JEFFERSON TRANSIT

Greenhouse Gas Emissions Inventory

4.30.2024

Acronyms and Abbreviations

APTA - American Public Transit Association

BEB – battery-electric bus

BPA – Bonneville Power Administration

CETA – Clean Energy Transformation Act

CH_4 – methane

CO_2 – carbon dioxide

CO_2e – carbon dioxide equivalent

FTE – full-time equivalent

GHG – greenhouse gas

HFC – hydrofluorocarbon

kg - kilograms

JPUD – Jefferson County Public Utility District

JTA – Jefferson Transit Authority

N_2O – nitrous oxide

NO_x – nitrogen oxides

MT – metric tons

PM – particular matter

VMT – vehicle miles traveled

VOCs – volatile organic compounds

Prepared by Peak Sustainability Group

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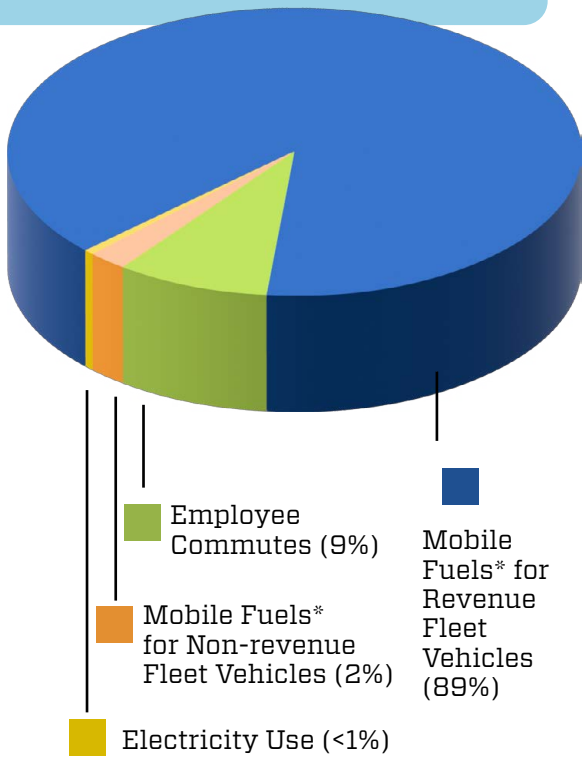
At a Glance

As part of a climate action planning process, Jefferson Transit Authority (JTA) conducted a greenhouse gas (GHG) emissions inventory for the year 2022 to assess emissions from its internal operations. This inventory quantified emissions from fleet vehicle fuel consumption, refrigerant use, purchased electricity consumption at JTA buildings and facilities, and fuel consumption associated with employee commutes.



