Maximizing Climate Benefits Through Transit

September 25, 2025

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I. Proviso Text[1]

P2 PROVIDED FURTHER THAT:

Of this appropriation, $100,000 shall not be expended or encumbered until the executive transmits a maximizing climate benefit through transit report.

A. The King County 2020 strategic climate action plan, which was adopted through Motion 15866, identifies several strategies to reduce transportation-related greenhouse gas emissions, including by increasing use of transit and by reducing emissions from county-owned vehicles. Ordinance 19052, which the council passed in 2020, set the goal that the Metro transit department would transition to a fully zero-emission revenue transit fleet by 2035. The Metro transit department was asked to identify the potential tradeoffs between expanding service to increase transit ridership and investing in the fleet and capital expenditures necessary to transition to a zero-emission fleet. That report, which was submitted to the council in late 2020, indicated that the tradeoff between service and capital to achieve the goal of reducing greenhouse gas emissions would depend on the costs to acquire and operate battery electric buses, specifically that, if costs remain steady over time, the additional cost of acquiring and operating a zero-emission fleet would be equivalent to providing two hundred thirty-seven thousand annual service hours over a nineteen-year period, but, if costs decrease with advances in technology, the lifecycle and societal costs of zero-emission and diesel hybrid buses would be roughly equivalent over the same nineteen-year period. Since that time, the Metro transit department has moved forward with the transition to a zero-emission fleet, consistent with the goal adopted through Ordinance 19052, receiving appropriation authority of more than $250,000,000 in the 2023-2024 biennium and requesting appropriation authority of nearly $500,000,000 for 2025 to continue with the fleet purchases and bus base development and conversion necessary to achieve a fully zero-emission fleet by 2035. In June 2024, the King County auditor published a report that noted that the Metro transit department faces significant risks in the transition to a fully zero-emission fleet, including the loss of domestic bus manufacturers, technology limitations, sufficient electricity supply in the future, and lagging battery electric bus performance. As the Metro transit department has been working to convert to a zero-emission fleet, it has also been working to recover from the pandemic by rebuilding operational capacity and recovering ridership. As of August 2024, the Metro transit department is operating approximately eighty-seven percent of prepandemic service levels for approximately sixty-four percent of prepandemic weekday ridership. The combination of the pandemic's impacts on transit service and ridership, as well as the technological challenges involved in moving to a zero-emission revenue bus fleet, make it imperative to reevaluate the optimal balance between strategies to achieve King County's climate goal of reducing transportation-related greenhouse gas emissions through the public transportation system.

B. The maximizing climate benefits through transit report required by this proviso shall include, but not be limited to:

1. A timeline and anticipated annual costs for the planned fleet purchases, base conversions, and other capital investments necessary to achieve a fully zero-emission revenue bus fleet;

2. An update covering the years 2025 through 2045 to the cost projections developed for the September 30, 2020, Zero-Emission Battery Bus Preliminary Implementation Plan, 2020-RPT0142, which compared the cost of a zero-emission fleet to continuing the Metro transit department's current

[1] Link to Ordinance 19861, Section 17, Proviso P2

fleet practices, and which indicated that, in a moderate case that included social benefits, battery-electric buses would be forty-two percent more expensive than diesel hybrid buses, for a total cost change of $574,000,000 or approximately 237,000 annual service hours over nineteen years; and

3. Information on the Metro transit department's coordination with the King County climate office on the development of the 2025 update to the strategic climate action plan to update the analysis in that plan about the contributions of transportation to greenhouse gas emissions, including the health impacts of greenhouse gas emissions from transit compared with increased ridership on transit, as well as the strategies that could be implemented to reduce these emissions.

The executive should electronically file the report required by this proviso by August 28, 2025, with the clerk of the council, who shall retain an electronic copy and provide an electronic copy to all councilmembers, the council chief of staff, and the lead staff for the transportation, economy, and environment committee or its successor.

II. Executive Summary

Metro is one of the largest contributors of greenhouse gas (GHG) emissions in County government. In 2017, King County Metro Transit Department (Metro) committed to making its fixed-route vehicles (buses) zero-emission (ZE) by 2040. This followed commitments made to reduce transportation-related emissions in the 2015 King County Strategic Climate Action Plan (SCAP).[2] King County Ordinance 19052 (2020) updated the commitment for Metro to transition to a 100 percent ZE bus fleet by 2035.[3] This update was reflected in the 2020 SCAP and the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan.[4] The plans detailed that this goal would be met through a combination of battery-electric buses (BEBs) and ZE trolley buses (trolleys).

To date, Metro is a national leader in the transition to a ZE fleet, working with manufacturers to advance technology and shape ZE bus operations by being an early adopter. Metro has taken significant strategic steps in alignment with Ordinance 19052.

Key achievements include the retirement of the last diesel (non-hybrid) bus in 2020 and expansion of the BEB fleet to 40 buses in revenue service, surpassing two million BEB miles as of July 2025. Metro successfully launched the South Base Test Facility to pilot new charging technologies and secured more than $35.5M in Federal Transit Administration (FTA) grant funding to support bus acquisition and workforce development. A major milestone is the groundbreaking of Tukwila Base, Metro's first new bus base in over three decades, which will be Metro's first fully electric facility — beginning ZE revenue service in 2026 and reaching full capacity by fall 2027.

Metro is rapidly transitioning its hybrid-diesel bus fleet to run on renewable diesel, further reducing its carbon footprint as an interim step toward incrementally reducing GHG emissions until Metro fully transitions to a 100 percent ZE fleet. This transition immediately cuts Metro's bus fleet GHG emissions by roughly 60 percent, without requiring costly capital investments.[5]

Metro's efforts have included partnerships with utilities, industry leaders, bus manufacturers, and technology providers to build the necessary infrastructure and resilience for future ZE operations. The strategy underlying these achievements balances service reliability, emissions reduction, BEB technology, and financial realities.

Metro's 2017 "Feasibility of Achieving a Carbon-Neutral or Zero-Emission Fleet" study noted that Metro will pursue a goal of transitioning to a ZE fleet so long as vehicles and technology evolve to meet current and future service goals, as defined in Metro Connects:

- Metro is able to secure reliable and renewable energy supplies from local utilities;
- Incremental costs do not limit Metro's ability to deliver and expand service; and
- Additional safety, training and emergency preparedness risks can be addressed.[6]

[2] Link to Strategic Climate Action Plan (SCAP) 2015
[3] Link to Ordinance 19052
[4] Link to 2020 Zero-Emission Battery Bus Preliminary Implementation Plan (2020-RPT0142)
[5] Link to Argonne National Laboratory National Laboratory AFLEET Tool
[6] Link to Feasibility of Achieving a Carbon-Neutral or Zero-Emissions Fleet at King County Metro Transit, March 2017

Since then, the landscape for public transit and ZE bus manufacturing has changed significantly. During the COVID-19 pandemic, ridership was reduced and Metro reduced service. Like many transit agencies across the country, Metro is currently facing financial challenges, limited domestic bus manufacturing, BEB range limitations, and federal policy and funding uncertainty — all of which affect Metro's ability to achieve a 100 percent ZE bus fleet by the 2035 target. Given these challenges, the Council issued a proviso requesting that Metro update its timeline and cost projections and evaluate the optimal balance between moving to a ZE revenue bus fleet and strategies to achieve King County's climate goal of reducing community transportation-related GHG emissions through public transportation.

Each requirement of this proviso references specific forward-looking information with key differences. In response, Metro employed different forecasting tools and methodologies for each proviso requirement and developed four scenarios to reflect varying levels of service investment and ZE fleet transition timelines. These scenarios were informed during Metro's budget process and further developed in direct response to this proviso:

- Scenario 1: Proposed 2026-2027 Capital Improvement Plan; ZE implementation with funding constraints
    - Responds to Proviso requirement Section B1 and B2.
- Scenario 2: ZE implementation without budget constraints
    - Responds to Proviso requirement Section B2 and B3.
- Scenario 3: ZE implementation without budget constraints plus additional service hours
    - Responds to Proviso requirement Section B3.
- Scenario 4: Adopted 2025 Capital Improvement Plan baseline that also reflects ZE SCAP targets
    - Responds to Proviso requirement Section B3.

Re-evaluating the 2035 Zero Emissions Timeline

Metro's long-term vision for transitioning to a fully ZE bus fleet is designed to prioritize service and evolve alongside technology advancements, shifting policy landscapes, and financial realities. By integrating ongoing research on ZE advancements, partnering with industry leaders, and maintaining flexibility in its planning, Metro positions itself to seize emerging opportunities and accelerate the transition when conditions allow.

Metro's proposed 2026-2027 budget and 10-year Capital Improvement Plan (CIP) will reflect current fiscal challenges and a transition to ZE beyond the 2035 timeline. A 100 percent target timeline is pending resource availability, capital capacity, and technology evolution. Every two years, through the budget process, Metro will review and refine the timeline and cost estimates to transition to a 100 percent ZE fleet, incorporating new data, funding, and/or technology developments.

Moving forward, Metro is proposing to adjust its BEB service as BEB range improves. This would significantly reduce the need for capital investments in opportunity charging infrastructure (to recharge buses in the field during layovers) and lower service costs as mid-day charging will be largely unnecessary.

In alignment with County goals for equitable climate action, and in direct response to community voices engaged in the 2017 ZE feasibility study, Metro is investing in ZE technology first in South King County, where communities are disproportionately burdened by air and noise pollution from vehicle emissions.

In King County and across the U.S., people of color and low-income families are more likely to live in areas with higher concentrations of air pollution and face greater risks of poor public health outcomes as a result. Going forward, Metro will continue to prioritize deployment of ZE vehicles in equity priority areas while also ensuring that service quality and productivity in equity priority areas are not negatively impacted by the transition to a ZE fleet.

2025 through 2045 Cost Projections for a Zero Emissions Fleet Transition

Section B2 of the proviso requires Metro to compare "the cost of a zero-emission fleet to continuing the Metro transit department's current fleet practices" between 2025 and 2045. Metro chose to use the proposed 2026-2027 budget and 10-year CIP to represent Metro's "current fleet practices" (referred to as Scenario 1). This plan phases in a limited number of BEBs at select bases while otherwise maintaining a predominantly hybrid-diesel fleet. To represent the "zero-emission fleet" alternative, Metro developed Scenario 2 which reflects ZE implementation without budget constraints. The cost estimates developed for this proviso suggest that fully converting the bus fleet to ZE would increase costs by at least approximately $1.3 billion more than Scenario 1 over a 20-year time period.

Scenario 2 is consistent with the forthcoming ZE Implementation Plan to be finalized in 2026. The ZE Implementation Plan is Metro's long-range strategy for an ambitious but achievable pathway to ZE that is not resource-constrained. This strategy will allow Metro to scale up its investment in ZE as resources are available. Metro is planning on updating its Zero Emissions plan in 2026 to reflect the 2026-2027 budget as adopted by the Council. Going forward, Metro plans to revise the ZE Implementation Plan biannually.

The cost analysis performed for this proviso suggests that higher initial costs for BEBs are not fully offset by the lower price of electricity, as compared to diesel, or by the societal benefits of reducing emissions and noise. However, BEB and charging technologies continue to evolve. Since Metro developed the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan, the industry has shifted toward the use of overhead gantry systems and a mix of slow and fast charging strategies. The maintenance costs in this analysis are also higher than those in the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan. They are based on Metro's historical maintenance records, providing a more accurate projection of future expenses. This update also includes costs for Metro's trolley system, which were not included in the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan.

