Mercer Island Climate Action Plan

October, 2022

Greenhouse Gas Emissions Trends

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 Mercer Island Climate Action Plan (CAP).

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** (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 (209,634; 287,189; and 335,866 MTCO2e, respectively).[1] After this legislation takes effect, Mercer Island will still need to reduce **38,457 MTCO$_2$e** (**16%** of forecasted emissions) in 2030, **71,843 MTCO$_2$e** (**20%** of forecasted emissions) in 2040, and **116,968 MTCO$_2$e** (**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%

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[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 existing buildings (% fossil fuel use converted to elect.)	20%	50%	95%
Reduce overall vehicle miles traveled (% reduction in VMT)	1%	2%	5%
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%
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[3] Mercer Island's community 2019 inventory to 2007 based on change in service population (residential population + employment) between those years.

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[3] The City has updated 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[4] municipal and community emissions by sector.

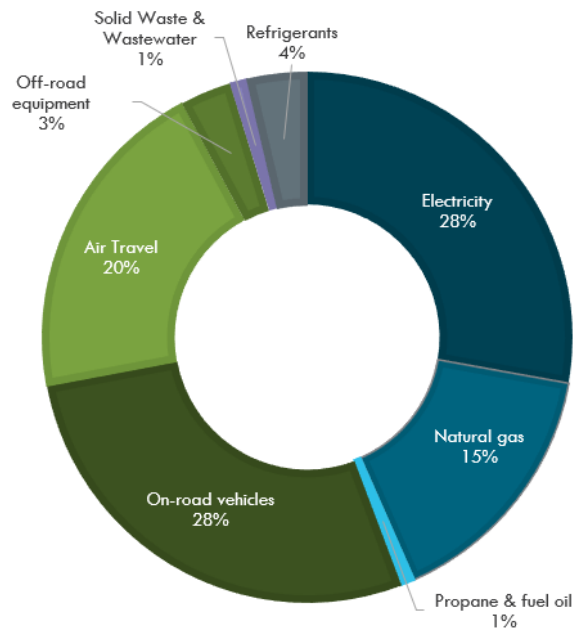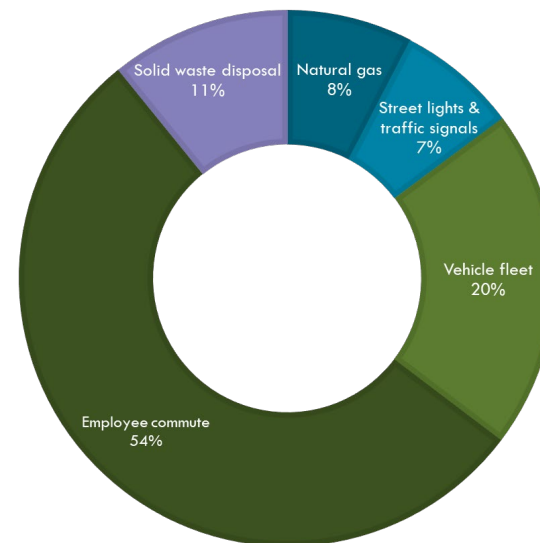**Figure 1**: 2019 Community emissions by sector   **Figure 2**: 2019 Municipal emissions by sector