**gasoline, diesel, and biodiesel*

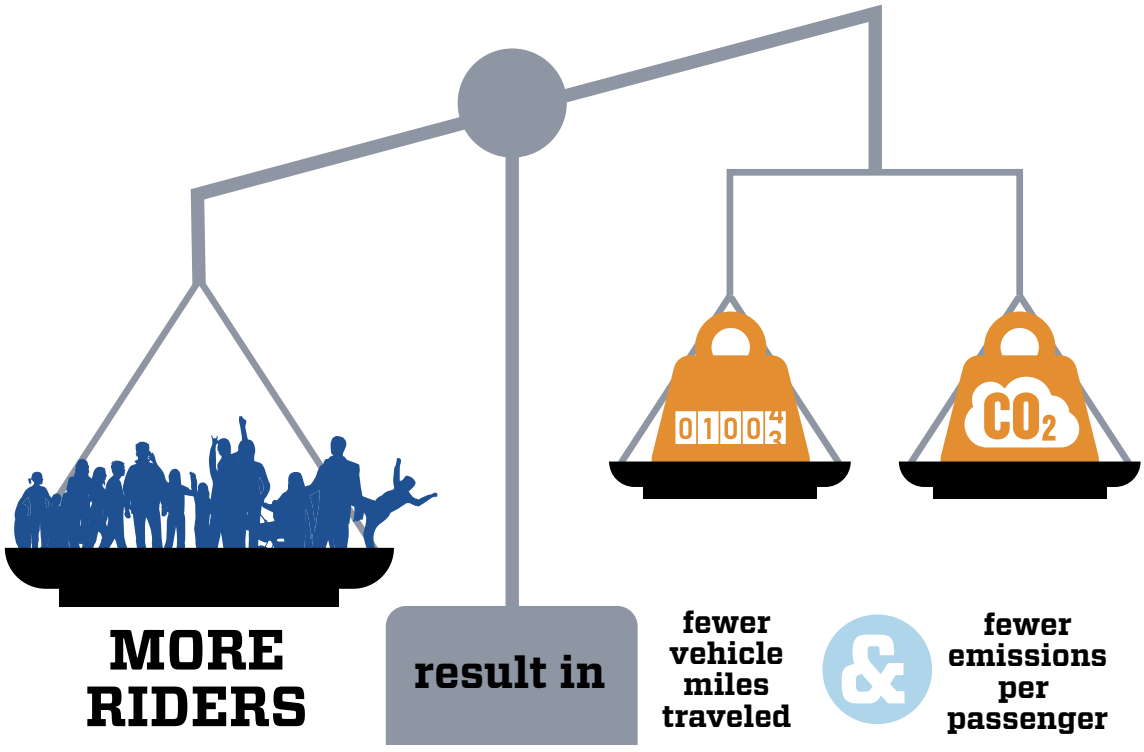
Figure 1: JTA 2022 GHG emissions by category

In 2022, JTA's internal operations emitted a total of **1134.13 metric tons of CO2 equivalent (MT CO2e)**, the equivalent of 270 gasoline-powered passenger vehicles driven for one year. The largest portion of these emissions, accounting for 88.70% of the total, came from mobile fuels (gasoline, diesel, and biodiesel) used in revenue fleet vehicles (vehicles providing service to passengers). Employee commuting was the second largest contributor, emitting 8.62% of total emissions. Non-revenue fleet vehicles contributed 2.32% of the total, and electricity use contributed 0.35% to overall emissions. The low emissions percentage associated with electricity use is primarily because Jefferson County Public Utility District (JPUD), the energy supplier of JTA, obtains its electricity from the Bonneville Power Administration (BPA), which has a low-emissions fuel mix of approximately 85% hydropower and 11% nuclear.

In 2022, the largest portion of JTA's GHG emissions came from vehicles providing service to passengers.

JTA's emissions represent a relatively small proportion of emissions from sources throughout Jefferson County. However, the organization can continue to play a pivotal role in reducing county-wide transportation emissions by continuing to encourage people to use its services rather than drive a personal vehicle. As more people use JTA's public transit services over personal vehicles, there are fewer vehicles miles traveled (VMT) throughout the county and a reduction in association emissions. In 2022, the public transit service offered by JTA avoided 244.71 MT CO_2e that would have been emitted if the trips were completed in personal vehicles (equivalent to 21.6% of JTA's operational emissions).

As JTA implements additional measures to decrease emissions linked to its services, the organization can help to further reduce overall transportation emissions across Jefferson County.



GHG Emissions

Introduction

In Washington State, the transportation sector is the largest contributor of anthropogenic greenhouse gas (GHG) emissions. The reliance on fossil fuel-powered vehicles for commuting, freight transportation, and other activities releases substantial amounts of carbon dioxide (CO_2) and other GHGs into the atmosphere, exacerbating the effects of climate change. Additionally, emissions from the transportation sector contribute significantly to air pollution, emitting pollutants such as nitrogen oxides (NO_x), particulate matter (PM), and volatile organic compounds (VOCs). This pollution not only harms human health, leading to respiratory illnesses and cardiovascular problems but also has adverse effects on ecosystems and contributes to environmental degradation.

