



# *reimagining* SUSTAINABILITY

COTA SUSTAINABILITY PLAN 2022

IN PARTNERSHIP WITH:



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## executive SUMMARY

COTA's mission is to provide solutions that **CONNECT PEOPLE TO PROSPERITY THROUGH INNOVATION, DEDICATION, AND TEAMWORK**. As sustainability is pursued within central Ohio, COTA recognizes its responsibility to embrace its role in the coming transition to a more equitable world. This plan identifies multiple goals, centered on sustainability, and a framework within which to pursue them. This framework is built upon the recognition that COTA's ability to achieve these goals is dependent upon collaborative interdepartmental engagement on the activities that will impact the metrics by which they are measured.



**JOANNA M. PINKERTON**  
CEO/President

## 1.1. SUSTAINABILITY PLAN FRAMEWORK

This framework is comprised of three primary components:



### PERFORMANCE CATEGORIES

The focal points for improvement in sustainability and reflect those initiatives being engaged and embraced by other organizations and society



### GOALS

Quantifiable improvement objectives that will be pursued within each Performance Category



### MANAGEMENT AREAS

Interdepartmental teams whose overlapping responsibilities, when combined, bring to the table all the parties necessary to effectively promote the changes necessary for success

Working within this framework, this plan will serve as a living document to help guide COTA as it progresses towards achievement of its goals. Given the evolving technological landscape that has developed, **THIS PLAN WILL NEED TO ADAPT WITHIN THIS DYNAMIC ENVIRONMENT** if it is to leverage the best solutions economically. Consequently, a repeated four step cycle developed for ongoing **STRATEGIC ENERGY MANAGEMENT** has been incorporated. The steps are:

### step 1

**CREATE** an action plan around each performance category and their related goals.

### step 2

**IMPLEMENT** the action plan activities to achieve their projected benefits.

### step 3

**EVALUATE** results to ensure successful implementation and capture progress.

### step 4

**MESSAGE** achievements and identify next steps for incorporation in the future cycles.

This method will foster the necessary agility to progress towards goals while adjusting to the changing economic and technological landscape over the coming decades.

The baseline year against which progress will be measured is 2013 and was selected to align this plan with the City of Columbus Climate Action Plan. While COTA's plan is being adopted in 2022, COTA has already engaged in numerous sustainable initiatives, upon which this plan is built. The following sections present the goals, metrics, achievements, and next steps for each performance category.



## 1.1.1. EQUITY, DIVERSITY, AND INCLUSION (EDI)

### GOALS AND METRICS

- Expand access to underserved individuals and communities.
- Determine EDI metrics and begin tracking progress.
- Work towards internal DBE spending goals.
- Increase the number of women at COTA by 10% over the next 10 years in support of the Mobility XX initiative.

### ACHIEVEMENTS

- Establishing EDI, surrounded by COTAs four guiding principles, as the central characteristic of its strategic plan.

### NEXT STEPS

- Expand access to underserved communities through increased accessibility to critical destinations and affordability.
- Increase participation and engagement of employee resource groups in implementation of the sustainability plan.
- Expand access to economic opportunity for minority, female, LGBTQ, disabled, and veteran owned businesses by intentionally increasing spend with these businesses in both COTA capital projects and operational needs.

## 1.1.2. EMISSIONS—GREENHOUSE GAS AND POLLUTION

### GOALS AND METRICS

- Net-Zero Green-House Gas (GHG) Emissions by 2045.
- Net-Zero Particulate Matter 2.5 (PM2.5) Emissions by 2045.

### ACHIEVEMENTS

- Reduced GHG emissions per vehicle mile by 11% since 2013.
- Reduced PM2.5 per vehicle mile, a local pollutant, by 73% since 2013.
- Pollution reductions fostered more than \$10 million dollars in community savings through avoided work disruptions and medical costs within Franklin County.
- Collaborative engagement in regional development through LinkUS, Columbus Downtown Development Corporation, and other initiatives.

### NEXT STEPS

- Continue phasing out diesel vehicles. To maximize the CNG investment, investigate the benefits and risks of purchasing renewable energy supplies for electricity through supplier contracts or Renewable Energy Certificates (RECs) and natural gas through acquisition of Renewable Natural Gas (RNG).
- Define the fueling strategy for electric buses, on route charging locations, and number of chargers required for the transition to battery electric buses (BEBs). Continually monitor the capabilities and trade-offs to a 100% electric fleet makeup.
- Install the maximum number of charging cabinets that can be currently accommodated at both McKinley and Fields. Study alternative electric transmission and distribution line upgrade options, on-site energy reduction, on-site energy generation, and on-site storage options to increase electric charging capacity.
- Implement system to capture performance of COTA BEBs to recognize the fluidity of the current plan to adopt to 100% BEBs by continuing to record vehicle performance and investigate new technologies.
- Determine energy efficiency measures to implement at facilities, on-site generation capabilities, and clean energy procurement strategies.





**1.1.3. RIDERSHIP GOALS AND METRICS**

- Aspirational pursuit of annual increase of 2% for COTA's internal ridership Performance Incentive Compensation metric of annual unlinked passenger trips per total payroll hours.
- Pursue and support Columbus Climate Action Plan's goals.
  - Increase passenger miles traveled by 20% by 2030.
  - Increase passenger miles traveled by 50% by 2050.
  - Implementation of 3 regional high-capacity rapid transit lines by 2030.
  - Implementation of at least 5 high-capacity rapid transit lines and up to 8 by 2050.

**NEXT STEPS**

- Assess aspirational ridership goal and adopt or revise the targeted annual increase based upon that engagement.
- Generate a mode shift factor for use in capturing impact of increased ridership on regional emissions goals, which has already been initiated.
- Continue and increase engagement with regional initiatives to identify collaborators in reducing regional emissions through mode shift.



**1.1.4. WASTE GOALS AND METRICS**

- Achieve a 100% waste diversion rate from landfills by 2045.



**ACHIEVEMENTS**

- Revenue is generated from scrap metal and paper and cardboard recycling.
- Several recycling and waste diversion programs are already in place including recycling of yard waste, waste oil, transmission fluids and oil filters, wooden pallets, and fluorescent lamps. Tires are recycled through a contract with Goodyear.

**NEXT STEPS**

- Work with local stakeholders like SWACO to identify any support or grant opportunities that would support waste related activities and their application timetable.
- Conduct a waste assessment to identify all waste streams generated, quantify the streams in tons, record current management practices, and select waste streams where opportunities for improvement should next be investigated.



**1.1.5. WATER GOALS AND METRICS**

- Interim goal of 2% reductions per year in water consumption.

**ACHIEVEMENTS**

- Installation and use of water reclamation and recycling for the vehicle wash systems at both bus facilities.

**NEXT STEPS**

- Establish a water end use breakdown that identifies each portion of water usage across the building portfolio by the function it supports.
- Update interim goal to be a technically and financially achievable percent reduction from the 2013 baseline as informed by the end use breakdown analysis.
- Establish protocols to capture and record all facility water use.

**1.1.6. RESILIENCY AND BUSINESS CONTINUITY GOALS AND METRICS**

- COTA will incorporate vehicle and fueling planning into the existing Business Continuity Plan to enable:
  - Continuation of essential functions no later than 12 hours after the event.
  - Maintenance of these functions for at least 30 days.



**ACHIEVEMENTS**

- Resiliency management is already in place through COTA's Business Continuity Plan (CBCP)
- Creation of the Safe and Secure COTA for All Task Force

**NEXT STEPS**

- Support existing business continuity planning and incorporate the needs of this sustainability plan into the CBCP through identification of personnel who can best oversee that process.
- Support the CBCP by continually evaluating how best to build out a resilient vehicle portfolio, back-up power contingencies, and climate change adaptation planning.
- Continually collect information on long-term trends that could threaten COTA's operations.

## 1.2. KEY FINDINGS

Through the course of developing this plan, several noteworthy takeaways were illuminated which will be helpful in navigating the path forward. In this section we summarize and highlight these findings.

### 1.2.1. A DYNAMIC ECONOMIC AND TECHNOLOGICAL LANDSCAPE

This sustainability plan serves as a framework to guide COTA in pursuit of sustainability goals through 2045 while allowing flexibility in the exact path chosen to achieve these goals. This is particularly critical given the coming decades will see dynamic changes and volatility within the technologies and economics associated with climate change solutions. Activities are under way to generate information to guide decisions that achieve progress in the near term. While longer term aspirational trajectories have been identified for investigation and pursuit, new information and changing economics may foster adjustments to planning and should be leveraged to optimize success.

### 1.2.2. PRIORITIZED ENGAGEMENT WITH EMISSION REDUCTION OPPORTUNITIES

For COTA to achieve its GHG and pollution goals, a transition to a zero-emission fleet vehicles and facility operations is required. While in the long term this will include every vehicle in COTA's portfolio, the near-term engagement will differ between portions of the fleet. Below are presented the basis for the strategy currently being pursued for the vehicle fleet and the facility portfolio.

#### 1. BUS FLEET

- a. Produces 71.1% of COTA's GHG emissions.
- b. Are the area of greatest opportunity and are primary focus in the immediate term, including the current study to inform on-route charging and facility capacity expansion strategies.

#### 2. MOBILITY FLEET

- a. Produces 7.3% of COTA's GHG emissions.
- b. Currently there are no vehicle replacement options for this fleet that meet the certifications required by the FTA. While manufacturers have been engaged and will continue to be monitored, pursuit of zero-emission vehicle solutions for this portion of the fleet are on hold until solutions reach the market.

#### 3. NON-REVENUE VEHICLES

- a. Produces 0.6% of COTA's GHG emissions.
- b. While not prioritized due to their small contribution to overall GHG emissions, staff will monitor availability of zero-emission replacements and acquire them when it can be facilitated. As charging infrastructure is built out, compatibility with facility charging equipment will be a critical consideration to minimize required fueling infrastructure. In the near term, hybrid vehicles are being pursued to achieve reductions during the existing equipment replacement cycle. Because of the high public visibility of specific non-revenue vehicles, prioritization of zero-emission replacements may be desirable in those cases.

#### 4. FACILITY ELECTRICAL USE

- a. Produces 11.4% of COTA's GHG emissions.
- b. Opportunities for reducing GHG emissions related to electricity use is currently under investigation. This will result in a capture or identification of facility improvements that maximize energy efficiency. This investigation will also include on-site renewable energy, storage, off-site renewable energy, and emission free supplier contracts. In the long term, success will require a combination of these options in conjunction with the GHG reductions occurring within the electricity grid itself.

#### 5. FACILITY NATURAL GAS USE

- a. Produces 8.6% of COTA's GHG emissions.
- b. Natural gas energy efficiency opportunities are also being investigated. It is expected that in the long-term natural gas equipment will need to be replaced with equivalents that consume emission free electricity. Pursuit of this transition is not an immediate priority.

#### 6. EMPLOYEE TRAVEL

- a. Produces 1.0% of COTA's GHG emissions.
- b. While capture of employee GHG emissions for travel will be improved, this contribution to organizational emissions serves as an opportunity for employee engagement and education around emission reduction initiatives. Strategies for reducing and eliminating these emissions will be developed over time.

### 1.2.3. SOURCING EMISSION-FREE ENERGY SUPPLIES

Even with the acquisition of alternative vehicles and the equipment to fuel them, to achieve zero-emission the source of the energy used must be GHG and pollution free. While on-site renewable energy assets provide an opportunity to reduce the energy needs obtained from utilities, the sheer magnitude of energy required far exceeds the potential contribution possible from on-site renewable energy. For COTA's current fleet, this means that BEBs will need to be fueled with renewable electricity and the CNG fleet would need to use renewable natural gas. One common pathway to achieve this for either utility source is through supplier contracts, though this may entail paying an increased utility rate for clean energy.

1. Sourcing renewable energy supplies for either electric or natural gas utility use is one option for maintaining achievement trajectories towards long term goals. Maintaining GHG emission reductions at a rate to be "on track" for 2045 goals would only require a portion of current energy fueling and facility use to be supplied by renewable sources.
2. While opportunities to reduce emissions through supplier contracts for electricity should be investigated, doing so often comes at a price premium and requires diverting resources from investment in organizational improvements to purchase offsets in the form of renewably sourced electricity or renewable energy certificates (RECs).
3. Interestingly, COTA's CNG buses and fueling equipment have positioned COTA to be in position to leverage this portion of the fleet into the market created by the Renewable Fuel Standard (RFS). This could result in the ability to claim emissions reductions, monetize the trade of these credits through Renewable Identification Numbers (RINs), or some proportion of both. The average value of the RINs associated with COTA's CNG fuel use between 2018 and 2021 is just over \$4 million dollars annually.

#### 1.2.4. REGIONAL TRANSPORTATION EMISSION REDUCTIONS AND MODE SHIFT

COTA's emissions are less than 1% of regional transportation emissions. While it is critical for COTA to transition its own operations to zero-emissions, COTA is positioned to have a greater, transformative impact in reducing regional emissions through mode shift than by eliminating COTA's internal GHG emissions.

1. COTA's engagement and focus on mode shift are key to realizing the City of Columbus Climate Action Plan goals and reducing regional emissions. COTA must collaborate with external agencies to promote transit-oriented development which will incentivize residents to opt for public transit over single occupancy vehicle.
2. In addition to the emissions reductions that come from mode shift, there are other benefits to the community, including safety. An APTA study shows that metro areas with 40 annual transit trips per capita have about half the traffic fatality rate of those with 20 annual transit trips per capita.<sup>1</sup>

#### 1.2.5. VEHICLE ELECTRIFICATION, CHARGING, AND CAPACITY STUDIES

During the development of the emissions section of this sustainability plan, various analyses were identified as critical to inform the strategies and next steps for COTA in elimination GHG from its operations. Consequently, funding was acquired to conduct the necessary studies to address these needs in advance of completion of this plan and were referenced as underway within the plan itself. Below is a summary of the various analyses currently being pursued to inform development of an electric vehicle charging strategy for battery electric buses.

1. Analysis of current routes and blocks to identify optimal locations for on-route high-speed charging using pantographs. This will include dialogue with utility partners to inform beneficial locations for grid interconnection.
2. Analysis of facility electrical capacity and opportunities that will allow for increased depot charging by increasing the number of depot cabinet chargers that can be installed at bus maintenance facilities including:
  - Investigation into additional electrical capacity at the distribution circuits facilities where facilities have existing interconnection.
  - The cost of installing additional interconnections to facilitate additional electrical vehicle charging at bus facilities.
  - Assessment of hourly load profiles at bus facilities to understand electrical load and identify periods when additional capacity is available for charging.
  - Increasing available capacity by facility energy use through implementation of energy efficiency measures.
  - The potential impact of on-site renewable energy assets, like solar panels, and a quantification of the benefit they might provide.
  - The potential impact of on-site electricity storage and a quantification of the benefit they might provide.

<sup>1</sup><https://www.apta.com/wp-content/uploads/Resources/resources/hottopics/Documents/APTA%20VZN%20Transit%20Safety%20Brief%208.2018.pdf>



## introduction

COTA engaged Go Sustainable Energy and BlueCSR to create this Sustainability Plan to serve as a guiding strategy for organizational transformation around engagement and pursuit of sustainability. COTA has already identified equity, diversity, and inclusion as a core tenant of its identity within COTA's "Moving Every Life Forward Strategic Plan 2019-2024". As a transit agency, greenhouse gas (GHG) emissions are a primary focus of sustainability and will be a key area of engagement within the sustainability initiatives the plan lays out. This plan identifies goals to pursue and provides processes to navigate the changing technological landscape. Throughout the timeline of pursuit of the goals laid out, the plans strategies should evolve with the changing solutions, challenges, and economics over time.

This plan was developed through broad engagement with stakeholders both inside and outside of COTA. Consultation with various staff, regional partners, and documentation and resources from Federal Agencies and the National Laboratories were consulted to inform strategies, identify best practices, and align this plan local, regional, and national initiatives. This was particularly important during a period when governmental entities from the city to the federal level were creating, revising, and issuing their own initiatives to pursue or support sustainability.

To be successful, this plan will need to be embraced within COTA's organization and its culture. This means every staff member should understand the goals of the plan and what opportunities each person must contribute to this organizational transformation within their responsibilities.

## 2.1. VISION

Environmental and social challenges affect every organization. These complex challenges do not have simple solutions. Sustainability plans create a framework to set direction for an organization, establish next steps, and measure progress. The vision of this plan is to establish a strategy for engagement and pursuit of multiple sustainability goals across COTAs operations that will address critical social and environmental needs of the community, particularly equity, diversity, and inclusion as well as climate change.

This sustainability plan will guide COTA in pursuing its own sustainability goals while supporting regional initiatives external to the agency. Though the exact plan is expected to shift over time as technology advances and regional needs change, the strategy being laid out will result in a process that supports navigation of organizational decisions across all departments, with interim engagement points over the next two and a half decades. To do this, the plan will be built upon the engagement cycle often utilized for strategic energy management. The process begins with an initial commitment to making change, which is embodied by this document. Following this initial commitment, progress is achieved through cycles of engagement that include each of the following steps:



Figure 1 is a visualization of this process.

Such a strategy allows pursuit of the sustainability plan to be a constant practice, incorporated into decision making consistently throughout the course of the plan. A determination of the optimal cycle of engagement is critical to ensure activities align with resource and funding cycles. Our initial recommendation is to establish annual cycles for this process that also incorporate COTA's regular budgeting cycle. This will allow COTA to align existing investment practices while facilitating incorporation of the opportunities and challenges that result from changing technologies, EDI priorities, and economic factors such as energy costs.

Figure 1: ENERGY STAR'S GUIDELINES FOR ENERGY MANAGEMENT<sup>2</sup>



<sup>2</sup>[https://en.wikipedia.org/wiki/Strategic\\_energy\\_management](https://en.wikipedia.org/wiki/Strategic_energy_management)

The plan establishes areas of focus for sustainability, referred to as "Performance Categories", which will each have targeted goals along with metrics by which they will be measured. Pursuit of these goals will require consideration and inclusion of each "Performance Categories" within ongoing decision making through the plan's target year of 2045.

Management areas will be identified that reflect appropriate interdepartmental teams within COTA. Each team's composition will reflect the stakeholder departments whose contributions are critical for success. Personnel selected for each team will be tasked with illuminating the needs, providing information, and coordinating contributions from their respective departments. This will allow COTA to empower existing groups to identify action plans to engage with solutions and improvements within their jurisdiction, moving COTA towards its Sustainability goals.

## 2.2. PLAN DEVELOPMENT PROCESS

To incorporate regional sustainability initiatives, leverage existing computation tools, include requirements for future funding and grants, and understand functions and needs of COTA departments, several documents and stakeholder groups were engaged.

During creation of this sustainability plan, identification, and review of various literature internal to COTA as well as from regional and national entities was conducted. This was to ensure awareness of established efforts pertinent to the sustainability plan. Internal foundational documents provided a framework for COTA's mission, vision, and values to be incorporated into the plan. These documents also served as a reference for status of operations and progress already made. Some of the key documents can be seen in the table below:

Table 1: KEY FOUNDATIONAL AND SUPPORTING DOCUMENTS

- APTA—Quantifying Greenhouse Gas Emissions from Transit
- COTA Sustainability Report
- City of Columbus Climate Action Plan
- LinkUS Columbus Initiative
- COTA Strategic Plan 2019-2024
- MORPC Sustainable 2050 Regional Sustainable Agenda
- Insight 2050 Corridor Concepts
- Disadvantage Business Program Policy
- Local, State & Federal Public Policy Agendas
- COTA Capital Improvement Program 2021-2025

Additionally, many COTA departments provided input and feedback during the creation of the plan. These teams gave further insights on current operations, areas where they would like to see change, and where they saw challenges in proposed actions. Inclusivity in plan's creation was important to promote widespread participation and adoption of the sustainability goals set within it. A non-exhaustive list of these departments is provided below:

Table 2: PARTICIPATING INTERNAL STAKEHOLDERS

- Capital Projects
- Communications
- Economic Development
- Ops Engineering
- EDI Leadership
- ERG Leadership Teams
- Facilities
- Finance
- Marketing
- Mobility Development

COTA's pursuit of this sustainability plan will impact the Columbus region and play a role in assisting achievement of broader regional goals and objectives around sustainability. To better understand outside perspectives, various regional entities were engaged in interviews to obtain insights on COTA's role in collaborative regional transformation. These outside perspectives serve to illuminate areas of opportunity where regional support exists and potential partners in initiatives whose success depends upon collaboration with COTA and other agencies in a regional partnership. At a societal level, de-carbonizing transit will require desirable and functional alternatives to the current paradigm, which are single passenger vehicles (SPVs).

Other regional entities were engaged because they are seen as critical partners in furthering COTA's own sustainability plan. Their engagement and expertise are needed for COTA's decarbonization, expansion, and funding.

**Table 3: REGIONAL STAKEHOLDER ENGAGEMENT**

- City of Columbus
- City of Hilliard
- Franklin County
- Mid-Ohio Regional Planning Commission
- The Ohio State University
- American Electric Power
- Clean Fuels Ohio
- Columbus Department of Power
- Department of Energy
- Ohio Environmental Council

Finally, several tools and methodologies already exist for transportation and sustainability measurement and tracking. To utilize to existing processes and datasets, the following national databases and references were researched and investigated.

**Table 4: TECHNICAL REFERENCES**

- American Pubic Transportation Association (APTA)
- Federal Transit Administration (FTA) - National Transit Database (NTD)
- Argonne National Laboratory (ANL) - Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool
- National Renewable Energy Laboratory (NREL) - Vehicle Emissions Studies
- US Environmental Protection Agency (EPA) - COBRA Tool

## 2.3. PERFORMANCE CATEGORY

Each "Performance Category" will have metrics to track progress, achievement, and inform decision making. KPIs should drive engagement and may result in interdepartmental strategies and engagement unique to specific management area teams.

**Table 5: ENGAGEMENT MATRIX**

PERFORMANCE CATEGORY	GOAL AREAS	Vehicle Fleet	Facilities	Employee Engagement	Customer Engagement	Community Relations / Stakeholders
EDI	ERG participation & Community Engagement			●	●	●
Emissions	Net-Zero Greenhouse Gas & Pollutants (PM2.5)	●	●	●		●
Ridership	Unlinked passenger trips, Rider Access & Mobility				●	●
Waste	Zero Landfill Waste & Litter	●	●	●	●	
Water	Minimize Water Use & Stormwater Mitigation	●	●			●
Resiliency	Uninterrupted Operations— Achieve 100% Uptime	●	●	●		●

## 2.4. TIMELINE AND PHASES

Long term goals have a target date of 2045 with interim goal trajectories available across the plan's entirety. In conjunction with the annual review cycle and 5-year fiscal planning cycles, progress towards goals should be regularly evaluated to inform budget and sustainability action items. Frequent tracking of these goals helps better evaluate organizational progress and can help imbed the sustainability mindset within company culture. Ongoing engagement can also help apply resources strategically based upon the relative impact possible through improvement in specific areas of COTA.

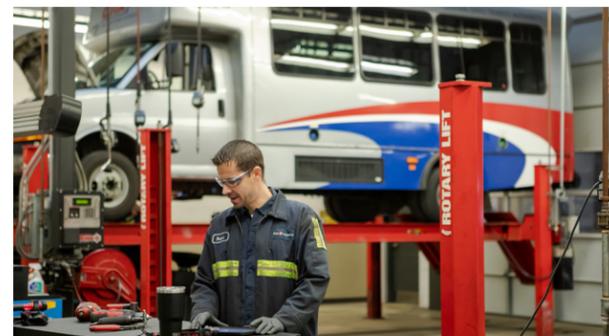
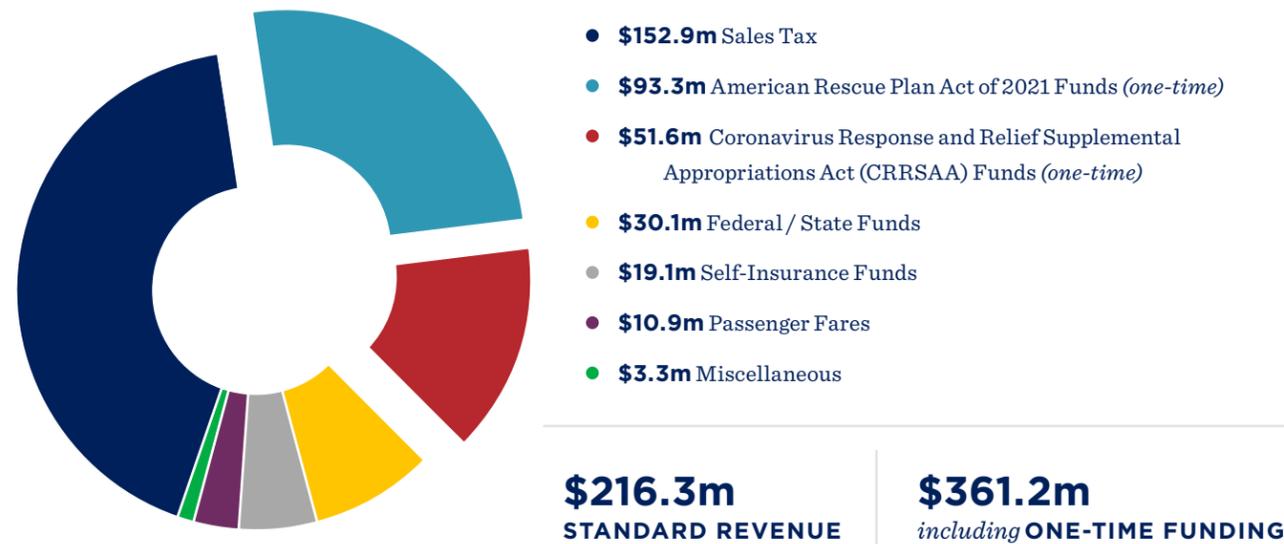
Because these goals span over 20 years, it is impossible to determine an exact path to their achievement at this time. Technological, operational, and budgetary changes will change what opportunities offer the best next steps towards ultimate success. Each management area section below has identified action items that address the immediate needs and next best steps for progressing towards the sustainability goals.



# agency overview

The Central Ohio Transit Authority (COTA) serves 1.2 million residents in the greater Columbus and Central Ohio area. More than 19 million trips are taken every year. Pre-COVID, there were 41 routes covering a service area of 562 square miles. COTA's mission is to provide solutions that connect people to prosperity through innovation, dedication, and teamwork. These solutions include 40 fixed-route lines and 4 on-demand service zones. The COTA fleet includes 321 buses and 20 COTA//Plus vehicles.

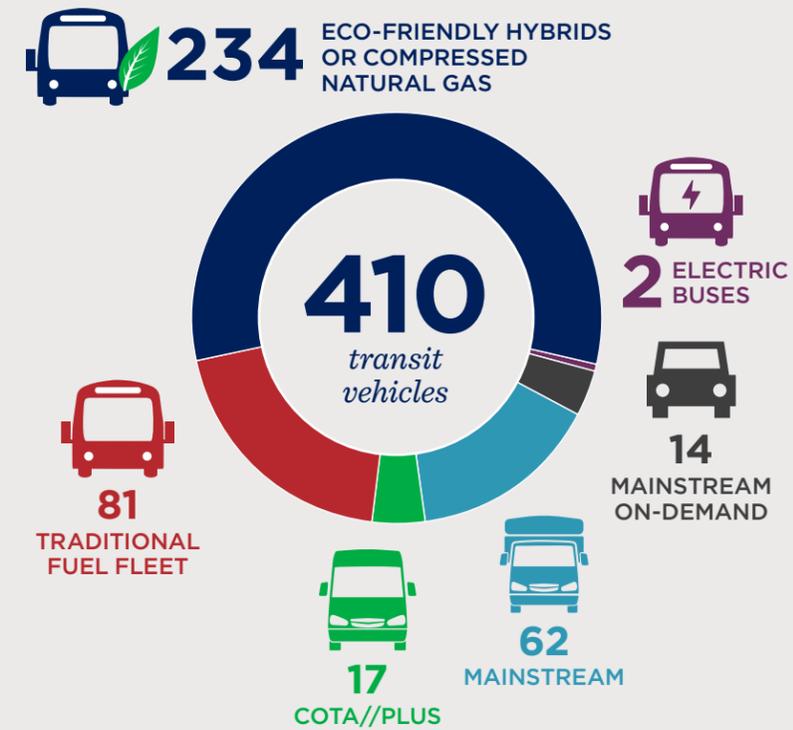
Figure 2: 2021 OPERATIONAL COST BREAKDOWN



## OUR FACILITIES

COTA operates out of several facilities, the largest of which are the maintenance garages and fueling stations at 1600 McKinley Ave and 1330 Fields Ave. These sites host CNG and diesel refueling stations, bus washing and servicing, and offices. Other facilities include an administrative building, paratransit facility, transit centers and terminals, park and ride facilities, and 424 bus stop passenger shelters.