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[4] We are using 2019 to analyze current emissions rates to account for the temporary impact from the COVID-19 pandemic on 2020 emissions.
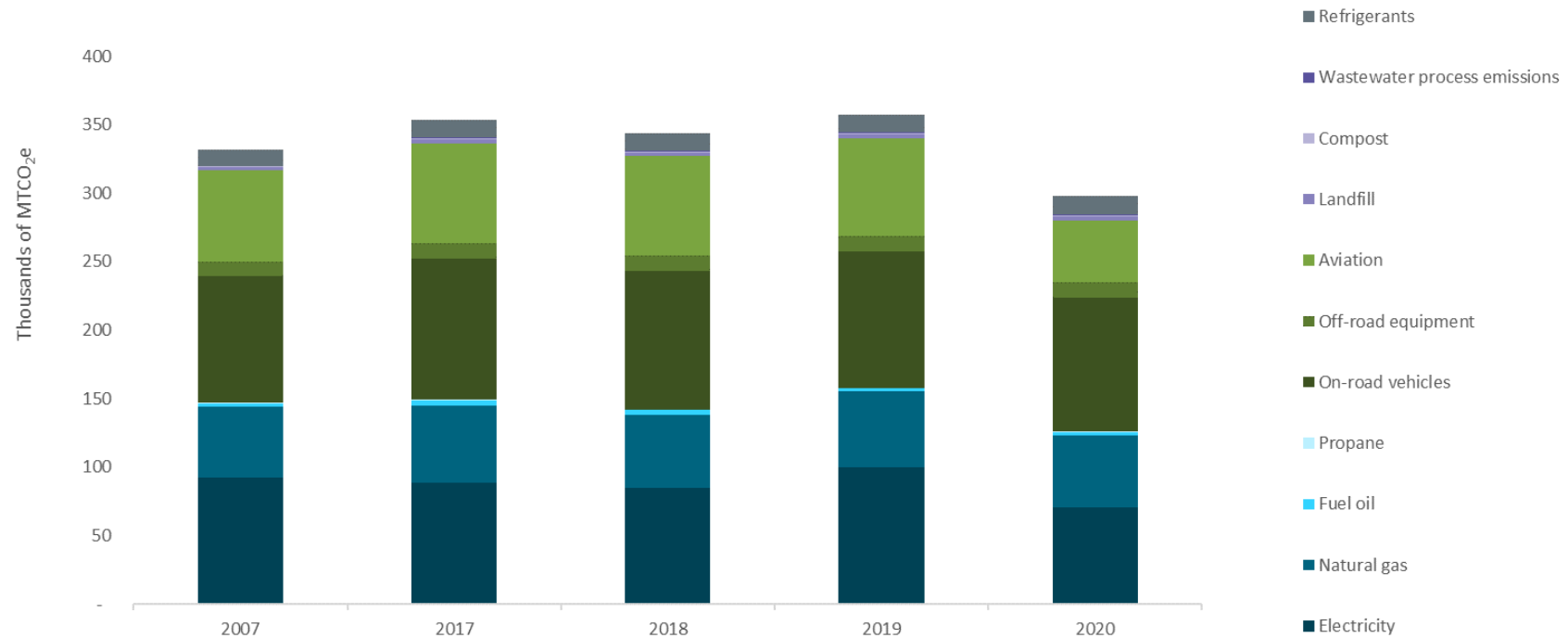
Our analysis of Mercer Island's current emissions profile revealed the following trends:

- 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 and air travel, which accounted for 28% and 20% of total emissions, respectively.

- **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 16% 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 rated 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 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 by 10%; per capita emissions decreased by 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.
    - 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 outlines annual emissions totals since 2007, along with key community demographic data.

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

	2007	2017	2018	2019	2020
Community emissions ($MTCO_2e$)	332,035	353,172	343,389	357,157	297,937
Population (residents)	22,271	24,992	24,270	24,470	24,705
Per capita emissions ($MTCO_2e$)	14.9	14.1	14.1	14.6	12.1
Municipal emissions ($MTCO_2e$)	N/A[5]	2,608	2,594	2,463	1,675
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

[5] 2007 municipal emissions not included in analysis. 2007 back-casting focused on total community emissions, which includes municipal emissions.

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 and ABAU scenario.

o 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.

o The BAU forecast uses projected changes in community demographics (see Table 3) to approximate growth in emissions generating activities and associated GHG emissions over time. 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, 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: Forecasted business-as-usual emissions and reductions achieved under additional scenarios specified in Table 1

(1) Business-as-usual (BAU) projection – forecasted emissions assuming no action is taken to reduce emissions.

Federal, State, & Regional Policies
- WA Energy Code
- WA Clean Buildings Act
- Federal Vehicle Regulations
- WA Clean Fuel Standards
- WA Internal Combustion Engine Ban
- PSRC Regional Transportation Plan VMT Reductions
- WA Hydrofluorocarbon Policies
- WA Clean Energy Transformation Act
- WA Climate Commitment Act

(2) Adjusted business-as-usual (ABAU) projection – forecasted emissions after accounting for impacts of federal, state, & regional policy.

Sector-Specific Plans & Commitments
- Aviation industry

Additional Targets & Scenarios
- Buildings (energy efficiency, decarbonization)
- Transportation (VMT, electric vehicles)
- Solid Waste (increased diversion)

(3) Resulting emissions – final projected emissions after also accounting for impacts of achieving additional reduction targets/scenarios.

