Greenhouse Gas Emissions Report – October 2022

This document provides an overview of greenhouse gas emissions trends and future scenarios for Mercer Island. Findings below are based on an updated greenhouse gas (GHG) inventory and forecasting analysis completed by Cascadia Consulting Group as part of the development of the **2023 Mercer Island Climate Action Plan (CAP)**. This report uses emissions data through 2020.

Analysis Highlights & Target Scenarios

Analysis of Mercer Island's historic GHG emissions between revealed the following key insights:

- **The largest sources of communitywide GHG emissions in Mercer Island are typically on-road passenger vehicles (~30%), building electricity (~25%), building natural gas (~15%), and passenger air travel (~20%).** Other minor sources include freight vehicles, refrigerants, off-road equipment, solid waste disposal, and building fuel oil and propane.

- **Overall communitywide greenhouse gas (GHG) emissions have been generally increasing over time**, increasing 4% between 2018 and 2019 (Figure 3). The exception is 2020, which saw a 17% decline in community emissions compared to 2019, largely due to reduced travel during the COVID-19 pandemic.

- **Between 2017 and 2020, the City avoided a cumulative total of 5,296 MTCO$_2$e of electricity emissions** (i.e. 36% of total municipal emissions across these four years before deducting electricity emissions) due to Mercer Island's *Green Direct* power purchase agreement with Puget Sound Energy. Through the 20-year agreement, signed in 2016, the City purchases 100% renewable electricity to power municipal buildings. Because municipal emissions are a small portion (~1%) of annual community emissions, these savings are equivalent to 0.4% of total cumulative community emissions between 2017 and 2020.

- **Overall communitywide GHG emissions increased** 8% between the estimated 2007 baseline year and 2019, and are **projected to increase 41% by 2050** compared to 2007 levels under a business-as-usual (BAU) scenario.

We also analyzed the expected impact of external factors on Mercer Island's emissions to identify what local actions are needed to meet the shared King County-Cities Climate Collaboration (K4C) targets to achieve 50%, 75%, and 95% emissions reductions from a 2007 baseline by 2030, 2040, and 2050. This analysis revealed the following:

- We estimate that **existing federal, state, and regional climate policies will reduce GHG emissions** 84% by 2030, 80% by 2040, and 74% by 2050 compared to the forecasted emissions rates in each of these years (210,072; 287,786; and 336,499 MTCO2e, respectively).[1] After this legislation takes effect, Mercer Island will still need to reduce **39,129 $MTCO_2e$** (**16%** of forecasted emissions) in 2030, **72,859 $MTCO_2e$** (**20%** of forecasted emissions) in 2040, and **118,372 $MTCO_2e$** (**26%** of forecasted emissions) in 2050 to achieve the shared K4C targets.

- **To achieve these targets, additional action by industries, individuals, businesses, and governments will be needed**. Table 1 outlines one potential pathway for Mercer Island to achieve K4C targets.[2]

Table 1: Additional scenarios required within Mercer Island to achieve K4C GHG emission reduction targets.

Scenario	2030	2040	2050
Electrify new buildings (% fossil fuel use converted to elect.)	100%	100%	100%
Reduce energy use in existing buildings (% reduction in energy use)	25%	35%	45%
Electrify existing buildings (% fossil fuel use converted to elect.)	20%	50%	95%
Reduce overall vehicle miles traveled (% reduction in VMT)	20%	30%	50%

[1] This finding is based on an adjusted business-as-usual (ABAU) scenario, described in more detail below.
[2] There are additional scenarios that will also reach the targets and can be identified using the dynamic wedge analysis tool.

