



Portfolio Emissions Evaluation



Wellesley Municipal Light Plant

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A. Executive Summary

The Wellesley Municipal Light Plant (“WMLP”) requested that Energy New England (“ENE”) compare its power supply greenhouse gas (“GHG”) emissions from 2007 to its actual portfolio from 2019 and its projected portfolios through 2025. For the first three calendar quarters of 2007, WMLP was served by an “All Requirements” contract with Constellation Energy. This provided all WMLP’s needs aside from its entitlement in hydropower from the New York Power Authority, which equates to 3-4% of WMLP’s annual energy needs. ENE began tracking WMLP’s settlement data in the fourth quarter of 2007 and assumed the Constellation contract provided a New England Power Pool (“NEPOOL”) average emission profile. We have also used average regional emissions for WMLP’s open position to the wholesale market.

ENE utilized WMLP’s annual Department of Public Utilities of Massachusetts report for retail sales data as well as WMLP’s GHG Reports for Renewable Energy Credits (“RECs”) for non-emitting megawatt-hour totals. Emission rates for each year can be found in ISO-NE final emission reports for each year.¹

ENE focused on ISO’s method of average system emission rates for the Carbon dioxide (“CO₂”) emissions. Given there are other components of GHG such as Methane (“CH₄”) and Nitrous oxide (“N₂O”), Environmental Protection Agency (“EPA”) states “CO₂ emissions represent more than 99 percent of the total CO₂-equivalent GHG emissions from all commercial, industrial, and electricity generation combustion sources CO₂ emission rates.”² In order to not double count the non-emitting generation, the method ENE chose was to show WMLP retiring 100% of their RECs and to increase the CO₂ rates by adding back in the renewable portion of WMLP’s portfolio to ISO New England’s generation supply.

ENE’s forecast not only shows WMLP increasing their renewable portfolio but also reducing energy consumption. From 2007 to 2019 the retail sales load data decreased 2.8%. The 2025 forecast is roughly 2.9% lower than the 2019 load. ENE assumed that WMLP’s sales would decrease due to energy efficiency and solar projects. The renewable increase is due to REC retirement. Below in Table 1 ENE

¹ https://www.iso-ne.com/static-assets/documents/genrtion_resrcs/reports/emission/

² https://www.epa.gov/sites/production/files/2016-03/documents/stationaryemissions_3_2016.pdf

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has made assumptions that WMLP will retire all the wind, hydro, and nuclear RECs for all future years. The large increase from 2017 to 2018 is the Canton Wind project beginning in 2018. In 2020, WMLP will retain Emissions Free Energy Certificates (EFECs) from Seabrook Nuclear project that are included in a Purchase Power Agreement. With the WMLP decision to increase its REC portfolio has resulted in a reduction of CO₂ within its power supply.

Table 1 WMLP Retail Sales and REC/Attribute Retention

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Sales (MWH)	246,127	242,810	236,468	243,556	239,564	243,044	247,319	243,491	245,029	238,855	234,746	253,077	239,284	233,169	232,353	232,339	232,274	233,058	232,373
SRECs													50	50	50	50	50	50	50
NYPA	10,880	11,434	9,303	8,518	8,671	9,281	8,996	9,727	10,601	10,854	11,335	10,448	11,577	9,491	9,470	9,455	9,443	9,481	9,450
Nuclear													-	59,149	68,274	82,933	86,264	69,931	69,730
Spruce MT					372	5,736	7,276	7,664	6,629	4,171	7,559	7,178	5,930	7,618	7,592	7,592	7,592	7,618	7,592
Saddleback MT								76	1,281	3,448	6,697	6,449	4,205	6,663	6,639	6,639	6,639	6,663	6,639
Canton MT											901	4,884	2,506	4,865	4,848	4,848	4,848	4,865	4,848
First Light RECs													4,266	8,509	8,491	8,482	8,475	-	-
Granite RECs													-	7,905	7,877	7,877	7,877	7,905	7,877
MILLER											6,753	6,773	4,486	6,961	3,544	-	-	-	-
Less Renewable	(10,880)	(11,434)	(9,303)	(8,518)	(9,043)	(15,017)	(16,272)	(17,467)	(18,511)	(18,473)	(33,245)	(35,731)	(33,020)	(111,210)	(116,784)	(127,875)	(131,187)	(106,512)	(106,186)

Shown below in Table 2 ENE compares CO₂ emissions for WMLP by assuming 100% REC retirement and NYPA reduction to 2007 emission volumes.