Figure 3: OUR FLEET



## FLEET CHANGES coming in 2022

- +18** ECO-FRIENDLY HYBRIDS OR CNG
- 26** TRADITIONAL FUEL BUSES
- +3** COTA//PLUS VEHICLES IN THE FIRST QUARTER
- +8** ELECTRIC BUSES IN THE FOURTH QUARTER



# past and current INITIATIVES

COTA has long been engaged with sustainability within its operations. This can be reflected in a number of initiatives that have taken place over the last decade. It is because of this engagement that COTA is in a position to adopt the baseline year of 2013 to match the starting point reflected in the City of Columbus Climate Action Plan. Past efforts have already achieved progress towards the goals laid out in this plan and built a strong foundation upon which to build out COTA's own sustainability initiative. Below we present a list of historical and ongoing initiatives that COTA has pursued which align and support this sustainability plan:



## 1. EQUITY, DIVERSITY, AND INCLUSION (EDI)

- COTA's strategic plan placed EDI at the center of institutional decision making as reflected in the strategic plan compass.
- COTA created a Chief Equity Officer and an EDI program.
- Engagement has been initiated through four Employee Resource Groups (ERGs).
- Engagement with external partners and entities to advance equity.
- Pursuing a public policy agenda at local, state, and federal levels that continue to support and advance equitable access to public transit.
- Disadvantaged Business Enterprise (DBE) program.



## 2. EMISSIONS

- COTA's decision to transition its bus fleet away from diesel, which began in 2013 with the installation of the compressed natural gas (CNG) fueling stations at both major coach facilities which resulted in:
  - A 17% reduction in fleet GHG emissions
  - An 11% GHG emissions reduction overall
  - A 73% reduction in pollution emissions
  - Economic benefits of over \$10 million to the county.



## 3. RIDERSHIP

- Collaboration in the development of the LinkUS initiative which will develop multiple high volume transit corridors within the Columbus region.
- Collaboration in the City of Columbus Climate Action Plan which has laid out increased ridership targets through 2050.



## 4. WASTE

- Monetizing waste streams with value including paper, cardboard, and scrap metal
- Investing in proper disposal of waste streams including waste oil and batteries
- Collaborating with suppliers to recycle tires



## 5. WATER

- COTA continually works to meet and exceed the established watershed requirements facilities fall under
- Water reclamation systems were added to the bus washing systems at both vehicle facilities to recycle water with the process, reducing water consumption requirements of fleet operations.



## 6. RESILIENCY AND BUSINESS CONTINUITY

- Maintaining operations has always been a mission critical objective for COTA and will continue to be moving forward. This includes:
  - Ongoing development and management of the COTA Business Continuity Plan.
  - The coordination and communication used to facilitate live re-routing of coaches around various traffic blockages
  - Assisting in reducing transit strain during snow emergencies by offering cost free access to minimize traffic during winter weather events
  - Development of the COTA Safe and Secure for All Task Force
- Navigating the broad and dynamic impacts of the COVID-19 pandemic and its historic impact on resident's use of transit for personal and work-related needs.
  - Facilitating cost-free transportation to vaccination sites across Columbus.





# *sustainability* GOALS, METRICS, TIMELINE

Building off the progress already made, COTA wishes to pursue bold, ambitious goals as they move into the future.

Goals must be measurable, reportable, and relatable to facilitate real progress and broadcast achievements to stakeholders. Additionally, goals should be technically and economically achievable, and consistent with COTA's equity, diversity, and inclusion principles. The final Sustainability Plan will outline short-term targets, on a five-year cycle, and long-term (2045) targets for COTA to achieve across environmental, social and governance (ESG) areas of impact. 2013 has been selected as the baseline year because it aligns with the baseline year established by the Sustainable Columbus Climate Action Plan. Tracking for each performance category may be limited due to access to historical information.

Long term goals will provide a decision-making framework that enables navigation of changing technological opportunities and cost constraints over the next three decades. To be in alignment with external stakeholders such as the city and MORPC, goals should match or exceed goals set by these agencies.

Short term goals will act as waypoints to ensure constant progress. As milestones are met, we encourage internal and external messaging for recognition. It is important to celebrate achievements to keep teams encouraged and to bring outside awareness to improve customer, community, and government relations.

We are recommending that COTA establish performance categories in its Sustainability Plan. We recommend the following Performance Categories for COTA's consideration and feedback: EDI, emissions, ridership, waste, water, and resiliency. These performance categories will have their own set of short- and long-term goals. Key Performance Indicators (KPIs) specific to each performance category will be the metrics or unit of the goal and the measurement used to track progress toward each goal.

For each performance category, the plan will identify goal(s) to be pursued by 2045 along with KPI(s) to measure progress. In the following sections we provide descriptions of each performance category, why they are important, and the direction we plan to take in identifying goals and KPIs.



## 5.1. EQUITY, DIVERSITY, AND INCLUSION

Equity, diversity, and inclusion (EDI) are at the core of everything COTA does and influences culture both inside its own walls and in the greater Columbus region to serve its purpose "to move every life forward". EDI is integrated into this sustainability plan both by intentionally advancing specific EDI objectives and goals and with how COTA pursues achievement of other sustainability goals across the enterprise.

As we look to COTA's employees, operations, customers, and the communities it serves, EDI is foundational to its work and is integrated into its operations, strategic planning, procurement and hiring & human resources practices, and community investment strategies. As outlined in the COTA strategic plan, EDI is an underpinning strategy that connects everything that COTA does.

Specific measurable and actionable areas of impact include performance categories and metrics that advance EDI at COTA and align with supporting the tenants of this plan. These initiatives and goals will elevate employee engagement, health & safety, economic development, community investment and support customer satisfaction.

Developing this plan included an equitable approach to engaging with internal and external stakeholders to identify priority areas for COTA to focus on with developing the strategies, initiatives, and goals to create a more equitable and inclusive transit agency. This included meetings with EDI leadership at COTA, Disadvantage Business Enterprises (DBE) program management, employee resource group (ERG) leaders, surveys of ERG membership and interviews with several external partner organizations. These engagements result in a more inclusive sustainability plan consistent with the values of COTA.

### 5.1.1. BACKGROUND AND CONTEXT

COTA and the many organizations in the greater Columbus area have been actively investing in and supporting equity & inclusion initiatives to provide greater access to prosperity for minority and underserved communities and to increase the diverse representation in their organizations. In addition, the Justice 40<sup>3</sup> Initiative announced by the Biden administration seeks to direct public funding to those who are affected most by climate change, which is predominately people of color (POC), low-to-moderate income (LMI) and indigenous and underserved communities. This initiative is included in Executive Order 14008<sup>4</sup> which outlines the Administration's approach to addressing climate change and demonstrates that equity is embedded in the Administration's approach to climate change.

COTA is investing in equity, diversity and inclusion (EDI) to support its employees, customers, suppliers and the communities where they operate. By integrating EDI into the sustainability plan, COTA is better able to align this plan with and support both COTA's and the region's efforts to create more opportunity for minority and underserved individuals, families and communities, to support creating a diverse and inclusive workforce and create economic opportunity for minority-owned and DBE businesses in the region.

<sup>3</sup><https://www.transportation.gov/equity-Justice40#more-about-justice-40>

<sup>4</sup><https://public-inspection.federalregister.gov/2021-02177.pdf>

The figures below present excerpts from COTA's strategic plan that lays out what EDI means and how it places EDI at the center of COTA's mission.

Figure 4: EDI DEFINED



### Equity

Providing fair access, opportunity and advancement for all people is achieved by understanding and eliminating barriers that prevent full participation for disadvantaged groups. Employee motivation is critically contingent on the incorporation of equity.



### Diversity

By seeking to attract and retain individuals of demographic diversity, such as, but not limited to race, ethnicity, gender, age, orientation, socio-economic background, physical ability and religion, COTA will derive value from individuals' differences of experiences, perspectives and thought processes. Diverse organizations are also more successful at attracting and retaining talent.



### Inclusion

Organizations succeed at maintaining diversity when they focus on inclusion. Employees feel valued, respected and supported when inclusion is part of the organizational culture. In establishing a strong inclusive culture, COTA can expect job satisfaction to increase among employees, resulting in maximum productivity.

(Source: COTA Strategic Plan 2019–2024)

Figure 5: EDI'S POSITION IN COTA



(Source: COTA Strategic Plan 2019–2024)



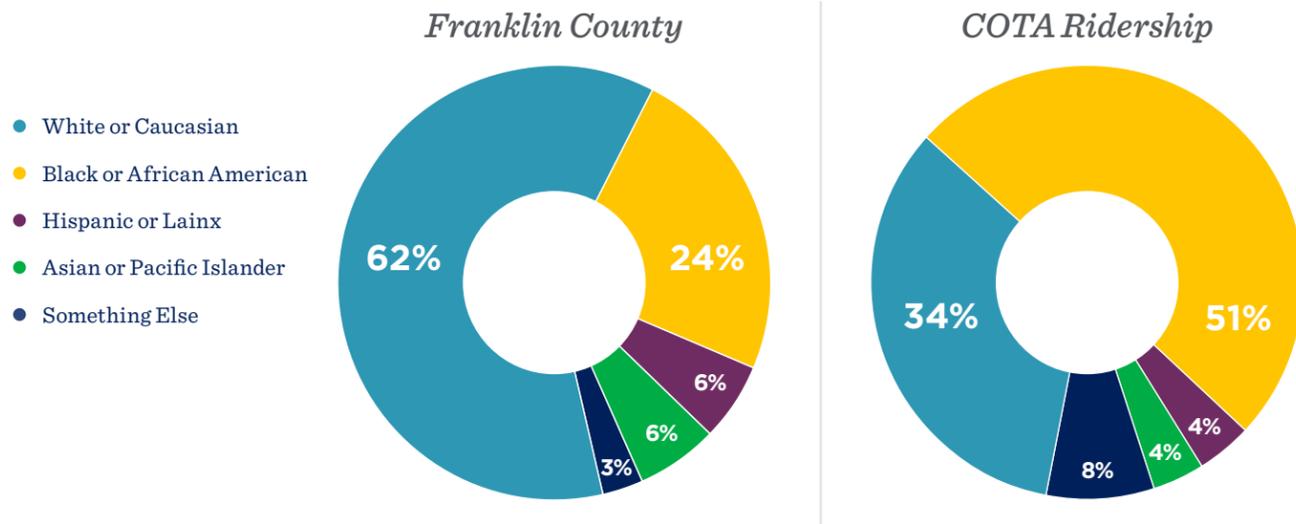
Initiatives within COTA's strategic plan support EDI within COTA and the sustainability strategy outlined within this plan specifically supports many of the initiatives that COTA is driving in its strategic plan.

Table 6: EDI INITIATIVES IDENTIFIED IN COTA STRATEGIC PLAN 2019–2024

INITIATIVE	EARLY OPPORTUNITY	IMPROVEMENT	TRANSFORMATION
Leverage a mobility partner to pilot a first- & last-mile solution	●		
Implement a multi-modal trip planning and payment app with options that provide access to mobile users and the un-banked			●
Ensure transportation planning supports access to jobs, healthcare, and education for disadvantaged communities	●		
Increase and expand service to capture new customer segments, including disadvantaged riders		●	
Implement programs to retain, train, and attract a diverse talent pool at all levels of the organization		●	
Establish and engage employee resource groups (e.g. Veterans, LGBTQ, African-American women, etc) within the organization	●		
Incorporate targeted recruiting to increase diversity within departments		●	
Promote the use of small, disadvantaged businesses through partners		●	

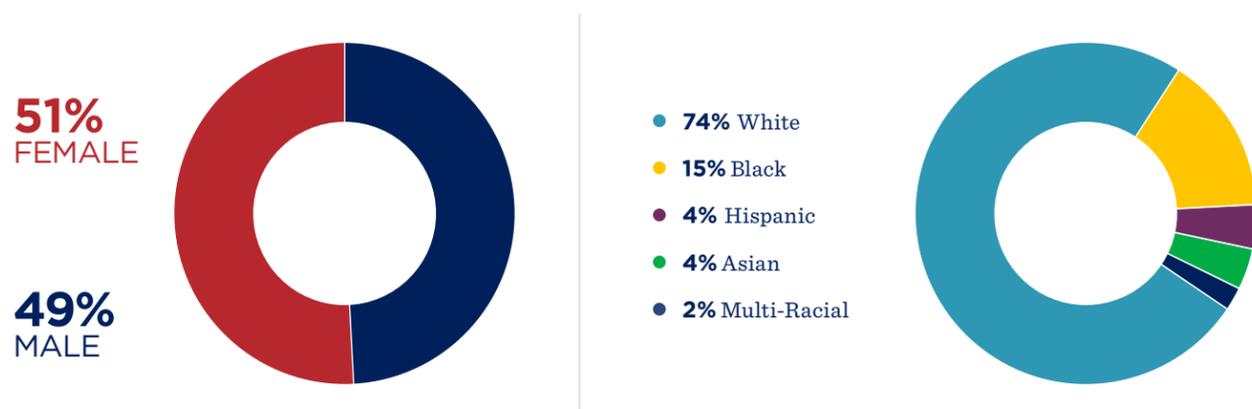
By elevating EDI and including a focus on advancing EDI into the sustainability strategy we are better able to align the plan in support of the ridership demographics of COTA. COTA's ridership is a majority minority customer base, which presents a terrific opportunity to engage with and educate on COTA's sustainability efforts and what COTA's customers can do to advance the sustainability of the region. The service to minority populations can be seen in Figure 6 which shows that while 63% of Franklin county's population identifies as white or Caucasian, COTA's riders are 33% white or Caucasian.

Figure 6: RIDERSHIP DEMOGRAPHICS (2021 Q4 CUSTOMER SURVEY)



Further, a breakdown of workforce diversity within Franklin County generated by COTA in January of 2022, illuminates how well county demographics are reflected within the makeup of businesses within the region.

Figure 7: FRANKLIN COUNTY BUSINESS DEMOGRAPHICS BASED ON GENDER AND RACE



Advancing EDI as part of this sustainability plan includes internal efforts within COTA, how COTA interacts and supports its customers and economic prosperity in the communities that COTA serves. COTA's approach to advancing EDI is still in development, but it can be categorized in three pillars in support of these areas of influence as part of this sustainability plan.

Table 7: COTA SUSTAINABILITY EDI FRAMEWORK

INSIDE COTA	COTA CUSTOMERS	ECONOMIC PROSPERITY
Improve employee engagement and development of EDI through higher level of participation in employee resource groups (ERGs) and in EDI activities being developed at COTA to further cultivate an inclusive working environment at COTA.	Support individuals, households and communities that are bearing the greatest burden of the impacts of climate change by prioritizing customer initiatives for POC, LMI and households with limited access to vehicles.	Invest in and support minority, female, LGBTQ, veteran, disabled owned businesses in COTA's procurement practices in both capital projects initiated by COTA and in operational needs.
Proactively monitor and continue to seek out hiring of diverse talent across the organization.	Evaluate routes and access to COTA services to communities, access to employment, services and amenities needed by the households that need COTA's services most.	Invest in community economic development and essential services that support minority, LMI and underserved individuals, households, and communities.

COTA has been supporting EDI by integrating and elevating its visibility across the enterprise including creating a Chief Equity, Diversity and Inclusion officer role and program office to align and accelerate EDI at COTA.

COTA has a Disadvantage Business Enterprise (DBE) Program that adheres to the U.S. Department of Transportation's DBE regulations, 49 CFR Part 26. This program drives COTA's DBE policy to ensure that DBE's have an equal opportunity to receive and participate in US DOT-assisted projects. COTA's Chief Diversity Officer has been delegated as the DBE Liason Officer and is responsible for implementing the program. The DBE Liason officer has direct, independent access to the Chief Executive Officer on all matters concerning the DBE program.

DBE certified businesses are small for-profit businesses that are at least 51 percent owned by one or more individuals who are both socially and economically disadvantaged, and whose management and daily business operations are controlled by one or more socially and economically disadvantaged individuals. The DBE program seeks to provide further economic opportunities for DBE businesses in the greater Columbus region for both DOT-assisted projects and other spending at COTA. In 2021, spending within the DBE program represented 4.5-6.3% of spend at COTA.<sup>5</sup>

<sup>5</sup>B2Gnow Diverse Spend 2021—Year-End report—the range is to show certified diverse firms vs certified and non-certified diverse firms.

COTA recognizes certified MBE, WBE, VBE, EDGE, LEDE as part of its DBE program to continue to support greater supplier diversity. The tables below present the groups COTA defines as socially and economically disadvantaged and recognized DBE certification agencies.

**Table 8: SOCIALLY AND ECONOMICALLY DISADVANTAGED GROUPS AS DEFINED BY COTA**

- Women (regardless of race)
- African Americans
- Hispanic Americans
- Native Americans
- Subcontinent Asian Americans
- Any additional group whose members may be designated as socially and economically disadvantaged by the Small Business Administration (SBE).

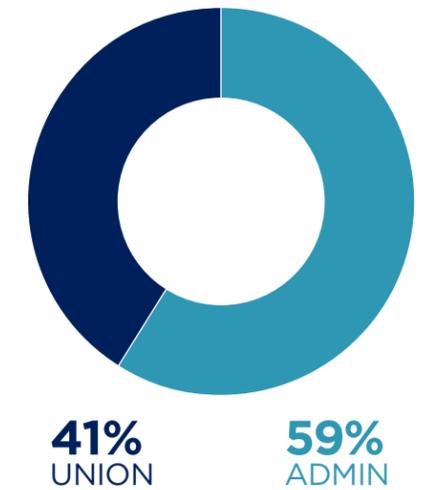
**Table 9: DBE CERTIFICATION AGENCIES**



## EMPLOYEE RESOURCE GROUPS

COTA has also made significant progress elevating EDI through engagement with employees, participation in the community, and supporting efforts to improve EDI in the region. Part of this success is demonstrated by COTA's Employee Resource Groups (ERGs). COTA has four ERGs that support and engage employees on EDI efforts across the organization. The four groups are Veterans Employee Resource Group (VERG), Parents Actively Collaborating Together (PACT), Black Employees Leading in Inclusion, Excellence, Vision & Education (BELIEVE), and Women for Inspiration, Strength and Excellence (WISE). With nearly 300 employee members of the ERGs, COTA is actively engaging its diverse workforce to better connect with and support the individual needs and interests of COTA employees and both union and administrative employees actively engaged in ERG efforts.

**Figure 8: ERG PARTICIPATION**



### VETERANS EMPLOYEE RESOURCE GROUP (VERG)

VERG was formed in May of 2019 and was COTA's first ERG. In 2021, VERG had more than 120 members and a representation of 33% administration employees and 67% union employees. VERG participates in projects both internally at COTA and in the community supporting Veterans employees and families, Veteran focused organizations, and Veterans in the greater Columbus community.

**VERG PURPOSE STATEMENT:** "The VERG is committed to serving employees of COTA and Community Partners through innovative and diverse initiatives, programs, and activities. Members of VERG strive to provide an inclusive environment and advocate for the growth, career advancement and overall support of all COTA's employees and their families."



### PARENTS ACTIVELY COLLABORATING TOGETHER (PACT)

PACT was formed in May of 2020 and was COTA's second ERG. In 2021, PACT had 24 members with representation of 75% administration and 25% union employees. PACT Participates in projects in support of parents at COTA and their collaborative education on parenting.

**PACT PURPOSE STATEMENT:** "To promote an inclusive environment for working parents and family structures through support, education, resources, and outreach."



**BLACK EMPLOYEES LEADING IN INCLUSION, EXCELLENCE, VISION & EDUCATION (BELIEVE)**

BELIEVE was formed in October of 2020 and was COTA's third ERG. In 2021, BELIEVE had more than 90 members and a representation of 31% administration employees and 69% union employees. BELIEVE supports, educates, and creates greater awareness of issues African Americans face by creating a safe platform for employees to support one another.

**BELIEVE PURPOSE STATEMENT:** "The African American Employee Resource Group exists to create a safe platform where employees can empower, embrace, support, and educate one another on African American culture and the issues we face. Striving to break down barriers and dissolve systemic issues through advocacy, corporate events, employee activities, community partnership and networking; pushing the organization beyond a diversity statement and into the domain of a true leader of Diversity, Equity, & Inclusion."



**WOMEN FOR INSPIRATION, STRENGTH AND EXCELLENCE (WISE)**

WISE was formed in May 2021 and was COTA's fourth ERG. In 2021, WISE had more than 50 members and a representation of 64% administration employees and 36% union employees. WISE supports the empowerment women in the workplace, transit industry and in the greater community.

**WISE PURPOSE STATEMENT:** "Every Woman's voice, journey and experience has power. We lead through an intentional, and inclusive, and intersectional lens that focuses on career development, wealth building, and whole person living for all women across Team COTA. WISE is a safe space for employees who identify as women and their allies to connect and grow. Together, we are united in empowerment for all."

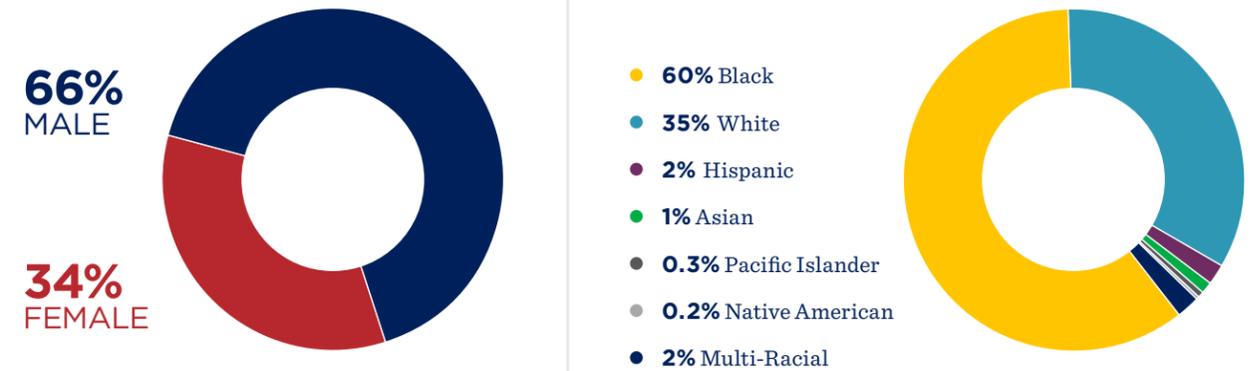
As COTA continues to focus on employee engagement and further cultivating an equitable and inclusive workplace, COTA anticipates expansion of its ERGs.



**EMPLOYEE DEMOGRAPHICS**

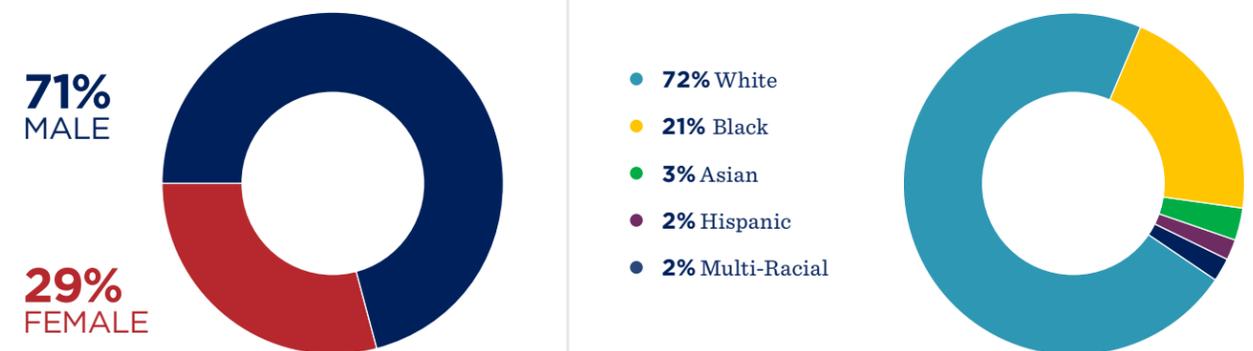
COTA's employees represent a cross section of individuals from the greater Columbus area. COTA's focus on EDI has helped to attract a retain diverse talent to the organization, which can be seen in its employee representation. The employee demographics at COTA are closely aligned with the demographics of COTA's ridership. Intentional focus on EDI elevates the importance of this alignment and provides an opportunity to provide meaningful careers for diverse individuals across the region. COTA will continue keep EDI at the center of everything it does.

**Figure 9: TEAM COTA DEMOGRAPHICS ON GENDER AND RACE**



COTA third quarter EEO report

**Figure 10: TEAM COTA DEMOGRAPHICS ON GENDER AND RACE FOR MANAGERS AND ABOVE**



**MOBILITY XX INITIATIVE**

To further support women in the transportation industry, COTA has signed on to the Mobility XX initiative to increase the number of women in the transportation industry by 10% over the next 10 years.<sup>6</sup> Currently only 15% of the transportation workforce is comprised of women, however, COTA's own demographics show a higher representation of women at 33%. These numbers are even lower at the C-suite level nationally. At COTA, women comprise 29% of positions at a managerial level and above. As part of the Mobility XX pledge, COTA commits to specific actions to increase women representation at the organization.

<sup>6</sup><https://www.mobilityxx.org>

### 5.1.2. GOALS—LONG AND INTERIM

To support the sustainability of COTA and the community and to help mitigate the effects of climate change for those who are least equipped to implement their own mitigation efforts, COTA will incorporate EDI as a factor in its sustainability planning and climate change efforts. COTA is currently undertaking significant EDI actions as part of its strategic plan that fit within the sustainability plan framework. Currently, COTA has yet to establish quantifiable EDI goal(s) with which to measure progress, though progress on EDI can be made by completing actions absent a goal. Thus, COTA could set a goal of completing a set of defined actions which improve EDI. In the following metrics section, a number of options are presented by which to measure EDI. One or multiple of these metrics, or others developed by COTA for use within this framework, should be identified and adopted. Once selected, pursuit of an appropriate increase or decrease to the selected metric can be pursued, allowing positive EDI impacts to be captured, illuminated, and embodied.

1. Determine EDI metrics and begin tracking progress
2. Work towards internal DBE spending goals
3. Increase the number of women at COTA by 10% over the next 10 years in support of the Mobility XX initiative.

### 5.1.3. METRIC

Engagement on EDI is a relatively new initiative at COTA. Consequently, this is a time of great transition as teams are being built out to lead COTA forward based upon the directives laid out in the strategic plan. For this reason, this Sustainability Plan has identified a number of pathways by which COTA could measure progress within EDI. This list should serve as a resource to the teams directing EDI efforts within COTA and this plan should be revised over time to incorporate the vision of that team and align the goals of the sustainability plan with the organizational initiatives being undertaken.

#### OPTIONS FOR EDI METRICS INCLUDE:

1. Percentage of POC households served
2. Percentage of LMI households served
3. Percentage of limited-to-no-vehicle households served
4. Routes and zero emissions vehicles
5. Percentage of POC employees at COTA
6. Gender ratios of employees at COTA
7. Employee engagement scores
8. Percentage of employees participating in employee resource groups (ERGs)
9. Number of projects ERGs are engaged with in the community
10. Dollars spent in the community supporting EDI initiatives, organizations & activities
11. Dollars spent with minority, female, LGBTQ, veteran, disabled owned businesses.
  - On a project basis / Overall spend at COTA

### 5.1.4. SCOPE

The scope of EDI at COTA exists within three primary areas of impact, inside COTA with its employees and supply chain, with its customers, and within the community. We recommend selecting a leading goal for each area, employee engagement, diverse suppliers, ridership, and community impact.