Scenario	2030	2040	2050
Electrify passenger vehicles (% new vehicles sold that are EV)	65%	100%	100%
Electrify freight/service vehicles (% new vehicles sold that are EV)	0%	0%	0%[3]
Decarbonize offroad equipment (% reduction in emissions)	25%	75%	95%
Decarbonize aviation fuels (% reduction in fuel carbon intensity)*	10%	40%	95%
Reduce air travel (% reduction in aviation fuel use)*	5%	10%	15%
Divert C&D materials (% of C&D waste diverted)	85%	85%	85%
Divert other recyclable and compostable materials (% reduction in waste to landfill)	5%	50%	95%

* Actions to achieve these targets will focus on regional collaboration with the airline industry, airports, and neighboring communities to promote sustainable aviation fuel and jet fuel efficiency.

Current & Historic Emissions Trends

The City of Mercer Island and Cascadia completed new community and municipal GHG emission inventories for 2017, 2018, 2019, and 2020. Because K4C targets are based on a 2007 baseline inventory, we back-cast[4] Mercer Island's community 2019 inventory to 2007 based on change in service population (i.e. residential population + employment) between those years.

[3] Freight/service vehicles are not anticipated to electrify at the same rate as passenger vehicles. In Mercer Island, the City has more capacity to support passenger vehicle electrification, so will focus resources on that sub-sector of electric vehicle adoption.
[4] The City has updated and enhanced its methodology for completing GHG inventories since the previous 2007 inventory was completed, so back-casting provides a more accurate comparison to the most recently completed inventories.

Current Emissions Profile

Figure 1 and Figure 2 below outline the breakdown of 2019[5] municipal and community emissions by sector.