Jefferson Transit Authority (JTA) recognizes that reducing emissions within the transportation sector is essential for achieving both statewide and local climate objectives and ensuring the well-being and health of its riders, employees, and community in Jefferson County. JTA strives to be a part of the solution and a model for how rural transit agencies can help tackle the challenge of climate change, in part, by reducing emissions.

Completing a GHG emissions inventory (GHG inventory) is an important starting point for a community or organization undertaking a climate action planning process. A GHG inventory is a record of the amount of GHGs emitted directly or indirectly into the atmosphere by an organization over a defined period, often one year. GHG emissions, including carbon dioxide (CO_2), methane (CH_4), nitrous

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oxide (N_2O), and hydrofluorocarbons (HFCs), are typically measured and expressed in terms of metric tons of CO_2 equivalent (MT CO_2e). This standardized unit enables comparisons of the impact of various GHGs on global warming by equating them to the warming effect of CO_2 (the most prevalent GHG emitted by human activities).

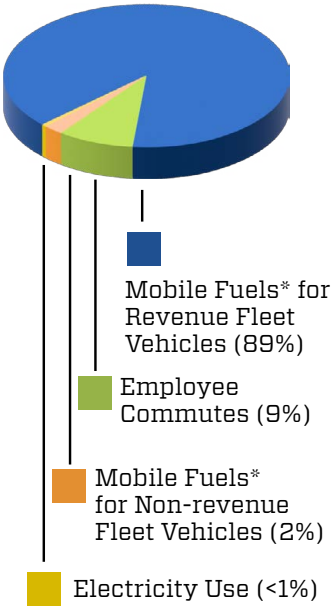
GHG inventories help communities and organizations understand where emissions come from and where there are opportunities to reduce them. They also provide a way to keep track of emissions over time and see how an organization is progressing towards its climate action goals.

In addition to GHG inventories, calculating emissions projections is a key step in an organization's climate action planning process. Emissions projections involve predicting the level of GHGs that will be emitted into the atmosphere in the future over a specific timeframe, typically years or decades. These projections may be based on factors such as current emission trends, population growth, economic activities, technological advancements, and regulatory policies. They provide insights into future emission trajectories and help organizations prioritize actions to reduce GHG emissions. GHG projections can inform long-term planning efforts, investment decisions, and risk assessments related to climate change and its associated impacts.

As part of JTA's climate action planning process, a GHG inventory for the year 2022 and an analysis of projections were conducted for the organization's internal operations. The subsequent sections detail the methodologies and data sources used to formulate the assessment and the findings.

2022 GHG Emissions Inventory

The following GHG inventory outlines emissions from JTA operations for the year 2022. The results provide insights into where JTA's emissions come from and where there are opportunities to reduce them. The inventory will also serve as a benchmark for comparing GHG inventories in future years, enabling JTA to monitor progress toward its climate action goals.



gasoline, diesel, and biodiesel

Figure 1: JTA 2022 GHG emissions by category

Methods

The completion of JTA's GHG inventory was guided by the Local Government Operations Protocol, a methodology designed for local governments to accurately quantify and report their GHG emissions. This Protocol offers a standardized framework that classifies GHG emissions into three scopes, covering various emission sources commonly encountered in local government operations. Scope 1 emissions are direct GHG emissions from sources owned or controlled by an organization while Scope 2 emissions are indirect GHG emissions from purchased electricity, heating, or cooling consumed by an organization. Scope 3 encompasses emissions associated with the broader value chain, including employees, suppliers, and customers.

This GHG inventory quantifies emissions that fall within JTA's operational control, including those from fleet vehicles and refrigerant use (Scope 1), buildings and facilities (Scope 2), and employee commutes (Scope 3). The GHGs measured include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and hydrofluorocarbons (HFCs). Other GHGs are not included in this inventory as they are not significant to JTA's operations.