### 5.1.5. MEASUREMENT AND REPORTING

For the purposes of advancing EDI both within COTA and in the community, the efforts outlined within this strategy can be monitored annually and reported to COTA leadership on an annual basis. External progress will be reported and evaluated concurrent with the other metrics outlined within this plan.

### 5.1.6. RECENT TREND AND CURRENT STATUS

EDI is at the core of COTA's strategic plan which has several clearly identified initiatives to improve EDI, as shown in Section 5.1.1. To incorporate the foundation the strategic plan created, COTA needs to establish a measurable EDI goal for use within this plan. Thus, COTA's success on EDI can be best measured currently by the status of these EDI actions. COTA continues to develop strategies for implementing each of the Early Opportunity, Improvement, and Transformational actions listed in its strategic plan.

### 5.1.7. ACTIONS AND RECOMMENDATIONS

Initiatives to advance and integrate EDI into COTA while pursuing its goals include:

1. Expand access to underserved individuals and communities.
  - a. Percentage of service to underserved communities including:
    - People of Color (POC)
    - Low to moderate income individuals (LMI)
    - Households without access to vehicles
  - b. Ensure new and existing bus stops are accessible and linked with pedestrian access to residential and businesses approximate to each stop.
  - c. Ensure routes and stops are proximal to destinations such as hospitals, parks, grocery stores and places of work.
  - d. Plan deployment of zero emissions vehicles by prioritizing areas that are experiencing the poorest air quality within COTA transportation network.
  - e. Improve affordability and accessibility of transit for LMI individuals and households.
2. Increase participation and engagement of the employee resource groups on implementing the plan. Providing opportunities for the ERGs to support the plan will further engage the ERGs on COTA priorities. A goal of each ERG should be participating in one activity to advance the sustainability goals outlined in this plan.
  - a. Volunteer activities in the community
  - b. Educational awareness on how COTA employees can improve sustainability at home & at work.
  - c. Drives to increase use of public transit for COTA employees and participation in regional efforts such as bike-to-work day.
  - d. Wellness activities with COTA employees.
3. Expand access to economic opportunity for minority, female, LGBTQ, disabled, and veteran owned businesses by intentionally increasing spend with these businesses in both COTA capital projects and operational needs.
  - a. Capital projects goals for spending.
  - b. Operational expenses and overall, COTA spend goals.



## 5.2. EMISSIONS

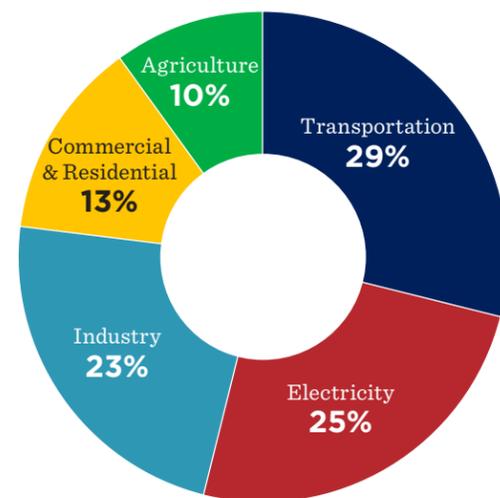
### 5.2.1. BACKGROUND AND CONTEXT

As society has increased its focus on eliminating emissions, transportation agencies across the nation have identified the need to de-carbonize operations. This is because transportation comprises 29% of total U.S. greenhouse gas emissions.<sup>7</sup> While public transportation is only one part of the transportation sector, agencies will need to establish emission-free operations to eliminate their contribution to climate change. Furthermore, to achieve transportation emission reductions across society, regional governance, planning, and resources will be needed to support expansion of existing transit services to meet regional goals and facilitate zero-emissions mobility for all citizens.

A primary focus of sustainability for transit agencies is the decarbonization of their vehicle fleets. This reflects the goals and initiatives of the federal government and transit agencies across the country. Consequently, emissions reduction will likely be the primary way the federal government, peer agencies, and other external stakeholders evaluate COTA's sustainability progress. Thus, it is critical for COTA to pursue net-zero-carbon goals, targeting at latest 2050, along with its peers and society at large.

Moreover, the city of Columbus has developed an evolving Climate Action Plan to pursue similar goals in the region. While initially they intended to use 2018 as their benchmark year, the Draft Climate Action Plan<sup>8</sup> from 2021 indicates 2013 will be the new baseline upon which progress will be measured.

**Figure 11: EPA SUMMARY OF U.S. GREENHOUSE GAS EMISSIONS BY ECONOMIC SECTOR IN 2019**



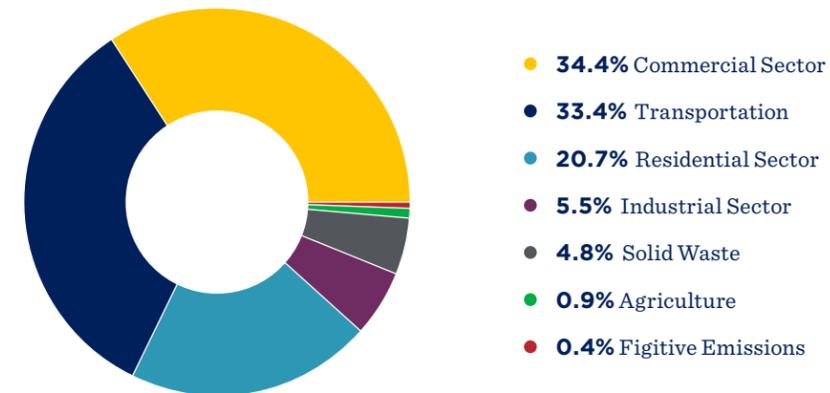
<sup>7</sup><https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>  
<sup>8</sup><https://www.columbus.gov/sustainable/cap/>

Figure 12 shows the breakdown of emissions from the City of Columbus's 2021 Climate Action Plan report which attributes 33.4% of the 2013 emissions to regional transportation. The emissions baseline breakdown indicates that transportation is a major component of the city's own community emissions reduction goal and engagement.

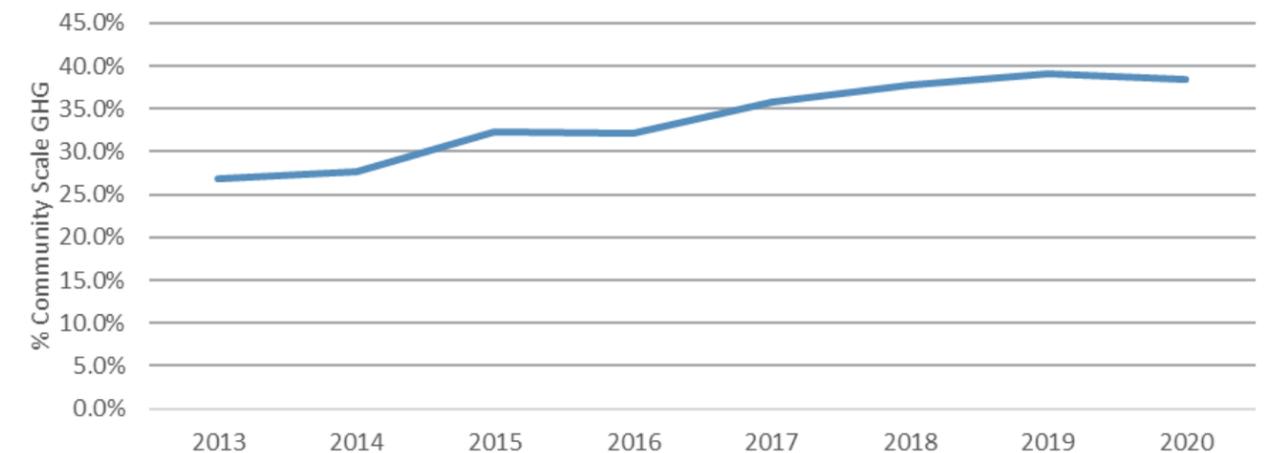
Figure 13 shows the change in transportation related GHG that from 2013 to 2020 in the 2020 City of Columbus Greenhouse Gas Inventory report created by MORPC. That report indicates that since the baseline year Columbus regional transportation GHG emissions have grown from 27% to 39%.

COTA anticipates that the City of Columbus will have growing concern with transportation related emissions. Thus, decarbonizing the entirety of the transportation sector is a critical need of the community.

**Figure 12: CITY OF COLUMBUS 2013 SECTOR EMISSIONS BASELINE<sup>9</sup>**



**Figure 13: TIME TREND OF TRANSPORTATION AS PERCENT OF COMMUNITY SCALE GHG IN COLUMBUS<sup>10</sup>**



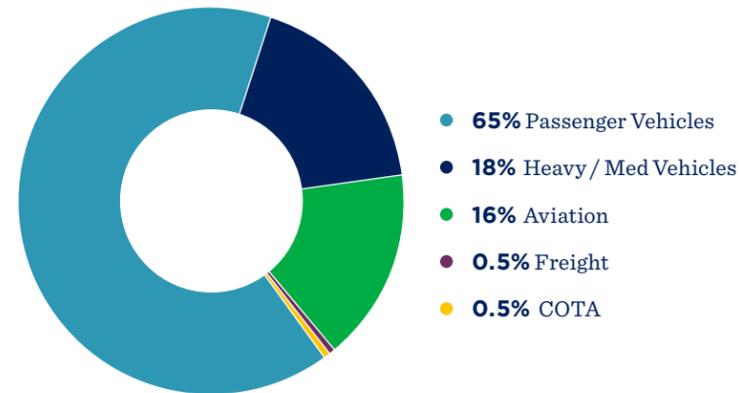
<sup>9</sup><https://www.columbus.gov/sustainable/cap/>  
<sup>10</sup><https://www.columbus.gov/Templates/Detail.aspx?id=2147519329> - 2020 City of Columbus Greenhouse Gas Report

While transportation is a growing focus for the Columbus region, COTA's contribution to regional emissions is roughly 1% of regional transportation emissions, or 0.33% of the community's emissions, as shown in Figure 14. This indicates that to achieve reductions in regional emissions for the city, COTA will need to both transition to net-zero-GHG emission operations while at the same time expanding its services and ridership. That is to say, COTA's own emissions are of relatively small concern to Columbus, but COTA's ability to help reduce the city's transportation sectors emissions is a significant opportunity within the region.

It is currently unclear what percentage of Columbus residents are able to transition to net-zero-emissions vehicle use. It is also likely that the cost of privately owned electric vehicles, charging systems, and green electricity may be prohibitive for some of the population to achieve these reductions on their own.



**Figure 14: BREAKDOWN OF COLUMBUS REGIONS TRANSPORTATION EMISSIONS**



**5.2.2. GOALS—LONG AND INTERIM**

Goals within the Emissions performance category are centered around two primary components, green-house gases (GHG) and other pollutants. These emissions areas capture critical impacts on the community resulting from COTA's operations. GHG will be used to refer to climate changing emissions include carbon dioxide, methane, and other gaseous compounds most frequently associated with fossil fuels and their combustion. The GHG metric will focus on CO<sub>2</sub>e, which is the combined impact of the various GHGs in common units based upon the climate change impact of carbon dioxide. Pollution will be used to refer to non-GHG emissions closely tied to vehicle operations that have adverse impacts on the populations within the service area.

We recommend tracking the pollutant particulate matter 2.5 (PM<sub>2.5</sub>) which is defined as fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller, as a proxy for all other pollutants.<sup>11</sup> Other pollutants include NO<sub>x</sub>, SO<sub>x</sub>, and VOCs.

Eliminating GHG emissions has become a national and global priority in recent years. Consequently, COTA will benchmark its efforts against other transit agencies and work with supporting entities like the Federal Transit Authority to achieve a goal of net-zero GHG emissions by 2045. Continual identification of technical and economic barriers to progress will become standard practice with aspirations to transition to Zero Emissions operations as soon as possible. Achieving Net-Zero Emissions will require transitioning the fleet to zero-carbon vehicles, ensuring the fuel being sourced for these vehicles are carbon free, and transitioning all support operations to be powered by clean energy. Long term, sourcing carbon free electricity through RECs or onsite generation and any natural gas use from renewable natural gas will be critical. Assessing the price for sourcing zero-emission utility supplies should be a regular activity to facilitate updated understandings of any additional costs that may be required.

Within the transit sector, PM<sub>2.5</sub> emissions are directly tied to fossil fuel combustion. This pollution directly affects the health of riders, the environment, and community of Central Ohio. Due to PM<sub>2.5</sub>'s adverse impact on public health, and in alignment with COTA's focus on EDI, a parallel goal of net-zero-pollution within COTA operations by 2045 has been set. To achieve this pollution goal, elimination of all fossil fuel use will be required by the 2045 target date.

As society shifts to focus on these common goals, it should be expected that there will be transitions in technologies, costs, and opportunities in the coming decades. For this reason, the plan recommends interim assessments of progress on five-year intervals. This will facilitate and actionable cycle of engagement to assess progress, where it has been achieved, areas that require focus, and strategic identification of steps to take within the dynamic landscape that manifests.

In order to transition operations in alignment with internal and societal objectives addressing emissions, COTA will:

- Set a goal of Net-Zero Green-House Gas (GHG) Emissions by 2045
- Set a goal of Net-Zero Particulate Matter 2.5 (PM<sub>2.5</sub>) Emissions by 2045

**5.2.3. METRIC**

Emissions metrics include:

- Measuring and tracking GHG emissions in pounds (lbs) of CO<sub>2</sub>e, and lbs CO<sub>2</sub>e/mile.
- Measuring and tracking PM<sub>2.5</sub> emissions in grams (g) PM<sub>2.5</sub>, and g-PM<sub>2.5</sub>/mile.

The emissions goals are to be measured with two metrics, one for GHG emissions by measuring pounds of CO<sub>2</sub>e and one for pollution that effects local air quality by measuring pounds of PM<sub>2.5</sub>. Both will capture progress towards elimination of emissions from operations and will be normalized by annual revenue vehicle miles which is already tracked for the NTD. Normalization is needed because both tracked emissions' metrics vary with operational miles, and it is expected that other organizational objectives could drive increases in services in the coming decades. This will allow COTA to measure progress in reducing fleet emissions even if there is an increase in vehicle miles for expanding services occurring at the same time.

<sup>11</sup><https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>

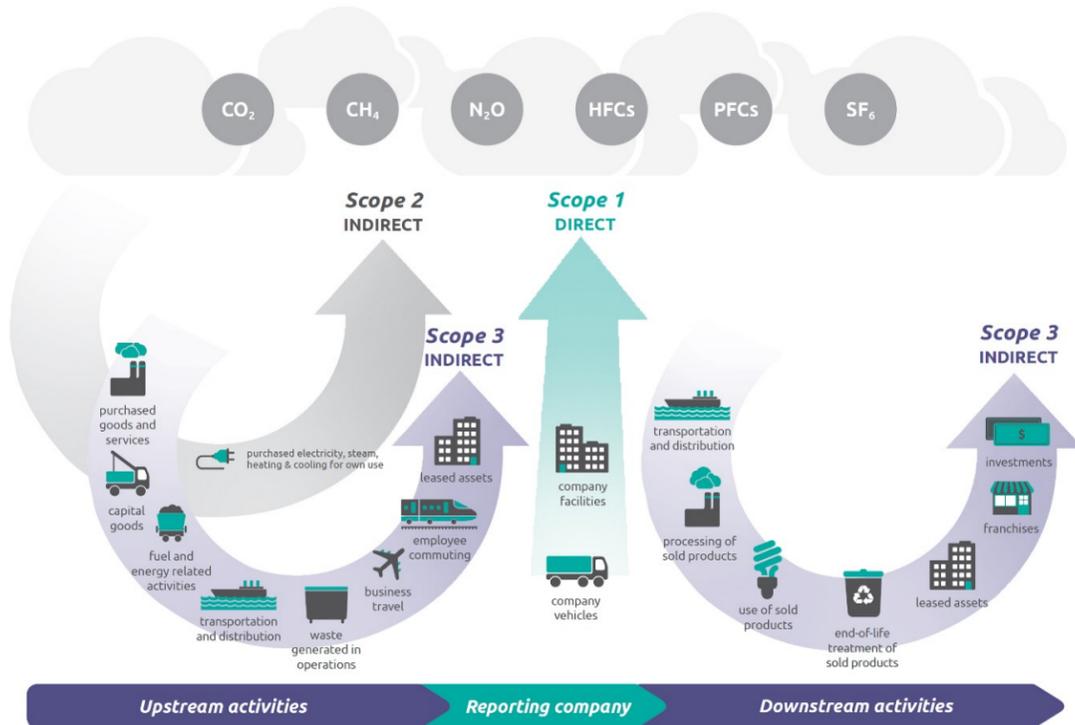
The metric we recommend for tracking GHG is pounds CO2 equivalent per revenue vehicle mile (lb-CO2e/mile) as recommended by APTA's method for "Quantifying Greenhouse Gas Emissions from Transit".<sup>12</sup> The calculation can largely be generated from data currently tracked for submission to the National Transit Database (NTD) including the use of fuel, electricity, and natural gas. Of particular importance is the current ability to capture fuel use that comes from electricity and natural gas. This is currently feasible because the compressed natural gas fueling equipment has its own electric and natural gas utility meters that can be totaled separately from facility utility use. Total service vehicle miles are currently captured for the revenue fleet for NTD reporting. The procedures for tracking this metric are laid out in Supplement A - Metric Calculation Guides and are built upon the existing NTD reporting requirements and COTA's existing data collection.

The metric for tracking pollution is grams PM2.5 per revenue mile (g-PM2.5/mile). This will allow COTA to leverage the same data necessary for GHG tracking to be used for tracking pollution. While the metric will be based upon PM2.5, tracking will include other pollutants identified by the EPA including NOx, Sox, and VOCs. Vehicle pollutants can be estimated using the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool<sup>13</sup> created by Argonne National Laboratory. The pollution calculation will include direct emissions, such as combustion of natural gas and vehicle exhaust, as well as indirect emissions from utility use.

**5.2.4. EMISSIONS CATEGORIES (SCOPE)**

GHG emissions are currently categorized into three scopes for reporting purposes. This is done to differentiate between the varying levels of control an organization has over the emissions associated with their operation. The figure below presents a visualization of the three scopes.

**Figure 15: OVERVIEW OF GHG PROTOCOL SCOPES AND EMISSIONS<sup>14</sup>**



<sup>12</sup><https://www.apta.com/research-technical-resources/standards/sustainability/apta-suds-cc-rp-001-09/>  
<sup>13</sup>[https://greet.es.anl.gov/afleet\\_tool](https://greet.es.anl.gov/afleet_tool)  
<sup>14</sup><https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance>

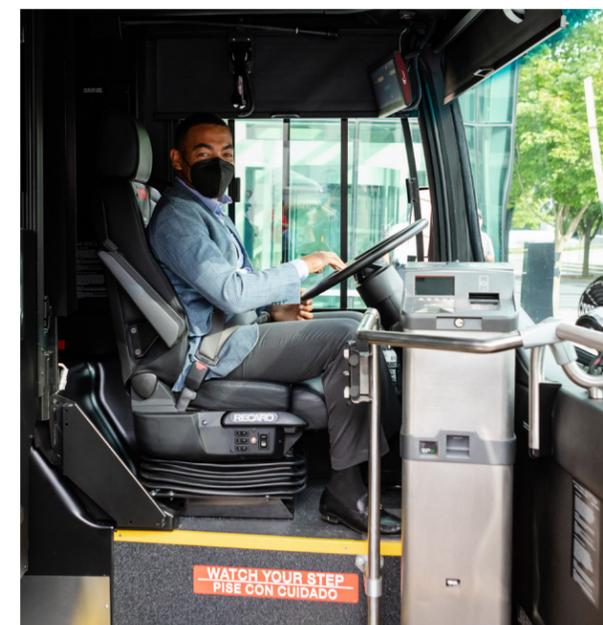
Initial tracking will focus on Scope 1 and 2 emissions, which are the areas COTA can directly engage to reduce emissions. As the figure shows, Scope 1 emissions are emissions associated with direct use within COTA's facilities or vehicles. Scope 2 are the emissions tied to purchased utilities, which for COTA is their electricity consumption. Table 1 shows Scope 1, 2, and 3 emissions sources for COTA.

**Table 10: OVERVIEW OF GHG FROM COTA OPERATIONS BY SCOPE**

EMISSIONS CATEGORIES ACTION AREA			SCOPE 1	SCOPE 2	SCOPE 3
<b>Fleet</b>	Buses	Diesel Buses	●		●*
		CNG Buses	●		●*
		BEB Buses		●	●*
	Mobility Fleet	Diesel	●		●*
		Gasoline	●		●*
	Nonrevenue Vehicles		●		●*
<b>Facilities</b>	Electricity		●		
	Natural Gas	●			
<b>Employee Travel</b>				●	

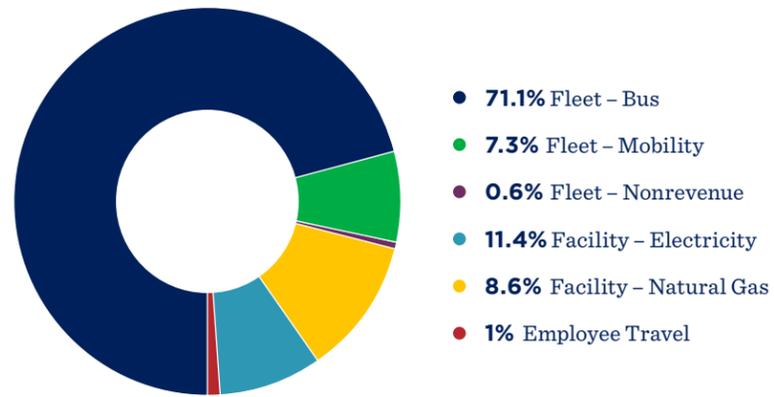
\*Scope 3 emissions for vehicles are tied to their constructions and parts

For the purposes of tracking emissions, we suggest adopting the recommendation from the "Quantifying Greenhouse Gas Emissions from Transit"<sup>9</sup>. This means only Scope 1 and 2 emissions would be quantified and tracked within this goal. The only exception to this will be the incorporation of employee travel for job duties, and for commuting. Including the emissions associated with employee travel in the emissions goal and metric will foster engagement and promote greater awareness of this initiative across the organization. This does not mean that COTA ignores its sources of Scope 3 emissions from vendors and manufacturers, especially as many may also be pursuing decarbonization. Rather Scope 3 emissions reductions achieved through increasing partnerships with organizations who are also pursuing these goals will not directly benefit or hurt COTA's internal progress. While COTA will engage across all areas of GHG contributions, maintaining an awareness of what areas constitute major contributions is important.



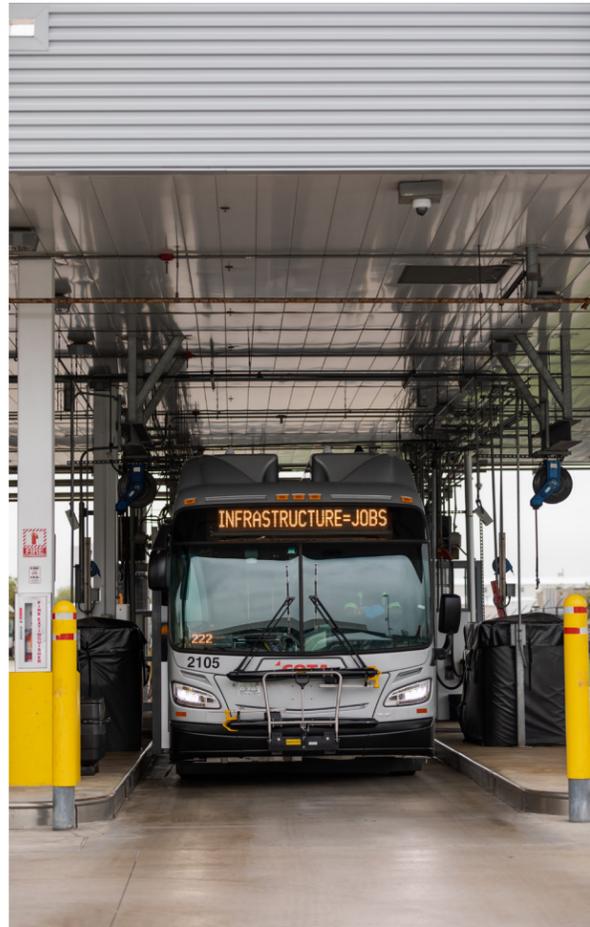
The figure below presents the breakdown of GHG emissions from 2019.

**Figure 16: BREAKDOWN OF COTA'S ANNUAL GHG EMISSIONS IN 2019**



This breakdown shows that the majority of COTA's current emissions are associated with its bus fleet (71%), facilities second (20%), and the mobility fleet third (7.3%). This understanding should allow prioritization of resources and efforts to begin engagement with the major contributors and opportunities related to each.

Over the lifetime of the plan, the importance of including Scope 3 emissions may change. Consequently, when conducting the "reassessment" phase of the engagement cycle every five years, COTA will maintain awareness of evolving practices within the transit sector.



**5.2.5. MEASUREMENT AND REPORTING**

The recommended emissions measurement methodologies were designed for both GHG and pollution to use data already required within current reporting requirements for the NTD, and thus this is data that COTA already collects and reports. These values will need to be supplemented by other publicly available conversion factors. A complete description of the methodology we recommend can be found in Supplement A—Metric Calculation Guides.

**5.2.6. RECENT TREND AND CURRENT STATUS**

By applying the methodology presented above, progress towards the emissions goal can be captured through 2020 for both the GHG and PM2.5.

As can be seen in Figure 17, COTA's existing efforts towards transitioning the bus fleet away from diesel vehicles assisted in achieving organizational GHG reductions of 11% since the baseline year of 2013. This achievement includes fleet GHG reductions, increases in facility GHG emissions, and electrical grid GHG reductions that occurred between 2013 and 2020. These comprehensive GHG reductions occurred before the 2045 goal was established and reflects the agencies existing awareness and pursuit of improvement. While GHG reductions have been achieved since 2013, these achievements are slightly behind the time trend needed to achieve a 2045 Net-Zero Emissions goal.

**Figure 17: CURRENT STATUS OF GHG GOAL**



Several changing factors both helped and hurt COTA's progress towards the 2045 target since 2013. These include:

**1. GHG CHALLENGES**

- COTA has experienced a 28% increase in facility GHG emissions. This resulted from the expansion of facilities needed for services as well as increased facility energy consumption required to meet safety requirements of the CNG fleet. Due to the emissions associated with electricity and natural gas, this resulted in increased energy and GHG emissions at the organizational level.
- The COVID-19 pandemic resulted in reduced revenue vehicle miles in 2020 of 19% when compared to the previous three years. This increased the greenhouse gas metric of lbs-CO2e/revenue vehicle mile as non-varying emissions sources, like building energy, remained relatively constant but were divided by a substantially lower revenue vehicle mile value.

**2. GHG SUCCESSES**

- The vehicle fleet achieved a 17% reduction in GHG emissions since 2013, largely due to the transition to CNG vehicles.
- The EPA tracks GHG emissions from the electrical grid in its Emissions & Generated Resource Integrated Database (eGRID).<sup>15</sup> Within eGRID, the portion of the electric grid COTA and Columbus are connected to, RFC West, has seen a 30% reduction in GHG intensity of electricity. This reduction has occurred because RFC West has experienced a shift in its generation assets towards reduced or zero GHG emission sources. This means that on average, using 1 kWh of energy in 2021 has 30% lower GHG emissions associated with it when compared to using 1 kWh in 2013.

