

Knoxville Area Transit Decarbonization Plan

February 2023





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Executive Summary

The transportation sector makes up the largest share of greenhouse gas (GHG) emissions in the United States. Compared to single-occupancy vehicles, public transportation can significantly reduce GHG emissions and the amount of harmful pollutants from tail pipes and brakes. This means healthier and more resilient communities.

Recognizing its important role in these efforts, Knoxville Area Transit (KAT) and the City of Knoxville's Office of Sustainability developed this decarbonization plan as a guide to reach its GHG emission reduction goals and improve air quality for all residents and visitors. KAT will continue its commitment to the Knoxville community and the environment through the goals, strategies, and actions shared in this plan.



KAT will use this plan to:

- Align internal priorities, strategies, and operations with GHG emission reduction goals
- Guide procurement plans for replacement rolling stock and new equipment
- Establish a strong foundation for reports and grants that prioritize GHG mitigation
- Educate community partners, staff, and riders on decarbonization efforts



Introduction



With a strong economy and more people attracted to living in a thriving urban area, Knoxville observed increased transportation emissions.

Transportation emissions make up approximately 59% of Knoxville's community emissions profile. They have become a larger share of the profile as building codes increase energy efficiency and utilities, like Knoxville Utilities Board and Tennessee Valley Authority, increasingly invest in lower carbon renewable electricity.

As a city partner and environmental steward, KAT recognizes its role in advancing the City of Knoxville's GHG emission reduction goals.

In 2019, KAT participated in Mayor Indya Kincannon's Climate Council and committed to the GHG emission reduction goals set by the City:

- 50% reduction in greenhouse gas emissions for municipal operations by 2030 (from 2005 levels)
- 80% reduction in greenhouse gas emissions for the entire community by 2050 (from 2005 levels)

Community-Wide Emissions

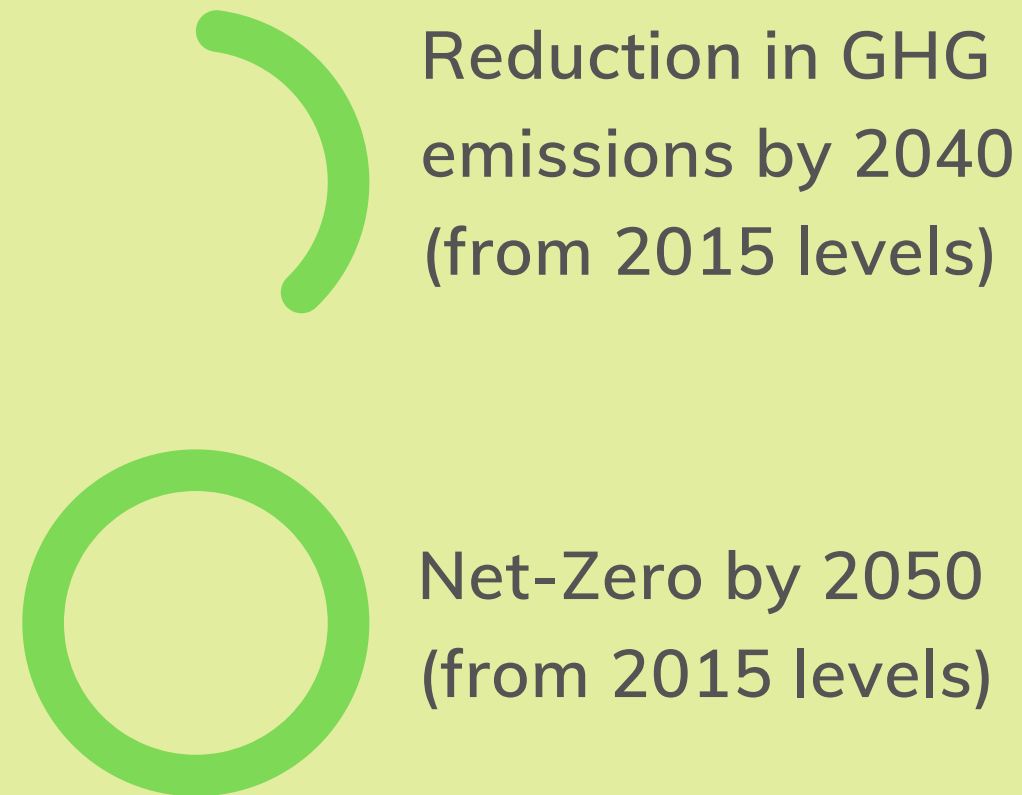
Buildings & Facilities
37%

Transportation
59%

Waste & Water
4%

In 2023, KAT continues to lead in Knoxville through its commitment to the agency-wide goals in this decarbonization plan.