JTA's General Manager and Fleet and Facilities Manager compiled data for fleet vehicle fuel consumption and refrigerant purchases, the consumption of purchased electricity at JTA buildings and facilities, non-revenue vehicle charging, and public vehicle charging, and fuel consumption associated with employee commutes. Data on employee commutes was collected through a survey distributed in January 2024 and then scaled to reflect the average number of JTA full-time equivalents (FTEs) in 2022.

No refrigerants were purchased in 2022 with the most recent purchases occurring in 2018 and 2023. A streamlined mass balance approach was applied to calculate fugitive emissions for refrigerants. This approach simplifies the estimation of fugitive emissions by assuming that all refrigerant purchases equate to the amount of refrigerant leakage. It does not account for the recovery or recycling of refrigerants. While this approach streamlines the inventory process by using straightforward calculations based on purchase data, it may lead to an overestimate of fugitive emissions, especially if refrigerants are recovered or recycled with methods that reduce emissions. The streamlined mass balance approach was selected based on JTA's infrequent refrigerant purchases and to simplify the inventory process for JTA staff for future inventories.

The data for fleet fuel use, refrigerant purchases, electricity consumption, and employee commutes was converted into the common unit of MT CO_2e for direct comparison using the 2022 default emission factors provided by The Climate Registry. The data was compiled in an Excel workbook and analyzed to develop insights into the scale of JTA's GHG emissions and the relative contributions of different emissions sources.

Table 1. 2022 JTA operations GHG inventory results

Category	GHG Emissions (MT CO_2e)	Percent Total GHG Emissions (%)
Mobile fuels* for revenue fleet vehicles	1005.99	88.70
Mobile fuels* for non-revenue fleet vehicles	26.35	2.32
Refrigerants	0	0
Electricity use	4.01	0.35
Employee commutes	97.78	8.62
Total	**1134.13**	**100%**

gasoline, diesel, and biodiesel

GHG inventory findings

In 2022, JTA internal operations emitted **1134.13 MT CO_2e** (see Table 1 and Figure 1). This is equivalent to the quantity of GHGs emitted by 270 gasoline-powered passenger vehicles driven for one year. The largest portion of these emissions, comprising 1005.99 MT CO_2e or 88.70% of the total, originated from mobile fuels (gasoline, diesel, and biodiesel) for revenue fleet vehicles (vehicles providing service to passengers). Employee commuting

was the second largest contributor, emitting 97.78 MT CO_2e or 8.62% of total emissions. Mobile fuels for non-revenue fleet vehicles accounted for 26.35 MT CO_2e or 2.32% of the total, and electricity use contributed 4.01 MT CO_2e or 0.35% of overall emissions.

The relatively low emissions percentage associated with electricity use is largely due to Jefferson County Public Utility District (JPUD), the energy supplier of JTA, sourcing its electricity from the Bonneville Power Administration (BPA), which has a fuel mix that is approximately 85% hydropower and 11% nuclear. The per-unit emissions for BPA's power generation are significantly lower than the average per-unit electricity generation emissions for Washington State and the U.S.

Estimated metrics that quantify GHG emissions per passenger and per revenue mile can help JTA track operational efficiency over time for GHG emissions. These metrics can be standardized to make comparisons in future years even as service levels fluctuate (see Table 2).

JTA internal operations emitted the equivalent quantity of GHGs emitted by 270 gasoline-powered passenger vehicles driven for one year.

In 2022, JTA's emissions were equivalent to approximately 5.79 kg CO_2e per passenger and 1.64 kg CO_2e per revenue mile. For comparison, the average passenger vehicle emits 0.4 kg of CO_2 per mile, according to the Environmental Protection Agency. JTA's emissions per revenue mile for 2022 were roughly equivalent to the emissions of four passenger vehicles. This suggests that if JTA service replaced four cars on the road on average, the emissions would be equivalent. If JTA service replaced more than four cars on the road on average, the emissions from JTA service would be less than the emissions from those trips if they had been made in personal cars.