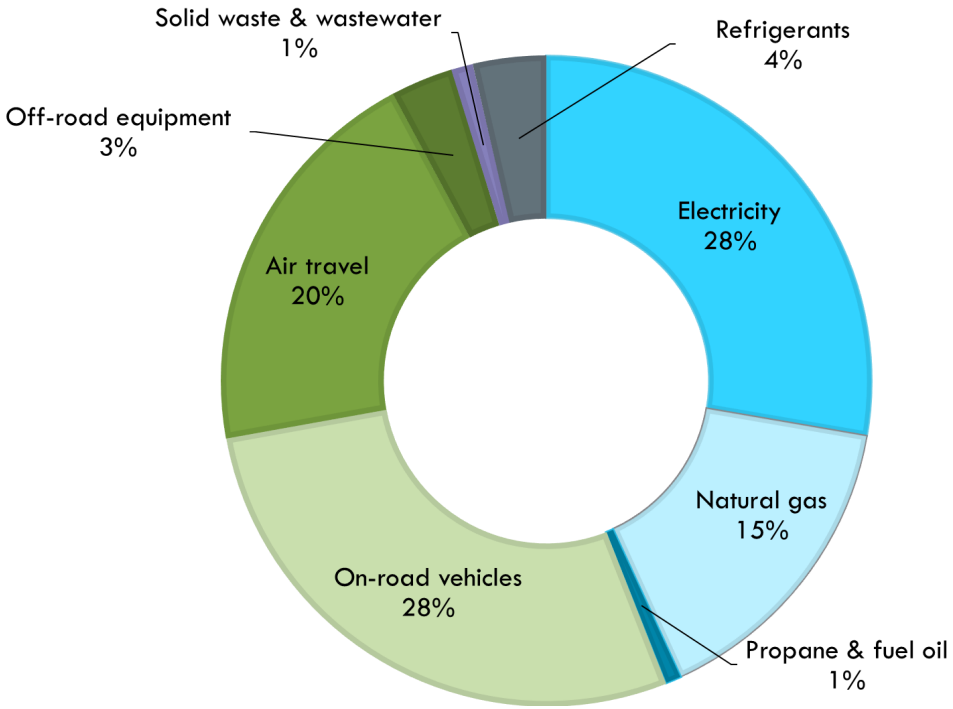


Figure 1: 2019 Community emissions (**358,777 MTCO$_2$e**) by sector

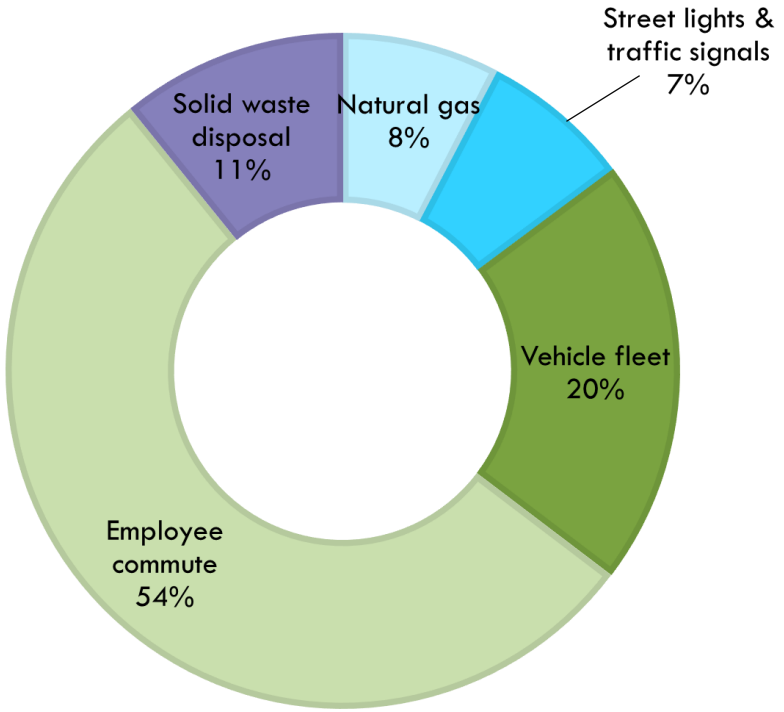


Figure 2: 2019 Municipal emissions (**2,463 MTCO$_2$e**) by sector

[5] We are using 2019 to analyze current emissions rates to account for the temporary impact from the COVID-19 pandemic on 2020 emissions.

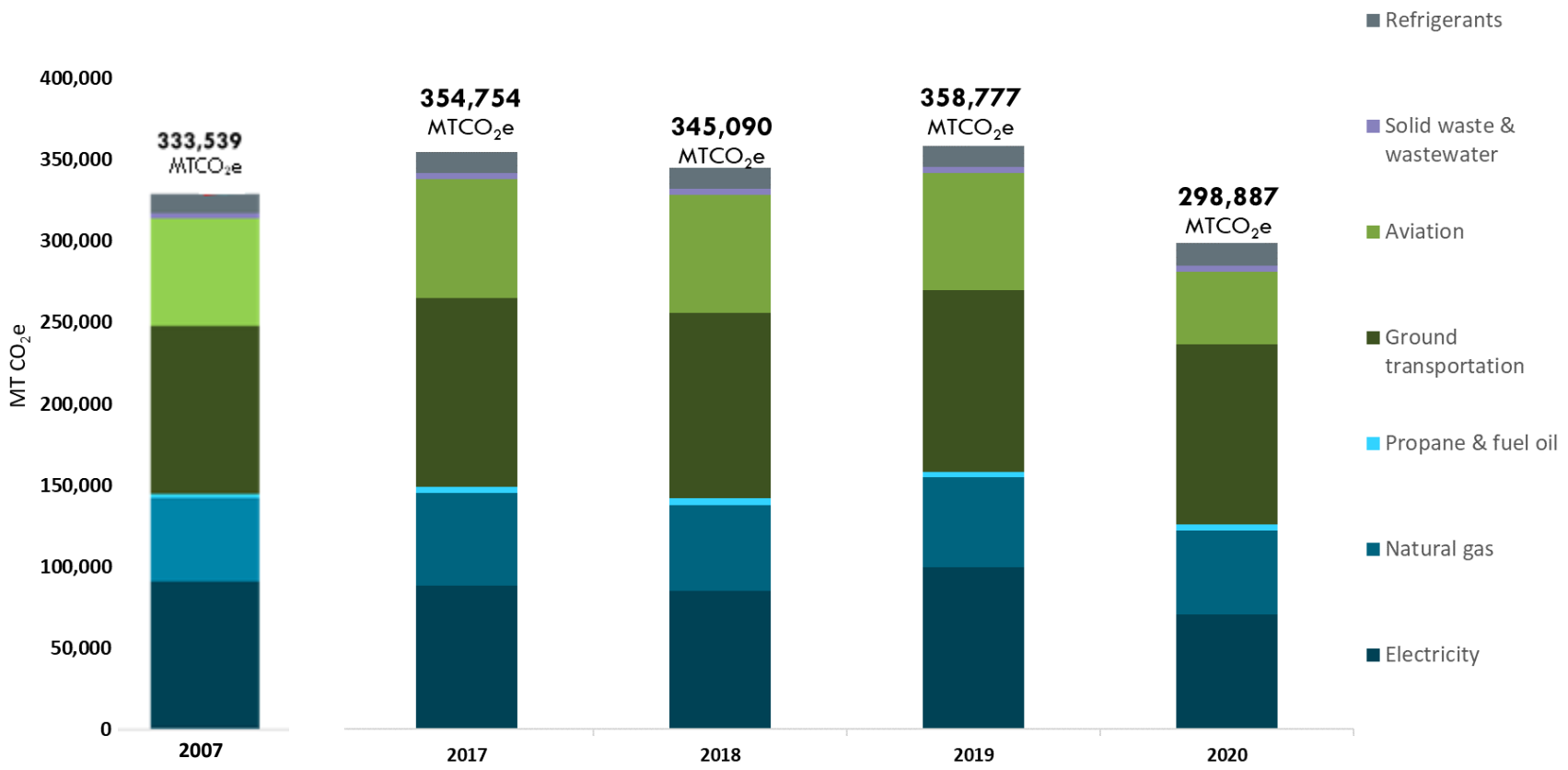
Our analysis of Mercer Island's current emissions profile revealed the following trends:

- **Community wide, transportation emissions have contributed the most to total emissions**—accounting for 51% of overall emissions in 2019.
    - The majority of these emissions come from on-road vehicles (28% of total emissions) and air travel (20%). Note: on-road vehicles includes bus transit, but this is <1% of transportation emissions.
- **Building energy use is the second largest emissions source** (44% of total 2019 emissions). Electricity represents the majority (63%) of these energy emissions and 28% of total emissions. The remaining energy emissions come from natural gas (35% of energy emissions and 15% of total emissions) and propane and fuel oil (2% of energy emissions and 1% of total emissions).
    - Residential electricity consumption is the largest source of building energy emissions, contributing to 39% of building energy emissions and 17% of total emissions. Residential natural gas consumption is the second largest source (28% of building energy emissions and 12% of total emissions).
    - Combined, commercial electricity and natural gas contribute 14% to total emissions and 32% of energy emissions. The remaining energy emissions come from industrial electricity and natural gas, and propane and fuel oil.
- After accounting for the emissions reduced through the PSE Green Direct agreement, **employee commute is the single largest emissions source for municipal operations** (54%), followed by the municipal vehicle fleet (21%). The remaining emissions come from natural gas consumption, disposal of solid waste and compost generated at municipal facilities, and street lights and traffic signals.
    - Through the PSE Green Direct power purchase agreement, the City purchases 100% carbon-free wind power from the Skookumchuck windfarm in Centralia, Washington to cover all the electricity used for City operations (2,706,339 kWh in 2019). Purchasing this renewable energy **decreased 2019 emissions by 38%**; without the agreement, electricity emissions would have been the City's single largest emissions source.

Historic Emissions Trends

We also analyzed Mercer Island's emissions rates between 2007 and 2019 to understand how emissions have trended over time. Figure 3 below highlights how community emissions have changed since 2007.