GHG Emission Reduction Goals

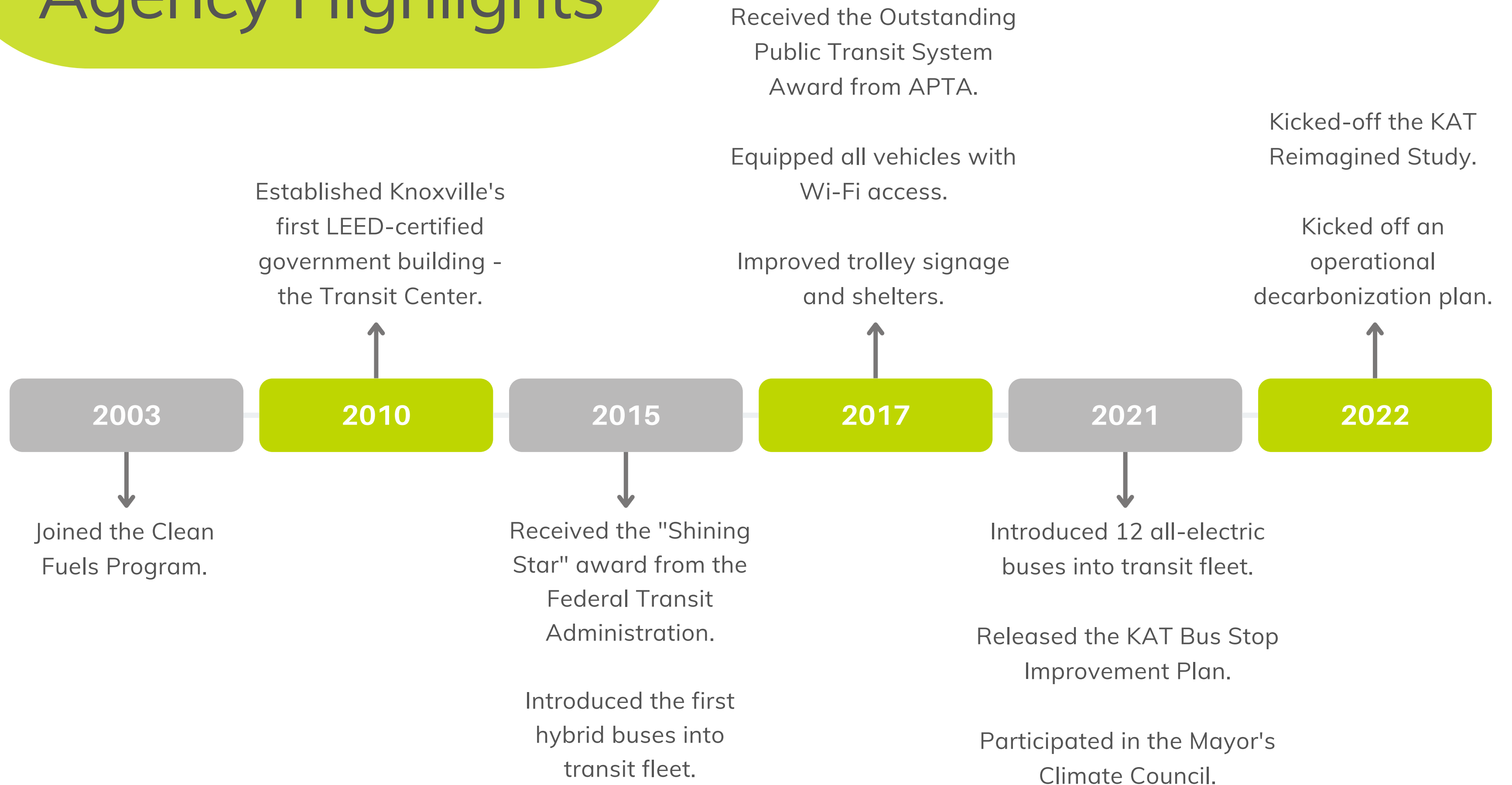


These targets are based on KAT's transit asset management plan for replacement cycles and availability of electric vehicles.

Percent of Fleet Electrified

	2022	2030	2040	2050
Buses	16%	33%	53%	100%
Paratransit	0%	0%	50%	100%
Support Vehicles	0%	100%	100%	100%

Agency Highlights



A History of Leadership

KAT Reimagined Study

This study is a system-wide examination of KAT's network, balancing the areas covered with services provided to make the system work effectively for as many people as possible. After a comprehensive community engagement process, KAT will focus 70% of its resources on ridership goals and 30% on coverage goals. This increased ridership model can help reduce GHG emissions and traffic congestion.