If WMLP retires 100% of all their wind, nuclear and hydro RECs from 2020 through 2025, the carbon percent decrease would be 37.6% for 2019 and 63.5% for 2025.

Table 2 WMLP’s carbon reduction from 2007 to 2019 and future

Annual System (NE)	2007	2019	2024	2025
Load	246,127	239,284	233,058	232,373
RECs and NYPA	10,880	33,570	106,512	106,186
Emission Emitting Load	235,247	205,713	126,545	126,187
Co2 Emission lb/MWH	906	646	622	617
CO2 Emission (tons)	106,567	66,445	39,356	38,929
Emission reduction from 2007		-37.6%	-63.1%	-63.5%

B. Emission Calculation

ENE chose to calculate WMLP’s emission rates using ISO-NE’s yearly ISO New England Electric Generator Air Emissions Report. Although the report is published on a two-year lag, the methodology used to create the emission rate most accurately reflects WMLP’s portfolio emission estimates. The ISO uses a total system emission rate calculation method. It is based on the emissions by all the ISO New England generators during a calendar years’ worth of production. Actual run time for on and off-peak generation at the emission rate is used for each month. The emission rate uses reported CO₂ from actual US EPA’s Clean Air Market Division (CAMD) database, the Clean Air Interstate Rule (CAIR) and the Regional Greenhouse Gas Initiative (RGGI); lastly for those units that information is not available ISO New England uses the system information from the annual emission rates from EPA’s eGRID. All units that are dispatched are included in the emission rate calculation. The calculation is:

$$\text{Annual System Emission Rate (lb/MWh)} = \frac{\text{Total Annual Emissions (lb) all generators}}{\text{Total Annual Energy (MWh) all generators}}$$

Using ISO data is important because not all generation is operational at the same or all of the time. The ISO tracks the air emissions from the NE system Grid while taking into consideration:

- Forced and scheduled maintenance outages
- Fuel and emission allowance costs
- Imports and exports to and from NE region
- System energy consumption
- Water availability, etc.

These considerations are significant factors that separate ISO New England emissions verses eGRID’s methods. EPA’s eGRID states “Emissions and emission rates in eGRID represent emissions and rates at the point(s) of generation . . . they do not take into account any power purchases, imports, or exports of electricity into a specific state or any other grouping of plants, and they do not account for any transmission and distribution losses between the points of generation and the points of consumption. Also, eGRID does not account for any pre-combustion emissions associated with the extraction,

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processing, and transportation of fuels and other materials used by the plants or any emissions associated with the construction of the plants.”³

Because “all electric generators dispatched by ISO New England are included in the emissions calculations.”⁴ ENE had to address the double counting of non-emitting generation and REC retention for WMLP’s analysis. ENE used WMLP’s hydro, solar and wind retired REC amounts as a percentage of ISO New England’s hydro and wind generation to calculate the adder used for the yearly CO₂ rate from 2007 to 2019.

Below in Table 3 is the calculation of the adder used for year 2019. WMLP’s non-emitting hydro, solar and wind generation is .24% of the ISO’s hydro, solar and wind total.