Figure 3: Historic communitywide emissions trends (*Note*: 2020 declines are due to COVID-19 pandemic)



Our analysis of Mercer Island's history emissions trends revealed the following:

- **Relative emissions have not varied significantly across sectors** since 2007.
    - The contribution to total emissions from the largest emissions sources—on-road vehicles, electricity, air travel, and natural gas—have all remained steady at ~30%, ~25%, ~20%, and ~15%, respectively.
- Between 2007 and 2019, **total community emissions increased** 8%.
    - During the same period, the Mercer Island population also grew 10%; per capita emissions decreased 2%.
- **GHG emissions declined by 17% between 2019 and 2020**. The largest reduction came from air travel emissions, which declined by 38% due to COVID-19 travel restrictions. Electricity emissions also dropped between 2019 and 2020, due primarily to a 25% reduction in the carbon intensity of electricity provided by Puget Sound Energy (driven by an increase in the amount of renewable energy sourced by the utility).
    - Compared to the 2007 baseline, 2020 emissions decreased by 10%.
- **Between 2017 and 2019 municipal emissions remained steady** at around 2,500 $MTCO_2e$.
- **Municipal emissions declined 32% between 2019 and 2020** due primarily to the reduction in employee commute emissions (-55%) and building energy emissions (-40%) from the closure of municipal facilities and a shift toward remote work during the pandemic.

Table 2: Summary of Mercer Island historic emissions and key demographic data

	2007	2017	2018	2019	2020
Community emissions ($MTCO_2e$)	333,539	354,754	345,090	358,777	298,887
Population (residents)	22,271	24,210	24,270	24,470	25,748
Per capita emissions ($MTCO_2e$)	15	14.7	14.2	14.7	11.6
Municipal-only emissions ($MTCO_2e$)	N/A[6]	2,608	2,594	2,463	1,675

[6] 2007 municipal emissions not included in analysis. 2007 back-casting focused on total community emissions, which **includes** municipal emissions.

	2007	2017	2018	2019	2020
Number of employees	N/A	223	262	248	223 (pre-Covid)
Per employee emissions ($MTCO_2e$)	N/A	11.7	9.9	9.9	7.5

Future Emissions Projections & Scenarios

To identify the sector-specific targets and scenarios needed to meet Mercer Island's overall GHG reduction target (see Table 1), we forecasted Mercer Island's community emissions through 2050 based on a BAU ("Business-as-Usual") and ABAU ("Adjusted-Business-as-Usual") scenario.

- The **BAU forecast estimated emissions through 2050** based on Mercer Island's 2019 GHG emissions profile, assuming no climate action (programs, policies, standards) at the local, state, or federal level.
    - The BAU forecast uses projected changes in community demographics (see Table 3) to approximate growth in emissions generating activities and associated GHG emissions. As Mercer Island's population continues to grow and there are more jobs in the community, energy usage, vehicle miles traveled, waste generated, and other sectors that produce GHG emissions will likely continue to increase.
- The **ABAU forecast adjusts the BAU forecast** to take into account the impacts of adopted federal and state policies (still assuming no climate action at the local level). The policies that were modeled in the ABAU forecast are outlined in Table 4 below.

We then built upon these forecasts to identify the additional reduction targets and scenarios for achieving Mercer Island/K4C targets of a 50%, 75%, and 95% reduction in GHG emissions by 2030, 2040, and 2050 compared to estimated 2007 baseline levels.

This complete forecast is depicted in Figure 4: this **wedge analysis** which shows (1) how emissions will change assuming no action is taken, (2) the impact of external policies and initiatives, and (3) the impact of achieving the additional sector-specific 2030, 2040, and 2050 emission reduction targets outlined in Table 1. Figure 5 shows these forecasted emissions by emissions sector.