Mayor's Climate Council

KAT worked among a group of 65 community leaders and technical experts to discuss effective strategies to reach city emission reduction targets. KAT helped develop high impact strategies likely to advance equity outcomes while reducing GHG emissions.

Regional Studies

Knoxville Regional Transportation Planning Organization (TPO) is partnering with KAT on studies to uncover a more regional solution to a variety of challenges, like carbon emissions and traffic congestion, and to guide more coordinated service that better serves the needs of riders.

KAT Bus Stop Improvement Plan

In 2021, KAT developed this set of best practices and standard operating procedures for installing new bus stop signs and on-street amenities. This plan helps establish uniformity and visibility of suitable bus stops and bus stop amenities.

Grant Programs

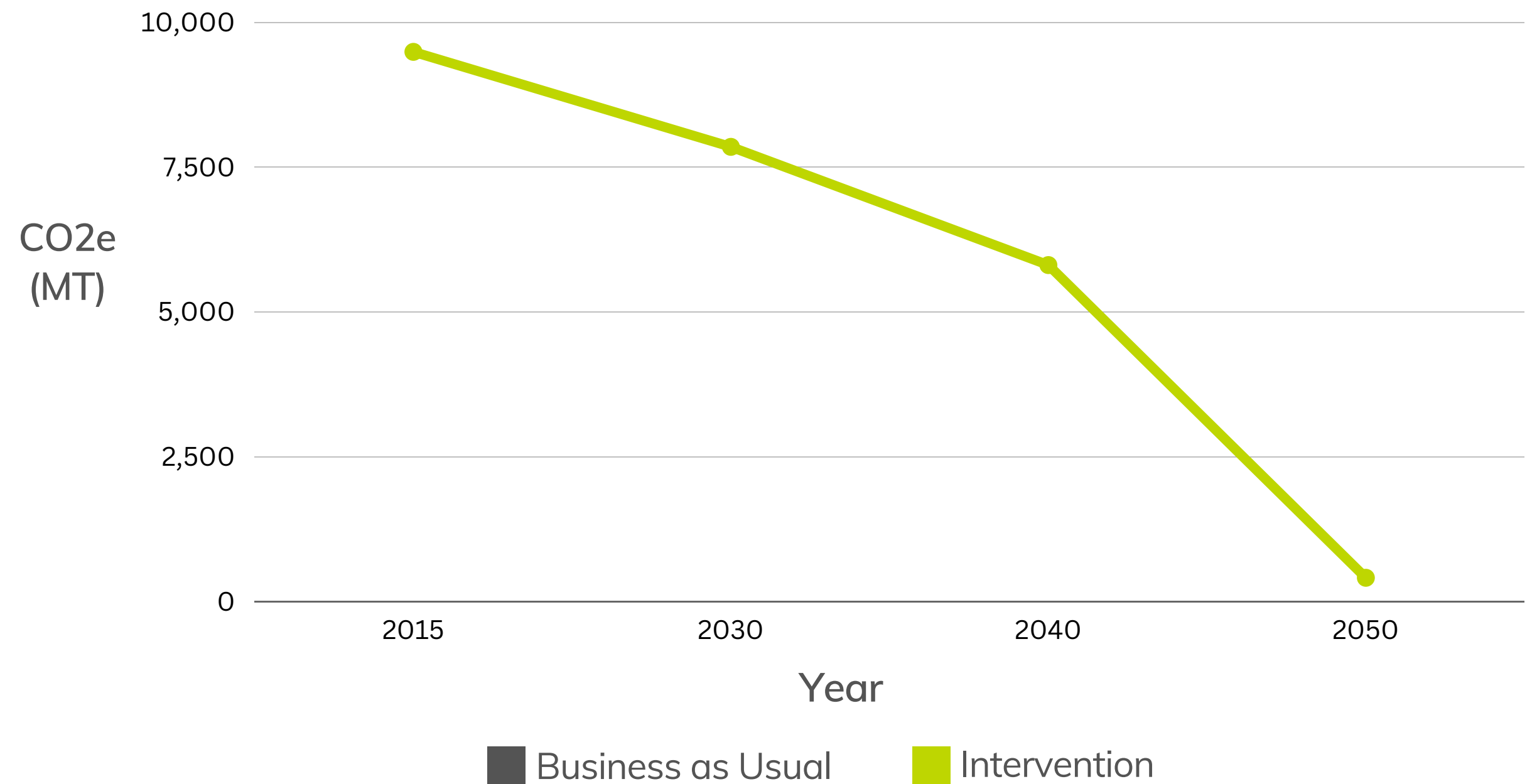
- TDOT's Congestion Mitigation and Air Quality Improvement (CMAQ) Program for electric bus in-route overhead charging infrastructure
- FTA's Low or No Emission Vehicle Program for electric buses
- TDOT's IMPROVE Transit Investment Grant Program for bus stop improvements