Despite improvements in the data and assumptions included in this 2025 analysis, costs remain uncertain over this 20-year period. Future bus pricing, availability of bus manufacturers, and federal policy present interrelated uncertainties. Metro will continue to improve cost estimates as data becomes available and may find that some costs, particularly for BEB maintenance, can be reduced with additional experience.

Although this proviso asked for an equivalent number of service hours that could be provided with the approximately $1.3 billion cost differential associated with a full ZE bus fleet conversion, that comparison is not included. Comparing the cost of converting to a ZE fleet versus investing in more service does not demonstrate Metro's current strategy for reducing GHG emissions, nor does it align with goals and performance measures in the King County SCAP that ask Metro to both grow transit service and transition County fleets to ZE vehicles and fuels. This more holistic, long-term strategy forms the basis of proposed budget investments.

2025 SCAP Alignment & GHG Emissions Comparison for Fleet Operations vs. Avoided Emissions from Transit Service

Metro staff partnered with the Executive Climate Office and community partners to develop key actions to reduce GHG emissions associated with on-road transportation as included in the Executive's proposed 2025 SCAP. This included defining how to quantify GHG emission reduction benefits of proposed actions and performance targets. These efforts also included Metro support of modeling vehicle miles traveled based on varying levels of service investment over time. This analysis was used to show how the County can reduce emissions to achieve targets in the updated wedge analysis, which projects emission reductions from federal, state, and local actions, including key measures identified in the 2025 SCAP.

For this proviso response, Metro analyzed GHG emissions from three scenarios (2, 3, and 4) with varying levels of investment in ZE infrastructure and service growth. GHG emissions were not analyzed for Scenario 1 given the timeline for developing this scenario and because this analysis was not necessary to respond to this proviso requirement. This GHG analysis quantified the impact of multiple strategies to reduce GHG emissions: investing in service, transitioning to ZE buses, and using renewable fuels in existing hybrid-diesel coaches. Metro collaborated with the Executive Climate Office to support this analysis, which shows that continued investments to grow transit service offer the greatest potential for GHG emissions reduction**.** That said, transitioning the fleet to ZE vehicles as battery ranges improve to meet service needs will further reduce air and noise pollution, providing important health benefits for Metro employees, riders, and residents. These strategies should be considered complementary rather than mutually exclusive.

Summary

As detailed in this report and the accompanying analysis, investments in both service growth and a ZE fleet transition are essential to reducing air and noise pollution, and improving public health for Metro employees, riders, and residents. These strategies are most effective when pursued together. Growing service while investing in ZE fleets helps Metro reduce emissions and deliver reliable, sustainable mobility options that people depend on.

III. Background

Department Overview

King County Metro is the Puget Sound region's largest public transportation agency. Metro provides bus, paratransit, vanpool, and water taxi services, and operates Seattle Streetcar, Sound Transit Link light rail, and Sound Transit Express bus service. Metro is committed to providing safe, equitable, and sustainable mobility, and prioritizing service where needs are greatest.

Key Historical Context

Metro's use of trolleys, hybrid-diesel buses, and now BEBs have positioned Metro as a leader in the United States in reducing bus fleet GHG emissions. Metro was the first transit agency in North America to adopt hybrid-diesel buses in 2004 and retired its last diesel bus in 2020. Metro renewed its commitment to trolley fleet by purchasing 174 new trolleys in 2015. In the late 2010s, Metro introduced its first BEB into operation on the Eastside of King County to begin testing and using this new technology.

King County's 2015 SCAP set targets and priority actions for reducing emissions and increasing efficiency. In the 2015 SCAP, the County committed to reducing GHG emissions for its own operations by 25 percent by 2020 and 50 percent by 2030, relative to a 2007 baseline. Metro committed to increasing ridership without increasing operational GHG emissions through fleet fuel efficiency, increasing adoption of alternative fuels for fleets including electricity, and transitioning to an all hybrid-diesel and electric bus fleet by 2018.

In 2017, in alignment with a 2015 SCAP goal to increase ridership without increasing operational GHG emissions, Metro committed to making its bus fleet ZE by 2040. The 2017 "Feasibility of Achieving a Carbon-Neutral or Zero-Emission Fleet" study noted that Metro would pursue a goal of transitioning to a ZE fleet so long as vehicle and technology continued to evolve to meet service goals, as defined in Metro Connects: Metro is able to secure reliable and renewable energy supplies from local utilities; incremental costs do not limit Metro's ability to deliver and expand service; and additional safety, training and emergency preparedness risks can be addressed.[7]

In 2020, King County Ordinance 19052 set a target for Metro transit department to transition to a fully ZE revenue bus fleet by 2035. The 2020 update to King County's SCAP identified several strategies to reduce transportation-related GHG emissions, including expanding transit use and reducing emissions by 70 percent by 2030, compared to a 2017 baseline, from County-owned vehicles. Metro updated the Strategic Plan for Public Transportation and Metro Connects in 2021 to integrate the 2020 SCAP performance measures and priority actions.[8]

In June 2025, the Executive transmitted the proposed 2025 SCAP to the King County Council. The proposal builds on these earlier commitments with new and enhanced actions to further reduce transportation-related emissions from County-owned vehicles. These actions include the use of alternative fuels, such as renewable diesel, when ZE vehicles are unavailable or not feasible. The SCAP

[7] Link to Feasibility of Achieving a Carbon-Neutral or Zero-Emissions Fleet at King County Metro Transit, March 2017

[8] Link to Metro Connects

would also update the County's electric vehicle (EV) targets to reflect current EV market conditions and the slower-than-expected availability of medium-duty and heavy-duty EVs.

Since 2020, Metro has gained extensive operational experience with BEBs, engaged with national and international leaders, and shared lessons learned. This learning is reflected through the refinement of Metro's ZE implementation strategy, updated cost estimates for bus and capital investments, and prioritization of delivering reliable transit service while transitioning to a clean energy fleet. During this time, Metro has made significant strides in the transition to a ZE fleet:

- 2018: Leased and piloted 10 BEBs from three different manufacturers.
- 2022: Opened South Base Test Facility to pilot new charging technologies and started BEB operations serving up to 22 routes.
- 2023: Secured $33.5 million in FTA grants for buses and workforce development.
- 2024: Added the 40th BEB on revenue service in South King County and broke ground on Tukwila Base, Metro's first fully BEB base and Metro's first new base built since 1991.
- Coming in 2026: Tukwila Base opens, creating opportunities to scale BEB service and providing capacity to complete infrastructure upgrades for electrification at other existing bases.

As described in the 2024 King County Auditor's report, "Zero Emissions: Metro Transit Working to Mitigate Risks to County's Ambitious 2035 Goal," Metro — like many agencies nationwide — is navigating significant challenges.[9] While the agency has worked hard to maintain momentum for ZE, some of these challenges, such as price inflation, declining bus manufacturing capacity in North America, and uncertainty with federal policy, are industry-wide pressures beyond Metro's control.[10]

Despite the current uncertainty, Metro remains committed to achieving a 100 percent ZE fleet and continuing to reduce GHG emissions. As detailed in this report and the accompanying analyses, investments in both service growth and a ZE fleet transition are essential to reducing air and noise pollution, and improving public health for Metro employees, riders, and residents. These strategies are most effective when pursued together — growing service while investing in ZE fleets helps Metro reduce emissions and deliver reliable, sustainable mobility options that people depend on.

Report Methodology

This report was written and compiled by Metro staff. Additionally, Metro staff worked with Executive Climate Office staff to inform updates to the cost projections presented in Section IV, B2. Zero Emissions Cost Comparison. Metro also partnered with consultants from Fehr & Peers to model avoided emissions associated with increased service and ridership in Section IV, B3. SCAP Coordination and Greenhouse Gas Analysis.

Each requirement of this proviso references specific forward-looking information with key differences between proviso requirements. To respond directly to each requirement, Metro employed different forecasting tools and methodologies. In coordination with budget planning efforts and ZE transition strategic planning, Metro developed four scenarios to reflect varying levels of service investment and ZE fleet transition timelines:

[9] Link to King County Auditor's report, "Zero Emissions: Metro Transit Working to Mitigate Risks to County's Ambitious 2035 Goal"

[10] Link to King County Auditor's report, "Zero Emissions: Metro Transit Working to Mitigate Risks to County's Ambitious 2035 Goal"

- Scenario 1: Proposed 2026-2027 CIP; ZE implementation with budget constraints
    - Responds to Proviso requirement B1 and B2.
- Scenario 2: ZE implementation without budget constraints
    - Responds to Proviso requirement B2 and B3.
- Scenario 3: ZE implementation without budget constraints plus additional service hours
    - Responds to Proviso requirement B3.
- Scenario 4: Adopted 2025 CIP baseline that also reflects ZE SCAP targets
    - Responds to Proviso requirement B3.

Table 1 summarizes the key differences across all scenarios developed in response to proviso requirements. Table 2 identifies which scenarios applied to each section to respond strictly to the proviso requirements and the analyses conducted as necessary to respond to the proviso requirements. Proviso responses to requirements B1 (Zero Emissions Timeline and Cost) and B3 (SCAP Coordination and Greenhouse Gas Analysis) cover the 2025 through 2035 period to align with Metro's proposed 10-year CIP. The response to proviso requirement B2 (Zero Emissions Cost Comparison) includes a longer analysis time horizon, from 2025 to 2045, as directed in the proviso language.

To respond to proviso requirements, Metro began scenario development and analysis in early 2025, before the development of Metro's proposed 2026-2027 budget, service hour plan, and 10-year CIP. The service hours modeled in each scenario are estimates that reflect the anticipated level of service growth and restoration proposed in the 2026-2027 budget. Scenarios 2 and 3 were developed in March 2025 to reflect Metro's early 2026-2027 budget planning (a modified version of the 2025 CIP). Later that month, the King County Office of Economic and Financial Analysis (OEFA) updated its revenue forecast, prompting further reductions to its budget plans.

Scenario 1 incorporates the proposed 2026-2027 CIP decisions but does not model private vehicle-miles-traveled (VMT) reductions with associated service hours. Scenario 2 reflects the forthcoming ZE Implementation Plan (to be finalized in 2026) that shows an ambitious but achievable pathway towards 100 percent ZE if technology improves and funding was unconstrained. Scenario 3 builds on Scenario 2 by adding a hypothetical 250,000 additional service hours above what has been planned in the 2025 budget and proposed 2026-2027 budget to assess the additional GHG benefits of delivering more transit service, per the proviso. Finally, Scenario 4 was included to conduct the GHG analysis using the adopted 2025 CIP and SCAP targets as a baseline for comparison. Transitioning routes to battery electric buses before battery range can deliver service needs will require re-blocking of schedules and added non-revenue service hours. Scenarios 2 and 3 do not fully transition fleet to zero emissions until 2045, allowing for minimal added non-revenue service hours. Scenario 4 transitions fleet to zero emissions by 2035, which has a higher estimated added non-revenue service hour cost.