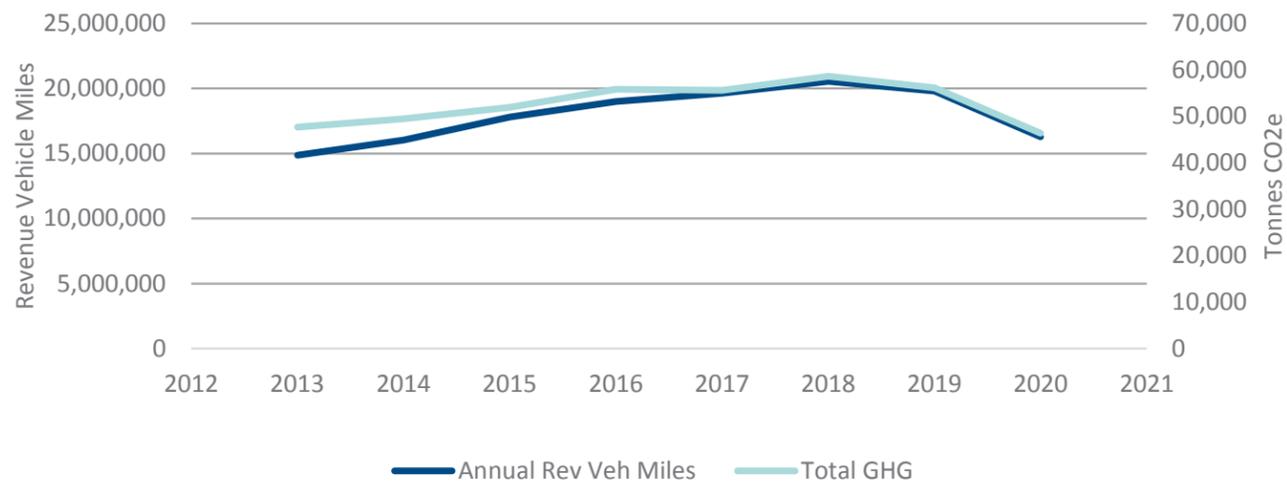
<sup>15</sup><https://www.epa.gov/egrid>

**3. GHG REDUCTION OPPORTUNITIES**

- Cost benefit analysis of zero-carbon sourcing for both vehicle fuels and facility energy.

To better understand the impact of the pandemic on the normalized GHG emissions metric, the annual trend of vehicle miles shows a sharp decline in vehicle miles in 2019 and 2020. Because emissions contributions from facilities and employees do not correlate to revenue vehicle operations, declines in annual vehicle miles result in facility emissions being distributed across less operational load. Thus, reduced operating miles cause a negative impact on the GHG metric from the constant operational emissions occurring at facilities.

**Figure 18: ANNUAL REVENUE VEHICLE MILES AND TOTAL GHG FLEET EMISSIONS**

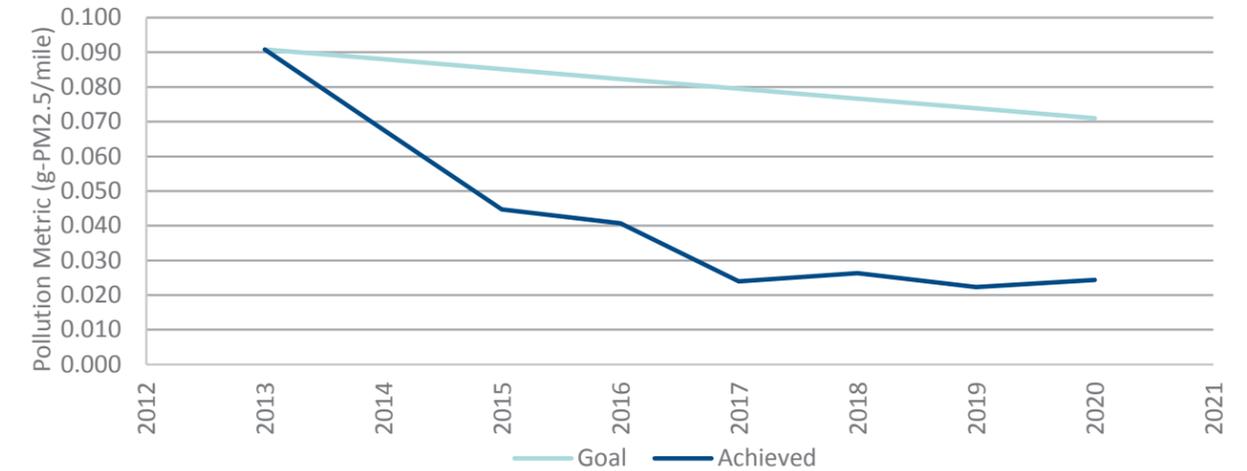


Relative to the pollution metric of g-PM2.5/mile, the impact of transitioning the bus fleet away from diesel vehicles has been even more impactful. The currently achieved reductions far exceed the progress required to meet Net-Zero PM2.5 Emissions by 2045. Since 2013, g-PM2.5/mile has been reduced by 73%. That said, continued engagement with pollution will be necessary to eventually achieve long term goals. Fortunately, COTA's pursuit of the goal set for GHG will address the primary challenges remaining for the pollution metric.

Benefits from these pollution reductions can be quantified using the EPA's Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool, called COBRA<sup>16</sup>. Using the tool to run scenarios for Franklin County, using a 7% discount rate, more than \$10 million dollars were saved through avoided work disruptions and medical costs within Franklin County. The details of this calculation can be found in Section 7.3 of this document.

<sup>16</sup><https://www.epa.gov/cobra>

**Figure 19: CURRENT STATUS OF POLLUTION GOAL**



The pandemic's impact on the pollution metric, g-PM2.5/mile, was similar to what occurred for GHG emissions. The more constant pollution associated with COTA facility's combustion of natural gas is again distributed across less revenue vehicle miles, negatively impacting this metric.

**5.2.7. TECHNICAL VIABILITY**

The full transition to zero-emissions operations requires the pursuit of a portfolio of zero-carbon vehicles and energy sources to support facility operations and fueling. This includes those vehicles used for non-revenue vehicles, mobility services, and bus services that support the rest of the fleet's operations. It also includes stationary assets in the form of facilities that house the staff who service and support COTA's mission. Based upon the emissions breakdown illuminated in Figure 16, the greatest contributor to GHG emissions, and thus a focus of engagement, lies with transitioning the bus fleet.

**5.2.7.1. FLEET TRANSFORMATION FEASIBILITY**

While the immediate focus for reducing emissions is not the mobility and non-revenue vehicles, COTA's team will continue to monitor available replacement technologies for these vehicles. COTA's team is engaged in identifying and pursuing alternative fuel sources for the mobility fleet and has met with some manufacturers to investigate potential options. At this time, no commercially available EV options that meet FTA requirements could be identified for these vehicles. Because technology options for mobility vehicles are just starting to become available, and are not yet fully commercialized, COTA will re-evaluate mobility vehicle options on a regular basis. This could happen as part of regular job responsibilities for specific COTA staff, or, as part of the 5-year Sustainability Plan update.



Non-revenue vehicles contributed less than 1% of COTA's GHG emissions in 2019. Due to its small contribution, resources will be focused on other larger GHG contributors in the near term. If non-revenue vehicles fueling can be conducted outside of fueling operations for the larger bus fleet, then the transition to EV non-revenue service vehicles can be pursued as soon as locations for charging are available and replacement equivalents are identified. This would require these vehicles have compatibility with the available charging cabinets. Availability of EV alternatives for the non-revenue fleet will determine when they can be transitioned to zero-emissions in the long term. Once established, a well-planned charging schedule will be beneficial to coordinate fueling. Non-revenue vehicle charging at COTA bus facilities can be assessed once bus charging schedules are developed. In the near term, hybrid vehicles can increase fuel economy by between 25% and 33%<sup>17</sup>, reducing emissions while supporting operational needs. Hybrid vehicles are currently being pursued to replace some existing vehicles that are at end of life. Because of the high public visibility of specific non-revenue vehicles, prioritization of zero-emission replacements may be desirable in those cases.

As previously presented in Figure 16, COTA's bus fleet is the primary contributor of GHG within COTA's operations. The bus fleet is currently comprised of diesel, CNG, and the new BEBs that were recently obtained. Decarbonizing this portion of the fleet will require continued elimination of diesel within the portfolio. To do this COTA plans to fully leverage the already built out CNG infrastructure through its end of life, which is 15 years, all while expanding charging infrastructure to facilitate expanded incorporation of BEB's. Together this fleet mix will need to provide for all COTA's service offerings, which will expand in the long term.

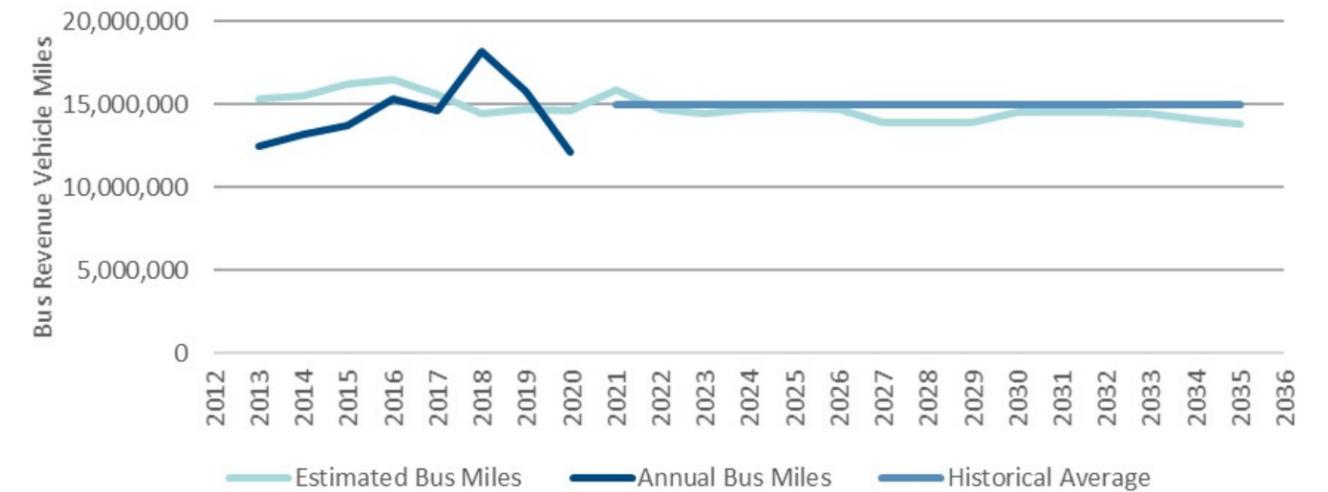
The immediate fueling obstacle to expanding BEB operations within COTA are electrical capacity limitations at the bus facilities. The power requirements of charging large numbers of buses cannot be accommodated on the current electrical services. Through engagement with the utility, available electrical capacity has been identified that can accommodate additional cabinets at the current time. Below is a summary of the various constraints that create limits on EV charging.

1. Capacity limitations restrict the number of EV cabinets that can be added at COTA facilities:
  - a. EV Charging capacity is limited to 34 cabinets within current service connections at existing facilities.
    - 20 cabinets at McKinley
    - 14 cabinets at Fields (2 already installed)
  - b. Additional connections can be pursued with both AEP Ohio and Columbus Department of Power. The cost of new service connections and the additional charging capacity they would offer is being pursued.
2. Based upon the make and model of BEBs being acquired at the current time, 2 buses can be charged using the same charging cabinet during overnight fueling operations between 7 PM and 5 AM.
  - a. Maximizing available capacity to support depot charging at McKinley and Fields will enable charging for 68 BEBs.
    - 40 BEBs at McKinley
    - 28 BEBs at Fields
  - b. On-route charging using a pantograph would likely increase depot charging capability by at least one vehicle per charger per night. The location of on-route charging would determine how many BEBs service could be aligned to enable the added range this capability would allow. Future projections currently assume the addition of 3 pantographs would enable depot charging to support 3 BEBs per cabinet.

<sup>17</sup><https://www.carsdirect.com/car-buying/fuel-economy-comparison-hybrid-vs-diesel-vs-gas>

- c. BEB vehicles are still new to COTA with the first 2 BEBs having arrived in 2021. Investigating actual charging needs will be established for identification of actual charging capabilities per charger based upon actual operations. Maximizing the number of buses that could be fueled per depot charger would minimize the cost of capacity buildout required for expanding the EV proportion of the bus portfolio.
3. Vehicle range differs between vehicle technologies. Consequently, BEB buses may not be able to replace CNG buses on specific routes without additional planning and fueling infrastructure. The vehicle range for each vehicle type used in the model are seen below:
  - Diesel buses - 46,000 miles per year
  - CNG buses - 44,000 miles per year
  - BEB buses - 39,000 miles per year
4. The annual revenue vehicle miles that can be provided within this bus portfolio transition is constrained by BEB vehicle range and on-route charging. Between 2013 and 2021, an average of 15.4 million annual revenue miles of bus service were provided. The current model projects and average of 14.4 million annual revenue miles of bus service, 7% below historical levels. This indicates that, based upon current ranges assumptions, additional buses will be needed to maintain service at previous levels. A chart of these trends can be seen below.

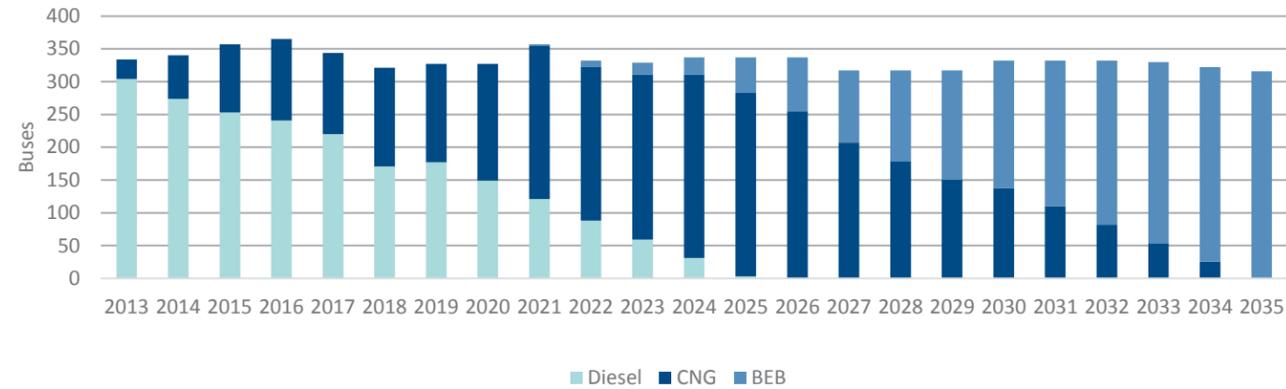
**Figure 20: HISTORY AND PROJECTIONS OF BUS ANNUAL REVENUE MILES**



As COTA initiates an aspirational pursuit of electric vehicles buildout within its operations, a model was developed to quantify the impacts of such a strategy. It has already been recognized that there are technical obstacles to pursuing this forecast and investigation has already begun to better inform the feasibility of this aspirational goal. This displays the appropriate application of this sustainability plan and how it can be used to identify potential paths to meet its goals, engage the team in assessing long term strategies and identifying obstacles, and promote identification of whether maintaining or adjusting strategies is the optimal course. This will be particularly critical during the coming decades as many components required for zero-emission fleets will be experiencing accelerated and dynamic changes.

The following charts present timelines for various data from the baseline year through 2035. For example, Figure 21 shows the quantity of diesel, CNG, and BEB vehicles through 2035, if COTA purchases 46 more CNG vehicles by 2025, and then begins purchasing 28 BEBs per year from 2025 to 2035. Additional EVs will require transformative planning and infrastructure buildout which are detailed later in this section. These requirements will be further analyzed in a study launched in 2022 to identify options for navigating charging needs within existing facilities.

**Figure 21: BUS PORTFOLIO BREAKDOWN BY VEHICLE TYPE**



In this aspirational forecast, maximizing EV charging capacity will require the following steps:

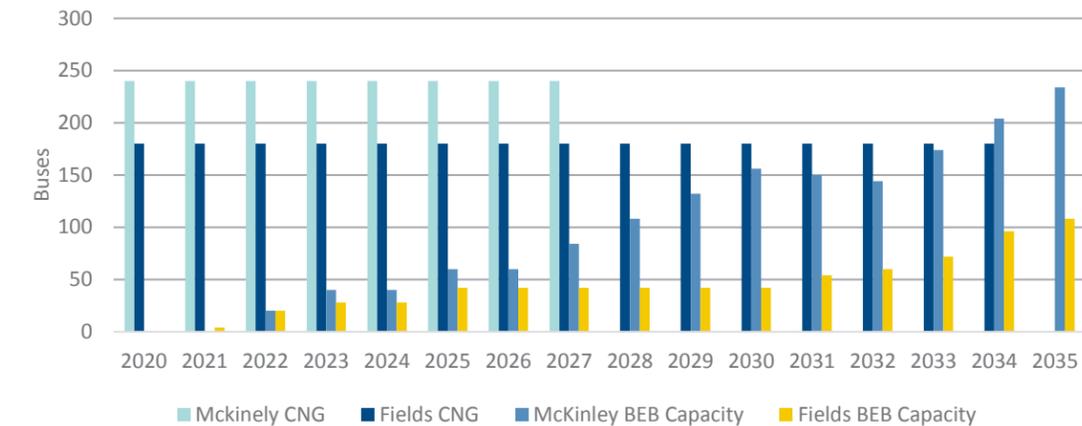
1. Installation of the maximum number of EV charging cabinets current electrical service capacity can accommodate.
  - Adding 10 cabinets at McKinley 2022
  - Adding 10 cabinets at McKinley 2023 for a total of 20
  - Adding 12 cabinets at Fields 2022 for a total of 14
2. Include on-route charging in the near term within concentrated vehicle corridors including the planned BRT routes associated with the LinkUS initiative. This will allow direct assessment of these systems capabilities in leveraging fueling outside of overnight fueling periods at locations other than the bus facilities.
  - On route charging will be added in the near term, likely starting as early as 2023. The specific strategy adopted will be informed by an analysis that was initiated during the development of this plan. It is assumed this increases the charging capability for all EV Cabinets from 2 to 3 buses every night.
3. Determine the maximum charging cabinet and capacity requirement at the McKinley facility, whose CNG fueling system will reach end of life first.

Current long-term planning is based upon the aspirational forecast of BEB expansion. The projected fueling capacity at both the McKinley and Fields facilities was generated assuming the following actions:

1. An additional 10 MW feed is obtained at the McKinley in 2026 facility which adds capacity for up to 58 additional EV cabinets
2. Continue adding charging cabinets to McKinley between 2027 and 2035 to facilitate charging capability necessary to support BEB acquisition.
3. Capacity for an additional 8 cabinets will exist at McKinley after decommissioning of the CNG plant based upon interval analysis of that meter.
4. This proposed expansion of BEB within the fleet would require:
  - Additional capacity not yet accounted for either at Fields or another facility
  - Planning to ensure electric vehicle fueling is established in a way to fulfill operational resiliency requirements.

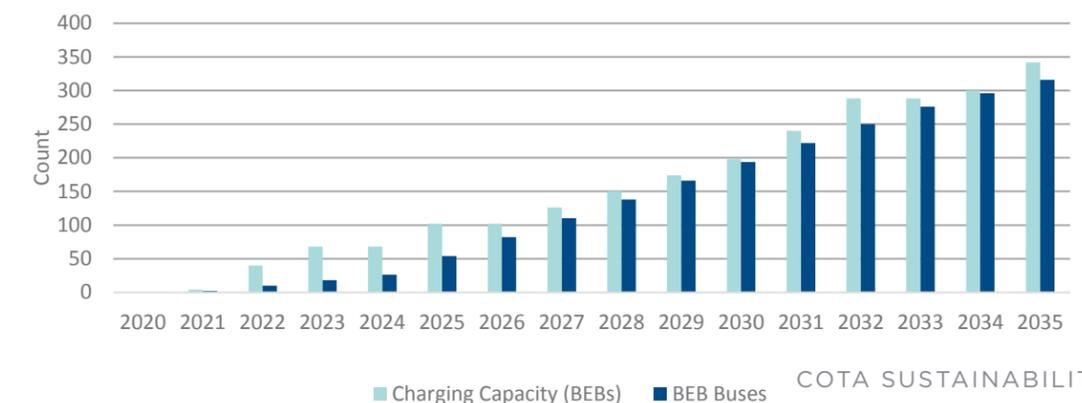
Due to the logistics of building out EV charging capabilities, beginning with a focus on the McKinley facility allows the option of decommissioning the CNG operations in 2028 at that equipment's end of life. Based upon this buildout of charging infrastructure the fueling capacity for both CNG and BEBs can be seen in the figure below.

**Figure 22: FUELING CAPACITY PROJECTIONS BY FACILITY**



This capacity buildout aligns with the currently planned BEB purchase schedule assumed in this model. This is to ensure charging capacity is in place before vehicles have been acquired and are depended upon for service. The figure below presents the currently projected charging capacity and expected BEB vehicle counts.

**Figure 23: BEB FUELING CAPACITY versus PURCHASE PROJECTIONS**

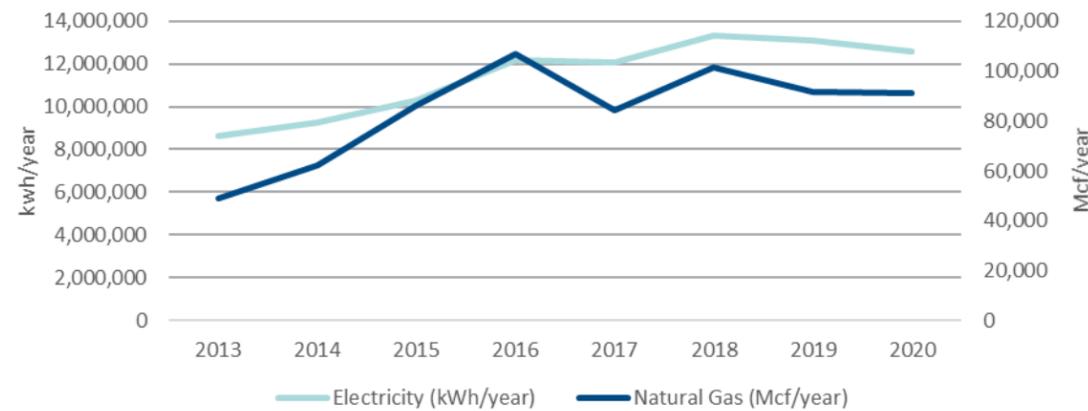


That said, additional investigation is necessary to identify the specific path and logistics of the proposed timetables. Changing EV costs and the fleet limitation requirements required for federal funding constrains vehicle transition to a limited number of buses per year, which is 28 within current planning. This highlights the importance of fully leveraging the investment already made in CNG buses in the near term.

**5.2.7.2. FACILITY TRANSFORMATION FEASIBILITY**

While analysis presented in support of the aspiration forecast to this point has focused on zero-emission vehicle transition, COTA's facilities are another area of critical engagement to achieve emission goals. While it is unlikely whether every COTA facility and property can be self-sustaining using only on-site renewable energy assets, pursuing this goal across its building portfolio will allow COTA to minimize energy use at its facilities along with the associated emissions. As shown in Figure 24, total energy use trends for both the electric and natural gas utilities for all COTA facilities shows an increase over the past seven years. This was driven by the addition of meters for both utility types. This included an increase in electric meters from 27 to 106 and an increase in natural gas meters from 3 to 8 between 2013 and 2020. This indicates that while there were 5 larger facilities added to the portfolio, including the Admin and Paratransit facilities, a large number of small electric meters were added across the system.

**Figure 24: FACILITY UTILITY USE TRENDS**



Energy use data can be used to translate electricity and natural gas facility usage into facility emissions.

**Figure 25: FACILITY GREENHOUSE GAS EMISSIONS TREND**

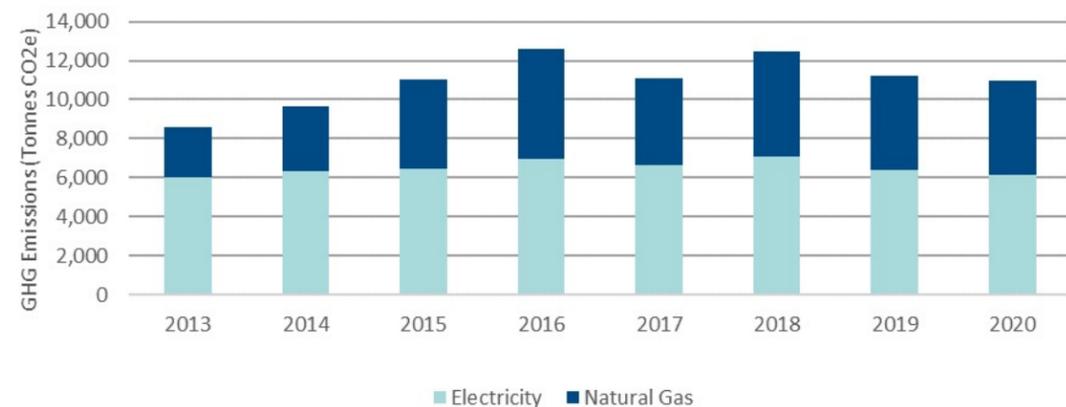
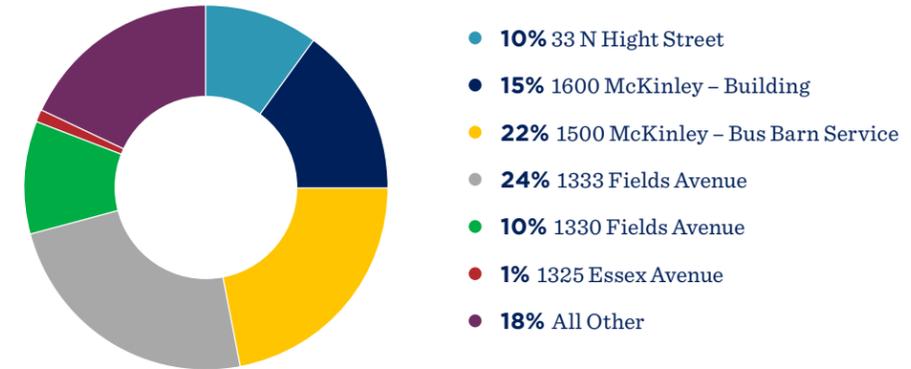
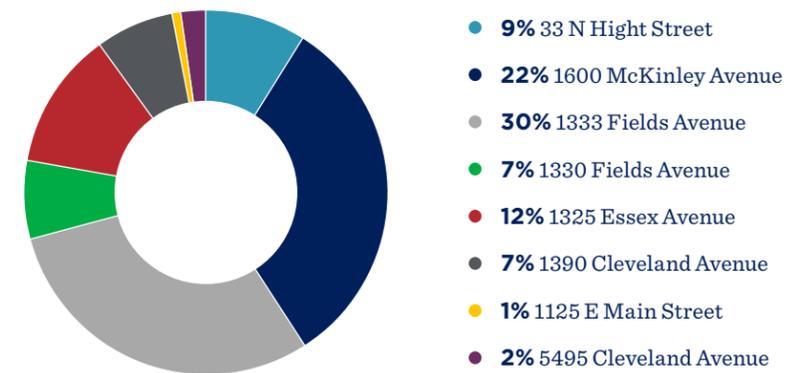


Figure 26 and Figure 27 show a breakdown of COTA's electricity and natural gas use by site.