Table 2. JTA operational efficiency for GHG emissions based on passenger and revenue mile totals

Metric	Total
Emissions per passenger (kg CO_2e) (Total emissions ÷ 2022 passenger boardings)	5.79
Emissions per revenue mile (kg CO_2e) (Total emissions ÷ 2022 revenue miles)	1.64

JTA's first battery-electric bus

JTA added its first battery-electric bus (BEB) to the revenue vehicle fleet in late 2023. JTA has ordered two more BEBs which are set to be added to the revenue vehicle fleet in late 2025 or early 2026. The reduced emissions associated with the BEB are not reflected in this GHG inventory, which was conducted for 2022. It is expected that, for future GHG inventories, the BEBs will decrease JTA's total operational emissions, emissions per passenger, and emissions per revenue mile as the BEBs emit less CO_2e than the existing biodiesel buses.

Limitations of the 2022 GHG inventory

This GHG inventory estimates emissions from JTA's internal operations for the year 2022. The inventory addresses several direct and indirect emission sources from JTA operations including vehicle fleet fuel consumption, fugitive emissions from refrigerants (none purchased in 2022), electricity consumption, and employee commuting. It does not consider emissions associated with other activities outside of those categories such as water consumption, waste disposal, or the emissions produced during vehicle manufacturing processes.

The 2022 GHG inventory presents an estimate of emissions derived from available data and standard calculation methods. This estimate may be updated as more accurate data sources, emissions factors, and calculation methodologies become available or if JTA incorporates additional emission sources into the inventory in the future.

Jefferson Transit Authority GHG Emission Projections

Using the results of the 2022 JTA inventory, the below projections estimate future GHG levels from JTA's internal operations in the years 2035 and 2050.

No-action projection

The first scenario is a no-action projection that assumes no federal, state, or regional policy implementation and no emission reduction actions taken by JTA. For this scenario, two estimated annual growth rates were derived from JTA employee headcount data from 2013-2022 and population growth assumptions from Jefferson County's 2018 Comprehensive Plan update (Jefferson County, 2018). This led to average annual growth rates of 2.29% and 0.98%, respectively.

It is important to note that JTA is primarily funded by local sales tax and receives state funding to support operations and capital projects. To determine an estimated annual growth rate, it is assumed that the population growth assumptions from Jefferson County's 2018 Comprehensive Plan update also apply to the local sales tax revenue, which significantly influences the level of service that JTA can provide. The estimated annual growth rate may be less accurate if JTA's local sales tax revenue does not increase at the same rate as the population of Jefferson County.

The estimated annual growth rates were applied to relevant categories of the GHG inventory to produce emission estimations for 2035 and 2050. Emissions projections from electricity use and employee commutes were calculated with a 2.29% annual growth rate while emissions projections from mobile fuels for both revenue and non-revenue vehicles were calculated using a 0.98% annual growth rate.

As previously mentioned, JTA added its first BEB to the revenue vehicle fleet in late 2023 and has ordered two more BEBs which will likely be added to the revenue vehicle fleet in late 2025 or early 2026. These BEBs will emit less CO_2e than biodiesel buses, which will help decrease JTA's total operational emissions. The impacts of BEBs on JTA's total operational emissions are not included in the projections because these vehicles were not operational in the GHG inventory base year of 2022 and were only in operation for part of 2023. The GHG emission reduction benefit of the BEBs will be captured in future GHG inventories.