Table 1. Scenario Modeling Description and Assumptions

	Scenario 1 (Proposed 2026-2027 CIP; ZE implementation with budget constraints)	**Scenario 2** (ZE implementation without budget constraints)	**Scenario 3** (ZE implementation without budget constraints plus additional service hours)	**Scenario 4** (Adopted 2025 CIP baseline that also reflects ZE SCAP targets)
Target Year for 100% ZE Transition	TBD	~2045	~2045	2035
20-Year Cost Analysis	Yes	Yes	*Cost analysis was not conducted. If implemented, Metro anticipates additional capital and operational costs.*	*Cost analysis was not conducted. If implemented, Metro anticipates additional capital and operational costs.*
Greenhouse Gas Emissions Analysis	No	Yes	Yes	Yes
CIP Assumptions	Proposed 2026-2027 CIP	Modified version of 2025 CIP	Modified version of 2025 CIP	Adopted 2025 CIP
ZE Transition Methodology	Partial campus conversion (e.g., transition a portion of a base at one campus). Paced ZE transition with flexibility to accelerate pending resource availability.	Phased campus-by-campus transition (e.g., transition one base at a campus) with sequential base closures. Paced ZE transition with limited flexibility to accelerate given sequential closures.	Phased campus-by-campus transition (e.g., transition one base at a campus) with sequential base closures. Paced ZE transition with limited flexibility to accelerate given sequential closures.	Full campus-by-campus transition (e.g., convert multiple bases at multiple campuses) with some overlapping base closures. Aggressive ZE transition timeline.
Customer-facing Service Hour Growth by 2035 Used in GHG Modeling[1]	Not modeled	~535,000 hours	~785,000 hours[2]	~445,000 hours
Service Modeling Assumptions	Not modeled	• Scenario 2 does not fully transition fleet to zero emissions until 2045, allowing for minimal added non-revenue service hours. • Service hours suspended during	• Scenario 3 does not fully transition fleet to zero emissions until 2045, allowing for minimal added non-revenue service hours. • Addition of hypothetical new service funding to	• Scenario 4 transitions fleet to zero emissions by 2035, which has a higher estimated added non-revenue service hour cost. • Restoration of service hours suspended during

		the pandemic are restored by 2027	add 250,000 additional service hours phased in starting in 2028 to allow for workforce recovery[3]	the pandemic delayed past 2027 to offset added non-revenue service hour/inefficiency costs from ZE

[1]Total customer-facing service hour growth by 2035 was developed for GHG reduction modeling purposes to show the impact of service hour investment where investment would be expected to increase ridership. This excludes non-revenue service hour investment needed to maintain service due to construction re-routes or battery bus range limitations, because these hours will not add service for riders and therefore are not expected to increase ridership.
[2]Modeling of fleet emissions also considered the different levels of total customer-facing service hour growth by 2035 for each scenario and resulting impacts to fleet needs. Delivering the 250,000 additional service hours assumed in Scenario 3 would require Metro to purchase and operate additional buses in the late 2020s. Because Scenarios 2 and 3 represent a programmatic shift towards an all-ZE future by 2045, it is assumed that the additional buses required in Scenario 3 will be BEBs.
[3]Scenario 3 assumes hypothetical new service funding sources and was considered for illustrative purposes only.

Table 2: Scenario Timeframes and Descriptions

Proviso Requirement	Key Comparison	Analysis Timeframe	Scenarios Analyzed
B1	Not applicable	2025 – 2035	Scenario 1: Proposed 2026-2027 CIP; ZE implementation with funding constraints
B2	Cost	2025 – 2045	Scenario 1: Proposed 2026-2027 CIP; ZE implementation with funding constraints Scenario 2: ZE implementation without budget constraints
B3	Greenhouse gas emissions	2025 – 2035	Scenario 2: ZE implementation without budget constraints Scenario 3: ZE implementation without budget constraints plus additional service hours Scenario 4: Adopted 2025 CIP baseline that also reflects ZE SCAP targets

The resulting analyses demonstrate different paths towards meaningful progress in Metro meeting climate goals. However, combining transit service growth with strategic investments in ZE fleet and infrastructure leads to the greatest GHG emissions reductions and public benefit.

IV. Report Requirements

B1. Zero Emissions Timeline and Cost

B1. A timeline and anticipated annual costs for the planned fleet purchases, base conversions, and other capital investments necessary to achieve a fully zero-emission revenue bus fleet.

A. Metro's Zero Emissions Transition Goal

Metro's 2035 ZE goal, originally planned as a base-by-base rollout, is now proposed to extend beyond 2035 due to industry challenges (range, limited bus manufacturing), rising costs, flat revenues, and federal funding uncertainty, while preserving reliable service. Necessary facility and system improvements and limited capacity within Metro's Capital Division also constrain the agency's ability to design and construct the infrastructure needed to meet the 2035 ZE timeline.11 Metro will be able to provide an updated ZE implementation plan after the 2026-2027 budget is adopted by the Council when annual costs and milestones will be more certain.

King County Ordinance 19052 established an ambitious goal for Metro to transition to an electric bus fleet by 2035. In response, Metro developed the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan that leveraged efficient capital delivery and construction methods. This approach entailed sequentially closing full bases, building out the infrastructure, and fully converting fleet to ZE one base at a time based on 2020 assumptions about cost, technology, and industry knowledge at the time.

Significant developments over the past few years have affected Metro's financial outlook. Metro faces financial challenges due to increasing costs, flat revenue, and an uncertain economic outlook. Volatility of FTA funding — which supports Metro's capital investments and bus procurements — adds to this uncertainty. The financial assumptions underlying the 2025 10-year CIP no longer align with the current economic landscape.

As a result, the proposed 2026-2027 budget reflects a scaled-back capital program and extends the ZE transition beyond 2035. Metro remains committed to transitioning to a ZE fleet and reducing GHG emissions from fleet operations while proposing a shift to a phased, longer-term approach that aligns with available funding and ensures service quality and reliability. This strategic shift centers the priorities outlined in Metro's Long Game — and the importance of delivering safe, clean, and reliable service to its customers — with an emphasis on restoring suspended bus service.[12]

Metro will be able to provide an updated ZE implementation plan after the 2026-2027 budget is adopted by the Council when annual costs and milestones will be more certain. Metro will continue to monitor market conditions and maintain flexibility in planning to mitigate risks and adjust the transition strategy. This includes revisiting the timeline and costs of the ZE transition every two years through the CIP budget planning process.

B. Revised Zero Emissions Investment Strategy

Metro proposes extending its bus fleet electrification efforts over 20–25 years with phased base conversions and strategic use of renewable diesel to immediately cut GHG emissions by roughly 60

[11] Link to Follow-up on Metro Transit Capital Project Planning and Delivery (April 2025)
[12] Link to Metro's Long Game - King County, Washington

percent, and a proposed $710 million 10-year CIP for electric buses and infrastructure. The current 10-year CIP proposal is tentative and subject to revision prior to the Council's adoption later in 2025.

The key elements of Metro's revised ZE investments proposed in the 2026-2027 budget and 10-year CIP are:

- **Open Tukwila Base as Metro's first fully electric facility.** Tukwila Base will accommodate a total of 120 BEBs.
- **Distribute ZE investments over 20-25 years.** The longer transition timeline provides greater opportunity to adapt to current financial realities, emerging technology, market conditions, and improved BEB range. It also allows Metro to deliver a capital program that balances the need for state-of-good-repair for existing fleet and facilities with new capital investments.
- **Balance investment in available ZE technology with service requirements.** A longer transition is anticipated to allow Metro to take advantage of advances in BEB technology and range over time and allow Metro to maintain service levels for transit customers through the transition. As of 2025, existing BEB technology meets approximately half of Metro's service needs. In 2026, Metro started testing GILLIG BEBs, which feature a larger battery pack and extended range. These advancements have also informed Metro's decision to remove expensive opportunity charging capital investments in the near term. Extending the transition timeline supports continued technological improvements in range and charging efficiency, which will allow Metro to operate more service without expensive route scheduling changes and improve the BEB-to-hybrid-diesel replacement ratio — ultimately generating long-term cost savings.
- **Evaluate smaller fleet conversions.** Metro will continue to plan for cost-effective fleet transitions, including reconsidering partial base conversions in addition to full base conversions. Phased investments will allow Metro to apply lessons learned from early stages of the ZE transition to future investments, reducing implementation and operational risks.
- **Deploy and scale renewable diesel to decrease GHG emissions by approximately 60 percent without costly capital investments.** Metro has already deployed renewable diesel at East Base, Ryerson Base, and South Base, immediately reducing GHG emissions without requiring additional investments in new fleet or infrastructure. Over the next 20 years, expanding this approach will lead to a significantly smaller carbon footprint while Metro continues to transition to a 100 percent ZE bus fleet. Renewable diesel is an effective interim solution for reducing emissions, but it is not considered a good long-term solution as it does not eliminate GHG emissions entirely and misses the broader, long-term full decarbonization goals.

The proposed 2026-2027 budget reflects this approach, and includes a scaled-back CIP proposal including roughly $300 million for BEB procurement and $410 million of capital investments in ZE infrastructure over 10 years, including:

- Charging infrastructure and maintenance facility upgrades to a single Central Campus base to convert a portion of the base's fleet to BEBs.
- Procurement and testing of four BEBs from Solaris, a European bus manufacturer, to evaluate a new ZE bus provider and support future bus manufacturing capacity in North America.
- Capital improvements to support operation of trolleys on Route 48 (University District to Mount Baker via the Central District).
- A facility project to construct an isolation and inspection area for BEBs to protect employees and other assets and reduce the impact of a potential thermal event (fire).
- A pilot project to evaluate hydrogen fuel cell buses, pending recommendations from a hydrogen fuel cell study currently underway.

- Completion of ZE projects already underway, including the final phases of construction and opening of Tukwila Base, ongoing investments at South Base Test Facility, and non-revenue EV charging.

Metro is proposing to remove the South Annex Base (SAB) project from its 10-year CIP. Originally envisioned before the pandemic to support expanded service, Metro restructured plans for SAB to support the ZE transition. However, Metro's service demand has changed due to the pandemic and shifted toward a more all-day and less peak-oriented network. As Metro now adopts a longer-term, phased approach to its ZE strategy, existing base capacity is sufficient to meet service needs for the foreseeable future. If Metro were to resume a more accelerated 100-percent ZE transition, SAB or other system-wide base capacity would be necessary.

In summary, this adaptive strategy underscores Metro's commitment to both environmental sustainability and fiscal responsibility. As conditions evolve, Metro remains poised to adjust and accelerate progress, ensuring the path toward a ZE fleet stays on course while balancing current constraints with long-term success.

C. Future of Metro's Zero Emissions Fleet

Tukwila Base launches ZE service in 2026, the hybrid-diesel bus fleet shifts to renewable diesel immediately, and Metro will revisit its ZE timeline biennially to integrate new technologies and funding.

Metro is committed to sustainability and an equitable transition to a ZE fleet, prioritizing improvements in communities most impacted by air and noise pollution. Tukwila Base will begin ZE revenue service in 2026 and reach full capacity by fall 2027. Metro will rapidly transition its hybrid-diesel fleet to run on renewable diesel, further reducing its carbon footprint. This strategy balances service reliability, emissions reduction, and financial realities.

Looking beyond the 10-year horizon described in the proposed CIP, Metro's long-term vision for a fully ZE fleet is designed to adapt and evolve alongside breakthrough technologies, shifting policy landscapes, and funding availability. By integrating ongoing research on ZE advancements, partnering with industry leaders, and maintaining flexibility in its planning, Metro positions itself to seize emerging opportunities and accelerate the transition when conditions allow. This strategy ensures that, while Metro's current investments lay a solid foundation, its roadmap remains agile, capable of integrating new funding pathways to ultimately deliver a fully sustainable and resilient transit network.