K4C emission reduction targets:
- 50% by 2030
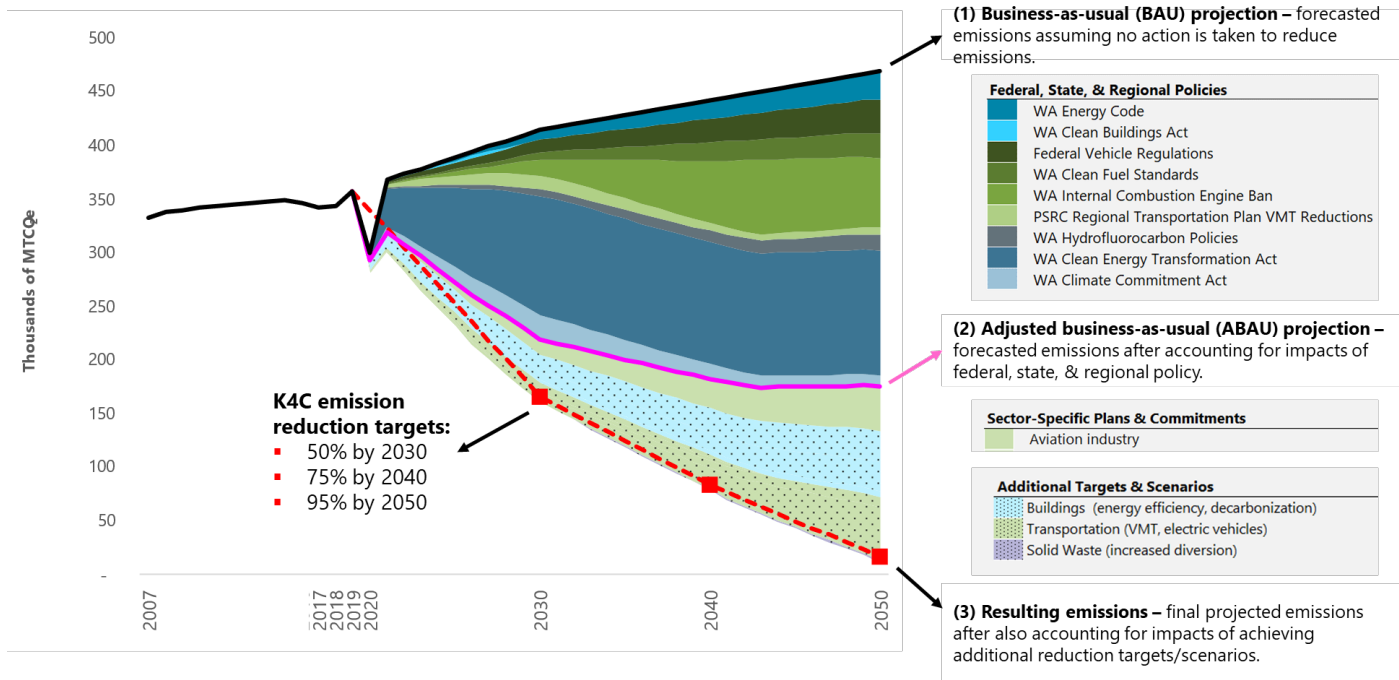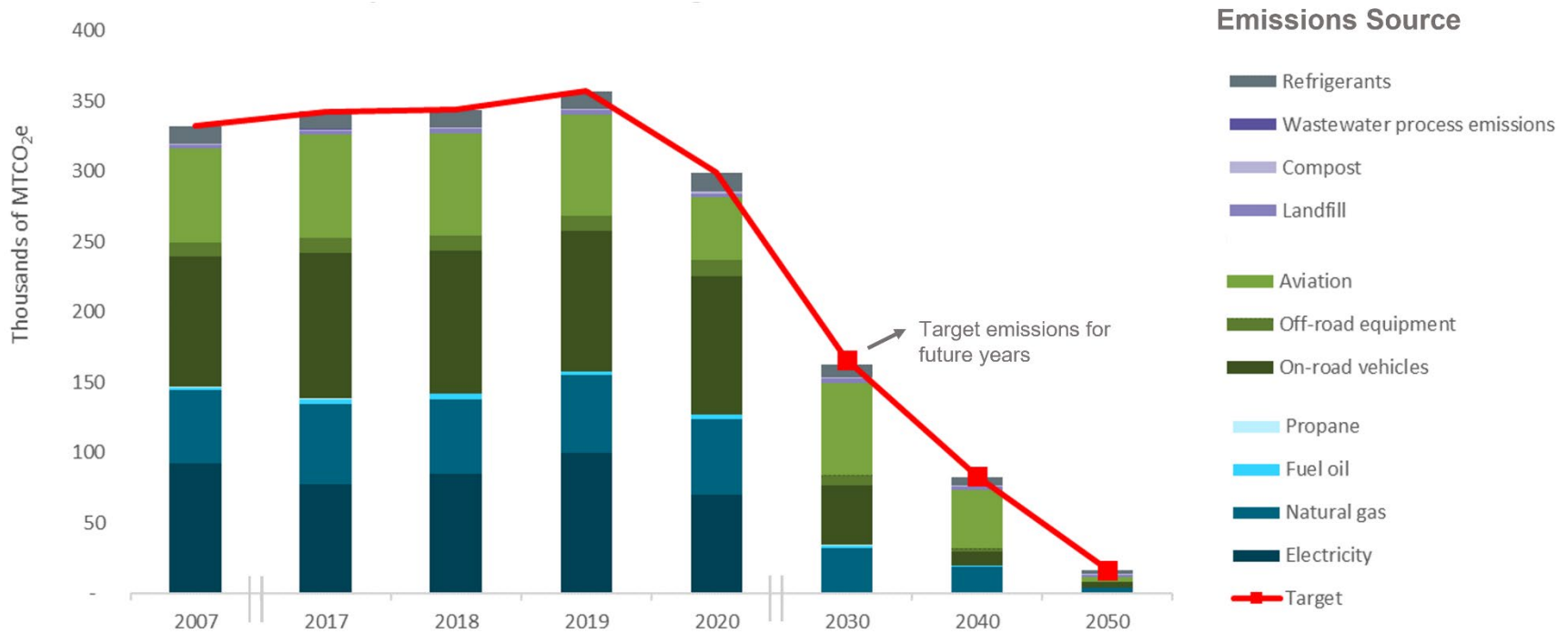- 75% by 2040
- 95% by 2050