Table 3 2019 Generation and WMLP’s Percentage

ISO NE 2019 - Supply (GWh)	SUM YTD
COAL	442
NATURAL GAS	47,449
HYDRO	8,788
NUCLEAR	29,818
OIL	161
LANDFILL GAS	433
METHANE	44
REFUSE	3,027
SOLAR	1,659
STEAM	0
WIND	3,531
WOOD	2,476
OTHER	21
PRD	26
Total Supply (GWh)	97,875
Total Hydro, Solar & Wind (GWh)	13,978
WMLP Hydro, Solar & Wind (GWh)	33.020
WMLP % of Hydro, Solar & Wind	0.24%

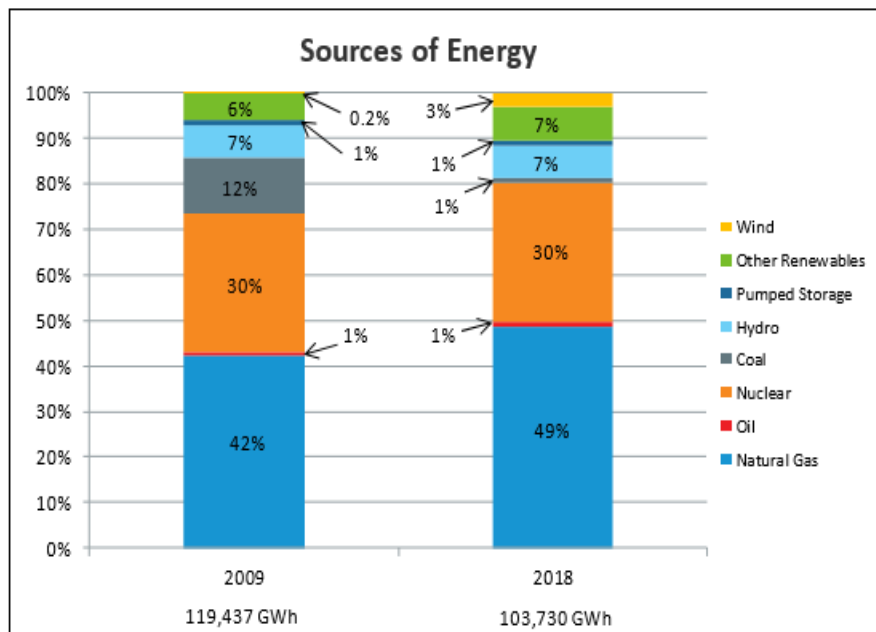
³ https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_technicalsupportdocument_v2.pdf

⁴ https://www.iso-ne.com/static-assets/documents/2019/04/2017_emissions_report.pdf

C. Portfolio and Trends

Figure 1 shows the fuel mix in the ISO New England control area in 2009 compared to 2018. Total generation is down by 13.15% from 2009 to 2018. We use 2018 as it is the most recent period for which the ISO regional emissions report is available. Coal has decreased the most over the period, dropping from 12% to 1%. Natural Gas has increased by 7% over this time span, this has resulted from a combination of tightening emission requirements, relatively higher operating and maintenance expenses of solid fuel and older thermal generating facilities. Market forces, namely low natural gas prices over the past several years have also contributed to the Natural Gas increase. The merchant generator boom that occurred in the late 1990's and early 2000's, resulted in the build out of thousands of megawatts of high efficiency, natural gas fired generating capacity. This moved natural gas to become the dominant marginal fuel in New England, where it now sets the marginal wholesale electricity price 60% of the time or more. This means that all generating technologies' fortunes are affected by the price and availability of natural gas.

Figure 1 Percentage energy generation by fuel type 2009 to 2018⁵



⁵ https://www.iso-ne.com/static-assets/documents/2020/05/2018_air_emissions_report.pdf

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Table 4 shows New England’s average yearly CO₂ emission rates. Following the build out of merchant, gas fired generating fleet, these rates continue to trend downward slightly as the underlying resource mix changes with less reliance on coal and oil generation. The adder for each year is the percent of WMLP’s non-emitting generation. These adjusted rates were used to determine WMLP’s supply emission profile for its open position and bilateral commodity energy contracts since these purchases are not tagged to a particular generator.

In the evaluation, ENE projected the emission rates for 2019 through 2025. By applying the average percent change from the past five years (2015-2019), which was a decrease of 2.0%. The adder used is forecasted beginning in 2020 through 2025, using the five-year average from 2015 through 2019. Beginning in 2020 WMLP’s nuclear percentage was included in the calculation. ENE used WMLP’s nuclear PPA estimate over the ISO’s 2019 nuclear generation for the nuclear percentage inclusion.