Strategies & Actions

In 2015, KAT operations resulted in 9,490 MT CO₂e. In 2050, KAT is striving to reduce its GHG emissions down to 412 MT CO₂e with the proposed interventions.

Implementing all strategies and actions will eliminate 78% more GHG emissions by 2050 than continuing business as usual - all but eliminating operational emissions.

The proposed interventions would drastically reduce GHG emissions by 2050 compared to business as usual operations.



Strategy	Description	CO2e Reduced (MT/yr)
<p>Electrify all buses and paratransit vehicles.</p>	<p>Replacing all ICE buses and paratransit vehicles with electric vehicles by 2050 will reduce heavy fleet emissions more than 95%. Due to the need for back-up diesel fuel heating in cold temperatures, even with net zero carbon electricity, there will be some associated bus emissions.</p>	<p>7,279</p>
<p>Electrify support fleet.</p>	<p>Replacing all non-revenue vehicles with electric vehicles by or after 2030 will reduce light fleet emissions by 66%. Net zero carbon electricity would eliminate those emissions altogether.</p>	<p>107</p>
<p>Electrify natural gas utilities across applicable facilities.</p>	<p>Natural Gas makes up 38% of all energy use in KAT facilities for space heating. Converting natural gas heating to electric allows KAT facilities to reap the benefits of utility investments in lower carbon fuels, and TVA's Net Zero Carbon aspirations would eliminate those emissions altogether.</p>	<p>452</p>
<p>Increase on-site renewable energy.</p>	<p>Increasing on-site renewable energy systems can reduce annual utility costs by producing carbon-free electricity on-site. A preliminary analysis of available roof capacity for solar indicates the potential for KAT to generate ~12% of its baseline annual energy use (645 MMBtu or 189,000 kWh/yr).</p>	<p>35</p>
<p>Increase energy efficiency at facilities.</p>	<p>The best available energy efficiency available for KAT facilities is thermal electrification of heating systems with heat pumps. Electric heat pumps present a 30% increase in efficiency compared to gas furnaces. Additionally, facility operations will be routinely evaluated to optimize efficiency.</p>	<p>61</p>
<p>Develop educational opportunities.</p>	<p>Additional education and engagement opportunities for staff and community members can enhance awareness and adoption of practices that support other strategies.</p>	<p>N/A</p>

Implementation

In addition to aligning procurement strategies to reach its GHG reduction goals, KAT will work to build a supportive culture around decarbonization plan through staff and community education and engagement. Education and engagement efforts can take various forms and will evolve over time. Staff and community members inform which initiatives would be most useful and how those initiatives should be designed to meet their diverse needs.

KAT is currently considering:

- Dedicating a public web page to the plan
- Hosting lunch and learn events
- Providing affordable workplace charging
- Developing public and internal education campaigns





Appendix

Glossary

American Public Transportation Association (APTA): Nonprofit group of public and private sector member organizations that promotes and advocates for the interests of the US public transportation industry

Decarbonization: Process of reducing 'carbon intensity', lowering the amount of greenhouse gas emissions produced by the burning of fossil fuels

Greenhouse Gas (GHG) Emissions: Various gases (primarily carbon dioxide, methane, and nitrous oxide) in the earth's atmosphere that trap heat and strengthen global warming, contributing to climate change

Knoxville Utilities Board: Independent utility provider of electric, natural gas, water, and wastewater services to Knoxville and parts of surrounding counties

LEED-Certified: Certification gained by meeting prerequisites and credits that address carbon, energy, water, waste, transportation, materials, health and indoor environmental quality.

MT CO₂e: Standard unit for measuring greenhouse gas emissions

Net Zero: A state in which the greenhouse gases going into the atmosphere are balanced by removal out of the atmosphere

Renewable Energy: Energy from a source that is not depleted when used, such as wind or solar power

Tennessee Valley Authority (TVA): Federally owned electric utility corporation in the United States

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For more information on Knoxville Area Transit,
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