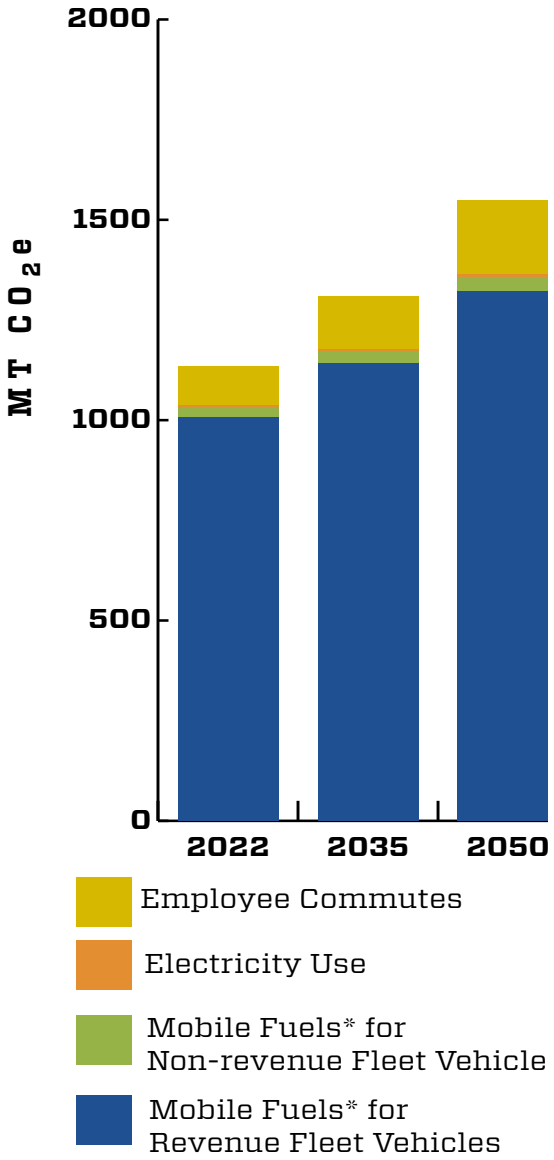
As shown in Table 3 and Figure 2, for the no-action projection with the assumptions detailed previously, JTA's emissions are projected to increase by 15.37% from 2022 levels to 1308.51 MT CO_2e by 2035. By 2050, JTA's emissions are projected to increase by 18.33% from 2022 levels to 1548.36 MT CO_2e.

State policies projection

The second scenario is a state policies scenario that models the predicted effects of relevant climate, energy, and transportation policies. The state policies projection uses the same estimated annual growth rates as the no-action projection, but calculations have been modified to include stated assumptions for relevant policies. The Washington Clean Fuel Standard and the Washington Clean Energy Transformation Act were included in this scenario as they may have a notable impact on JTA's GHG emissions now or in the future.

WA Clean Fuel Standard

Interpretation: The Washington Clean Fuel Standard requires fuel suppliers to gradually reduce the carbon intensity of transportation fuels to 20%