Table 4 Regional Annual CO₂ Emissions in lb/MWH

Annual System (NE)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
ISO CO ₂ Emission lb/MWH	905	890	828	829	780	719	730	726	747	710	682	658	645	638	632	626	619	613	607
Adder	0.17%	0.14%	0.11%	0.12%	0.10%	0.19%	0.18%	0.19%	0.21%	0.19%	0.28%	0.30%	0.24%	0.44%	0.67%	0.94%	1.24%	1.47%	1.71%
CO ₂ Emission lb/MWH with Adder	907	891	829	830	781	720	731	727	749	711	684	660	646	641	636	631	627	622	617

Figure 2 WMLP's CO₂ Emissions and Carbon Free Portfolio

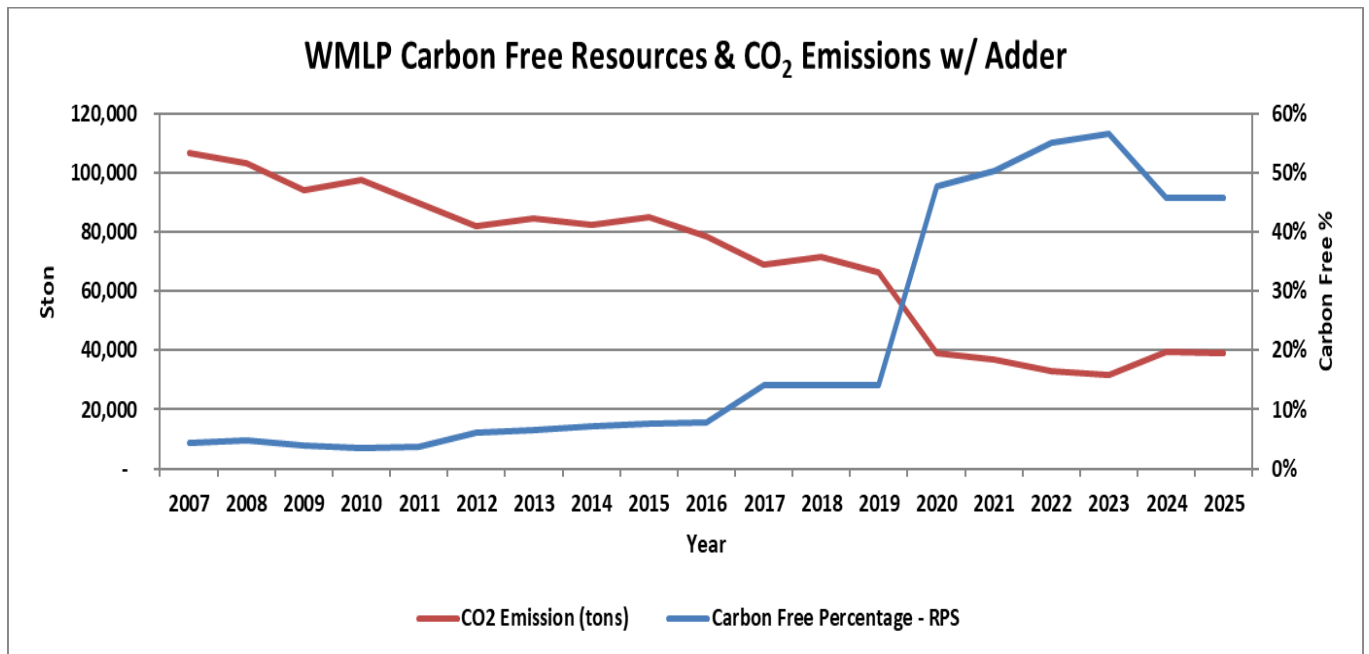


Figure 2 above shows WMLP’s portfolio GHG emissions of about 106,500 tons CO₂ in 2007, which dropped to around 66,445 in 2019. ENE’s projection for 2020 shows a little higher than 39,000 tons. WMLP increased their renewable portfolio by executing contracts with four wind projects, Spruce Mountain, Saddleback Ridge, Canton, and Granite Wind, and three run of river hydro units. These contracts include renewable attributes. Beginning in 2020 WMLP will receive nuclear attributes from an executed contract for Seabrook power. By retiring the attributes, the contribution of CO₂ has declined by 34.0% from 2007 to 2019.