**Figure 26: 2020 FACILITY ELECTRICITY ANNUAL USE BREAKDOWN**



**Figure 27: 2020 FACILITY NATURAL GAS ANNUAL USE BREAKDOWN**

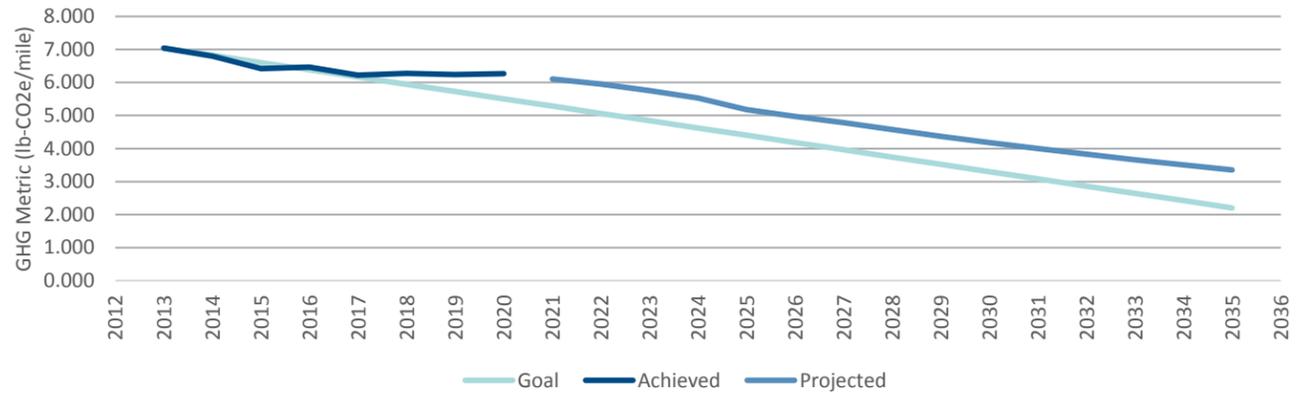


While COTA has been active in its effort to minimize facility energy use and cost, the new net-zero emission goals will require a more advanced pursuit of energy efficiency within its facilities. Across the country there are examples of zero energy buildings which illuminate the pathway towards super-efficient buildings and building design opportunities. As new buildings are added, renovations are conducted, and equipment replacements occur, including emissions as a design constraint will ensure that COTA's facility portfolio is optimized around this initiative. Incorporating onsite renewable generation is also a path for reducing electricity related GHG emissions while providing some on-site power capabilities. While it is unlikely that large COTA facilities can be self-sustaining using only on-site renewables, adding on-site assets would allow COTA to minimize utility needs while increasing the proportion of zero-emissions electricity used. Pairing on-site renewables with storage could further add to COTA's resilience. A study is currently underway that will provide initial analysis of these options within current markets and identify whether the economics indicate they should be pursued.

### 5.2.7.3. SOURCING ZERO-EMISSION ENERGY SUPPLIES

Based upon the projected vehicle acquisition, operating miles, and associated emissions the estimated GHG projections that result can be seen below. These projections also incorporate the achievement of 15% reductions in facility energy use through efficiency measures and expected carbon reductions within the electricity grid.

Figure 28: PROJECTED GHG METRIC ACHIEVEMENT



As the figure shows, additional GHG reductions are needed to stay on track with a 2045 target year. Within the process, validation of achieved reductions will be an important activity to verify actual reduction achievements as well as identify other opportunities that may be pursued during this period. The remaining margin of GHG reduction after such efforts could be achieved by contracting energy supplies for both CNG and electricity from renewable sources. For electricity, we recommend evaluating on-site renewable energy, and off-site options for renewably sourced electricity. This may take the form of purchasing renewable energy certificates (RECs), which convey to their holder the ability to claim the use of renewable energy.<sup>18</sup> Alternately, with the already built CNG fueling equipment and fleet, RNG markets offer an unexplored opportunity for COTA to obtain the benefits of the renewable fuel standard (RFS). Purchasing renewable energy may come at a price premium or could save money, so while it is an option to remain “on track” we would recommend minimizing its cost in order to allow the most capital be invested in improving COTA’s capabilities through low emissions vehicles and fueling capabilities. In other words, we believe it is better for COTA to spend available capital on BEBs than on purchasing, say, renewable energy credits. Based upon our projections, sourcing 50% renewable electricity use across COTA’s portfolio through 2035 would maintain alignment with GHG reductions goals. Alternately, sourcing landfill RNG for roughly 40% of CNG fuel would also achieve the necessary reductions through 2030 before CNG fleet proportions mitigate this benefit. This illuminates the need to prioritize an understanding RNG as part of fueling strategies within natural gas contracts.

In the long term, if RNG is not available to eliminate emissions associated with facility natural gas consumption, natural gas using equipment will need to be replaced with equipment powered by zero-emission electricity.

<sup>18</sup><https://www.epa.gov/repowertoolbox/renewable-energy-certificate-monetization>

### 5.2.8. ECONOMIC VIABILITY

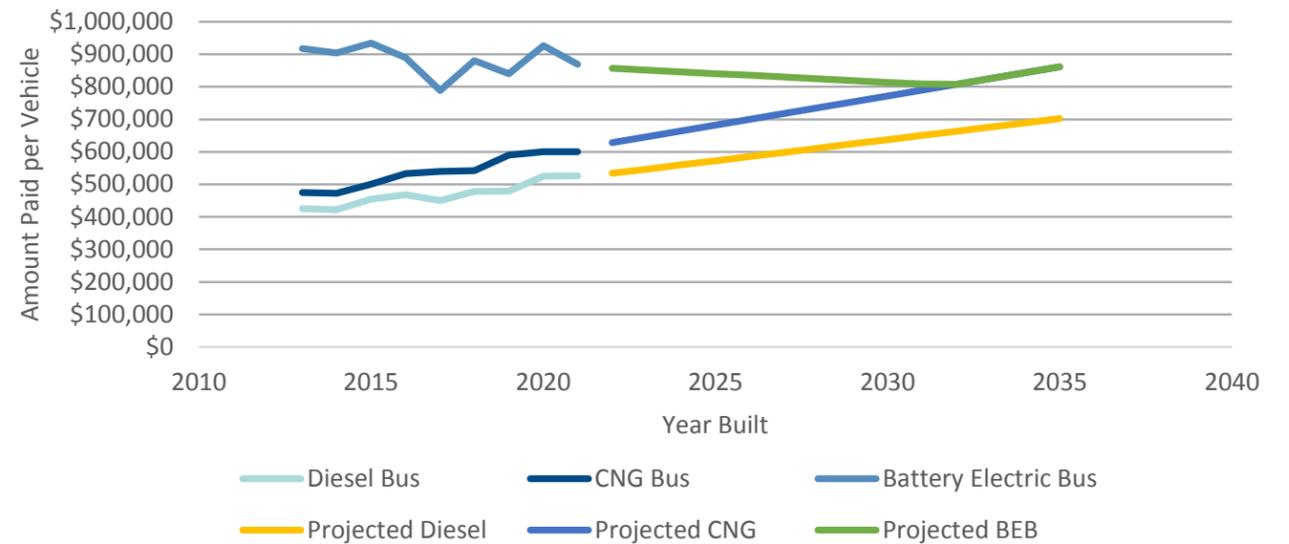
Taking the information presented in the technical feasibility section, an assessment of the economics of the various opportunities identified will allow an understanding of the costs associated with this transformation.

#### 5.2.8.1. FLEET TRANSFORMATION ECONOMICS

Comparing vehicle economics requires performance assumptions for each of the bus types used by COTA. For this analysis calculations were based on actual data from COTA’s fleets and publicly available references.

Using historical NTD data to estimate vehicle cost trends for diesel, CNG, and BEBs, as shown below with projections of future prices. The projections show that the increased premium required for purchasing electric buses diminishes in the coming years. For our analysis, once the projections for CNG and BEB vehicle costs are at parity, we apply a common cost for both.

Figure 29: BUS PURCHASE COST



While these vehicle pricing projections serve as a useful starting point, price volatility should be expected in this sector. COTA will monitor EV bus prices as changing market dynamics on components like batteries and their material inputs result in changing economics over time.

We also apply a 1.5% price escalation factor to fuel costs for each vehicle type to account for the potential of increased energy prices over the period analyzed, starting with known fueling prices for 2019. The expected maintenance costs for each vehicle type are held constant across the analysis.

Because the bus types being compared have different expected lifespans, an equivalent annual cost (EAC) was calculated using the net present value (NPV) of the purchase cost and total expected maintenance and fuel costs over the lifespan of the vehicle. A discount rate of 5% was used for these calculations. This allows a fair comparison between the technologies as the cost of vehicle purchase, maintenance, and fueling change over time.

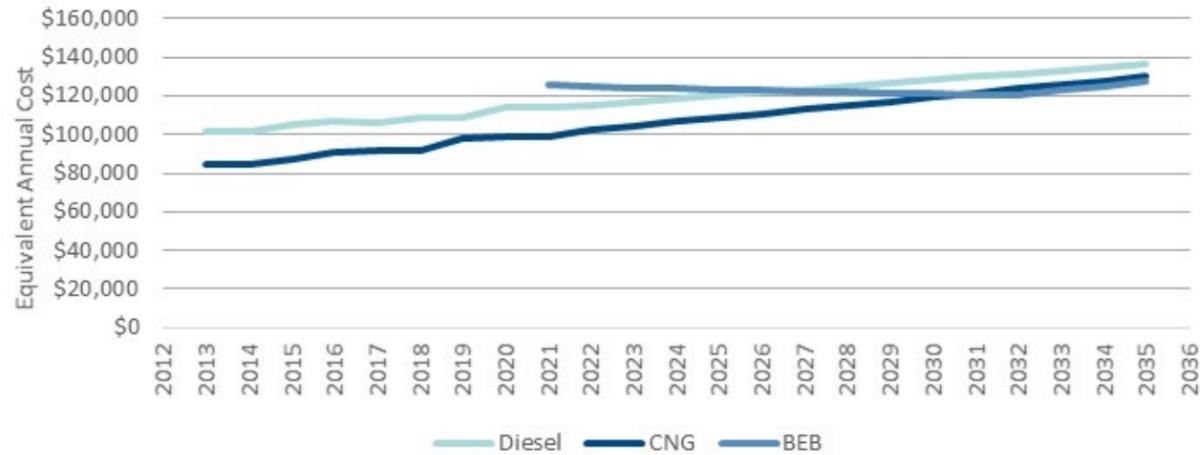
Table 11 presents the changing EAC for each vehicle type on a five-year increment.

The assumptions made around changing purchase and operational costs results in a changing return for the proposed vehicle transition. The figure below shows the EAC trends through 2035. The EAC for BEBs begins in 2021 as a reflection of the year of the first acquisition of these EVs.

**Table 11: EQUIVALENT ANNUAL VEHICLE COSTS**

YEAR	DIESEL	CNG	BEB
2015	\$105,055	\$87,197	\$132,397
2020	\$133,810	\$98,811	\$132,033
2025	\$120,155	\$108,671	\$123,101
2030	\$128,280	\$119,385	\$120,931
2035	\$136,551	\$130,147	\$127,190

**Figure 30: VEHICLE EQUIVALENT ANNUAL COSTS OVER TIME**



This analysis indicates that in the near term there is an increased lifetime cost of the BEBs when compared to diesel, but that over time savings should occur. Savings are based upon vehicle purchase and operations and does not account for the investment required to install the electric fueling infrastructure needed to support the BEBs.

By applying the difference in EAC to the projected fleet transition plan, we can quantify the lifetime vehicle savings for this strategy. The major drivers for the difference in cost between the different bus types are:

1. The difference in assumed vehicle life since each diesel bus is expected to function longer than a CNG or BEB. The 12-year equipment life currently assumed for CNGs and BEBs is based upon the minimums required by the grants used in vehicle acquisition. If longer useful life is achieved for these vehicles, the economics will improve.
2. The changing costs of fueling over time. This analysis applies the same price escalation factor of 1.5% to all three fuel sources. Monitoring changing fuel prices will be important to ensure operational costs are informing long term decisions.
3. The assumed charger costs obtained from COTA for this analysis vary from other costs values cited in NREL studies. Further, as EV technologies are adopted and manufacturing increases, the cost of charging equipment could come down.

Finally, a comparison of the lifetime vehicle savings can be compared to the cost of installing the fueling infrastructure for both the CNG and BEB vehicles.

**Table 12: LIFETIME SAVINGS FROM TRANSITIONING FROM DIESEL**

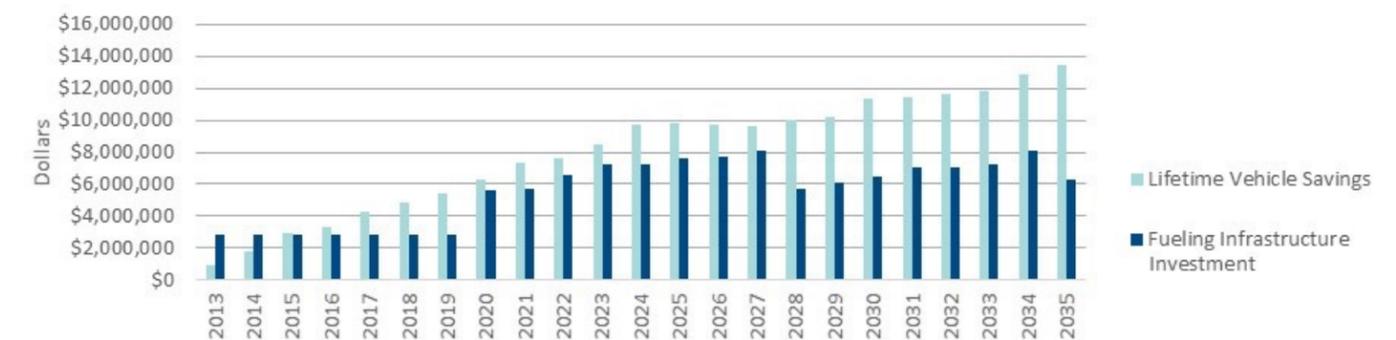
	LIFETIME VEHICLE SAVINGS	ALTERNATIVE FUELING COSTS	LIFETIME SAVINGS
<b>CNG</b>	\$105,000,000	\$84,000,000	\$21,000,000
<b>BEB</b>	\$235,000,000	\$129,000,000	\$106,000,000
<b>Total</b>	\$340,000,000	\$213,000,000	\$127,000,000

The equipment costs to support the fueling for both CNG and BEB buses are based upon COTA records and cost data from various studies. The fueling infrastructure costs for CNG buses are assumed to be equivalent at both sites and is estimated to be \$37 million based upon records provided for the Fields upgrade. Additional costs for the CNG buses include an annual support contract and increased facility utility use associated with require ventilation and safety monitoring. The expected lifespan of this equipment is 15 years. Fueling infrastructure costs for BEB buses are based upon the cost's assumptions below. The base costs cited were increased to account for professional services (30%), contingencies (35%), and unallocated contingencies (10%). It was noted that there existed high variability in charger equipment and installation costs between various NREL studies.

- Depot Cabinet — \$437,500<sup>19</sup>
- On-Route Pantograph Charger — \$1,312,500
- Cabinet/Pantograph Maintenance — \$4,800/year<sup>20</sup>
- Additional 10 MW (58 cabinet) AEP circuit — \$6,000,000<sup>21</sup>

For the fleet transition modeled, the lifetime vehicle savings is compared to annualized costs through 2035 for the estimated EV fueling infrastructure that will be required. These annualized costs are generated by distributing the total costs across the expected equipment life as an average value. The purpose of this comparison is providing an initial comparison between the fueling infrastructure required and the expected lifetime vehicle benefits.

**Figure 31: LIFETIME VEHICLE SAVINGS compared to ANNUALIZED FUELING INFRASTRUCTURE COSTS**



<sup>19</sup>[https://linkuscolumbus.com/wp-content/uploads/2021/05/EWC-HCT\\_Capital-Cost-Technical-Memorandum\\_Draft\\_5.20.21.pdf](https://linkuscolumbus.com/wp-content/uploads/2021/05/EWC-HCT_Capital-Cost-Technical-Memorandum_Draft_5.20.21.pdf)

<sup>20</sup>[https://afdc.energy.gov/fuels/electricity\\_infrastructure\\_maintenance\\_and\\_operation.html](https://afdc.energy.gov/fuels/electricity_infrastructure_maintenance_and_operation.html)

<sup>21</sup>High level estimate identified during initial discussion with AEP and subject to change

From a high level, this means that pursuing this strategy should be economically beneficial but is contingent upon the many assumptions made within this calculation. A comparison of this proposed electrification transition, as compared to a “business as usual” approach of diesel vehicles, can be seen in the next figure. It shows that initially investments are required to facilitate the necessary infrastructure to support BEB expansion but in the long-term begins to yield returns. It is important to note that this chart does not display future savings from BEBs whose useful life extends beyond 2035. It is worth noting that externalized costs, such as regional healthcare impacts, are not included in this trend.

Funding mechanisms that have been relied upon historically, such as grants from federal agencies, will continue to be pursued. Particularly those that support zero-emission fueling infrastructure and vehicles. Below are presented several federal grant opportunities from the FTA already monitored by COTA that could apply to the acquisition of zero-carbon vehicles and the equipment that supports them:

- Low or No Emissions Bus Discretionary Program (5339c)<sup>22</sup>
- Metropolitan Planning and State Planning Research Programs (5305d and 5305e)<sup>23</sup>
- Buses and Bus Facilities Discretionary Program (5339b)<sup>24</sup>
- Buses and Bus Facilities Formula Program (5339a)<sup>25</sup>

**5.2.8.2. FACILITY TRANSFORMATION ECONOMICS**

Facility GHG emission reductions require a less novel approach than that of the vehicle fleet largely because building energy efficiency is well established. While there are often increased upfront costs associated with the purchase of premium efficiency pumps and HVAC equipment, their performance benefit inherently provides a return on investment in the form of reduced utility bills. As society at large pursues GHG emission reduction strategies, changing utility costs will likely only improve the economics of energy efficiency improvements. The path to achieving facility GHG reductions requires the addition of lifetime cost and emission benefits within the design processes COTA practices. As noted previously, the electrification of natural gas equipment will be a critical long-term consideration. Opportunities for facility improvement at McKinley are currently under investigation.

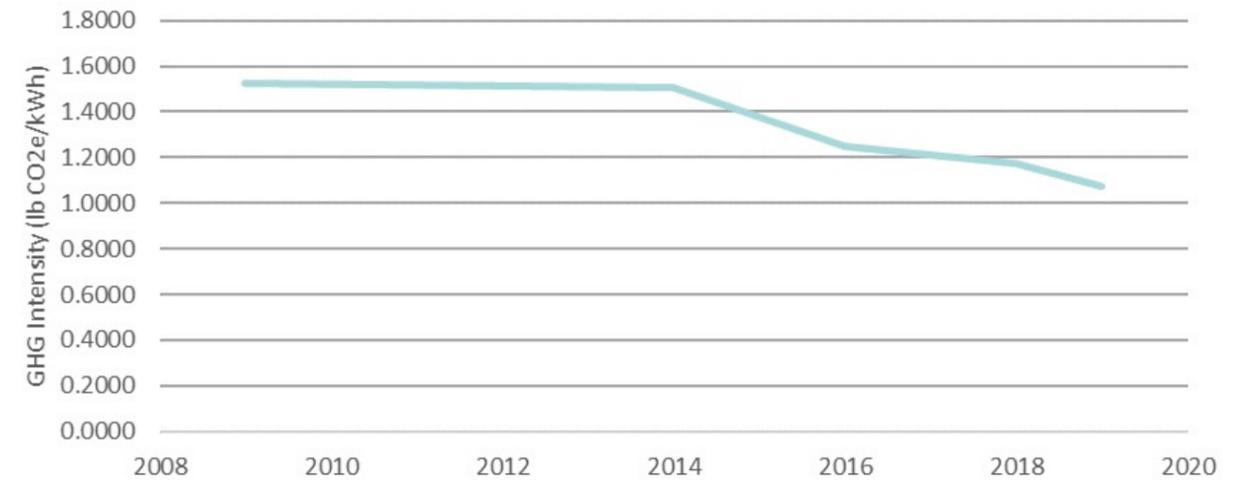
**5.2.8.3. ECONOMICS OF SOURCING ZERO-EMISSION ENERGY SUPPLIES**

While there are clear opportunities for reducing emissions through performance improvements in both vehicles and facilities, ensuring the energy COTA uses come from zero-emission sources is a critical component of achieving net-zero carbon emissions.

As COTA pursues its current plans to transition the bus fleet to electricity, it is important to note that for EVs to be zero-emission, their electricity consumption must be paired with renewable electricity. As has been shown, additional GHG reductions are needed to stay on track with a 2045 target year. While the electricity grid for the region COTA is in, RFC West, has reduced GHG intensity, the pace of this transition will impact progress. Additional emission reductions are achievable by contracting energy supplies for both CNG and electric buses from renewable sources.

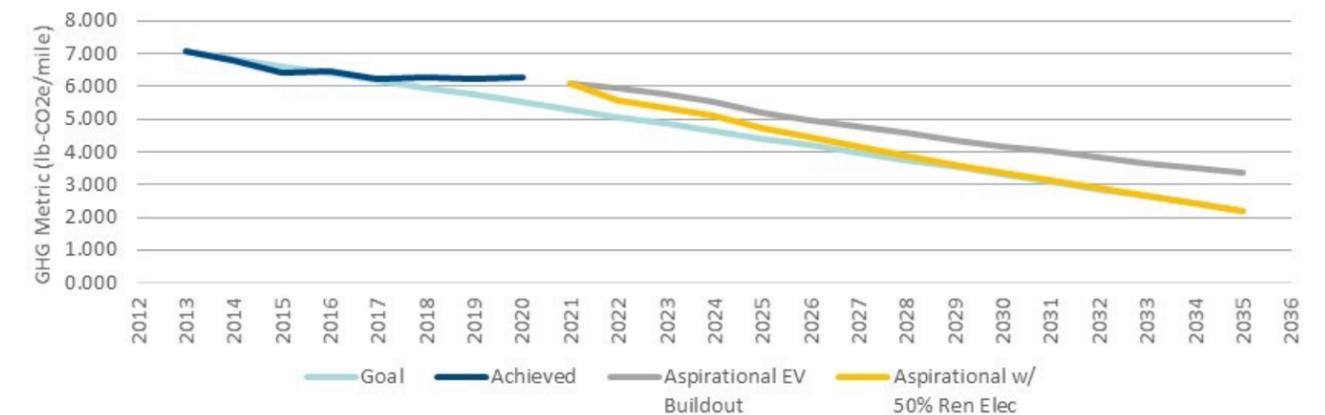
<sup>22</sup><https://www.transit.dot.gov/lowno>  
<sup>23</sup><https://www.transit.dot.gov/funding/grants/metropolitan-statewide-planning-and-nonmetropolitan-transportation-planning-5303-5304>  
<sup>24</sup><https://www.transit.dot.gov/bus-program>  
<sup>25</sup><https://www.transit.dot.gov/funding/grants/busprogram>

**Figure 32: ANNUAL RFC WEST GHG INTENSITY**



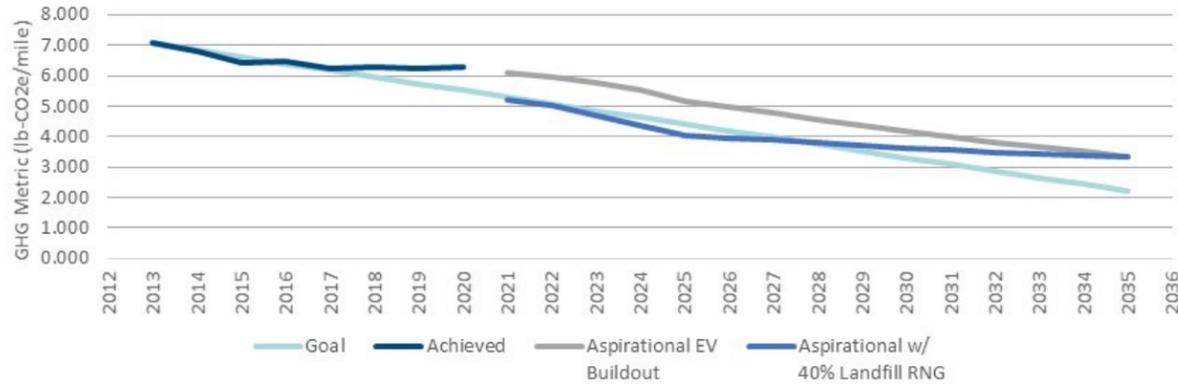
Purchasing renewable energy may come at a price premium or could save money. Consequently, evaluation of whether to leverage supplier contracts to remain “on track” should involve minimizing supplier contract costs to allow maximum capital to be available for vehicle purchase and facility improvements. In other words, it is better for COTA to spend available capital on zero-emission vehicle purchases rather than renewable energy credits. Based upon projections, sourcing 50% renewable electricity use across COTA’s portfolio through 2035 would maintain alignment with GHG reductions goals. This projection can be seen below along with the GHG goal, historically achieved reductions, and aspirational EV fleet buildout.

**Figure 33: GHG REDUCTION PROJECTIONS FROM SOURCING 50% OF ELECTRICITY USE FROM ZERO-EMISSION**



Alternately, sourcing landfill RNG for roughly 40% of CNG fuel would also achieve the necessary reductions though 2030 before the planned reduction in CNG vehicles mitigates this benefit.

**Figure 34: GHG REDUCTION PROJECTIONS FROM SOURCING 40% OF CNG FUELING TO LANDFILL RNG**



This illuminates the need to prioritize an understanding RNG as part of fueling strategies within natural gas contracts. Exploration of available options for zero-emissions supplier contracts for both electric and natural gas utilities will be pursued. This should include the pricing of renewable energy certificates (RECs) and pursuit of a full understanding of the economic potential associated with the Renewable Fuel Standard for the CNG fleet.

While the focus in the next three decades will be building out EV capacity, both in charging infrastructure and vehicle acquisition, there is also opportunity in fully leveraging the investment in CNG fueling infrastructure through its end of life. The Renewable Fuel Standard<sup>26</sup> (RFS) requires a portion of US vehicle fueling to come from renewable sources. This is done by requiring fuel producers to obtain a set percentage of renewable fuel by purchasing Renewable Identification Numbers (RIN) based upon an annual requirement. A RIN is the credit for one gallon of renewable fuel. One eligible renewable fuel is renewable natural gas (RNG). Within the RFS Program, RNG is a D3 category fuel. In order to monetize RNG, an RIN must be obtained, which requires quantification of production of the RNG as well as a validated capture that this natural gas was put in a vehicle. COTA's investment in CNG fueling stations at both Fields and McKinley mean that the investment in equipment that meets the required quantification of RNG into vehicles has already been made. The value of D3 RINs over time can be seen in the figure below.

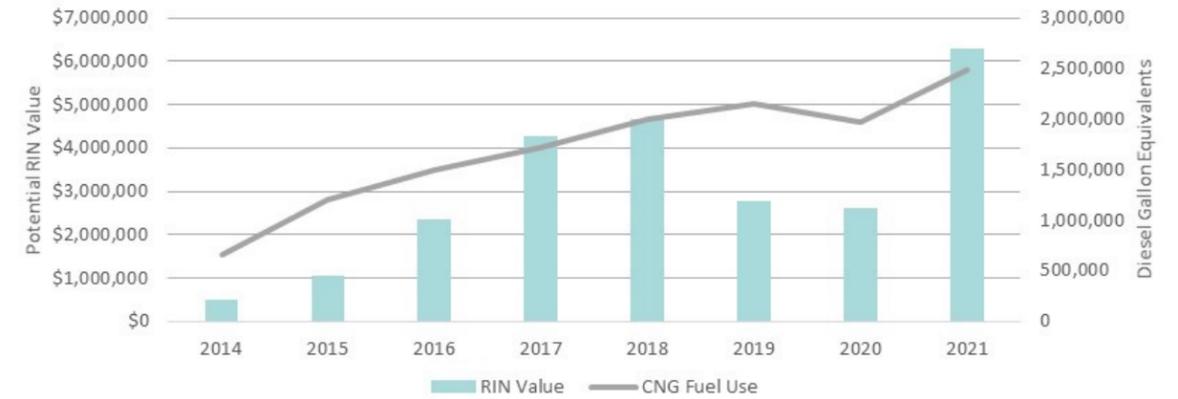
**Figure 35: D3 RIN VALUE OVER TIME**



<sup>26</sup><https://www.epa.gov/renewable-fuel-standard-program>

Based upon metered natural gas usage between 2014 and 2010, the potential RIN value within the RFS Program for COTA's CNG fueling operations can be seen below. The average value from 2018 to 2021 is just over \$4 million dollars annually. It is important to remember that this value would need to be shared with an RNG producer if COTA were able to find a partnership to leverage this value. This could come in the form of reduced natural gas costs, a portion of RIN GHG credits for COTA to claim, or a combination of both. While the addition of CNG vehicles to fleet provided positive impacts on GHG emissions, there is further potential of either economic or emissions benefits from leveraging CNG fueling operations.