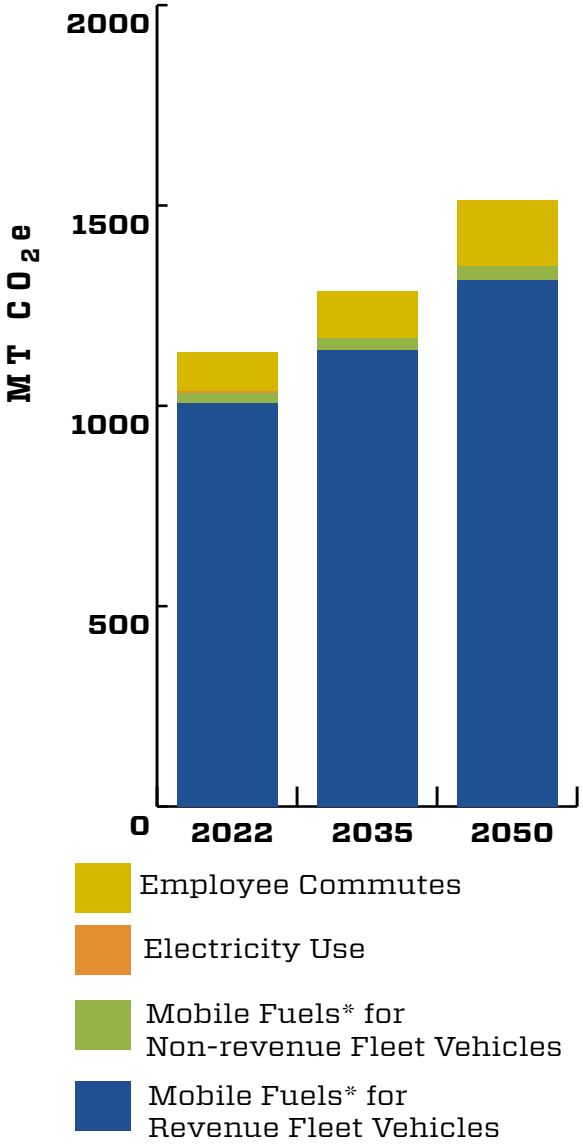
**gasoline, diesel, and biodiesel*

Figure 2: No-action emissions projections for 2035 and 2050

Table 3: No-action emissions projections for 2035 and 2050 by category

Year	Mobile fuels for revenue fleet vehicles (MT CO_2e)	Mobile fuels for non-revenue fleet vehicles (MT CO_2e	Electricity use (MT CO_2e)	Employee commutes (MT CO_2e)	Total (MT CO_2e)	% change from 2022
2022	1005.99	26.35	4.01	97.78	**1134.13**	-
2035	1141.97	29.91	5.38	131.24	**1308.51**	15.38
2050	1321.86	34.62	7.56	184.32	**1548.36**	18.33

**gasoline, diesel, and biodiesel*



gasoline, diesel, and biodiesel

Figure 3: State policy emissions projections for 2035 and 2050

below 2017 levels by 2038. Lower carbon intensity can be achieved by using cleaner fuels or acquiring clean fuel credits from cleaner producers such as those supplying electricity as a fuel source. Boats, trains, aircraft, and military vehicles and equipment are excluded from this standard.

Assumptions: Based on assumptions from Puget Sound Regional Emissions Analysis (Cascadia Consulting Group, 2022), the state policies projection:

- Assume a 5% reduction from 2022 levels in gasoline and diesel emission factors from cleaner fuels by 2035.
- Assume a 10% reduction from 2022 levels in gasoline and diesel emission factors from cleaner fuels by 2050.

WA Clean Energy Transformation Act

Interpretation: The Washington Clean Energy Transformation Act (CETA) applies to all electric utilities serving retail customers in Washington and sets specific milestones, including:

- By 2025, utilities must eliminate coal-fired electricity from their state portfolios.
- By 2030, utilities must be greenhouse gas neutral with the option to use limited amounts of electricity from natural gas if it is offset by other actions.
- By 2045, utilities must supply Washington customers with electricity that is 100% renewable or non-emitting with no provision for offsets.

Assumptions: All electricity will be GHG neutral in 2030 and beyond (emission factor of zero). JTA's current electricity supply through JPUD is already low carbon. Under CETA, utilities, including JPUD, will need to continue seeking renewable or non-emitting energy sources for electricity even as electricity demands increase.

As shown in Table 4 and Figure 3, for the state policy projection and using the assumptions detailed above, JTA's emissions are projected to increase by 13.37% from 2022 levels to 1285.77 MT CO_2e. By 2050, JTA's emissions are projected to increase by 17.72% from 2022 levels to 1513.68 MT CO_2e.