Metro will revisit the ZE transition timeline and cost estimates every two years through the budget and CIP process, adapting as new data, funding, and/or technologies emerge. This strategy reaffirms Metro's commitment to climate action and equity—advancing toward a cleaner, more resilient transit system while delivering service for riders.

B2. Zero Emissions Cost Comparison

B2. An update covering the years 2025 through 2045 to the cost projections developed for the September 30, 2020, Zero-Emission Battery Bus Preliminary Implementation Plan, 2020-RPT0142, which compared the cost of a zero-emission fleet to continuing the Metro transit department's current fleet practices, and which indicated that, in a moderate case that included social benefits, battery-electric buses would be forty-two percent more expensive than diesel hybrid buses, for a total cost change of $574,000,000 or approximately 237,000 annual service hours over nineteen years.

A. Cost Comparison Methodology

Metro's 2025 update strengthens its BEB-vs-hybrid-diesel cost model with current procurement, maintenance, infrastructure amortization, and social-emission cost inputs. It then compares a full ZE transition by approximately 2045 to a scenario that phases in about 230 BEBs at select bases (as proposed in the CIP) but continues to procure and operate a predominantly hybrid-diesel fleet.

This section describes recent results from a model that Metro originally developed in 2017 to compare the total cost of a BEB fleet scenario to a "business as usual" scenario.[13] This model was updated in 2020 to provide cost comparisons and results were captured in the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan. To respond to the proviso, Metro incorporated current cost estimates and economic conditions. These updates represent major improvements and draw on the hands-on experience that Metro has gained operating BEBs and engagements with other transit industry leaders since the analysis was last conducted in 2020.

Major updates and key assumptions include:

- Updated pricing for bus purchases, which reflects the current challenging market for bus procurement.
- Improved cost estimates for routine maintenance and bus battery system rebuilds.
- Recent inflation projections that reflect lingering effects of the COVID-19 pandemic and current economic uncertainty.
- Inclusion of Metro's trolley fleet, which was not captured in the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan.
- Fueling data that accounts for Metro's current transition to renewable diesel, which will significantly reduce GHG emissions and air pollution.

Section B2 of the proviso requires Metro to compare "the cost of a zero-emission fleet to continuing the Metro transit department's current fleet practices." Metro chose to use the proposed 2026-2027 budget and 10-year CIP to represent Metro's "current fleet practices" (Scenario 1). To represent the "zero-emission fleet" alternative, Metro developed Scenario 2 which reflects the forthcoming ZE implementation plan without budget constraints. More detail on all scenarios is provided in Table 1 (above).

1. **Scenario 1 (2026-2027 Proposed CIP; ZE implementation with funding constraints):** a gradual ZE transition in alignment with Metro's proposed budget and 10-year CIP. This scenario includes the capital projects described in the response to proviso requirement B1 (e.g., full buildout at

[13] Link to 2020 Zero-Emission Battery Bus Preliminary Implementation Plan (2020-RPT0142)

Tukwila Base, partial conversion of the fleet at a single Central Campus base to BEBs, and converting Route 48 from hybrid-diesel buses to trolleys). The fleet plan includes BEBs to support these new investments. All other bus purchases (with the exception of trolley bus replacements) are assumed to be hybrid-diesel.

2. **Scenario 2 (ZE implementation without budget constraints)**: a service-focused transition that would result in a full ZE bus fleet transition by 2045 via sequential base conversions.

Metro considered 35-foot, 40-foot, and 60-foot hybrid-diesel and BEB fleets, respectively, and 40-foot and 60-foot trolley buses. Bus costs are based on Metro's currently anticipated costs for planned bus procurements. ZE infrastructure costs are estimated based on those from Metro's recent Tukwila Base project. Maintenance costs are based on Metro's historical average costs by bus type.

The analysis assumes fueling and charging infrastructure are amortized over the life of the infrastructure. Electrical infrastructure as well as diesel underground storage and pumps have an assumed asset life of 50 years, whereas direct vehicle charging infrastructure has an assumed asset life of 10 years. Additionally, the cost projection is based on maintaining the current hybrid-diesel fueling infrastructure as well as building new BEB charging infrastructure. The initial cost of designing and installing the supporting electrical infrastructure is included in the analysis. Conventional fueling infrastructure is excluded from the analysis as storage tanks and pumps have already been installed at each of the bases and only future maintenance to these assets is assumed. Amortization assumes a set number of vehicles per base that does not change over the life of the asset.

The analysis includes estimates of the environmental and health impacts from GHG emissions, air pollution, and noise. The cost of GHG emissions is quantified using the social cost of carbon estimates employed by the Washington Utilities and Transportation Commission.[14] The social cost of carbon is an estimate of the economic harm that today's GHG emissions will cause for future generations due to climate change. The analysis also included the human health costs associated with emissions of regulated air pollutants, including particulate matter, nitrogen oxides (NOX) and sulfur dioxide (SOX), following guidance from the U.S. Department of Transportation.[15]

B. Cost Comparison Results

Achieving an all-battery-electric fleet by 2045 runs about $1.3B, or 19 percent, higher in total costs than the current proposed CIP plan with a predominately hybrid-diesel fleet, and about 18 percent more expensive when societal benefits like reduced emissions and noise are factored in. Scenario 2 (Phased ZE) is more expensive due to higher costs associated with vehicle purchase, charging infrastructure, battery replacement, and vehicle maintenance and tire costs.

Table 3: 20-year Scenario Cost Comparison Summary

[14] Link to Washington Utilities and Transportation Commission. "Utility regulators adopt social cost of carbon." September 20, 2019.

[15] Link to U.S. Department of Transportation. "Benefit-Cost Guidance for Discretionary Grant Programs." May, 2025. Benefit Cost Analysis Guidance 2025 Update II (Final).pdf

2025-2045 Fleet Replacement (2025 $ million)		Scenario 1 Proposed 2026-27 CIP; ZE implementation with funding constraints	Scenario 2 ZE implementation without budget constraints
Capital	Vehicle Purchase	$2,770	$3,320
	Charging/Fueling Infrastructure	$270	$470
	Total Capital Costs	*$3,050*	*$3,800*
Operating	Vehicle Maintenance and Tires	$3,380	$3,700
	Fuel / Electricity	$430	$410
	Battery Replacement and Disposal	$150	$420
	Total Operating Costs	*$3,950*	*$4,530*
Total Cash Costs		**$7,000**	**$8,330**
Comparison to Scenario 1	*Dollars*		*$1,330*
	Percent		*19%*
Total Cash Cost per Mile		**$7.10**	**$8.50**
Societal	GHG and Air Pollution Emissions	$120	$80
	Noise	$70	$60
	Total Societal Costs	*$190*	*$140*
Total Cash and Non-Cash Costs		**$7,200**	**$8,470**
Comparison to Scenario 1	*Dollars*		*$1,270*
	Percent		*18%*
Total Cash and Non-Cash Costs per Mile		**$7.30**	**$8.60**
Total Mileage (million miles)		***980***	***980***

Bus purchase price represents about 40 percent of the total cost in both scenarios.[16] Vehicle purchase costs are greater in Scenario 2 despite similar fleet sizes in both scenarios. As in the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan, BEBs remain more expensive to procure than comparable hybrid-diesel buses, even while costs for all types of buses have increased between 10 percent and 30 percent since the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan (over and above inflation).[17]

Future prices remain highly uncertain due to multiple contributing factors, including limited vendors in the North American bus market, federal policy and funding uncertainty, and transit agencies' demand for BEBs. Additionally, uncertainty in federal policy could result in fewer BEB orders for existing North American bus manufacturers, potentially leading to higher prices due to reduced manufacturing

[16] This scenario is hypothetical and is not intended to represent a specific budget or capital proposal. The fleet plan included in this scenario includes approximately 5 percent more buses between 2025 and 2045 than Scenario 1 because of the battery range limitations with BEB technology. For comparison, as of 2025, other transit agencies that operate BEBs are currently experiencing 15 percent to 30 percent increase in fleet needed to maintain service. The 5 percent is due to the extended transition period and expected BEB technology improvements.

[17] Link to 2020 Zero-Emission Battery Bus Preliminary Implementation Plan (2020-RPT0142)

capacity. Historically, federal grants have supported Metro's bus purchases, accounting for up to 80 percent of bus procurement costs. The costs shown in Table 3 represent full purchase costs; Metro may be able to leverage grant funds to cover some portion of these costs, particularly for bus purchases.

Vehicle maintenance is the largest driver of costs, accounting for approximately 45 percent of the total cost in both scenarios. Total maintenance costs are higher in Scenario 2 than in Scenario 1. Data from the past three years of operating BEBs out of South Base Test Facility show that BEBs have higher per-mile maintenance costs than hybrid-diesel buses. This maintenance cost estimate is based on costs associated with BEBs procured from the bus manufacturer New Flyer in 2022, which experienced an unusually high rate of maintenance issues initially. As a result, the current estimate may be higher than the maintenance costs that Metro can expect long-term. Metro has since procured and begun testing BEBs from a different manufacturer, GILLIG, which may have lower initial maintenance costs. This maintenance cost per mile could decrease in the future as Metro expands its BEB fleet to include other manufacturers and gains more experience repairing and maintaining BEBs.

Importantly, this pattern is not new to the transit industry. The last time the industry made a significant fleet transition — from diesel to hybrid-diesel — maintenance costs were initially elevated as agencies and manufacturers worked through early technology challenges. Over time, as the technology matured and maintenance practices improved, costs stabilized and ultimately decreased. Metro anticipates a similar trajectory for BEBs, with maintenance cost per mile expected to decrease in the future as the fleet expands, the technology matures, and operational experience grows.

Charging and fueling infrastructure, battery replacement and disposal, and cost of fueling (electricity or diesel) make up the remaining costs. Scenario 2 shows a faster transition to ZE because it is without budget constraint and assumes the buildout of charging infrastructure to support nearly 800 more BEBs than Scenario 1, resulting in a cost increase of approximately $200 million. This cost includes only the purchase and installation of the chargers, pantographs, and gantries to support these BEBs. In practice, Metro's cost to convert bus bases to support BEBs will include additional costs not captured in this model, such as maintenance facility improvements, retrofits, structural changes to existing buildings, and project soft costs. As a point of comparison, BEB charging infrastructure accounted for approximately 40 percent of the total project cost for Metro's Tukwila Base project. Future base conversion projects are likely to require more substantial site and building improvements. The comprehensive costs to operate BEBs, including charging infrastructure and other facility upgrades, could be significantly higher than what is reflected in Metro's current modeling. Metro did not include these additional costs in this analysis as they would need to be determined through detailed project design. Some of these costs, such as retrofits to existing operational buildings, are not specific to Metro's ZE program and may be required regardless of ZE as part of state-of-good-repair projects.

The analysis also includes costs associated with maintaining Metro's existing diesel fueling and trolley traction power infrastructure. These costs are based on the planned system major maintenance and replacement projects in Metro's proposed 2026-2027 CIP. Diesel fuel system replacement costs are higher in Scenario 1, assuming some fuel system projects could be avoided by converting bases entirely to ZE buses.

While this analysis includes the cost of replacement for both EV chargers and diesel fuel infrastructure, it does not account for minor, ongoing day-to-day maintenance costs. Metro will gather more data to better estimate these costs for EV chargers through the opening and operation of Tukwila Base.