**Figure 36: HISTORIC POTENTIAL VALUE OF CNG OPERATIONS WITHIN THE RFS PROGRAM**



Achieving zero GHG emissions for BEBs will require COTA to source 100% renewable sources for electricity. While improvements are being made, as stated earlier, within the electrical grid, there is the option of sourcing renewable electricity within utility supplier contracts. The availability and cost of renewable electricity supplies will be a dynamic market in the coming decades as emissions goals are being set and pursued across every sector. Consequently, ongoing assessments will be required to navigate whether COTA pursues emission goals through supplier contracts.

**5.2.8.4. A CASE FOR ELECTRIFICATION**

The aspirational model developed for the electrification of COTA's bus fleet indicate the transition to an all-electric fleet will be economically beneficial. This is dependent upon a decrease in the difference in price between BEBs and diesel buses as well as achievement of the expected fuel and maintenance cost savings annually. Further, the future of prices for the components require for BEBs is uncertain. If the assumptions made about future vehicle costs and savings turn out to be incorrect, this transition could require additional revenue. Due to this uncertainty, consideration of reasoning to pursue this transition outside of the economics alone becomes important. Below are provided a number of arguments in support of transition to a zero-emission fleet:

- COTA's emission reductions have direct positive impacts on the health of the local community and its own employees. Particularly, the disproportionate population of POC who use and depend on public transit. Further reductions in pollution will add to the savings in health costs within Franklin County.
- Societal focus on addressing Climate Change will likely continue to increase the availability and focus of grant funding on zero-emission vehicles.
- Support of regional initiatives like the City of Columbus Climate Action Plan require the pursuit of zero-emission technologies.
- As industry scales up manufacture of zero-emission vehicles in the form of EVs and hydrogen vehicles, there is uncertainty in long term product support of more traditional vehicles fueled by diesel and CNG.

### 5.2.9. ACTIONS AND RECOMMENDATIONS

Pursuit of COTA's emission goals will include the following actions:

1. COTA will continue phasing out diesel coaches as planned. Diesel phase-out will reduce COTA's bus fleets GHG intensity by more than 30% by the phase-out scheduled to be complete in 2026.
2. COTA will continue adopting battery electric buses (BEBs) so long as there is on-site charging capacity, can purchase BEBs with sufficient range, and back-up fueling/charging is available to maintain COTA's uptime goals. COTA will hit each of these technical barriers in due course and make will continually reassess whether strategies should be maintained or adjusted.
3. Based upon the aspirational electrification model currently envisioned:
  - a. In 2024, we assume COTA's facilities will reach the limit on its available electric distribution line capacity if the assumed timeline of depot charging cabinet installation is pursued. COTA will conduct a study on electric vehicle fueling strategies, alternate electric transmission and distribution line upgrade options, on-site energy reduction, on-site energy generation, and on-site storage options to increase electric charging capacity prior to 2023. This study is currently in progress and will be completed in 2022.
  - b. As COTA transitions its fleet operations to zero-emission vehicles, staff will continue to monitor and evaluate developments within the technologies available within automotive markets that would support COTA's GHG and pollution goals.
  - c. By 2029, COTA will have over 50% of its fleet converted to BEB based upon the vehicles needed to maintain current operations. At some point, COTA will be at risk of extended downtime from electricity outages. Back-up power or redundancy options are a critical consideration and are included within the electric capacity study. We further address action items to evaluate the impact of electricity outages in the Resiliency section of the Sustainability Plan.
4. Investigate renewable electricity options. This includes evaluating on-site renewable energy, off-site virtual power purchase agreements (vPPAs), off-site physical power purchase agreements (pPPAs), and renewable energy credit (REC) purchasing. On-site solar will be evaluated for the McKinley facility as part of a planned energy study of the facility. Obtaining renewable electricity through supplier contracts or RECs may increase operational electricity costs. Because of this, we recommend that COTA focus its capital on Facilities and Fleet upgrades first and use off-site renewable energy as a way to meet emissions goals in later years, but only to the extent necessary.
5. Evaluate the benefits and risks of purchasing RNG and retaining some of the RINs available to it through its use of CNG as a fuel. As we noted, COTA is creating several million dollars in RIN value per year which currently is not monetized.
6. Conduct energy studies at the major energy using facilities to identify specific energy efficiency opportunities to invest in.
  - a. Each study should identify expected facility-specific energy reduction potential.
  - b. A study is already underway at the McKinley facility.

7. Conduct a cost study of onsite renewable energy installations to assess if current economics support their pursuit at the present time. This could be included within the scope of facility energy studies, or as a separate analysis.
8. Investigate the cost of zero-emission energy sources for both vehicle fuel and facility utility supplies. This includes a renewable electricity procurement strategy, and an acquisition strategy for renewable natural gas (RNG).
9. Conduct a study of facility electrification needs. While it is currently possible to purchase renewable natural gas (RNG), we anticipate that RNG will be limited in the future, and that natural-gas fired hot-water and space heating equipment will likely need to convert to be electric.
10. Investigate how company travel is currently captured and develop a strategy to incorporate the associated emissions into the emissions metric.
11. Conduct a survey to assess how COTA employees commute to work. Findings from this survey will inform adjustments to the emissions calculation that is currently being used.
12. Establish improved building guidelines and requirements to minimize or eliminate emissions at existing and new facilities during renovation, new construction, and equipment replacement.





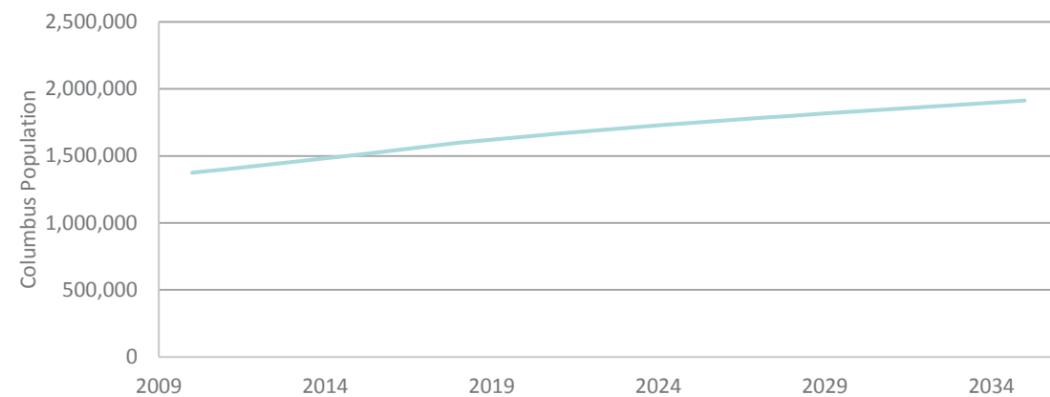
### 5.3. RIDERSHIP

#### 5.3.1. BACKGROUND AND CONTEXT

Ridership encompasses the interface between passengers and their use of COTA's services. Understanding rider demographics, trip purpose, trip length, and route selection are all useful to informing planning decisions.

Ridership intersects with regional needs in a few key ways. COTA's current contribution to regional emissions is very small. At the same time, COTA's potential to impact regional emissions, particularly by facilitating zero-emissions transit through increase ridership, will likely play a pivotal role in achievement of the City's goals. This will require strategic engagement to provide residents and communities currently choosing to use single passenger vehicles to embrace the benefits of mass transit service. As the region grows, as is projected, in the coming decades, collaboration with regional planning entities could make the difference between turning the tide on transportation emissions in the region or allowing existing practices to facilitate a continuation of current practices. Population projections for the Columbus region indicate roughly 1% annual growth between now and 2035. A trend of these forecasts can be seen in the figure below.

Figure 37: PROJECTED COLUMBUS POPULATION GROWTH<sup>27</sup>

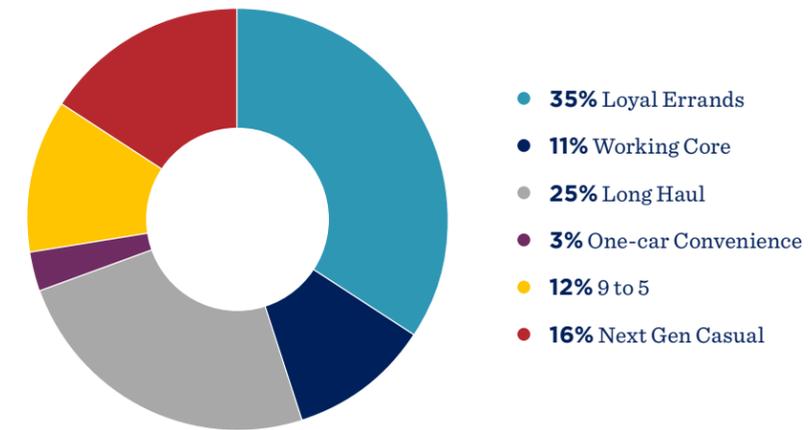


COTA's vision is to move every life forward and its mission is to provide solutions that connect people to prosperity through innovation, dedication, and teamwork. COTA is a customer centric organization that seeks to provide the safe and efficient transportation services for its customers.

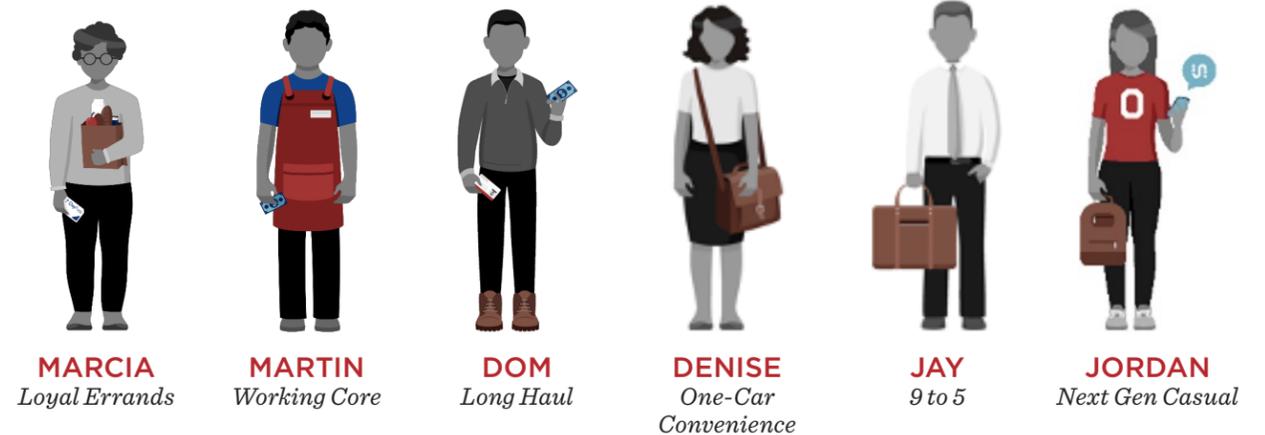
Riders of COTA are the heart of Columbus and Franklin County and backbone of the regional economy. They are a diverse set of customers, some that rely on COTA as their sole mode of transportation, some that have chosen to be a one car family and use COTA out of convenience, and some that use COTA as their primary commuting method to work weekly. Recognizing that COTA exists for its riders, and that COTA is an essential part of solving for the transportation sector's role in addressing climate change, COTA needs to retain existing and attract additional riders to support GHG emissions reductions in the region. While doing this, COTA needs to solve for challenges and changes in where people need to move to, how they hope to get there, and what they expect from their public transportation provider. In the coming post pandemic period, this will also require a greater understanding in how work location might have shifted for existing and potential riders, particularly the working core.

<sup>27</sup><https://www.macrotrends.net/cities/22963/columbus/population>

Figure 38: RIDERSHIP PERSONAS (2021 Q4 CUSTOMER SURVEY)



#### COTA CUSTOMER PERSONAS



**LOYAL ERRANDS:** customers that take COTA for all their daily needs, likely do not have a car, likely pay with a pass or ticket and are in the middle age.

**WORKING CORE:** Utilize COTA to get to work and occasionally for other errands. They frequently pay with cash and have low access to a car.

**LONG HAUL:** Utilize COTA to get to work and usually have to transfer at least once. Generally, a longer trip.

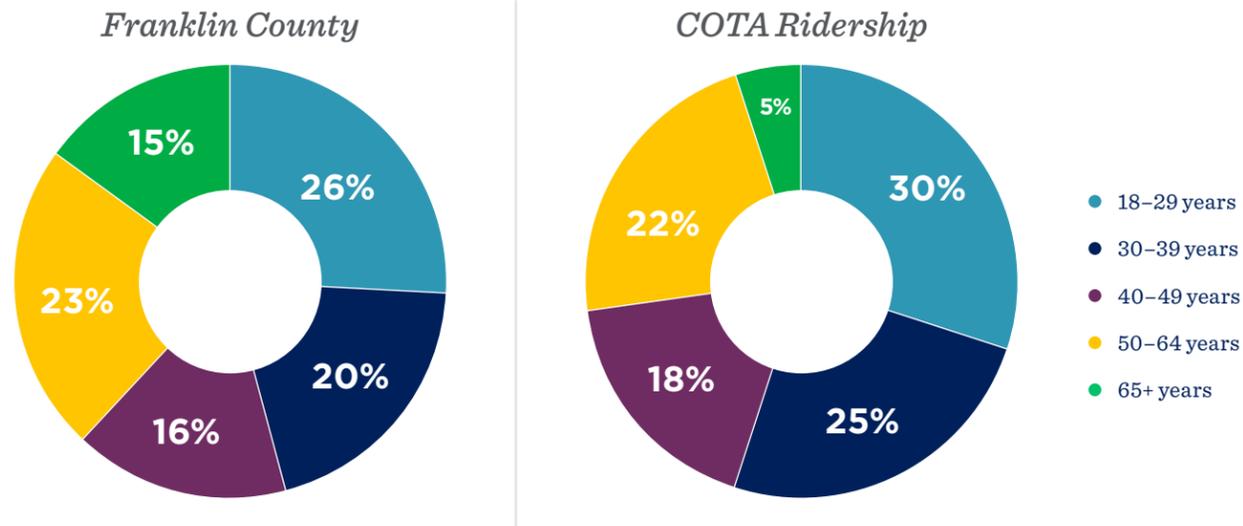
**ONE-CAR CONVENIENCE:** Majority use COTA to commute and pay with a pass or ticket.

**9 TO 5:** Majority use COTA for commuting for convenience. Most do not transfer and have vehicles. Split between cash and payment.

**NEXT GEN CASUAL:** Younger customers either OSU students or recent grad with high access to vehicles, majority pay with pass or ticket.

COTA's ridership demographics reflect the diversity of Central Ohio and Franklin County. Though COTA riders are majority minority and represent a higher representation of people of color (POC) than the surrounding community. This demonstrates the disparity between the 93% of Franklin County residents with access to a car as compared to COTA riders, 60% of whom have access to a car. Demographics by age reflect that diversity of purpose that public transportation is used and demonstrates that COTA is a preferred choice of transportation across all ages.

Figure 39: FRANKLIN COUNTY AND COTA RIDERSHIP BY AGE (2021 Q4 CUSTOMER SURVEY)



Demographics by age are distributed across all age categories. An outsized demographic of 18- to 29-year-old customers likely exists because of OSU.

Increasing ridership at COTA and more deeply engaging with current ridership will help secure a steady customer base and will provide COTA with the security to increase capacity as the population increases in Central Ohio. This coupled with replacing the fleet with zero and low-emissions vehicles will support both COTA and the region’s efforts to decarbonize. A strategy to engage on policies, prepare for future development, route planning, and service increases will position COTA to increase ridership while continuing to improve service options for existing ridership.

Table 13: RIDERSHIP STRATEGIC FRAMEWORK

FOCUS AREA	Improve Customer Experience	Expand Service Based on Community Needs	Strategic Partnerships	Support Smart Regional Planning, Policies
INITIATIVES	<ul style="list-style-type: none"> <li>Improved Service</li> <li>Mobility Services</li> <li>Expand On-board Amenities</li> <li>Maintain and Improve Safety within the System</li> </ul>	<ul style="list-style-type: none"> <li>Extended hours</li> <li>New Routes and Route Extensions</li> <li>Emergency response</li> </ul>	<ul style="list-style-type: none"> <li>Service Partnerships (Last mile)</li> <li>OSU</li> <li>Intel Development Downtown C-bus</li> <li>Economic Centers</li> </ul>	<ul style="list-style-type: none"> <li>LinkUS</li> <li>MORPC, City of Columbus, and Franklin County</li> <li>Support Policies that Expand Public Transportation</li> </ul>

COTA’s ability to influence and drive additional ridership is directly impacted by regional policies, development plans, cooperation with local governments and participation / partnerships with area employers and institutions. Aligning with and influencing the direction of regional planning efforts will shape COTA’s ability to drive additional ridership. There are ongoing efforts at COTA to better understand COTA ridership, the sustainability plan is one piece of a broader strategy to drive additional ridership at COTA.



The pandemic has had a significant impact on base ridership and has significantly reduced the number of daily riders for COTA and other transit agencies. NTD data indicates a drop in unlinked passenger trips between 2019 and 2020 of roughly 45%. Short and long-term projections indicate a sustained change in working habits and behavior that will continue to impact daily rides for COTA and other public transit agencies around the country. The shift to remote working and hybrid working becoming the norm reduces the number of daily riders and results in a lower number of monthly pass holders given the corresponding changes in commuting habits. Responding to these changes in working and commuting habits is essential for COTA’s future viability. Currently COTA has rebounded to 85% of pre-pandemic service hours in early 2022 and it is hoped with the return of services ridership will also rebound to previous levels.

Significant regional initiatives and development plans will dramatically impact COTA’s ability to grow and increase riders including efforts such as LinkUs Columbus which strives to create more equitable, efficient, and sustainable connectivity to accelerate economic growth in Central Ohio. The LinkUs Strategic Framework highlights the need to invest in critical regional corridors that connect employment to housing and other amenities to serve the growing central Ohio region. It recognizes that with a population growth of a projected nearly 30% by 2050 that a region with 3 million people requires transportation options inclusive of a vibrant public transportation system. In the near-term, design and implementation of multiple bus rapid transit lines is expected. With these additions, more frequent service along high-capacity corridors should improve transit availability and attract increased ridership.

Another initiative that intersects with ridership is Vision Zero<sup>28</sup>. Vision Zero is a strategy to eliminate all traffic fatalities and server injuries, while increasing safe, healthy, equitable mobility for all. The city of Columbus has engaged with and is pursuing this vision of what could be<sup>29</sup>. A study from APTA indicates that cities where residents average higher annual transit trips have roughly 50% less traffic fatalities as cities with lower transit use<sup>30</sup>. Further, COTA continually monitors reports on this topic and has noted that a 1.5–3% shift from single occupancy vehicles to transit has been shown to reduce traffic fatalities by 10–40%.<sup>31</sup> This is particularly important since youths have about twice the traffic fatality rate when compared to the total population.

Participating in shaping policies and programs that help to drive additional support for and use of public transit is essential for COTA to realize its goals on increasing ridership. This requires COTA to continue to research best practices, adopt these practices by modeling them internally and promote these practices through public policy and adoption by major employers.

- **RESEARCH**—Identify strategies being successfully implemented in other regions, transit authorities and major employers to drive additional public transit use, such as employee benefit programs that include free transit passes for employees.
- **ADOPT**—Deploy where appropriate strategies and programs within COTA and / or with partners to test the strategies.
- **PROMOTE**—upon successful implementation of policies and programs, help to bring them to scale through public policy and adaption more broadly with major employers, institutional partners.

<sup>28</sup><https://visionzeronetwork.org/about/what-is-vision-zero/>

<sup>29</sup><https://vision-zero-columbus.hub.arcgis.com/>

<sup>30</sup><https://www.apta.com/wp-content/uploads/Resources/resources/reportsandpublications/Documents/APTA-Hidden-Traffic-Safety-Solution-Public-Transportation.pdf>

<sup>31</sup>APTA, FHWA

### 5.3.2. GOALS—LONG AND INTERIM

Increasing ridership and expanding COTA's customer base will enable COTA to support the regional efforts to decarbonize, support regional economic development and increase access and equity for all. A strong public transportation system is an essential part of creating an equitable economy and society.

With the pandemic reducing the number of daily riders and creating long-term and sustaining changes in commuter behaviors due to the changes in working habits, COTA is resetting its expectations for ridership and how it contributes to the need to reduce carbon emissions from the transportation sector. COTA can do its part by both decarbonizing its fleet and operations and by working to increase sustained ridership in support of regional goals to decarbonize.

Currently COTA tracks ridership as total boardings divided by total payroll hours. Annually, goals are set around this Ridership Performance Incentive Compensation (PIC) metric for pursuit by the team. Consequently, we recommend adopting the existing performance metric and goals within this plan. This plan adopts an aspirational target of increasing this metric by 2% per year.

- **Pursue aspirational increase of both ridership metrics annually by 2%**

Additionally, alignment with the Columbus Climate action plan provides an opportunity for COTA to support regional efforts to decarbonize. Within that plan are three primary areas of support that COTA can implement to support reducing emissions and expanding the ridership base for COTA. It is important to note that achievement of these regional goals will require an evolution in regional planning which falls outside of COTA's jurisdiction. Consequently, while regional goals will be pursued, their success will require collaborative engagement and action of regional partners. A summary of pertinent goals from the City of Columbus Climate Action Plan can be seen below:

1. Employ Comprehensive Multi-Modal Network
  - a. Initiatives—Support and implement LinkUS efforts to create high-capacity rapid transit, bicycle, and pedestrian connections.
  - b. Goals
    - Implementation of 3 regional high-capacity rapid transit lines by 2030.
    - Implementation of at least 5 high-capacity rapid transit lines and up to 8 by 2050.
2. Increase Transit Use
  - a. Initiatives—Continue to improve customer experience, safety, and amenities to drive additional ridership. Include expanded hours of service for high demand routes.
  - b. Goals
    - Increase passenger miles traveled by 20% by 2030
    - Increase passenger miles traveled by 50% by 2050
3. Support Active Transportation Infrastructure
  - a. Support micro-mobility options, safe walking and biking infrastructure surrounding public transit infrastructure to connect riders to home and office and to complete the last mile.
  - b. Goals
    - 20% increase in walkscore and bikescore by 2030
    - Mobility hubs within 1/2 mile from all residents (in high density areas) by 2050

These efforts, when achieved, should increase the percentage of transit riders relative to residents using single occupancy cars. Establishing a mode shift factor, which is an action item already being pursued, quantifies how increases in ridership can be used to estimate the resulting emission reductions within the region as residents choose transit over driving.

### 5.3.3. METRIC

In order to support internal efforts and the City of Columbus Climate Action Plan, multiple metrics will be tracked in support of this sustainability plan. They will be:

- COTA's internal ridership Performance Incentive Compensation metric of annual unlinked passenger trips per total payroll hours.
- Climate Action Plan's target metric of annual passenger miles traveled.

Both metrics can be generated from data already being collected for submission to the National Transit Database annually. Discussions and engagement within this performance category should include any additional metrics COTA tracks that can support this initiative or inform decision making. Additionally, given the many factors outside of COTA's control that influence these metrics, aspirational objectives should be revisited regularly to ensure they are promoting improvement while not setting unreachable goals. Such metrics should be identified by the teams pursuing ridership goals within a management area.



### 5.3.4. SCOPE

Ridership is measured regionally and within Franklin County as well as within submission to the National Transit Database.

### 5.3.5. MEASUREMENT AND REPORTING

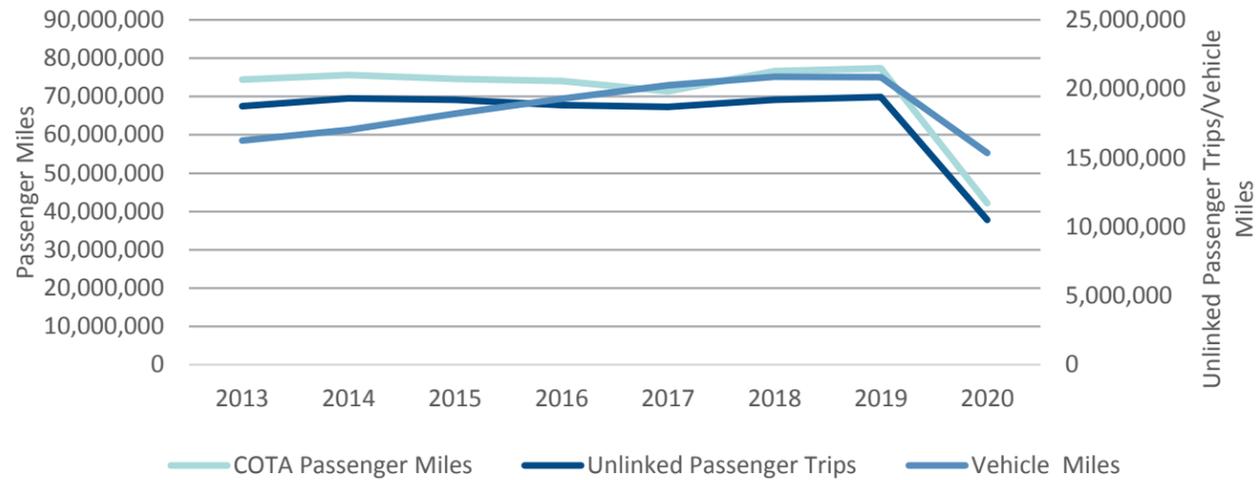
COTA measures and reports on ridership data to a variety of regulatory bodies that help to determine future funding levels for COTA with the Federal Department of Transportation as well as local and regional entities.

### 5.3.6. RECENT TREND AND CURRENT STATUS

Measures for ridership should capture the frequency in which people use COTA as a form of transportation and the capacity of the coaches or routes. Increasing regional ridership is a needed solution for total transportation emissions. There is a wide range of ways to capture ridership and the plan will build upon existing data and best practice measures like average daily ridership. Considering expanded capabilities resulting from internal improvements, like the new fare system, will also be considered.

Within NTD submissions, standard metrics that are reported include passenger miles, unlinked passenger trips, and vehicle miles recent trends for which can be seen in the figure below.

**Figure 40: RECENT NTD RIDERSHIP METRIC TRENDS**



From these trends the incredible impact of the pandemic is clearly illustrated.

Less quantifiable ridership measures whose importance garner consideration include convenience of use and access to values such as employment, healthcare, food, and customer satisfaction. These factors impact the desirability of public transit as an alternative to other transportation options and will be critical to achieve increases in ridership.

The LinkUS initiative is already expected to impact ridership in positive ways while at the same time fulfilling some of the goals laid out in the City of Columbus Climate Action Plan.

**5.3.7. TECHNICAL AND ECONOMIC VIABILITY**

Predicting the timetable of recovery from the unprecedented impact of the COVID-19 pandemic is difficult while society still struggles to transition into a new normal. Of particular importance is whether traditional work commute habits will return or whether paradigms, like work-from-home or use of distributed shared offices spaces replaces previous practices.

Regardless of what the future holds, COTA will continue to apply best practices as it always has when designing and implementing new services or revising existing offerings. Those procedures account for the necessary contingencies required in growing and evolving COTA's transit services. To do this COTA must position itself to be able to participate and acquire existing and future funding mechanisms that will be rolled out to support transit initiatives. This will include the monitoring and pursuit of grants to support further service development that will yield increased ridership and engagement.