Figure 4: Wedge Analysis - Forecasted business-as-usual emissions and reductions achieved under additional scenarios specified in Table 1

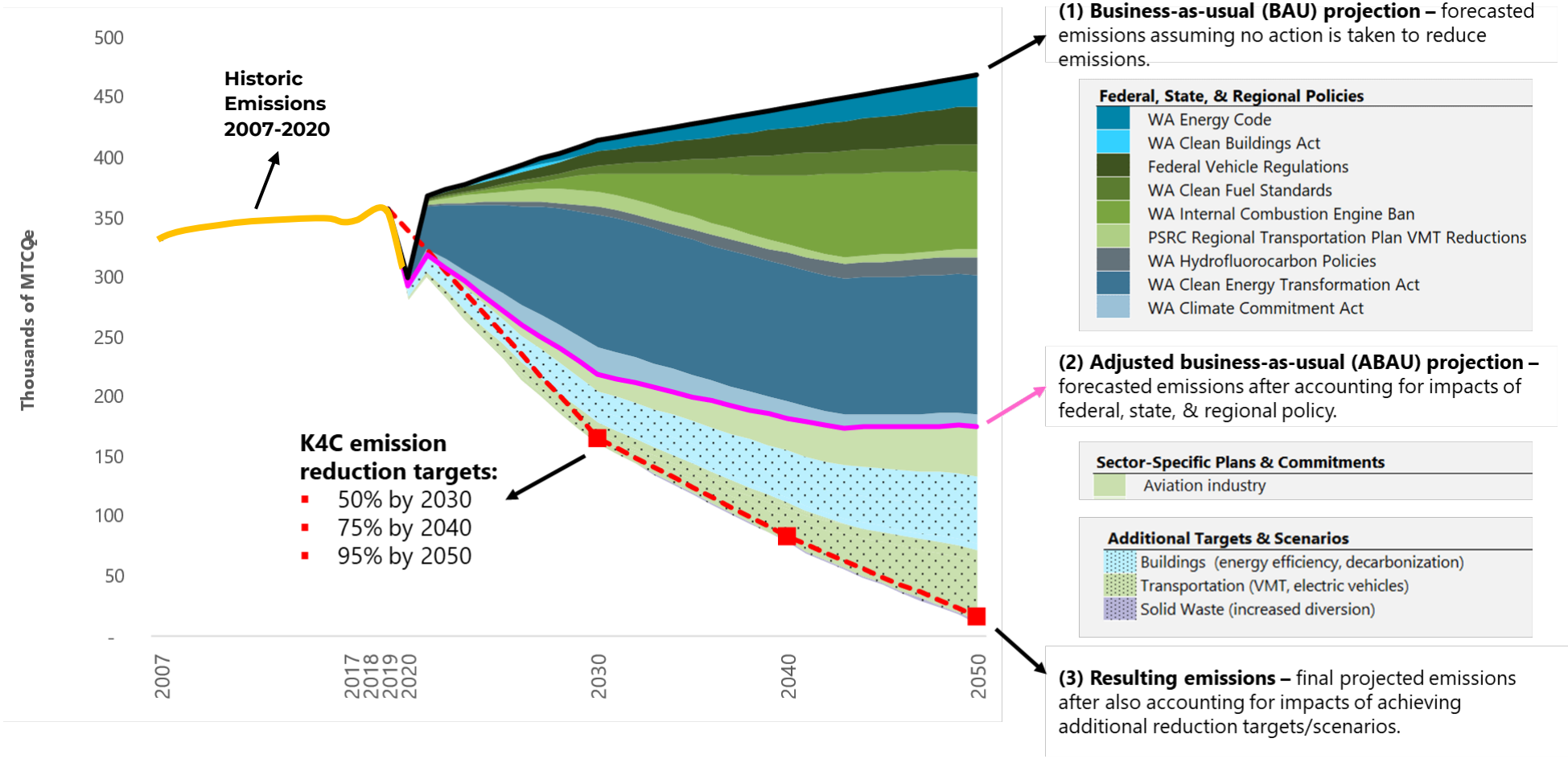
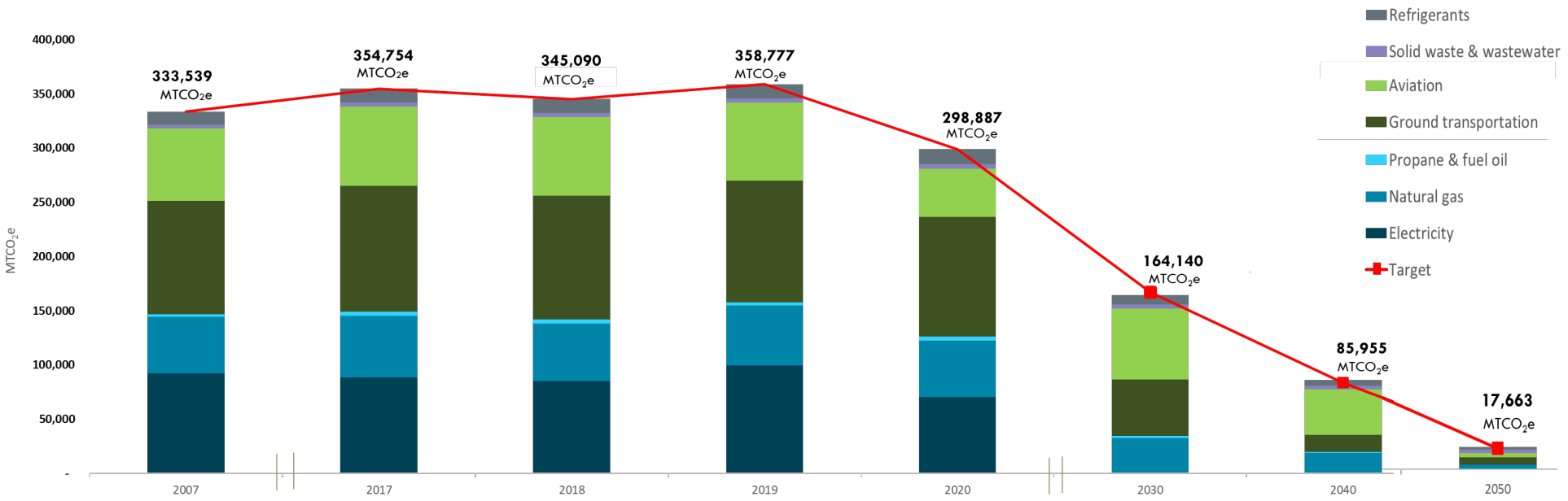