Both scenarios include costs for battery replacements and disposal, with higher costs in Scenario 2 due to the higher number of BEBs. The analysis assumes all BEBs, including those operating out of Tukwila Base, will receive a mid-life battery replacement at an estimated cost of $400,000, along with upgrades to trolley bus batteries estimated at $160,000 per bus. Metro included costs for hybrid-diesel battery system maintenance in vehicle maintenance costs.

Fuel costs are lower in Scenario 2 than Scenario 1. Historically, diesel costs have been highly variable, so it is challenging to predict average fuel prices through 2045. In addition, Metro's data on BEB energy efficiency, which determines how much electricity is required to deliver service, is currently limited. The energy efficiency values used in this analysis are based on preliminary data from the BEB routes that Metro currently operates out of South Base Test Facility. The opening of Tukwila Base and the accompanying increase in BEB operations will provide more data to assess BEB energy efficiency. Metro may also identify ways to iteratively improve BEB energy efficiency as more data become available.

Societal costs in both scenarios are relatively small. In Scenario 2, the relatively low GHG and air pollution costs are primarily the result of particulate matter (PM) emissions from BEB brake and tire wear. In Scenario 1, the GHG and air pollution emissions are largely the result of tailpipe emissions from hybrid-diesel buses. However, these emissions are dramatically reduced by assuming renewable diesel use for hybrid-diesel buses in both scenarios.

Results Summary

Ultimately, this analysis suggests that higher initial costs for BEBs are not fully offset by the lower price of electricity, as compared to diesel, or by the societal benefits of reducing emissions and noise. However, BEB and charging technologies continue to evolve. Since Metro developed the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan, the industry has shifted toward the use of overhead gantry systems and a mix of slow and fast charging strategies. The maintenance costs in this analysis are also higher than those in the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan, now based on analysis of Metro's historical maintenance records, providing a better representation of expected costs going forward. This update also includes costs for Metro's trolley system, which were not included in the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan.

A direct comparison between this analysis and the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan is not feasible due to the differences in the scenarios analyzed. In general, the overall program costs for both scenarios in this analysis are higher than the estimates in the 2020 Zero-Emission Battery Bus Preliminary Implementation Plan, even after accounting for inflation. This updated analysis also includes more data from Metro's direct experience operating BEBs and building ZE infrastructure, rather than industry-wide averages and estimates from vendors. As previously noted, Metro's estimates for bus purchase prices have increased beyond inflation since the earlier analysis, despite remaining at or below the lowest pricing in the industry. The 2020 Zero-Emission Battery Bus Preliminary Implementation Plan also underestimated the cost of electrical charging infrastructure, assuming the use of equipment more appropriate for light-duty vehicles.

The 2020 Zero-Emission Battery Bus Preliminary Implementation Plan noted that the cost difference between BEBs and hybrid-diesel buses — $574 million in the scenarios it evaluated — could fund

approximately 237,000 annual service hours over 19 years (2021-2040). Comparing the cost of converting to a ZE fleet versus investing in more service does not reflect Metro's strategy for reducing GHG emissions. Metro's strategy, which aligns with goals and performance measures in the King County SCAP, prioritizes both expanding transit service and transitioning County fleets to ZE vehicles and fuels. The design and construction of base electrification and other ZE projects does also assume grant funding that could not be used for service investments. As detailed in this report and the accompanying analysis, investments in both service growth and a ZE fleet transition are essential to reducing air and noise pollution, and improving public health for Metro employees, riders, and residents. The Council will see this strategy reflected in the proposed 2026-2027 budget investments for Metro.

C. Summary

Metro's current cost estimates suggest that fully converting to a ZE bus fleet would increase costs by at least approximately $1.3 billion between 2025 and 2045 for charging infrastructure and yard upgrades and does not include facilities or maintenance bay updates. Societal costs from GHG emissions, air pollution, and noise are relatively small, due in part to the transition to renewable diesel for all hybrid-diesel buses.

Despite improvements in the data and assumptions in this analysis, there is still significant uncertainty in costs over this 20-year period. Future bus pricing, availability of bus manufacturers, and federal policy present interrelated uncertainties. Metro will continue to improve cost estimates as data becomes available and may find that some costs, particularly for BEB maintenance, can be reduced with additional experience.

B3. SCAP Coordination and Greenhouse Gas Analysis

B3. Information on the Metro transit department's coordination with the King County climate office on the development of the 2025 update to the strategic climate action plan to update the analysis in that plan about the contributions of transportation to greenhouse gas emissions, including the health impacts of greenhouse gas emissions from transit compared with increased ridership on transit, as well as the strategies that could be implemented to reduce these emissions.

A. Strategic Climate Action Plan Coordination

Metro staff worked with the Executive Climate Office to update the County's operational and community GHG inventory, perform a wedge analysis of reduction pathways, and co-develop the proposed on-road transportation actions and performance measures for the 2025 SCAP.

More than 60 Metro employees contributed to the development of the 2025 SCAP update. Their work included developing and reviewing updated goals, actions, and performance measures for the Transit and Transportation and Zero-emission County Fleets sections.

King County measures county-wide and operational GHG emissions associated with its daily operations and the services it provides to the community. Metro supported this effort by providing the Executive Climate Office with data to update the County's operational and community GHG emissions inventory, which informed the development of actions and performance metrics for the 2025 SCAP.

County fleet/operational emissions: In 2023, fleet and fuel use accounted for 57 percent of King County governmental emissions, and the largest source of County fleet emissions were from Metro buses. Approximately 80 percent of County government fleet GHG emissions are attributed to Metro Transit fleets, followed by the Department of Natural Resources and Parks (10 percent), King County Sheriff's Office (5 percent), Department of Local Services (2 percent), Department of Executive Services (1 percent), and Public Health – Seattle & King County (1 percent). From 2019 to 2023, emissions for all County fleets decreased by 18 percent.

Community emissions from transportation: In 2023, transportation, including on-road vehicles, marine, and aviation, accounted for 47 percent.[18] Burning diesel, gasoline, and other fuels for on-road vehicles accounted for about 26 percent of King County GHG emissions. From 2019 to 2023, on-road transportation emissions increased by 2.5 percent overall. Per person, they fell by 18 percent, dropping from 3.5 to 2.8 MTCO2e (metric tons of carbon dioxide equivalent) per year.

Metro also coordinated with the Executive Climate Office to develop an updated GHG wedge analysis to identify pathways for achieving countywide emissions targets. Based on the County's 2023 GHG inventory, the updated analysis estimates emission reductions from federal, state, and local actions, along with key measures identified in the updated SCAP.

These analyses and input from the community led to the development of key actions for reducing GHG emissions associated with on-road transportation.

2025 SCAP: Key Actions to Reduce Operational Emissions from Metro Fleets
• GHG 2: Engage utilities to advance clean energy and vehicle electrification • GHG 8: Support the Washington State Clean Fuel Standard and robust life-cycle emissions accounting of low transportation fuels • GHG 79: Install infrastructure to support transition to zero-emission fleets • GHG 80: Transition King County bus fleets to zero-emission fleets • GHG 81: Transition light, medium, and heavy-duty vehicles to zero emission vehicles • GHG 82: Prohibit the purchase of new light-duty internal combustion engine vehicles without waiver approval • GHG 83: Increase the utilization of Metro's electric trolley bus system • GHG 84: Prioritize zero emission options for Water Taxi service • GHG 85: Use alternative fuels when zero emission vehicles are unavailable
2025 SCAP: Key Actions to Reduce Vehicle Miles Traveled from Single-Occupant Vehicles

[18] Link to Executive's proposed 2025 SCAP

- GHG 7: Improve local mobility by communicating the need for stable, sustained, and growing transit funding
- GHG 12: Champion equitable road and vehicle usage pricing, and road use charges
- GHG 13: Advance the development of Equitable Transit Oriented Communities (ETOC)
- GHG 14: Grow revenue backing the Transit Oriented Development (TOD) bond fund
- GHG 15: Develop and implement a funding strategy for Metro Connects
- GHG 16: Grow the number of people served by frequent transit, including RapidRide
- GHG 17: Invest in speed and reliability improvements at "hot spots" and along frequent bus routes
- GHG 18: Expand adoption of commuter benefit ordinances across King County
- GHG 19: Enhance transit rider education and incentive programs
- GHG 20: Improve access to mobility options
- SRFC 38: Plan Collaboratively with frontline communities to increase transit mobility

B. Greenhouse Gas Emissions Analysis

Metro evaluated GHG emissions for three of the four scenarios (Scenarios 2, 3, and 4) developed for this report, each representing a different approach to ZE implementation. These include a full BEB conversion by 2035 in Scenario 4, and two phased transitions by 2045 with stepped service hour growth in Scenarios 2 and 3. The analysis estimates emissions from the Metro fleet (assuming the use of renewable diesel until the fleet is fully converted to BEB) and reductions in private-vehicle GHG emissions from increased transit ridership.

In coordination with the Executive Climate Office, Metro worked with consultants from Fehr & Peers to assess the relative difference in transit ridership, vehicle miles traveled (VMT) from private vehicles, and GHG emissions associated with three of the four ZE implementation scenarios developed for this report:

- Scenario 2: ZE implementation without budget constraints;
- Scenario 3: ZE implementation without budget constraints plus additional service hours, and
- Scenario 4: Adopted 2025 CIP baseline that also reflects ZE SCAP targets.[19]

For each scenario, Metro analyzed the anticipated GHG emissions from fleet operations based on vehicle use and fuel type to provide a comparison of fleet emissions. Given the timing of this work, performed in advance of the Executive's 2026-2027 budget transmittal, these scenarios are intended to provide high-level guidance only. The associated service and capital assumptions are hypothetical and do not represent a specific proposed budget.

In coordination with budget planning efforts and ZE transition strategic planning, Metro developed three scenarios to reflect varying levels of service investment and ZE fleet transition timelines. A 10-year timeline was used for this analysis to align with Metro's 10-year CIP. Scenario 4 represents the budgeted service hours associated with the currently adopted ZE Transition Plan (full ZE transition by 2035), whereas Scenarios 2 and 3 represent greater service hour investments associated with more gradual ZE implementation timelines (see Table 1 for more information about these scenarios and Appendix A

[19] GHG emissions were not modeled for Scenario 1 as this analysis with an outside consultant was initiated before the 2026-2027 CIP was developed and the analysis for Scenarios 2-4 specifically addressed item B3 from the Proviso.

"Memo RE: King County Metro Service Modeling for Zero Emission Implementation Plan" for more information about this modeling effort).

Metro's Service Guidelines and the 2024 System Evaluation Report guided the recommended service hour allocations across each scenario. The Service Guidelines highlight the process to allocate investments based on three priorities (reducing crowding, improving reliability, and supporting service growth), while the 2024 System Evaluation report applies the Service Guidelines framework by incorporating recent performance data to inform near-term service changes.

The following assumptions apply to Scenarios 2, 3, and 4:

- Metro will fully restore the service hours that were suspended during the COVID-19 pandemic and return to pre-pandemic service/route productivity levels.
- Metro will use renewable diesel to fuel all hybrid-diesel buses starting in 2026 until a full ZE transition is achieved.
- Ridership data includes Metro bus and Dial-A-Ride-Transit (DART) service only.

Fehr & Peers analyzed the climate benefits of expanded transit service in Scenarios 2, 3, and 4. This included analyzing "avoided" VMT — the car trips that did not occur because people chose transit instead. Avoided GHG emissions represent the tailpipe emissions from private vehicles that did not occur because these trips occurred via transit. The analysis assumed that approximately 50 percent of new transit trips came from people who would have driven if transit were not an option.