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% (~137,000 MTCO$_2$e) by 2050, compared to the 2007 baseline.

  - 2019 emissions rates are expected to increase 31% (~112,200 MTCO$_2$e) 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$_2$e).

- 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

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).

Policy/ Plan	Details
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". SB 5811 (allowing adoption of California's emissions standards) implements a complete ban by 2035.
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.

Policy/ Plan	Details
	• 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 have 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 level emissions by 95%. These targets will in turn inform the specific focus area targets of the Mercer Island CAP as well as the climate actions to achieve these milestones. Proposed targets by focus area are outlined in Table 5.

Table 5: Recommended targets by focus area for the Mercer Island CAP

Focus Area	Strategy	KPI/Metric	Suggested 2030 Target	Suggested 2050 Target
Buildings & Energy	Transition to non-fossil building energy.	Reduction in building GHG emissions (MTCO$_2$e)	78% reduction compared to 2019	97% reduction compared to 2019
Buildings & Energy	Transition to non-fossil building energy.	Reduction in building natural gas, propane, & fuel oil consumption (MMBTU)	35% reduction compared to 2019	92% reduction compared to 2019
Buildings & Energy	Reduce energy use in new and existing buildings.	Reduction in communitywide energy use (MMBtu)	22% reduction compared to 2019	63% reduction compared to 2019
Transportation	Transition to cleaner vehicles & equipment.	% of vehicles that are EVs	65% of new vehicles 20% of all vehicles	100% of all vehicles
Transportation	Reduce vehicle travel.	Reduction in overall vehicles miles traveled (passenger + freight)	1% reduction from 2019	5% reduction from 2019
Transportation	Transition to cleaner vehicles & equipment.	Reduction in average vehicle carbon intensity (MTCO$_2$e/mile)	44% reduction compared to 2019	96% reduction compared to 2019
Transportation	Transition to cleaner vehicles & equipment.	Reduction in onroad transportation GHG emissions (MTCO$_2$e)	45% reduction compared to 2019	96% reduction compared to 2019

Focus Area	Strategy	KPI/Metric	Suggested 2030 Target	Suggested 2050 Target
Transportation	Reduce aviation emissions.	% reduction in aviation fuel use % reduction in aviation fuel carbon intensity	5% reduction in aviation fuel use compared to 2019 10% reduction in aviation fuel carbon intensity compared to 2019	15% reduction in aviation fuel use compared to 2019 95% reduction in aviation fuel carbon intensity compared to 2019
Consumption & Disposal	Reduce waste generation & landfill disposal.	Increase in waste diverted from landfills (% of waste diverted)	70% diversion rate Zero waste of edible food	100% diversion rate
Consumption & Disposal	Reduce waste generation & landfill disposal.	Reduction in landfilled waste (tons)	11% reduction compared to 2019	60% reduction compared to 2019
Consumption & Disposal	Reduce waste generation & landfill disposal.	Reduction in solid waste GHG emissions (MTCO$_2$e)	81% reduction compared to 2019	86% reduction compared to 2019
Consumption & Disposal	Reduce waste generation & landfill disposal.	Diversion of construction & demolition (C&D) waste and other recyclable and compostable materials from landfills.	85% of C&D waste diverted	85% of C&D waste diverted
Consumption & Disposal	Consume sustainably.	Reduction in community waste generated, including solid waste, recycling, and compost (% of waste generated)	No net increase in waste generation compared to 2019 levels	Reduce overall waste generation by 10% compared to 2019 levels

Focus Area	Strategy	KPI/Metric	Suggested 2030 Target	Suggested 2050 Target
Cross-Cutting & Municipal	Engage and support community climate action.	Reduction in community GHG emissions (MTCO$_2$e)	50% below 2007 baseline levels	95% below 2007 baseline levels
Cross-Cutting & Municipal	Reduce climate impact of municipal operations.	Reduction in municipal GHG emissions (MTCO$_2$e)	Carbon neutral	Carbon neutral