Over the 2007-2019 period for which regional emissions information is available, average regional emissions dropped by 28.7%. Over the same period, WMLP’s portfolio carbon emissions dropped 37.6%. From 2019 through 2024 ENE decreased the yearly CO₂ rate by 2.0%. WMLP’s carbon is forecasted to decrease to 63.5% in 2025 as seen below in Figure 3. WMLP has increased the number of RECs retired from the wind, solar and hydro projects along with load reduction by energy efficiency projects, nuclear, and solar resources.

Figure 3 WMLP Portfolio CO2 changes vs. the New England grid

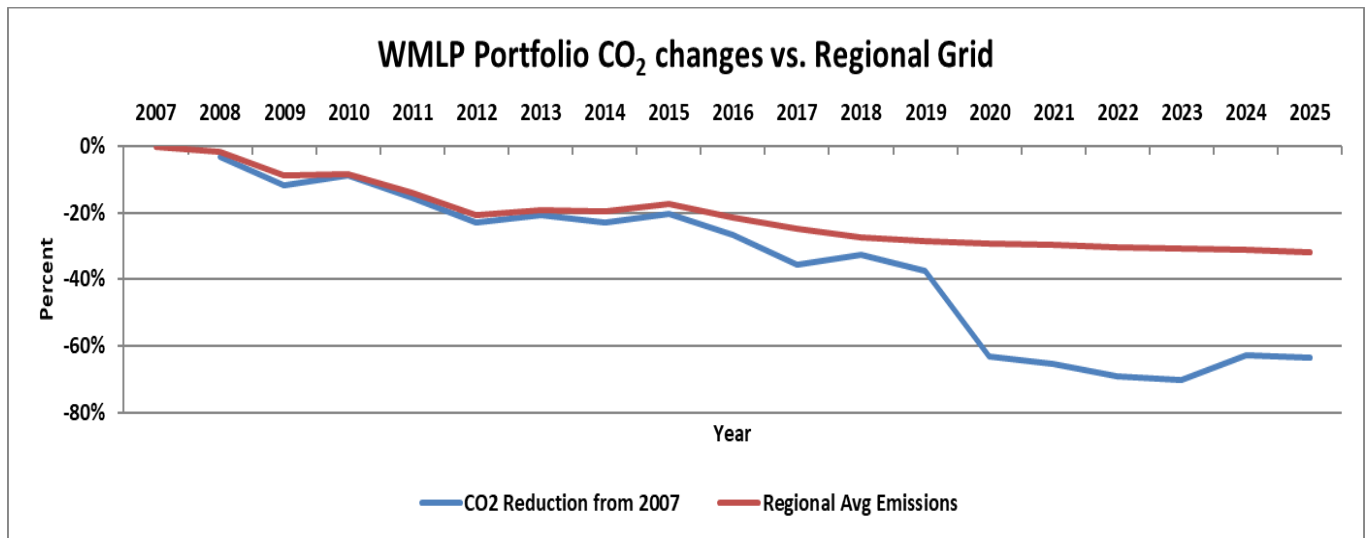
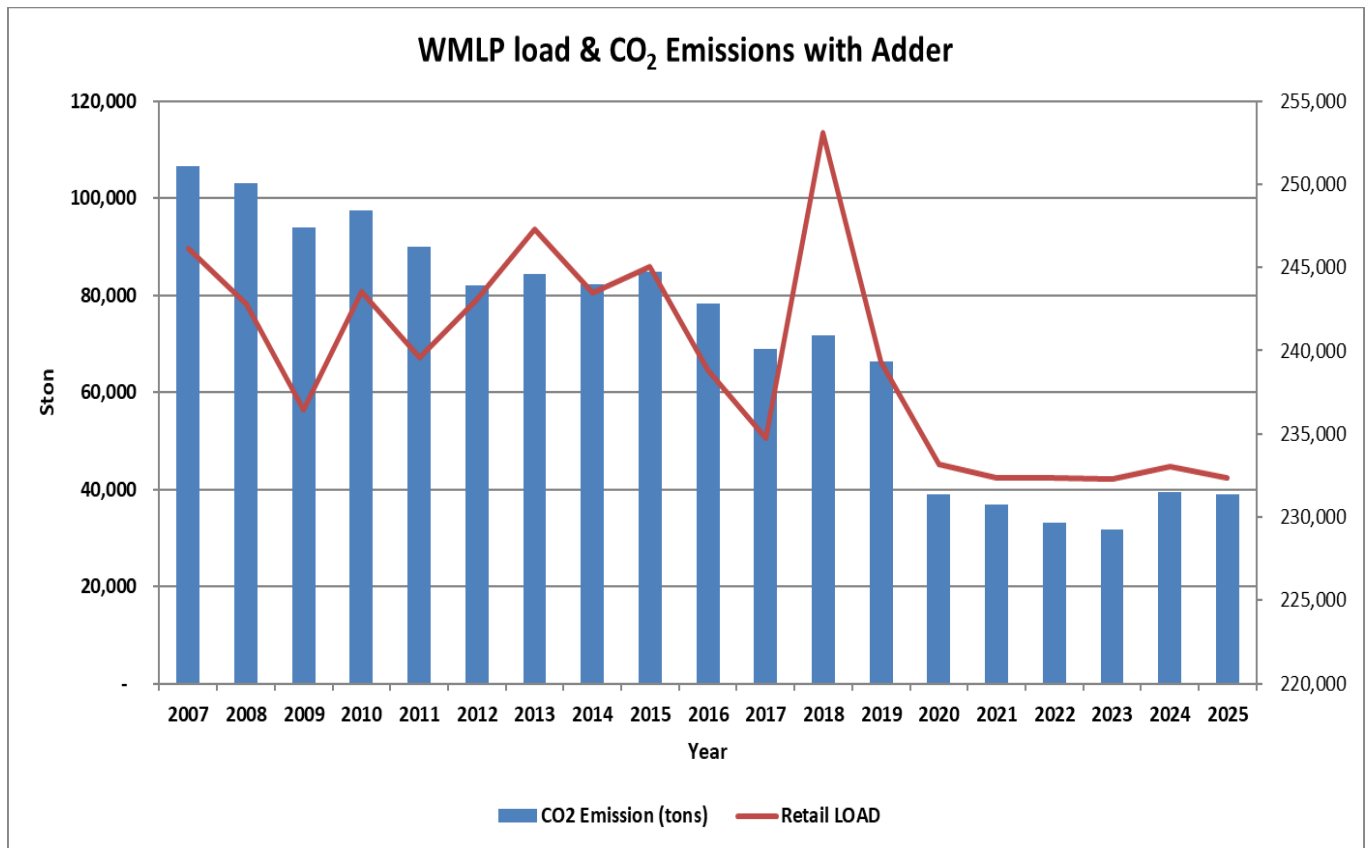