GHG emissions from bus fleet operations were quantified using the assumptions outlined in the above response to requirement B2 of this proviso. The modeling assumed base conversions to ZE on the timelines listed in Table 4. Scenarios 2 and 3 reflect a hypothetical timeline for modeling purposes and is not an indicator of when Metro will achieve 100 percent BEB conversion. Scenario 4 reflects the adopted 2025 CIP, which has significantly been revised in the 2026-2027 CIP. In all scenarios, all hybrid-diesel buses will be fueled with renewable diesel by 2026.

Table 4: ZE Base Conversion Timelines

Year	Scenario 2 (ZE implementation without budget constraints) & Scenario 3 (ZE implementation without budget constraints plus additional service hours)	Scenario 4 (Adopted 2025 CIP baseline that also reflects ZE SCAP Targets)
2026	Tukwila	Tukwila
2027		
2028		
2029		South Annex, Central, Ryerson
2030	Ryerson	East
2031		
2032		Bellevue
2033	Bellevue	North

2034		
2035	North Phase 1	
2036		Atlantic, South
2037		
2038	Atlantic, Central	
2039		
2040	East	
2041		
2042	North Phase 2	
2043		
2044	South	

C. Results

Metro's analysis confirms that investments in both ZE technology and service growth reduce GHG emissions in support of the County's climate goals.

As shown in Table 5 (see below), Metro is projected to remove more than 4 billion private VMT between 2025 and 2035 in all scenarios. This is evidence of the important role Metro plays in removing private vehicle trips, reducing congestion, and reducing air pollution. Table 5 also demonstrates the large climate benefit of these avoided private vehicle trips, ranging from 867,000 to over 1 million metric tons of avoided carbon emissions between 2025 and 2035.

The results in Table 5 also show that increasing customer-facing service hours can create mode shifts away from personal vehicles toward transit service. Scenario 2 provides approximately 90,000 more annual customer-facing service hours than Scenario 4, resulting in 90 million additional avoided VMT in Scenario 2. With 250,000 more annual service hours, Scenario 3 continues this trend with even greater avoided VMT, showing that higher levels of service investment can continue to drive greater reductions in private vehicle trips.

Table 5: Avoided Emissions Associated with Increased Transit Service, 2025 – 2035

Scenario[1]	**ZE Transition Assumption**	**Total 2025 - 2035 Service Hours** (cumulative, million)[1]	**2025- 2035 Ridership** (cumulative, million)	**Avoided VMT** (cumulative, million)	**Avoided GHG Emissions from Transit Service Investments** (cumulative metric tons CO_2e)[2,3]
2	ZE implementation without budget constraints	45.6	1,300	-4,150	-885,000 to -972,000
3	ZE implementation without budget constraints plus	45.9	1,350	-4,330	-917,000 to -1,009,000

	additional service hours				
4	Adopted 2025 CIP baseline that also reflects ZE SCAP targets	45.5	1,270	-4,060	-867,000 to -952,000

[1] GHG emissions were not modeled for Scenario 1 as this analysis with an outside consultant was initiated before the 2026-2027 CIP was developed and the analysis for Scenarios 2-4 specifically addressed item B3 from the Proviso.
[2]Includes Metro bus and Dial-A-Ride Transit (DART) service.
[3]The range of avoided emissions represent two different rates of EV adoption, fast and slow, in the private vehicle market. Fast EV transition assumptions are consistent with the PSREA/K4C GHG Inventories: 25% of new cars are EV by 2026, 65% by 2030, and 100% by 2035. Slow EV transition considers the current uncertainty around range/charging and federal policies: 20% of new cars are EV by 2026, 35% by 2030, and 50% by 2035.
[4]Metric tons CO_2e = metric tons of carbon dioxide equivalent.

Table 6 (see below) compares the avoided GHG emissions from transit service shown in Table 5 to GHG emissions resulting from the operation of Metro's bus fleet. In all scenarios analyzed, avoided emissions from transit ridership are approximately three times greater than bus fleet emissions, resulting in a net GHG reduction of approximately 557,000 to 691,000 metric tons of emissions avoided between 2025 and 2035. This demonstrates that regardless of whether the ZE transition is accelerated (as in Scenario 4) or slowed (as in Scenarios 2 and 3), Metro provides a large net climate benefit to the region through service and ridership.

The results for Scenario 3 in Table 6 demonstrate that investing in both a strategic ZE fleet transition (as in Scenarios 2 and 3) and additional service hours (as in Scenario 3) can provide significant community climate benefits. Of the three scenarios analyzed, Scenario 3 results in the largest net GHG reduction of approximately 599,000 to 691,000 metric tons between 2025 and 2035.

Table 6: Net GHG Emissions Comparing Metro Bus Fleet Operations and VMT Reduction Associated with Transit Service Investments, 2025 – 2035

Scenario	**ZE Transition Assumption**	**Metro Bus Fleet GHG Emissions** (cumulative metric tons CO_2e)[1]	**Avoided GHG Emissions from Transit Service Investments** (cumulative metric tons CO_2e)[1, 2]	**Net GHG Emissions Reductions** (cumulative metric tons CO_2e)[1]
2	ZE implementation without budget constraints	318,000	-885,000 to -972,000	-567,000 to -654,000
3	ZE implementation without budget constraints plus	318,000	-917,000 to -1,009,000	-599,000 to -691,000

	additional service hours			
4	Adopted 2025 CIP baseline that also reflects ZE SCAP targets2025	286,000	-867,000 to -952,000	-582,000 to -666,000

[1]*Metric tons CO_2e = metric tons of carbon dioxide equivalent.*

[2] *The range of avoided emissions represent two different rates of EV adoption, fast and slow, in the private vehicle market. Fast EV transition assumptions are consistent with the PSREA/K4C GHG Inventories: 25% of new cars are EV by 2026, 65% by 2030, and 100% by 2035. Slow EV transition considers the current uncertainty around range/charging and federal policies: 20% of new cars are EV by 2026, 35% by 2030, and 50% by 2035.*

D. Summary

Metro staff coordinated closely with the Executive Climate Office to develop the 2025 update to the County's SCAP. This included providing applicable data to update the County's operational and community GHG emissions inventory, as well as contributing to the County's GHG wedge analysis to identify pathways to achieve countywide emissions reduction targets. Metro staff also partnered with the Executive Climate Office and community partners to develop key actions to reduce GHG emissions associated with on-road transportation as included in the Executive's proposed 2025 SCAP.

Overall, Metro found that investments in both ZE technology and service growth can reduce GHG emissions in support of the County's climate goals. The analyses quantified the impact of multiple strategies to reduce GHG emissions: investing in service, transitioning to ZE buses, and using renewable fuels in existing hybrid-diesel coaches. Investing in ZE to reduce GHG emissions associated with the operation of fleet vehicles *and* increasing transit service and ridership are both important to further reduce air and noise pollution, providing important health benefits for employees, riders, and residents. Adding more service also provides benefits beyond GHG emissions reduction which were not analyzed but make progress towards broader Metro and County goals.

The forthcoming Zero-Emissions Implementation Plan (2026) will provide more detail about the implementation and tradeoffs associated with these and other GHG reduction opportunities.

V. Conclusion/Next Steps

Metro has laid a strong foundation for advancing climate goals through the agency's planned transition to a 100 percent ZE fleet and investing in service and ridership growth. Through strategic planning, significant capital investments, successful grant applications, and industry partnerships, Metro has positioned itself as a national leader in sustainable transit. The launch of Tukwila Base in 2026 will mark a major operational milestone, bringing cleaner, quieter bus service to communities in South King County.

Looking ahead, Metro will complete the Zero-Emissions Implementation Plan (2026) upon adoption of the 2026–2027 budget to reflect updated financial assumptions, evolving technology, and service needs. The agency will focus on the successful opening and operation of Tukwila Base, ensuring the workforce, technology, and operations are prepared for this transition and continuing to deliver and grow high-quality transit service. Metro will continue its proactive engagement with industry leaders, utilities, and

peer agencies to stay at the forefront of ZE advancements, while leveraging new data from BEB operations to refine future deployment strategies.

To ensure long-term success, Metro will maintain its focus on balancing service quality, financial sustainability, and climate action. The agency will pursue incremental ZE base and fleet conversions, expand workforce development, and continue analysis of GHG reduction impacts. This adaptive approach will allow Metro to maximize climate benefits and deliver on regional goals through investment in service and ZE fleet technology.

Next steps include:

- **Updating the Zero-Emissions Implementation Plan (2026)** upon the Council adoption of the 2026–2027 budget to reflect the updated financial plan, anticipated revenues, and CIP.

- **Continuing to implement ZE commitments outlined in the proposed 2026-2027 budget:**
    - Charging infrastructure and maintenance facility upgrades to a single Central Campus base to convert a portion of the base's fleet to BEBs.
    - Procurement and testing of four BEBs from Solaris, a European bus manufacturer, to evaluate a new ZE bus provider and support future bus manufacturing capacity in North America.
    - Capital improvements to support operation of trolley buses on Route 48 (University District to Mount Baker via the Central District).
    - A facility project to construct an isolation and inspection area for BEBs.
    - A pilot project to evaluate hydrogen fuel cell buses (in later half of 10-year CIP term), pending recommendations from a hydrogen fuel cell study currently underway.
    - Completion of ZE projects already underway at South Base Test Facility, including the completion of Tukwila Base and non-revenue EV charging.

- **Working with the Executive and the Council to update policies** related to Metro's revenue bus fleet ZE timeline.

- **Successful opening of Tukwila Base**, Metro's new 100 percent BEB base, which will expand ZE capacity and operational flexibility.

- **Continuing engagement with industry leaders and peer transit agencies** to track and drive technological advancements, advocate for funding opportunities, and share best practices in ZE fleet deployment.

- **Analyzing data and monitoring performance** to inform future decision-making and ensure Metro's transition remains adaptive, equitable, and cost-effective.

This report was made possible in partnership with colleagues from Metro, the Executive Climate Office, and the Office of Performance, Strategy and Budget; with significant modeling and data analysis conducted by Fehr & Peers, and PRR editorial support.

VI. Appendices

A. Appendix A "Memo RE: King County Metro Service Modeling for Zero Emission Implementation Plan"

Memorandum

Date: June 26, 2025

To: King County Metro

From: Fehr & Peers

Subject: King County Metro Service Modeling for Zero Emission Implementation Plan

Background

Expanding and improving transit service is a critical strategy for reducing passenger vehicle miles traveled (VMT) in King County. By making public transit a more viable, reliable, and convenient alternative to driving, Metro can shift more trips away from single-occupancy vehicles. The King County 2020 Strategic Climate Action Plan (SCAP), which was adopted through Motion 15866, identifies several strategies to reduce transportation-related greenhouse gas (GHG) emissions, including by increasing use of transit and by reducing emissions from county-owned vehicles. Transit service is key to reducing transportation emissions, both through mode shift and the support of high-density land use.
The mode shift associated with Metro transit service plays a large role in reducing passenger VMT in King County. Reductions in VMT deliver a range of environmental, economic, and social benefits. Lower VMT improves air quality by decreasing harmful air pollutants such as nitrogen oxides and particulate matter. It also reduces runoff pollution, which helps protect local water bodies, salmon habitats, and regional soil health, supporting more resilient ecosystems. Fewer vehicles on the road improve safety, especially for vulnerable populations who walk, bike, or roll across King County. Reduced VMT also lowers fuel costs, eases the financial burden of car ownership, and decreases wear on infrastructure, cutting long-term maintenance expenses.