Figure 5: Historic communitywide GHG emissions in Mercer Island through 2020. Projected reductions depicted for 2030, 2040, 2050 are achieved under additional scenarios specified in Table 1



- Without federal, state, or local climate action, Mercer Island's **emissions are expected to increase** by 41% (~138,000 $MTCO_2e$) by 2050, compared to the 2007 baseline.
    - 2019 emissions rates are expected to increase 31% (~112,700 $MTCO_2e$) by 2050.
- **State and federal policies are expected to decrease baseline emissions** by 47% and projected 2050 emissions by 37%.
    - The Washington Clean Energy Transformation Act (described in Table 4 below) is expected to have the largest impact, reducing projected 2050 emissions by **25%** (~116,000 $MTCO_2e$).

- Of the scenarios outlined in Table 1, **decarbonizing aviation fuels is projected to have the largest single impact**. A 95% reduction in the carbon intensity of aviation fuel by 2050 would lead to a 10% reduction in projected 2050 BAU emissions. This scenario is tied primarily to regional collaboration to promote sustainable aviation fuel and aviation fuel efficiency measures.
    - Reducing energy use in existing buildings and electrifying existing buildings will have the second largest impact among identified scenarios. Achieving both scenarios—a 45% reduction in building energy use and 95% electrification rate by 2050—would reduce projected 2050 BAU emissions by 6%. These scenarios would be achieved through local climate actions.