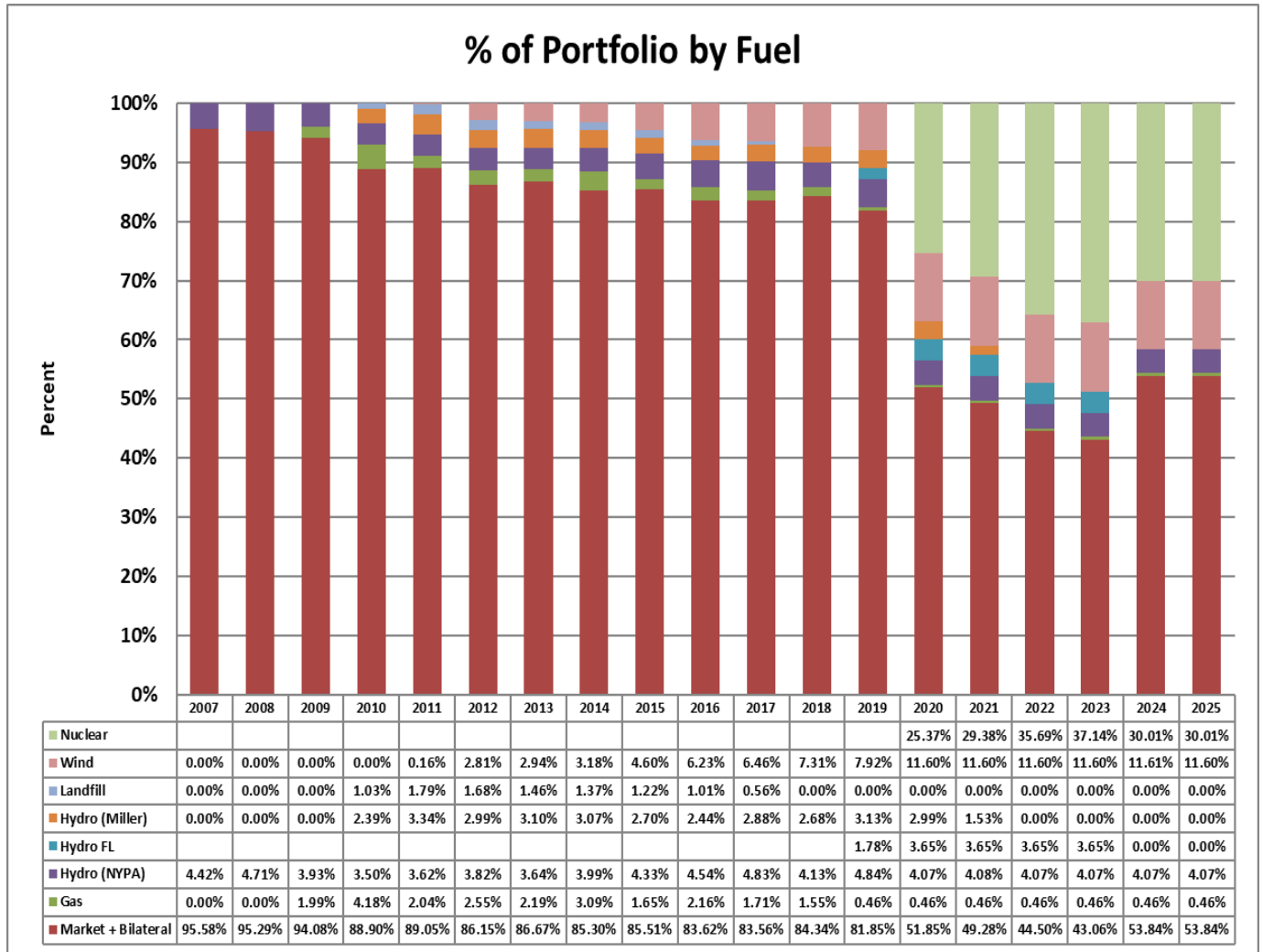
Figure 4 below represents WMLP’s forecast of carbon reduction against the 2007 levels. Here we can see the increase of renewable portion of the portfolio as well as the load forecast reduction due partly to solar installation and energy efficiency within WMLP’s system. The historical load fluctuations can be attributed to the increased retail sales from a large customer within the system. The forecasted sales do not include any estimate from this sporadic load.

