreadsheets:

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- a4_net_cone_supporting_data_part_1_revision_2.xlsx

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