Table 3*:* Projected changes in community demographics used to model future emissions absent of external factors

	2019	2030	2040	2050
Population (the number of people who live in Mercer Island)	24,470	27,060	28,930	30,750
% Change from 2019	N/A	+11%	+18%	+26%
Employment (the number of people who work in Mercer Island)	6,834	8,970	9,540	10,110
% Change from 2019	N/A	+31%	+40%	+48%
Service population (the number of people who live and/or work in Mercer Island)	31,304	36,030	38,470	40,860
% Change from 2019	N/A	+15%	+23%	+31%
Data provided by the Puget Sound Regional Council				

Table 4: Details on the federal and state policies and sector-specific strategic plans integrated into Mercer Island forecast (as of October 2022)

Policy/ Plan	Details
WA Energy Code (SB 5854)	• Requires residential and nonresidential construction permitted under the 2031 state energy code to achieve a 70% reduction in annual net energy consumption (compared to a 2006 baseline).
Clean Energy Transformation Act (CETA)	• Requires all electric utilities to eliminate coal-fired electricity from their state portfolios by 2025 and become GHG neutral by 2030.
WA Clean Buildings Act (HB 1257)	• Requires all new and existing commercial buildings over 50,000 square feet to reduce their energy use intensity by 15%, compared to the 2009-2018 average.
Corporate Average Fuel Economy (CAFE) standards	• Establish average fuel economy levels for manufacturers and sets related GHG standards. • Passenger Cars and Light Trucks require an industry-wide fleet average of approximately 49 mpg for passenger cars and light trucks in model year 2026, increasing fuel efficiency 8% annually for model years 2024-2025 and 10% annually for model year 2026. This also will also increase the estimated fleetwide average by nearly 10 miles per gallon for model year 2026, relative to model year 2021.
WA Clean Fuel Standard (HB 1091)	• Requires a 20% reduction in the carbon intensity of transportation fuels by 2038, compared to a 2017 baseline level.
WA Internal Combustion Engine Ban (SB 5974)	• Establishes a goal that, "all publicly owned and privately owned passenger and light duty vehicles of model year 2030 or later that are sold, purchased, or registered in Washington state be electric vehicles". This goal aligns with a separate bill (SB 5811) that allowed the WA Dept of Ecology to adopt California's vehicle emissions standards, which include low-emissions vehicle (LEV) and zero emissions vehicle (ZEV) standards. Those standards require that by 2035 all new passenger cars, trucks and SUVs sold in California will be zero emissions.

Policy/ Plan	Details
PSRC Regional Transportation Plan VMT Reductions	• A long-term transportation plan for the central Puget Sound region that is designed to implement the region's growth plan, VISION 2050, outlining investments the region is making in transit, rail, ferry, streets and highways, freight, bicycle and pedestrian facilities, and other systems.
HFC Superpollutants Acts (HB 1112 & HB 1050)	• Requires that new equipment be manufactured without HFCs or using refrigerants with a lower global warming potential (GWP) in a phased approach through 2024.
WA Climate Commitment Act (E2SSB 5126)	• Also known as “Cap and Invest” - places an economy-wide cap on carbon to meet state GHG reduction targets and remain consistent with best available science, while minimizing the use of offsets to meet those targets. • Every polluting facility covered under the program needs to hold one allowance for every ton of greenhouse gas that it emits.
Air Transport Action Group (ATAG) 2050 Plan	• Outlines a framework for reducing fuel use and the carbon intensity of air fuel. • ATAG is made up of representatives of the world’s major aviation industry associations and largest aircraft and engine makers. In 2021, ATAG committed to a goal of net zero by 2050 for global civil aviation operations. This will be supported by accelerated efficiency measures, energy transition and innovation across the aviation sector and in partnership with Governments around the world.

Considerations & Next Steps

Through this analysis of Mercer Island’s current emissions profile and forecasted future emissions **we identified specific emissions reduction targets and other associated key performance indicators (KPIs) that the city must meet** to reach its shared K4C commitment of reducing 2007 emissions by 95%. These targets, in turn, informed the specific focus area targets of the Mercer Island CAP as well as the climate actions to achieve these milestones.