In Spring 2025, the King County Council requested King County Metro to reevaluate the timeline and anticipated costs for transitioning to a fully zero emissions (ZE) fleet, as well as the GHG emissions impacts of fleet electrification and service investments that may further reduce GHG emissions. Fehr & Peers is supporting King County Metro's proviso response to the Council by assessing the relative difference in transit ridership, VMT, and GHG emissions associated with three service hour investment scenarios associated with different ZE implementation timelines and levels of funding availability. This memorandum covers the methods and resulting analysis of the three scenarios.

Scenarios

Fehr & Peers analyzed three different service level scenarios associated with updates to Metro's ZE Transition Plan. Scenario 4 represents the budgeted service hours associated with the currently adopted ZE Transition Plan (full ZE transition by 2035), Scenarios 2 and 3 represent greater customer-facing service hour investments associated with more gradual ZE implementation timelines, and Scenario 3 assumes new service funding is available from an unidentified source. Details and assumptions for each scenario are outlined below in **Table A1**:

Table A2: Scenario Assumptions

	Scenario 2: ZE implementation without budget constraints	Scenario 3: ZE implementation without budget constraints plus additional service hours	Scenario 4: Adopted 2025 CIP baseline that also reflects ZE SCAP targets
Target Year for 100% ZE Transition	2045	2045	2035
ZE Transition Methodology	More gradual transition with phased campus conversion	More gradual transition with phased campus conversion	Full campus-by-campus conversions with some overlapping base closures
Additional Service Hours[1]	534,795	784,795	446,795
Total Service Hours	4,180,000	4,430,000	4,090,000
Service Summary	2026 - 2027 draft service budget	2026 - 2027 draft service budget + 250k new service hours from unidentified funding source	2026 - 2027 draft service budget with reduced growth (-88k service hours) to compensate for inefficiency and higher ZE cost

1. Represents additional service hours over 2024 existing conditions, which is 3,640,000 total annual service hours
Source: King County Metro, 2025.

In 2024, Metro bus/DART service hours totaled approximately 3.6 million annual service hours. Under the currently adopted ZE transition timeline, Scenario 4 assumes an increase to about 4.1 million annual service hours. Scenarios 2 and 3 build on this baseline with only modest increases—approximately 2 percent and 8 percent more service hours, respectively, than Scenario 4. This indicates that the difference between the three scenarios is relatively minor compared to the current level of service.

Approach

This section outlines the approach used to allocate the added service hours across Metro routes, update the Sound Transit model, and estimate ridership for each scenario defined in **Table A1**. Based on the assumptions for each scenario, the analysis evaluates how changes in service hours are expected to affect overall transit demand.

Sound Transit Ridership Model

The Sound Transit (ST) incremental ridership forecasting model (version 2018.02) was used to evaluate weekday transit boardings for each scenario. This tool models weekday transit travel using a network that includes roadway infrastructure (nodes and links) and overlays detailed transit routes for local and regional providers. It incorporates key transit service characteristics, including route alignments, stop locations, headways, and travel times across both peak and off-peak periods. The model is driven by regional land use inputs from the Puget Sound Regional Council (PSRC), using its 2035 land use forecast as the planning horizon.

An annualization factor of 315 was applied to convert the estimated daily boardings into annual ridership values. This annualization factor is consistent with assumptions used in the development of

Metro Connects. Model outputs for each scenario were exported and post-processed to develop calibrated ridership estimates.

Scenario Development

Metro developed the service scenarios in coordination with its budget planning efforts to reflect varying levels of service investment and ZE transition timelines. Two sources guided the recommended service allocations from 2025 to 2035: Metro's *Service Guidelines*[20] and the *2024 System Evaluation Report*[21]. While the *Service Guidelines* highlight the process to allocate investments based on three priorities: reducing crowding, improving reliability, and supporting service growth, the *2024 System Evaluation* report applies the *Service Guidelines* framework by incorporating recent performance data to inform near-term service changes.

The *2024 System Evaluation Report* identified the number of additional service hours needed on each route to reduce crowding, improve reliability, and support growth. For each scenario below, a 75 percent factor was applied to the identified service hour need for each route. This approach allowed service growth to be allocated to more routes for the purpose of the scenario evaluation. This overall process guided the recommended distribution of added service hours on each route for all three scenarios.

This section describes the development of each scenario in detail. This analysis is intended for high-level planning purposes only and does not represent any service change decisions.

Scenario 2 (ZE implementation without budget constraints)
Scenario 2 represents service levels aligned with a more gradual ZE transition. *This 2035 network was compared to the Interim Network previously developed for the Metro Connects Update in 2020.*[22] Compared to the original Metro Connects network, which envisioned a more expansive interim network, the Scenario 2 network reflects a scaled down 2035 service network. While most routes remained unchanged, some new routes were added, and others were truncated. Regional routes operated by Community Transit, Pierce Transit, and Everett Transit, were not edited and reflect the assumptions in the Metro Connects *Interim Network*. Headways for both the Metro and Sound Transit routes were also updated for peak and off-peak periods. Scenario 2 served as the foundation for Scenario 4 and 3 models, with headways and service levels adjusted to represent the different levels of service investment associated with different ZE transition timelines.

Scenario 3 (ZE implementation without budget constraints plus additional service hours)
Scenario 3 represents an expanded service scenario, with an increase of 250,000 annual service hours compared to Scenario 2 and Scenario 4. These additional hours were applied to the highest priority routes until the scenario utilized the additional 250,000 service hours.

Scenario 4 (Adopted 2025 CIP baseline that also reflects ZE SCAP targets)
Scenario 4 represents a service scenario aligned with Metro's currently adopted 2025 Capital Improvement Plan and the associated service budget. As shown in **Table A1**, this scenario includes

[20] Link to King County Metro Service Guidelines
[21] Link to King County Metro 2024 System Evaluation
[22] The interim network was originally developed in 2020 and, while it does not have an official year designation, it essentially represents 2035 service conditions, as it reflects the appropriate Link light rail extensions and RapidRide openings.

88,000 fewer annual service hours than Scenario 2, reflecting the higher service hour requirements and inefficiencies associated with achieving a full ZE transition by 2035. This cost is a result of increased deadheading and route modifications necessary to serve some routes with BEBs using current battery range. To implement this reduced service scenario, service hours were removed from routes identified as the lowest priority for service investments in the *2024 System Evaluation* report.

Results

The following section presents the relative difference in transit ridership, VMT, and GHG emissions associated with the three service hour investment scenarios.

Transit Ridership

The ST model projected transit ridership for the three 2035 service scenarios described in **Table A1**. Because the model is calibrated to pre-pandemic travel behavior and because the overall service hours are similar to pre-pandemic conditions, the results reflect a full recovery in travel demand and return to pre-pandemic route productivity levels. Scenario 2 ridership is consistent with the 2035 SCAP ridership forecasts, which assumed a full pre-pandemic recovery of transit demand. KCM ridership forecasts for 2035 under all scenarios are shown in **Table A2**.

Table A3: 2035 Annual KCM Ridership

Scenario	2035 Annual KCM Ridership[1]
2	123,085,000
3	130,665,900
4	120,428,800

1. Includes KCM buses and Dial-A-Ride Transit (DART) service.
Source: Fehr & Peers, 2025.

To estimate boardings for Scenarios 4 and Scenario 3, the difference method was applied. This approach uses Scenario 2 as a baseline and adjusts its ridership based on the relative differences in modeled outputs between the scenarios. The difference method is particularly useful when ridership is calibrated for one scenario (in this case, Scenario 2, calibrated to 2035 SCAP ridership), and the other scenarios are variations in service levels, land use, or policy assumptions. As an example, this method estimates ridership for Scenario 4 using the formula:

Scenario 4 ridership = Scenario 2 ridership + (Scenario 4 model outputs – Scenario 2 model outputs)

The cumulative GHG emissions change requires annual ridership estimates between 2025 to 2035. The annual change in service hours under each scenario provided the annual distribution of ridership growth forecasts for each year. Fehr & Peers used the annual ridership forecasts to estimate the annual

passenger VMT reduction associated with Metro transit service changes, and the corresponding GHG emissions.

VMT Reduction

To quantify the benefits of passenger vehicle VMT and GHG emissions reduction associated with providing transit service, "avoided" VMT was analyzed to illustrate a shift in modal preference towards transit services due to a more robust and attractive transit system driven by greater service hours and increased headways. Thus, avoided VMT represents the passenger VMT that would be generated by private vehicles if transit was not an option. Avoided VMT for each year between 2025 and 2035 was estimated by multiplying annual Metro ridership, under each scenario, by an average vehicle trip length and an assumed vehicle to transit modal shift. In King County, the average vehicle trip length was 6.41 miles in 2023.[23]

The analysis assumed that approximately 50 percent of new transit trips came from people who would have driven if transit were not an option. Multiple sources provided guidance on this value, including *Understanding Transportation Demands and Elasticities* (2024) from Victoria Transport Policy Institute (VTPI) which states, "…when a disincentive such as parking fees or road tolls causes automobile trips to decline, generally 20-60 percent shift to transit, depending on conditions."[24] Additionally, the California Air Pollution Control Officers Association (CAPCOA) *2021 Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* utilizes a cap of 50 percent mode shift for new transit riders from driving in their cited studies.[25]

While not captured in the analysis, a study done in Sweden between 1986 to 2015 found that higher quality public transportation systems resulted in a decrease in car ownership (Holmgren, 2020).[26] This additional benefit may further reduce the passenger vehicle VMT reductions identified in this memorandum as the total number of private vehicles per capita in King County could decrease due with improved public transportation options.

Figure A1 and **Table A3** illustrate the avoided VMT from providing KCM transit service for all scenarios over the 10-year period.

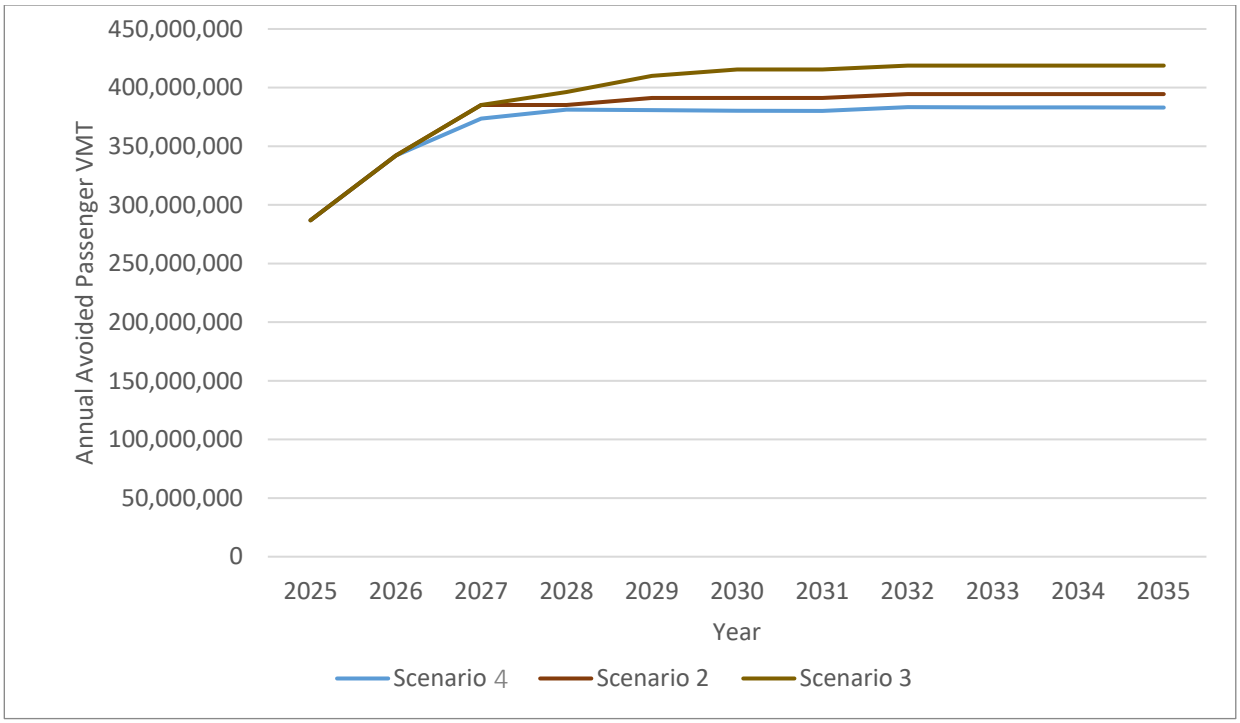
Figure A1: Avoided Passenger VMT by Year (2025 – 2035)

[23] Puget Sound Regional Council 2023 Household Travel Survey, summarized for King County for the 2025 Strategic Climate Action Plan update.