Figure 4 WMLP’s Carbon Emissions and load data



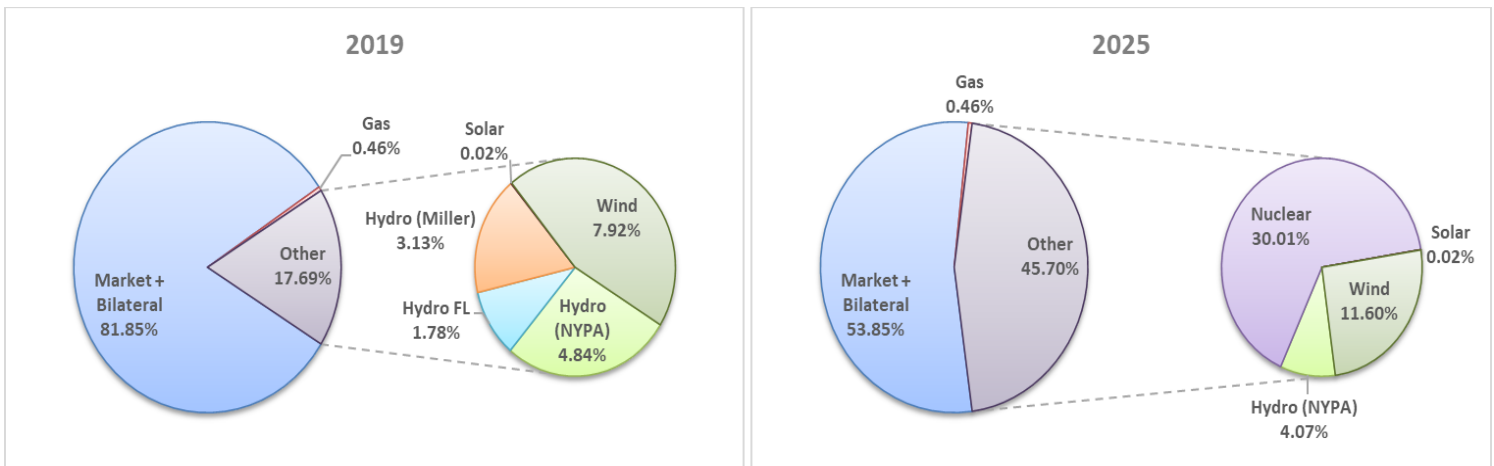
In Figure 5 below illustrate WMLP’s move to diversify its portfolio by adding more emission free energy resources to its mix. In the nineteen years shown, WMLP’s clean energy component has increased from around 4.4% to 45.7% of its portfolio.

Figure 5 WMLP Portfolio Resource Mix 2007-2025



WMLP’s current power supply portfolio is made up of several entitlements and contracts. This includes hydropower from the New York Power Authority (NYPA), run of river hydro, wind, solar, gas fired peaking resources and spot market purchases. The WMLP’s renewable portfolio in 2020 increases to 70.3% with the addition of Granite State Wind, and Nuclear. In Figure 6 below the emitting free load percentage grows from 17.69% in 2019 to 45.7% (forecasted) in 2025. The significant contribution will be made by the nuclear starting from year 2020, while the wind portion expands by 3%.

Figure 6 WMLP’s Carbon Free percentage for year 2019 and forecasted 2025



D. Summary

In the last 13 years WMLP has migrated from a virtually single source all-requirements supply arrangement to an actively managed portfolio. A little less than 18% of its supply is now directly sourced from carbon free resources, keeping pace or exceeding goals of the Commonwealth without a regulatory mandate to do so.

Going forward, WMLP will have the opportunity to continue to evaluate and pursue power resources that balance carbon intensity with cost and rate impact to its customers. This will include the potential to renew and extend its intermediate term purchase agreements for run of river hydro power and landfill gas energy. Other opportunities under review include base load contracting with existing carbon free resources at market prices. Further, WMLP is reviewing opportunities to add additional wind and offshore wind energy to its portfolio. Other alternatives include balancing contracts with large hydropower owners such as Brookfield Renewable Energy Marketing and First Light Power Resources, where hydro energy can be contracted to balance the intermittent nature of wind production. This balancing will enable WMLP to add even more renewable energy to its portfolio in a reasoned manner to avoid having too much energy under contract at times of high wind production and to avoid having higher spot market exposure (and associated higher carbon profile) when wind production is low. Last, while the new solar market program does not include municipal light plants like

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WMLP, discussions are ongoing with solar developers to evaluate contracting opportunities in a post solar-REC environment.

Future power supply purchases and possibility of a renewable energy credit program will affect WMLP's portfolio CO₂ profile. ENE will assist WMLP in evaluating future renewable generation and power resources to further reduce the carbon footprint of WMLP's supply portfolio.