**5.3.8. ACTIONS AND RECOMMENDATIONS**

Pursuit of COTA's emission goals will include the following actions:

1. Assess aspirational ridership goal for alignment with the current use of that metric and adopt or revise the targeted annual increase based upon that engagement.
2. Conduct a survey to facilitate generation of a mode shift factor for use in capturing impact of increased ridership on regional emissions goals. This process has already been initiated.
3. Contact mode shift collaborators involved in the City of Columbus Climate Action Plan, particularly Public Service and MORPC, to identify a point of contact with whom to work moving forward. These groups, leading the city's efforts, should be able to provide resources and guidance to COTA.
4. Continue engagement in collaborative engagement in regional development through LinkUS, Columbus Downtown Development Corporation, and other initiatives.
  - a. Continue partnership to complete 3 regional high-capacity rapid transit lines developed within LinkUS to support City's Climate Action Plan Goals.
5. COTA cannot create transformational increases in ridership on its own, as public transit ridership is highly dependent on how a region's development is designed. Achievement of increased ridership will thus require close collaboration with the City of Columbus, Franklin County, MORPC, and other entities with control over regional planning and development. For public transit to be successful, it needs to be a priority around which regional development is built. This includes fostering strategic development of dense corridors of residential opportunities, employment, and other land use directives with a vision for their interconnection using existing or new public transit routes.





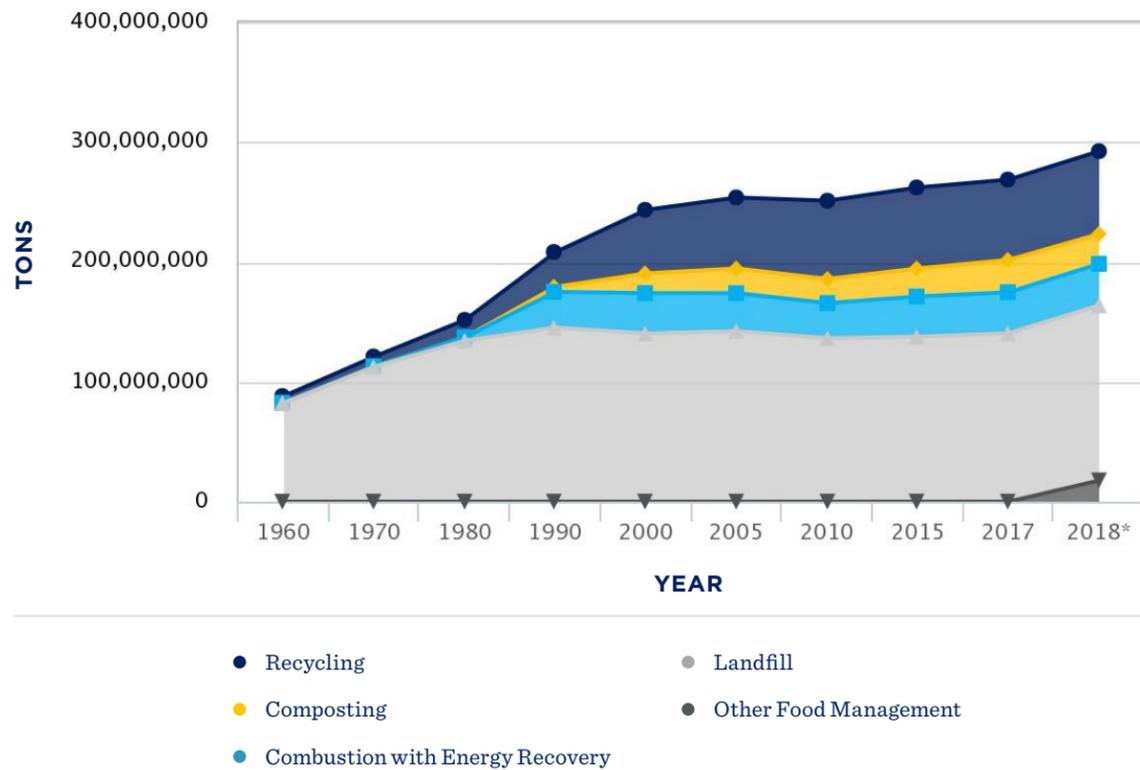
## 5.4. WASTE

### 5.4.1. BACKGROUND AND CONTEXT

Waste streams at COTA fall into two areas: operational waste from within COTA’s operations and environmental waste generated by riders and the public. Eliminating or diverting solid waste from COTA’s operations can serve as a measurable and economic means of engaging staff and riders on this topic. Such an undertaking will involve implementing waste stream measurement, staff engagement such as no-waste trainings, as well as broader reduction targets in solid waste over time. To pursue conventional waste management methodologies, steps must be taken in the near term to establish quantification of operational waste streams.

Several organizations have waste management programming initiatives. For example, the EPA has conducted efforts to capture, monitor, and support waste management programs nationally for more than three decades.<sup>32</sup> Their efforts, tools, and programs largely capture waste streams in tons of material, a time trend of which can be seen in the figure below.

Figure 41: MUNICIPAL SOLID WASTE MANAGEMENT: 1960-2018 (SOURCE: EPA)

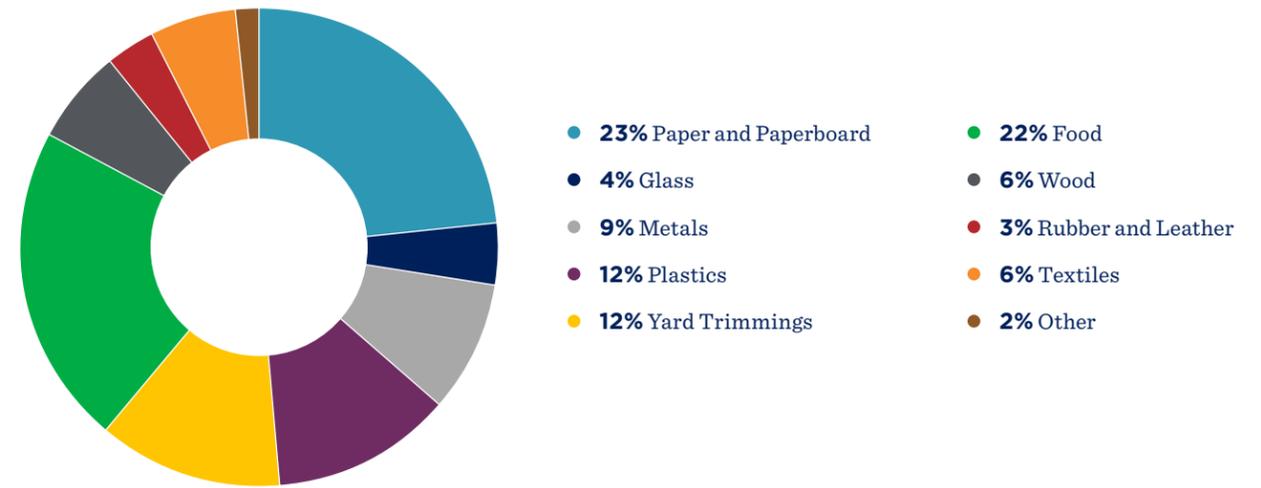


As can be seen, while there has been an increase in waste nationally, there has also been engagement to divert solid waste from landfills with engagement in practices like recycling and composting. These waste streams fall across various material types.

<sup>32</sup><https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials>

The national breakdown of municipal solid waste (MSW) for 2018 can be seen in the figure below.

Figure 42: TOTAL MUNICIPAL SOLID WASTE BY MATERIAL IN 2018 (SOURCE: EPA)



Nationally, many communities and organizations are pursuing waste goals as part of sustainability initiatives. In Ohio this includes **Cincinnati, Columbus, Montgomery County, and Cuyahoga County**. For many organizations, this has meant pursuing a zero waste to landfill objective by organizations such as **Subaru, Unilever, Procter and Gamble, Google**, among many others with many more adding their names to this list. The EPA provides a wealth of resources, tools, and opportunities to assist on the journey including best practices for those taking the first steps.<sup>33</sup>

Locally, the Solid Waste Authority of Central Ohio has identified that 76% of materials thrown away can be recycled, and also offers numerous recycling and waste diversion resources, including waste assessment materials<sup>34</sup>. SWACO’s resources will be leveraged as COTA establishes a benchmark of waste streams within its operations and to help guide activities in support of waste diversion from landfills.

#### The City of Columbus Climate Action Plan has the following waste reduction goals:

- Organic waste: 50% reduction of landfilled organic waste by 2030, 90% reduction by 2050
- Recyclable materials: 40% reduction of landfilled organic waste by 2030, 95% reduction by 2050
- Supporting a circular economy

Of course, not all waste is even landfilled today, but becomes litter in our community. The City of Columbus recently completed a Litter Index of the city<sup>35</sup> and has programming to clean litter from the community<sup>36</sup>. COTA’s stops and shelters can become a focal point for litter. Currently, COTA places trash cans at all stops with a shelter. Having trash cans at stops can reduce litter in the community.

<sup>33</sup><https://www.epa.gov/smm>

<sup>34</sup><https://www.swaco.org/368/Business-Recycling-Resources>

<sup>35</sup><https://www.columbus.gov/publicservice/Keep-Columbus-Beautiful/>, see “Litter Index” link

<sup>36</sup><https://www.dispatch.com/story/news/local/2021/08/10/columbus-ymca-central-ohio-set-big-goals-litter-program/5433650001/>

#### 5.4.2. GOALS—LONG AND INTERIM

COTA is pursuing an aggressive zero-waste goal, also referred to as a zero-landfill goal, which has become common amongst many communities<sup>37</sup> and corporations. This objective does not mean that waste is not produced by an organization, but rather waste streams are diverted to places other than the landfill. Waste reduction can be part of a strategy to lower the amount of diverted waste and achieve improvements based upon a benchmark. The SWACO resources and tools will serve to guide COTA's long term strategy and identification of which methods and tools are most useful is an area for immediate engagement. Additionally, some grant funding may be available from SWACO or other entities that support waste management initiatives<sup>38</sup> and dialogue with contacts there will be conducted to identify what grants best fit the steps that will be taken in the near term.

Facilitating waste capture at shelters promotes a clean and healthy environment while improving bus and shelter appeal to riders. Proper disposal of waste displays stewardship in COTA's system by keeping public areas free of litter. Metrics for tracking environmental waste management will align with efforts of the teams that maintain shelters to build upon existing resources. An additional step COTA can take to contribute to litter reduction would be to collaborate with SWACO and other regional stakeholders to increase trash capture at stops and shelters located in the "Littered" or "Extremely Littered" streets identified by the city's Litter Index, regardless of the number of riders per day at that stop.

The primary objective for COTA in reducing organizational waste.

- **Achieve a 100% waste diversion rate from landfills by 2045.**

#### 5.4.3. METRIC

Based upon a review of EPA's guidelines and common practices, waste is best tracked by its weight in tonnage. This will be captured as the ratio of tons of waste diverted from landfill over total tonnage of waste output by COTA.

- **Measuring and tracking waste in tons diverted/total tons generated.**

Once all waste streams are captured by weight and tracked, the percent of waste by weight that is diverted from the landfill can be calculated. The zero-landfill goal entails pursuing 100% diversion of all waste streams. This can often require the creation of alternative measurement strategies to those utilized by waste disposal providers. Based upon interviews with staff, COTA's current waste contractor does not include a quantification of waste removed by either volume or weight. As previously identified, there are numerous other waste streams COTA already captures by weight that can be used to generate the metric including cardboard, paper, scrap metal, tires, and engine fluids.

At the current time, the critical first step for this performance category is the identification of what metric best fits COTA's waste streams. Based upon our research into existing programs, tools, and resources, capturing weight in tons is the common method for measuring waste streams and should be adopted. Most likely, COTA will need to either weigh its solid disposal to determine tonnage, or visually assess the volume of waste in its containers prior to pick-up to determine cubic feet of waste.

<sup>37</sup><https://www.epa.gov/transforming-waste-tool/how-communities-have-defined-zero-waste>

<sup>38</sup><https://epa.ohio.gov/get-funding>

#### 5.4.4. SCOPE

COTA's zero landfill goal will include all facility waste generated as a result of their services. This will include waste streams from COTA offices, bus garages, and maintenance areas. While many waste streams are currently monitored, COTA needs to conduct a waste assessment<sup>39</sup> to benchmark existing operations, needs, and successes.

The zero-landfill goal will exclude the various trash receptacles available on fleet vehicles and at stops due to the lack of jurisdiction over public behavior and common activities contrary to the goal. Opportunities identified and applied to operational waste will be leveraged to improve the rider experience and promote better practices within the greater community.

#### 5.4.5. MEASUREMENT AND REPORTING

Portfolio Manager is a free tool that COTA is already using to track facility energy use as required by City of Columbus Energy & Water Benchmarking Ordinance<sup>40</sup>. Waste can also be tracked using this tool and the EPA has built out waste tracking capabilities to support initiatives of this kind. Consequently, COTA will be incorporating waste stream capture for its operations into this tool to allow capture, monitoring, and reporting of progress towards its zero-landfill goal over time. The immediate next step for this performance category is to identify all waste streams and establish a capture of them by weight or volume. This includes identifying which personal will hold these responsibilities. This will allow understanding and pursuit of waste reductions within operations moving forward. It is worth noting that the Portfolio Manager Tool provides tonnage estimates for trash dumpsters based upon container size, frequency of pickup, and percentage it is full at time of collection.

#### 5.4.6. RECENT TREND AND CURRENT STATUS

Because all waste streams are not currently recorded, recent trends and the current status cannot be generated. While the full picture has not been recorded, there continue to be many active efforts already in place including:

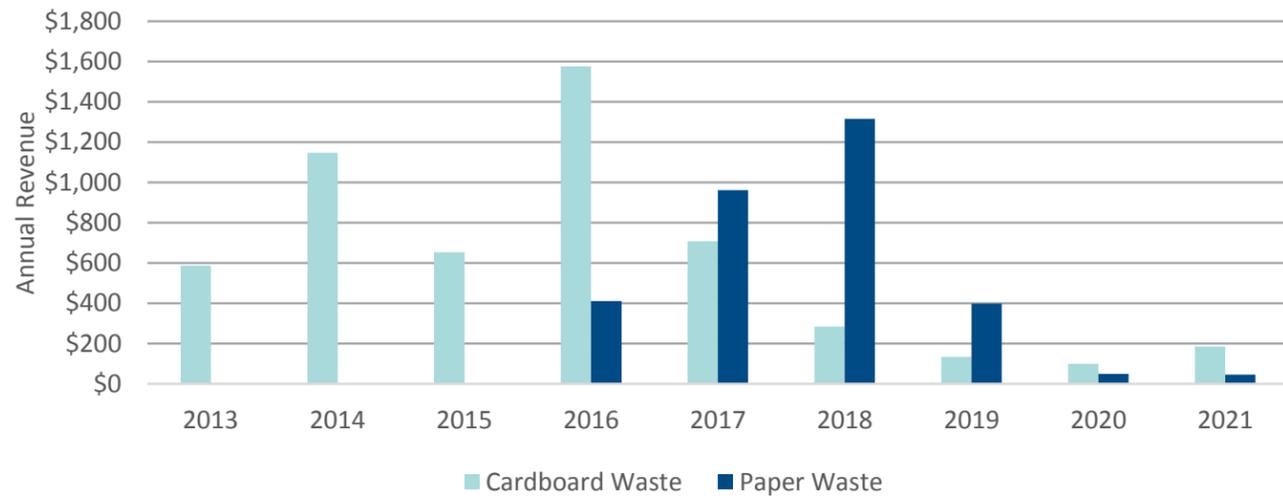
- **Tracked efforts**
  - Cardboard and paper recycling
  - Scrap metal recycling and diversion
- **Unquantified efforts**
  - Mixed refuse
  - Tire and battery contracted with Goodyear
  - Yard waste
  - Waste oil
  - Fluids—transmission and glycol
  - Plastic and glass
  - Transmission and oil filters
  - Wooden Pallets
  - Fluorescent lamps

<sup>38</sup><https://www.epa.gov/smm/best-practices-wastewise-participants#01>

<sup>39</sup><https://www.columbus.gov/sustainable/benchmarking/>

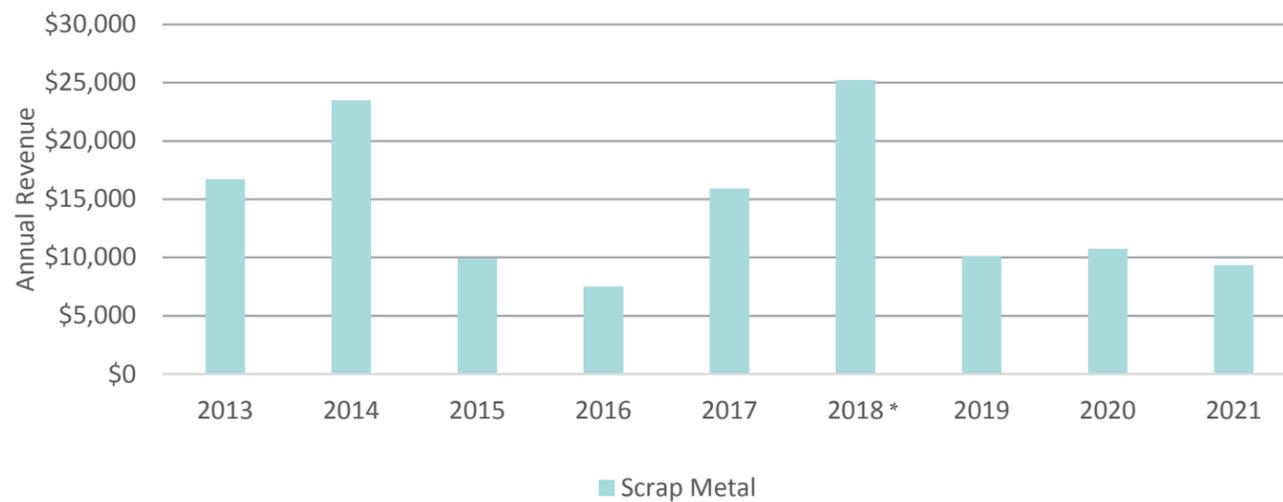
For some of these efforts, receipts have been documented in spreadsheets. Compilation of the available data for both revenue and costs can be seen below:

**Figure 43: CARDBOARD AND PAPER RECYCLING REVENUE—2013 TO 2021**



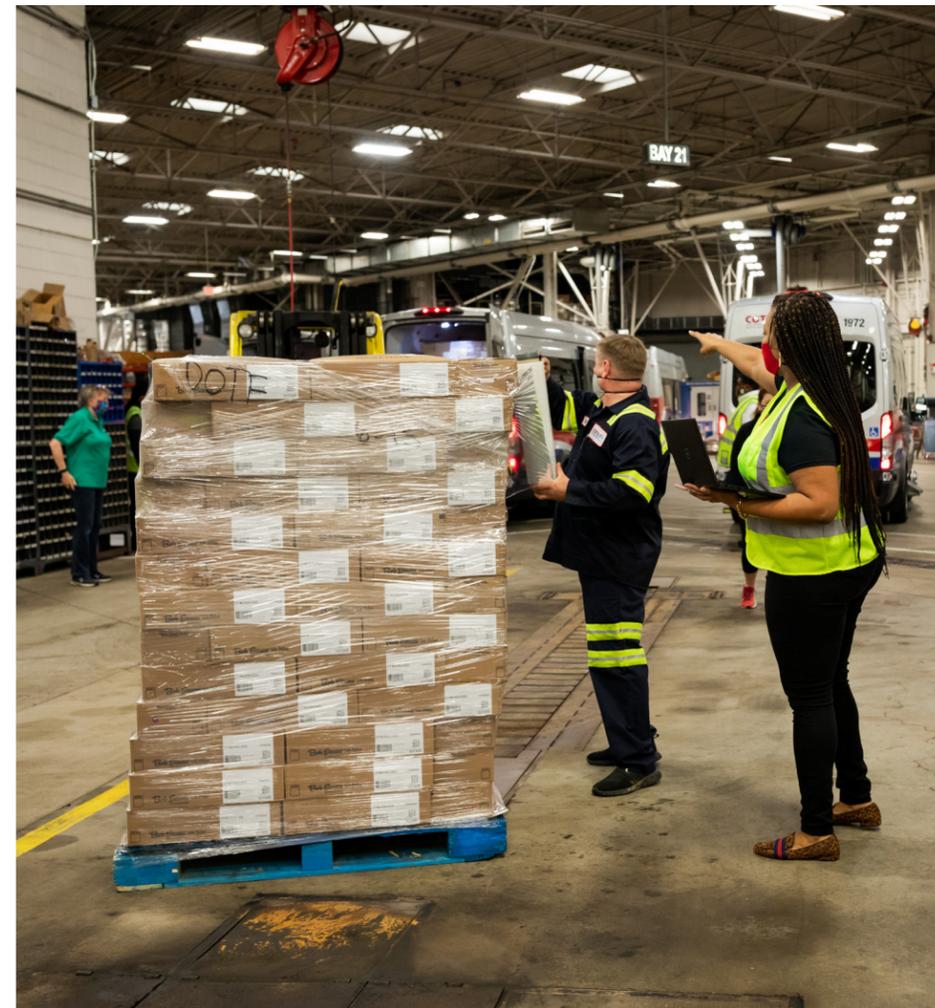
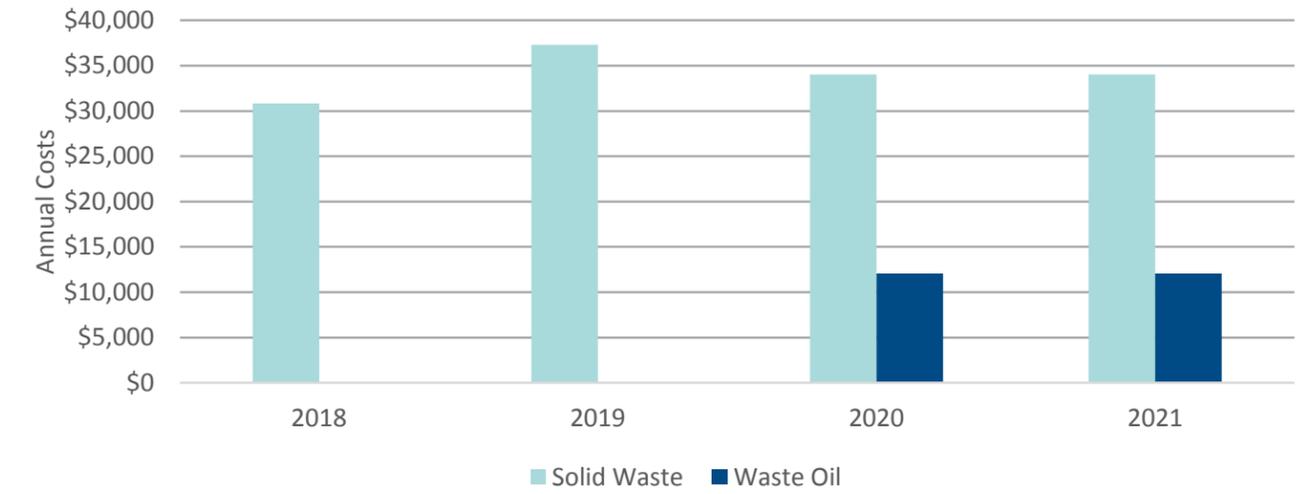
In 2018, there was an increase in paper recycling because a significant amount of paper was recycled with the closure of the in-house printing department. A reduction of paper recycling followed as a result of the elimination of these operations.

**Figure 44: SCRAP METAL RECYCLING REVENUE—2013 TO 2021**



\*Five buses were scrapped in 2018 which accounts for the increase in scrap metal weight and revenue during that annual period.

**Figure 45: SOLID WASTE AND WASTE OIL DISPOSAL COSTS—2018 TO 2021**



**5.4.7. TECHNICAL AND ECONOMIC VIABILITY**

To pursue the proposed strategies laid out in the plan, resources will need to be dedicated to this effort. While the activities recommended in the next section should provide additional direction on how to proceed, this effort will require the identification of the appropriate personnel to be responsible for data capture and compilation. This must include providing the necessary resources to support staff efforts. Due to the opportunity available through incorporation of Portfolio Manager software, coordinating certain data activities through a single point person could yield efficiency returns. This may or may not be best addressed through the creation of a position specific to sustainability efforts.

### 5.4.8. ACTIONS AND RECOMMENDATIONS

Pursuit of COTA's waste goals will include the following actions, some of which might be incorporated into a consolidated study of waste within a facility or across the organization

1. Work with local stakeholders like SWACO to identify any support or grant opportunities that would support waste related activities and their application timetable.
2. Conduct a waste assessment to identify all waste streams generated, quantify the streams in tons, record current management practices, and select waste streams where opportunities for improvement should next be investigated.
3. Establish protocols to capture and record all waste streams and recycling in tons by 2024.
  - a. For waste streams that are not currently tracked in units of tons, outreach to the contractor handling those materials should be the first step.
4. Add waste to data already tracked in Portfolio Manager to meet Columbus energy and water benchmarking ordinance and establish procedures to capture all waste streams within this tool. This will help facilitate comprehensive capture of waste management across the organization while also allowing COTA to assess site waste trends at specific facilities.
5. Once waste tracking is in place, identify the current diversion rate and set near and long-term landfill waste reduction goals that align with achievement of zero landfill waste by 2045.
6. Create a list of stops and shelters located in "littered" or "extremely littered" streets, as identified by the city's litter index, and work with community partners, such as Public Service and SWACO, to coordinate efforts to improve conditions.
7. Contact waste collaborators involved in the City of Columbus Climate Action Plan, particularly SWACO and Public Health, to identify a point of contact with whom to work moving forward. These groups, leading the city's efforts, should be able to provide resources and guidance to COTA.



## 5.5. WATER

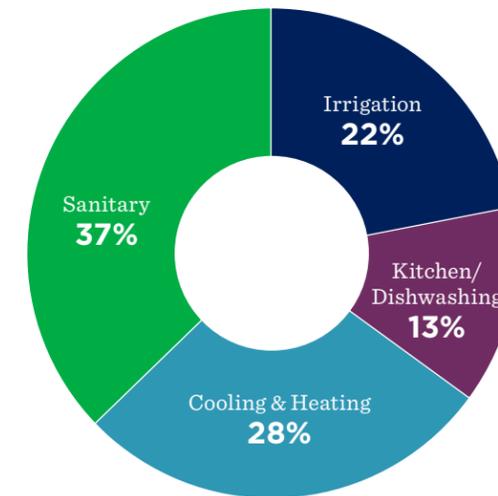
Water is a critical asset within every community and Ohio is fortunate to have an abundance of water available to support the health, businesses, and recreation of its citizens. Responsibly caring for this resource includes intentional stewardship of waters availability paired with its thoughtful use towards the improvement of our lives and our community.

### 5.5.1. BACKGROUND AND CONTEXT

Water's value as a regional asset makes stewardship of regional watersheds critical to ensure clean, potable water for residents and protection from environmental challenges like flooding. EPA compliance standards for watershed contamination are already measured and maintained by EPA. Reducing water use has already been pursued by COTA through water recovery during bus cleaning. Establishing a reduction goal will promote further conservation and recovery across operations. Capturing this effort is most effectively done by identifying a percentage reduction goal applied to a water use intensity metric. That metric will incorporate units captured in water utility billing.

The EPA has assisted many facilities in setting water conservation goals. Although many of COTA's facilities would not be categorized as a typical office building, this end use breakdown demonstrates how an end use breakdown illuminates the drivers of water use and informs where opportunities should be pursued.

**Figure 46: TYPICAL OFFICE BUILDING END USES OF WATER<sup>41</sup>**



Additionally, managing stormwater is another important avenue for contributing to water sustainability in the region. The Columbus Climate Action Plan repeatedly mentions the risk of increased stormwater to the community from climate change. The Climate Action Plan states that the Columbus Department of Public Utilities will conduct a vulnerability assessment to stormwater by 2025. Presently, the City of Columbus's Project Blueprint Columbus identifies Blueprint Neighborhoods and Project Areas that it is focusing on to mitigate stormwater overflows<sup>42</sup>. Neither of COTA's garages are in these current focus areas. That said, as Columbus evaluates future stormwater threats, if those at-risk areas encompass COTA's properties, COTA will collaborate with regional partners leading that engagement to develop additional stormwater management actions at that those locations.