[24] Link to Victoria Transport Policy Institute "Understanding Transport Demands and Elasticities", 2024

[25] Link to Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity, 2021

[26] Link to "The effect of public transport quality on car ownership – A source of wider benefits?"



Source: Fehr & Peers, 2025.

Table A45: Cumulative Avoided VMT

Scenario	Total VMT Reduction (2025 – 2035)[1]
2	4,150,940,000
3	4,326,514,000
4	4,057,440,000

1. Values rounded to the nearest ten thousandth.
Source: Fehr & Peers, 2025.

While **Figure A1** and **Table A3** highlight how avoided VMT grows over time with increases in transit service, **Table A4** summarizes the cumulative VMT reduction for Scenario 2 and 3 using Scenario 4 as the baseline for comparison because it represents the currently adopted ZE transition timeline.

Table A46: Cumulative Avoided VMT (Relative to Scenario 4)

Scenario	Total VMT Reduction (2025 – 2035) Relative to Scenario 4[1]
2	93,500,000
3	269,070,000

1. Values rounded to the nearest ten thousandth.
Source: Fehr & Peers, 2025.

By 2035, Scenario 2 could reduce passenger VMT by an additional 2 percent from Scenario 4. Scenario 3 could reduce VMT even further, by 7 percent compared to Scenario 4.

GHG Emissions Reduction

GHG emissions were analyzed for each scenario by comparing the cumulative emissions associated with the avoided VMT between Scenario 4 and Scenarios 2 and 3. This GHG emissions reduction represents the emissions from passenger vehicles displaced by providing transit service.

The inputs used to calculate GHG emissions were consistent with the *King County Communitywide Consumption-based GHG Emissions Inventory*[27] (September 2022) with only slight modifications to the vehicle fleet distribution, which was updated to incorporate King County data for 2025 to reflect the current distribution of electric vehicles (EVs).[28] The analysis incorporates federal and state policies that impact either the vehicle fleet distribution (such as the WA Clean Cars Program, SB 5974), or the carbon intensity of fuels (WA Clean Fuel Standard, HB 1091) to account for the improved GHG emissions forecasts in later horizon years.

Inputs used in the calculation of GHG emissions include:

- Total passenger VMT
- Percent of passenger vehicles that are electric
- Percent of passenger vehicles that are gasoline, diesel, CNG, or ethanol
- Mileage emissions factor for gasoline, diesel, CNG, or ethanol vehicles
- Fuel emissions factor for gasoline, diesel, CNG, or ethanol vehicles
- Efficiency of vehicles for gasoline, diesel, CNG, or ethanol vehicles
    - i.e., miles per gallon for gasoline vehicles

Two sets of GHG emissions reductions results were analyzed. The "Faster EV transition" assumption corresponds to the King County Emissions inventory assumptions from the WA Clean Cars Program (SB 5974) which aim to have 25 percent of passenger vehicles sold in WA be EV by 2026, 65 percent by 2030, 100 percent by 2035 and maintained at 100 percent after. However, a "Slower EV transition" represents current uncertainty around EV adoption rates given the federal funding and policy constraints, costs, and charging availability. This slow transition assumes that 20 percent of new passenger vehicles sold in WA are EV by 2026, 35 percent by 2030, and 50 percent by 2035.

The cumulative displaced GHG emissions for each scenario from 2025 to 2035 are shown in **Table 5.**

Table A57: Cumulative Avoided GHG Emissions from KCM Service (2025 – 2035)

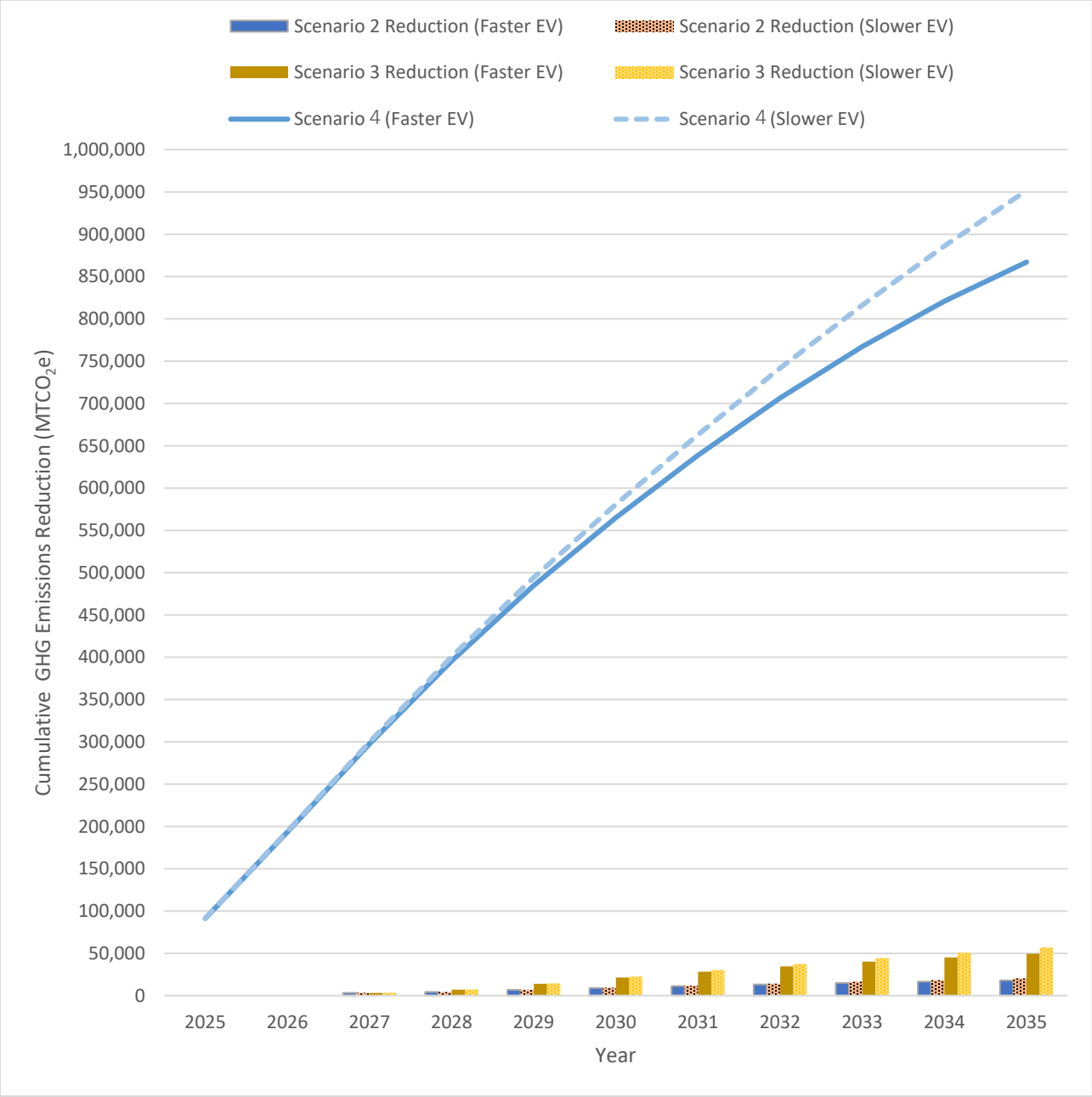
Scenario	Avoided GHG Emissions ($MTCO_2e$) Faster EV	Avoided GHG Emissions ($MTCO_2e$) Slower EV
2	885,048	972,008
3	916,596	1,008,622
4	867,120	951,666

Source: Fehr & Peers, 2025.

[27] Link to King County Communitywide Consumption-based GHG Emissions Inventory
[28] Link to King County Communitywide Consumption-based GHG Emissions Inventory

Since the purpose of this analysis is to compare the additional GHG emissions reduction from Scenario 2 and 3 compared to Scenario 4, **Figure A2** illustrates the cumulative difference in Scenario 2 and Scenario 3 GHG emissions reduction, compared to the cumulative avoided GHG emissions under Scenario 4.

Figure A2: Cumulative GHG Emissions Reduction (Compared to Scenario 4 Cumulative Avoided GHG Emissions)



Source: Fehr & Peers, 2025.

By 2035, Scenario 2 could reduce GHG emissions by about 17,930 to 20,340 $MTCO_2e$ compared to Scenario 4, depending on the pace of EV adoption. Scenario 3, which adds an additional 338,000 service hours from Scenario 4, could reduce GHG emissions by 49,480 to 56,960 $MTCO_2e$. While the additional

GHG emissions reduction from Scenario 3 is only 6 percent greater than Scenario 4, the added transit service is key to supporting King County's goals of effectively reducing passenger VMT and improving equitable access, mobility, and travel reliability across the region.
Overall results are displayed in **Table A6** and **Table A7**.

Table A68: KCM Cumulative 10-Year Results from 2025 to 2035

Scenario	10-Year Cumulative Service Hours	10-Year Cumulative Transit Ridership	10-Year Cumulative Avoided VMT	10-Year Cumulative Avoided GHG Emissions ($MTCO_2e$) Faster EV	10-Year Cumulative Avoided GHG Emissions ($MTCO_2e$) Slower EV
2	45,112,000	1,295,145,000	4,150,940,000	885,048	972,008
3	46,912,000	1,349,926,000	4,326,514,000	916,596	1,008,622
4	44,504,000	1,265,970,000	4,057,440,000	867,120	951,666

Source: Fehr & Peers, 2025.

The change across Scenarios 2 and 3 compared to Scenario 4 are displayed in **Table A7**.

Table A79: KCM Cumulative Change from 2025 to 2035 (Compared to Scenario 4)

Scenario	Service Hours	Transit Ridership	VMT Reduction	GHG Emissions Reduction ($MTCO_2e$) Faster EV	GHG Emissions Reduction ($MTCO_2e$) Slower EV
2	608,000	29,175,000	93,496,900	17,928	20,342
3	2,408,000	83,956,000	269,071,300	49,476	56,956

Source: Fehr & Peers, 2025.