Table 4: State policy emissions projections for 2035 and 2050 by category

Year	Mobile fuels* for revenue fleet vehicles (MT CO_2e)	Mobile fuels* for non-revenue fleet vehicles (MT CO_2e)	Electricity use (MT CO_2e)	Employee commutes (MT CO_2e)	Total (MT CO_2e)	% change from 2022
2022	1005.99	26.35	4.01	97.78	**1134.13**	-
2035	1139.03	29.90	0.00	116.84	**1285.77**	13.37
2050	1315.04	34.60	0.00	164.04	**1513.68**	17.72

gasoline, diesel, and biodiesel

Jefferson County Transportation GHG Emissions

In 2018, Jefferson County conducted a GHG inventory with countywide emissions totaling 275,083 MT CO_2e (Jefferson County and Port Townsend Climate Action Committee, 2020). Of this, community-wide transportation contributed 181,588 MT CO_2e, constituting 66% of the County's overall emissions. This underscores the transportation sector's substantial role in Jefferson County's greenhouse gas output, a trend consistent with Washington State where transportation is the leading source of GHG emissions.

JTA's 2022 greenhouse gas emissions (1134.13 MT CO_2e) are equivalent to just 0.62% of Jefferson County's 2018 community-wide transportation emissions. Although JTA's emissions may represent a relatively small portion of the total emissions at the county level, the organization can play a significant role in decreasing the overall transportation emissions within the region. As more individuals opt for public transit services provided by JTA, there will be a reduction in vehicle miles traveled (VMT), leading to a decrease in emissions per passenger. In 2022, the public transit service offered by JTA avoided 244.71 MT CO_2e that would have been emitted if the trips were completed in single occupancy vehicles (equivalent to 21.6% of JTA's operational emissions).[1] By implementing measures to keep emissions per passenger down, JTA can even further reduce community transportation emissions. This reduction can have a substantial impact on overall emissions as more people opt to use public transit for transportation needs.

JTA plays an important role in reducing transportation emissions in Jefferson County.

1 The American Public Transit Association's (APTA) "Quantifying GHG Emissions from Transit" Recommended Practice guided the estimation of emissions that would have occurred if people had driven a car instead of riding transit (APTA, 2018).

JTA staff provided estimates of the average trip length for each fixed route that JTA offers. Paratransit trips and staff vehicles do not have an emissions reduction component due to the nature of their service. The average trip length was multiplied by the annual ridership for each route to estimate annual passenger miles traveled.

Annual passenger miles were then multiplied by an APTA-provided mode-shift factor (0.284) to estimate VMT avoided due to transit trips. Avoided VMT was multiplied by an APTA-provided average fuel economy (21.4 mpg) to estimate how many gallons of gasoline were conserved due to people riding transit rather than driving a personal vehicle. Gallons of gasoline conserved was converted to the corresponding amount of CO_2e that would have been produced had that fuel been consumed.

References

American Public Transit Association [APTA]. (September 2018). Quantifying Greenhouse Gas Emissions from Transit. Retrieved from ***https://www.apta.com/wp-content/uploads/Standards_Documents/APTA-SUDS-CC-RP-001-09_Rev-1.pdf***

Cascadia Consulting Group. (August 2022). King County Communitywide Geographic Greenhouse Gas Emissions – Puget Sound Regional Emissions Analysis. Retrieved from ***https://your.kingcounty.gov/dnrp/climate/documents/2022/king-county-geographic-ghg-emissions-inventory-and-wedge-report-09-2022.pdf***

Environmental Protection Agency [EPA]. (August 28, 2023). Greenhouse Gas Emissions from a Typical Passenger Vehicle. Retrieved from ***https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle***

Jefferson County. (December 2018). Jefferson County Comprehensive Plan Appendices. Retrieved from ***https://www.co.jefferson.wa.us/DocumentCenter/View/18002/Jefferson-CP-Appendices-2018_12***

Jefferson County and Port Townsend Climate Action Committee. (June 24, 2020). Jefferson County, Washington 2018 Inventory of Greenhouse Gas Emissions. Retrieved from ***https://www.co.jefferson.wa.us/DocumentCenter/View/10166/2018_JeffCo_GHG_Inventory_Report_approved_062420***