<sup>41</sup><https://www.epa.gov/greeningepa/water-conservation-epa>

<sup>42</sup><https://www.columbus.gov/utilities/projects/blueprint/>, see "BluePrint Columbus" interactive map

**5.5.2. GOALS—LONG AND INTERIM**

Unlike other performance categories, a goal to eliminate use is an inappropriate target to set for water. Furthermore, a greater understanding of water use at facilities is necessary to inform what can and should be pursued. COTA will pursue a study to identify water use in its facilities and determine a realistic percent reduction goal based on technical and economic feasibility. In their 2020 Sustainability Report and Implementation Plan, the EPA has set 2% reductions per year in water intensity (gallons/GSF) for itself over the next two years.<sup>43</sup> This same objective will serve as COTA's interim goal as analysis is performed to determine a functional water reduction goal.

- Pursue an interim goal of 2% reductions per year in water intensity (ccf/gross square footage) for the next two years while investigations are conducted to maintain or adjust water reduction goals.

**5.5.3. METRIC**

The EPA uses gallons per gross square footage (GSF) to measure and track water intensity.

- Measuring and tracking water in hundred cubic feet of water use per facility square foot (ccf/ft<sup>2</sup>).

Instead of gallons as the volumetric unit, we recommend tracking water in units of one hundred cubic feet (ccf) because it is the unit of measure on the water bills. This will allow for simplicity and consistency in progress tracking. To normalize for building acquisitions, additions, and closures, hundred cubic feet of water use per facility square foot is appropriate to capture all facilities.

**5.5.4. SCOPE**

All water usage at COTA facilities should be captured and included in the goal. Standard building usage will include sink and restroom use along with landscaping and cooling tower operation. The bus facilities will also have bus wash and undercarriage wash. Understanding water usage sources can determine what areas of improvement to focus on. The EPA recommends the following actions for water management.<sup>44</sup>

- Meter/ measure/ manage
- Optimize cooling towers
- Replace restroom fixtures
- Eliminate single-pass cooling
- Use water-smart landscaping and irrigation
- Reduce steam sterilizer tempering water use
- Reuse laboratory culture water
- Control reverse osmosis system operation
- Recover rainwater
- Recover air handler condensate

**5.5.5. MEASUREMENT AND REPORTING**

Water bill costs and usages are already captured in finance's tracking. These records are sufficient for high level water use tracking. We recommend using Portfolio Manager, a free tool that COTA already utilizes for the City of Columbus Benchmarking Ordinance, to track water consumption more easily. Further analysis such as an end use breakdown will help facility teams understand how water is used which can guide actions and projects to have the most impact.

<sup>43</sup>[https://www.epa.gov/sites/default/files/2020-10/documents/srip\\_fy20\\_508.pdf](https://www.epa.gov/sites/default/files/2020-10/documents/srip_fy20_508.pdf)  
<sup>44</sup><https://www.epa.gov/greeningepa/water-management-plans-and-best-practices-epa>

We suspect that some equipment may be eligible for a deduct meter. Deduct meters measure water that will not be going down the drain to the sewer, thus reducing costs on the sewer portion of the bill. Deduct meters are often seen on cooling towers, for irrigation systems, and on boiler feed water. We recommend further investigation and coordination with the City of Columbus water department to see if a deduct meter can be applied to any water end uses at McKinley or Fields identified during any benchmarking efforts.

**5.5.6. RECENT TREND AND CURRENT STATUS**

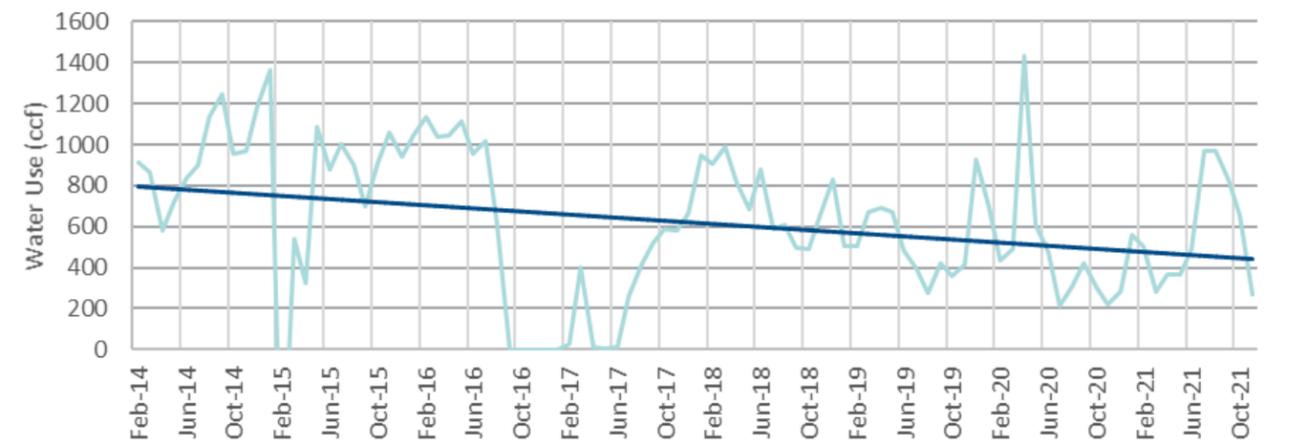
Table 14 shows the water use and associated costs for 2020 across COTA facilities. This demonstrates the large water use and cost tied to the McKinley and Fields facilities, which are at least partly tied to the bus washing operations.

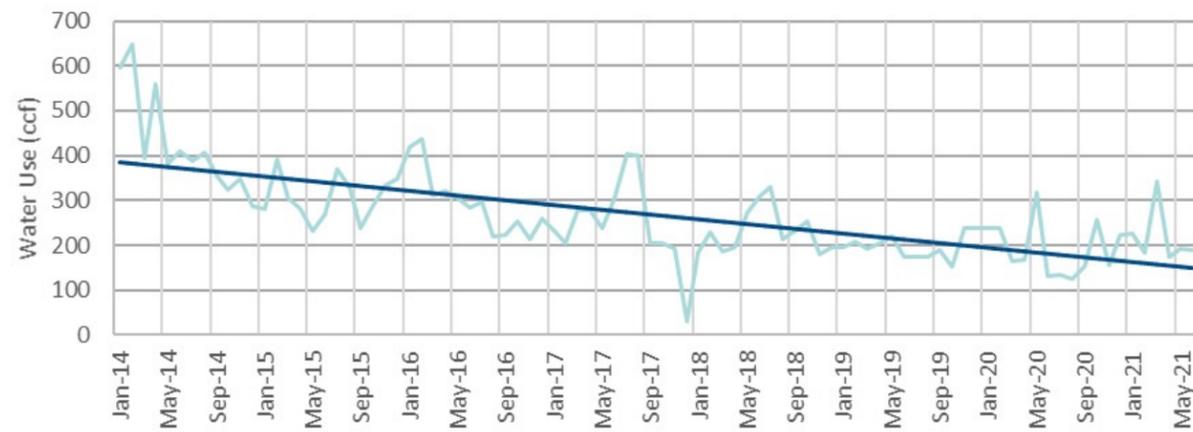
*Table 14: 2020 WATER USE AND COST*

	ANNUAL WATER USE (CCF)	ANNUAL WATER COST (\$)
McKinley	5,892	\$90,611
Fields	2,303	\$57,609
Paratransit	406	\$5,293
Essex Ave	28	\$515
33 N High	752	\$6,769
Other Meters	1,067	\$34,630

Recent trends of water data for the McKinley and Fields facilities are provided in Figure 47 and Figure 48. Water recycling for the bus washes became operational in November 2020 at McKinley and August 2020 at Fields. A correlated drop in water consumption does not seem apparent when reviewing trends of water use for both facilities. There may, however, be various factors that could hide the water savings. For example, the undercarriage wash is used more frequently in the winter to clean the underside of the buses and remove the salt and grime from the streets.

*Figure 47: MCKINLEY WATER USAGE*



**Figure 48: 1333 FIELDS WATER USAGE**

Water bills can vary in that one bill's metered use may have occurred over a different number of days than that of another. In Figure 48 some of the presented data was adjusted for periods where missed readings resulted in erroneous volatility to the monthly trend. Noting these occurrences and adjusting tracking can provide a more useful depiction of water usage. Portfolio Manager can assist in displaying this data to portray actual water consumption more accurately.

Keeping track of operational changes in water use will also provide insights into changes in water consumption. For example, in the summer of 2021, Fields installed a temporary water irrigation system to help the new landscape establish. Recording these water applications is important to tracking their impacts and if they help or hurt progress towards the goal.



Immediate next steps are to complete an end use breakdown of facility water use, determine a method of tracking water data which will likely be through billing data, implement new construction design standards to water efficient fixtures, and set an official water reduction target.

### 5.5.7. TECHNICAL AND ECONOMIC VIABILITY

Similar to the waste performance category, to pursue the proposed strategies laid out in the plan, resources will need to be dedicated to this effort. While the activities recommended in the next section should provide additional direction on how to proceed, this effort will require the identification of the appropriate personnel to be responsible for data capture and compilation. This must include providing the necessary resources to support staff efforts. Due to the opportunity available through incorporation of Portfolio Manager software, coordinating certain data activities through a single point person could yield efficiency returns. This may or may not be best addressed through the creation of a position specific to sustainability efforts.

### 5.5.8. ACTIONS AND RECOMMENDATIONS

Pursuit of COTA's water goals will include the following actions, some of which might be incorporated into a consolidated study of waste within a facility or across the organization

1. Establish a water end use breakdown that identifies what portion of water usage across the building portfolio is attributed to different uses such as bus washing, lavatories, etc.
2. Identify large water use areas to investigate opportunities for water savings and specify water reduction initiatives to pursue.
3. Update interim goal to be a technically and financially achievable percent reduction from the 2013 baseline as informed by the end use breakdown analysis.
4. Establish protocols to capture and record all facility water use by 2024.
5. Begin tracking water use for all meters using Portfolio Manager. This will help facilitate comprehensive capture of water use across the organization while also allowing COTA to assess site water use and trends at specific facilities.
6. Contact water collaborators involved in the City of Columbus Climate Action Plan, particularly MORPC and Public Utilities, to identify a point of contact with whom to work moving forward. These groups, leading the city's efforts, should be able to provide resources and guidance to COTA.



### 5.6. RESILIENCY

COTA has operations that must be performed, or rapidly and efficiently resumed, in the event of an emergency. COTA must also ensure that it is prepared to navigate changes in the demand for and use of its services within the community. Whether a disruption is permanent, such as accommodating significantly increased ridership on the transit system, or the change is acute, such as a natural disaster, a grid outage, or navigating routes to accommodate road closures, resiliency means having the tools and flexibility to adapt to changes and maintain business operations. Resiliency is essential to maintain business operations and reliably connect passengers to their destinations. COTA already maintains a COTA Business Continuity Plan (CBCP) which establishes plans and protocols to maintain operations during disruptive events. COTA's currently diversified fuel mixtures for its vehicle fleet offer some resilience benefits, especially against fuel disruptions and electricity outages. Additionally, COTA's operational adjustments implemented during COVID demonstrate the effectiveness of organizational planning around resiliency.

Resiliency should be considered for every part of the sustainability plan. As technology advances, plan implementation will need flexibility to navigate future uncertainties. Maintaining and evolving the ability to provide uninterrupted services for vehicle fleets, facility operations, and staff needs are pursuable measures of resiliency and should continue to be a component of the CBCP. Success in fostering operational resiliency will also position COTA to provide services and support to the region during a crisis.

### 5.6.1. BACKGROUND AND CONTEXT

From a high level, COTA can engage resiliency interests through two primary lenses, one that looks internally and one that looks externally. Internally, COTA has an inherent business interest in maintaining its own operations and having the ability to respond to more regular disruptive events and trends to maintain its regular services.

Externally, COTA plays a key role in the community's resiliency in several ways. In a general sense, COTA provides transportation to citizens without their own ability or means for mobility. Without COTA's transportation, hundreds of personal acute and chronic crises could emerge, which could contribute to broader system issues within the community. COTA's operations will serve as a critical component in achieving regional goals, one example being transportation related goals within the City of Columbus Climate Action Plan. Achievement of the objectives envisioned in that document will require contributions achieved from significant increases in transit ridership.

A key tool and driver of organizational resiliency is the COTA Business Continuity Plan (CBCP). COTA has operations that must be performed, or rapidly and efficiently resumed in the event of an emergency. The CBCPs purpose is to prepare for, respond to, and recover from emergencies affecting COTA's operations and depend upon the proficiency and well-being of COTA employees and the clarity of team leadership. This organizational plan creates goals for readiness and uninterrupted operations for its staff, vehicles, and facilities.

The CBCP is dynamic and adjusts to address the ever-changing challenges COTA could face. The CBCP ensures that COTA:

- Can implement the CBCP with or without warning.
- Can perform essential functions no later than 12 hours after the event.
- Can maintain essential functions for at least 30 days.
- Provides for a regular risk analysis of current and alternate operating facilities.

Maintenance of the plan will require regular testing and training and apply to everyone within the organization. The plan will prepare for emergency events related to, but are not limited to:

- Information Technology disruptions
- Building closure or inoperability
- Utility outages effecting access to electricity or natural gas
- Severe weather
- Civil disturbances
- Credible threats to facilities or staff
- Major regional disasters such as tornados

Some goals of the CBCP include quick organizational response, continuation of internal operations, and support to customers, emergency management, response agencies, and other agencies affected by the emergency. Consequently, the goals of this plan should be included in the considerations managed by the CBCP.

Ensuring organizational cyber security is an issue of growing importance for transit systems in recent years. COTA is actively engaged in this effort and has hired cyber-security professionals to facilitate increased cyber capabilities in recent years.

Another initiative COTA is involved with is a county level program facilitated through the DHS to prepare communities for complex coordinated terrorist attacks (CCTAs). CCTAs are acts of terrorism that involve synchronized and independent teams at multiple locations sequentially or in close succession, initiated with little or no warning, and employing one or more weapon systems. COTA is a regional participant in the planning and trainings in place to prepare the region should such an event take place.<sup>45</sup>

Finally, in the summer of 2020, COTA staff created an initiative to create a task force to address community challenges impacting the safety and security of COTA passengers and employees. It is called the Safe and Secure COTA for All Task Force. It began with engagement from 18 founding agencies and over time has incorporated many additional organizations. Its objectives are to:

- Reduce non-destination/shelter seeking customers through connections with partners who can address rider needs.
- Address concerns around and reduce illegal behavior at shelters.
- Increase security of female riders who are disproportionately targets of harassment.
- Increase safety through the connection of mental health or addiction services to those community members requiring that assistance.

This developing task force seeks to support engagement of the underlying issues that create challenges for and negative perspectives of COTA's services.

### 5.6.2. GOALS—LONG AND INTERIM

Resiliency considerations are already a part of COTA operations. Moving forward, new considerations will need to be incorporated into the CBCP, particularly as emissions goals are pursued using changing vehicle technologies and fuel sources. COTA's goal will continue to be aspirational to maintain planned services 100% of the time while fulfilling its CBCP. One key consideration will include maintaining uninterrupted fueling capabilities for all vehicle types, as well as maintaining operator availability. As this first objective is achieved, COTA will be positioned to support a secondary goal of serving as an asset for regional entities during emergency events. In the event of an emergency, the resulting operational capabilities will allow COTA to assist government agencies in assisting the community and reducing negative outcomes.

- COTA will incorporate vehicle and fueling planning into the CBCP to enable
  - Continuation of essential functions no later than 12 hours after the event.
  - Maintenance of these functions for at least 30 days.

To do this vehicle and fueling transitions will be incorporated into the CBCP moving forward.

### 5.6.3. METRIC

Resiliency will be assessed through achievement of the CBCP goals. This will be conducted under the direction and discretion of the teams that manage that plan.

<sup>45</sup>[https://www.dhs.gov/sites/default/files/publications/18\\_0822\\_cve\\_FEMA-effectiveness-of-CCTA-and-CVE-grants.pdf](https://www.dhs.gov/sites/default/files/publications/18_0822_cve_FEMA-effectiveness-of-CCTA-and-CVE-grants.pdf)

#### 5.6.4. SCOPE

COTA will apply these resiliency goals to all its services, including bus, demand response, and the soon to be added bus rapid transit.

#### 5.6.5. MEASUREMENT AND REPORTING

Additionally, COTA currently tracks the number of disrupted routes and can report this in its Sustainability Report. COTA will also engage with those organizations upon whose uninterrupted service is dependent, such as electrical utilities. This can take the form of internal tracking of electrical outages to the facilities or direct acquisition of outage information from the utility itself. Direct engagement with critical supply chain partners will be crucial to informing the fleet mix and fuel sources that will support COTA's resiliency and CBCP planning.

#### 5.6.6. RECENT TREND AND CURRENT STATUS

COTA currently conducts some tracking of whether a scheduled route was completed which can be useful in tracking service resiliency. At the time of issue, currently used metrics and trends were unavailable for inclusion in this report but should be considered for pursuit moving forward.

Currently, resiliency has been identified as a critical consideration in pursuing a zero emissions fleet. The proportion of battery electric buses (BEBs) that can be acquired and operated depend critically upon the ability to ensure their operation would not be impacted by common disruptions within electrical services. These considerations should be captured and communicated to the team that manages the CBCP. As COTA further develops its strategies for resiliency relative to the sustainability plan internally, other useful data should be identified for capture and monitoring to inform decision making moving forward.

#### 5.6.7. TECHNICAL AND ECONOMIC VIABILITY

At this time, the exact nature of the technical and economic challenges to COTA's Business Continuity Plan are not known. System improvements to support business continuity may encounter diminishing returns, wherein small gains in service maintenance can only be achieved at an extreme cost. For example, with a transition to BEBs, COTA will be reliant completely on electricity to fuel its buses. However, we know that central Ohio can experience extreme weather that can result in multi-day power outages. COTA is currently assessing the cost of upgrading its electrical system, while also assessing the reliability and redundancy of the electrical supply. This poses both technical and economic barriers to reliable electric supply in the current system, the goal of 100% uptime is an important variable of consideration in the conversion to 100% BEBs.

The feasibility of a full electric fleet is currently being investigated through further analysis. Within the development of this plan, more detail is available on the technical and economic viability of electrification within the emissions section of this report. In that section, additional considerations around both costs and constraints are summarized or identified for further investigation including:

1. Increased need for electric capacity at facilities to support total requirements for depot charging.
2. Need for additional information from the utility on electrical grid redundancy and outage risks.
3. An assessment of the benefits of energy storage to mitigate outage risk and ensure operational capabilities during outages.
4. An assessment of the impact of incorporating en-route charging into an electrification plan.

These questions, along with others, are already being pursued through additional analysis to inform current and future planning.

Separately, current funding mechanisms, such as those from the FTA, already contain robust requirements for recipients to establish and follow federally mandated procedures such as: Demonstrating legal, financial, and technical capacity to carry out programs and projects.<sup>46</sup> Thus, economic viability for COTA's projects is already a key concern for the organization.

#### 5.6.8. ACTIONS & RECOMMENDATIONS

Pursuit of COTA's resiliency goals will include the following actions:

1. Engage the COTA staff who oversee the CBCP to identify
  - a. Which member from that team will oversee the incorporation of sustainability plan objectives into the CBCP.
  - b. Identify and coordinate the best steps for connecting the needs of this sustainability plan with the existing development and implementation of the CBCP.
2. Support existing business continuity planning and incorporate the needs of this sustainability plan into the CBCP, including:
  - a. Continually evaluate how best to build out a resilient vehicle portfolio, whether that is best pursued with an all-electric fleet or will require some fuel diversity to achieve business continuity objectives.
  - b. Develop an integrated back-up power plan. The integrated back-up power plan should consider on-site electric load management, on-site generation, on-site storage, electric feeds from different distribution circuits, and ongoing engagement with the utility on circuit reliability.
  - c. Proactively plan for climate change adaptation, especially in regard to road flooding and the potential of road blockages from severe storms. The City of Columbus is planning a vulnerability assessment of stormwater, which COTA could use to identify areas of concern for roadway flooding. As Ohio may experience more severe winter storms, discussion of snow clearing and road salting prioritization for COTA routes with the city.
3. Continue collecting information on long-term trends that could threaten COTA's business model, including:
  - a. Understanding ridership tastes, desires, and trends.
  - b. Periodic or delegated responsibility to evaluate changes in vehicle and transportation technology.
  - c. COTA should work collaboratively with Columbus and Franklin County to estimate needed increases in public transportation due to decarbonizing—this should tie-in to the ridership goal.
4. Continue and improve collaboration with regional partners to support transit aligned planning and development. COTA will establish a liaison with developers, the downtown development corporation, the City, the County and participate in housing development planning.

<sup>46</sup><https://www.transit.dot.gov/regulations-and-guidance/regulations-and-guidance>

# management area ACTION PLANS

## To achieve its sustainability goals, COTA will need to take actions that involve collaborative interdepartmental teams.

These teams will execute coordinated strategic activities within COTA referred to as “Management Areas”. Management areas are portions of COTA broader than any one department but provide an appropriate and focused view of opportunities key to achievement of sustainability goals. While multiple management areas impact progress towards performance category goals, those teams working within a management area should include all those departments needed to achieve progress. Additionally, most management area team’s decisions and activities will have an influence on multiple performance categories. For example, actions taken in Facilities may influence Net-Zero Emissions achievement, Zero Waste, water reduction, etc.

Consequently, a useful strategy will be to plan engagement within each management area. Assessing the economics of actions that will help achieve goals is important to do on a repeated basis over time. This will ensure economic investments towards sustainability goals are leveraging optimal opportunities within an evolving technological landscape. This section provides a cost benefit analysis and critical considerations within each action area. This analysis does not provide projections past 2035 due to uncertainty.



## 6.1. MOBILE ASSETS *(fleet vehicles and operational support)*

### 6.1.1. SUMMARY

Vehicles will be a key consideration as COTA pursues reductions to its GHG and local PM2.5 pollutant emissions to 0% by 2045, and 70% of the 2013 baseline by 2035, which is the interim target for that year. In 2020, COTA’s planned diesel-to-CNG coach conversion along with other changing factors has already resulted in an 11% reduction in CO2e/mile GHG emissions and 73% reduction in gram-PM2.5/mile pollution emissions since 2013. COTA plans to continue a diesel vehicle retirement strategy with an intent to purchase CNG and BEBs going forward. Currently, aspirational forecasting assumes a transition out of CNG vehicles with a sunset year of 2035, which aligns with the expected end of life of the existing CNG fueling equipment. These forecasts assumptions are generated to assess the impact of this strategy on emission and pollution goals. Several technical and economic barriers are anticipated for these forecasts. Additionally, other factors which may inform revisions to the strategy laid out in the forecast will need to be navigated through the course of the plan.

The mobile assets team will be focused on strategically building out the vehicle portfolio necessary to achieve the zero-emissions, resiliency, and other goals, laid out in this plan. This includes the completing the transition away from diesel coaches, the planning and buildout of EVs within the vehicle portfolio, and ongoing engagement to continually inform the vehicle mix that best provides for COTA’s needs. Representation from several COTA departments including those below will be pursued:

- Vehicles
- Facilities
- Finance
- Capital planning
- Data & Analytics
- EDI

As of COTA’s 2021 fleet mix, 66% of coaches are CNG. COTA has already received two electric coaches as a pilot and are scheduled to receive 8 more in the fall of 2022. While understandable prioritization is being put on the revenue fleet, transitioning all COTA vehicles to be carbon neutral will be critical in the long term. This will require the plan to provide a means of navigating near and long-term fleet transition, including identifying the trade-offs associated with fleet technology diversity, electrification, and operational constraints like fueling time and distance capability per fueling.



### 6.1.2. ACTION ITEMS

COTA should pursue the following actions to meet its interim 2035 goal and align with its 2045 Net-Zero Emissions goal with the following actions relative to each performance category:

1. Prioritize scheduling of BEB buses to underserved individuals and communities
2. Continue phasing out diesel coaches as planned. Diesel phase-out will reduce COTA's bus fleets GHG intensity by 30% by the phase-out scheduled to be complete in 2026.
3. Conduct a study on the available options for expanding BEB charging capacity including:
  - a. Alternate electric transmission and distribution line upgrade options
  - b. On-site energy reduction, on-site energy generation, and on-site storage options to increase electric charging capabilities
  - c. Assess the impact of on-route charging to inform what mix best suits COTA's long term goals
  - d. Explore the costs and logistics of implementing electric capacity upgrades
4. Continue strategic addition of battery electric buses (BEBs) provided
  - a. BEB fleet additions can be supported with existing interconnections
    - COTA's facilities will reach available limits on available electric distribution line capacity
  - b. Back-up fueling/charging is available to maintain COTA's resiliency goals
  - c. Range capabilities of BEBs can meet COTA's service needs
  - d. Other vehicle technologies do not offer better opportunities
  - e. Cost competitive charging capacity can be pursued
  - f. BEB range challenges are addressed
5. Investigate zero-emission fueling costs for BEBs by obtaining pricing for purchasing zero-emission electricity including both supplier contract options as well as renewable energy credit (REC)
6. Assess the potential economic benefit of monetizing the CNG fueling equipment and fleet through pursuing Renewable Natural Gas (RNG), particularly the economic benefit of generating Renewable Identification Numbers (RIN) for trade within the renewable fuel standard (RFS). This includes assessing how GHG emissions reductions can be incorporated into such an arrangement.

Compare economic findings from investigations of zero-emission fueling options for BEB and CNG vehicles to inform near term vehicle acquisition strategies. This may take the form of some combinations of renewable supplier contracts, RINs, RECs, and on-site renewable generation.



## 6.2. STATIONARY ASSETS *(COTA facilities and operational support)*

### 6.2.1. SUMMARY

Facilities decisions, whether within existing buildings or related to new construction, will feed into the achievement of performance categories goals for emissions, waste, and water. For existing facilities, actions should be based on optimizing and reducing energy use to reduce emissions and utility costs. Additionally, water reduction actions should be technically and economically achievable. To better manage progress to the main goals, facility teams will likely need facility-specific goals and action items to help support their efforts to achieve emissions and water use goals.

Supply chain management is also critical for both the short and long-term targets that will be outlined in the sustainability plan. By engaging with COTA's supply chain, meaningful progress can be made across environmental, social and governance areas of impact. The practices of the businesses from whom COTA obtains the materials and supplies offer additional opportunities for improving its environmental footprint and extending its ability to elevate EDI to its supply chain.

The stationary assets team will be focused on reducing building energy and water use, reducing landfill waste, procuring renewable energy, and assisting the mobile assets teams in ensuring vehicle support activities that take place at facilities, such as fueling, are in place to support zero-emission fleet transition. Additionally, they are positioned to incorporate improved purchasing and sourcing practices into existing operations. Representation from several COTA departments including those below will be pursued:

- Facilities
- Finance
- Data & Analytics
- Capital planning
- Grants
- Supplier Contracts

### 6.2.2. ACTION ITEMS

The next steps in pursuing sustainability across all performance categories within this management area are:

1. Establish a process to include consideration of minority and DBE businesses when making purchasing decisions.
2. Net-Zero-emission-ready guidelines for new construction—ensuring new facilities do not add to COTA's emissions will be critical as building portfolio expansion occurs. Any new facility should be designed efficiently, capable of integrating on-site renewable energy, and should not have mechanical systems that lock-in emissions (ie, natural gas fired heating equipment).
3. Conduct energy studies at the major energy using facilities to identify specific energy efficiency opportunities to invest in.
  - a. Each study should identify expected facility-specific energy reduction potential.
  - b. A study is already underway at the McKinley facility.
4. Conduct a cost study of onsite renewable energy installations to assess if current economics support their pursuit at the present time. This could be included within the scope of facility energy studies, or as a separate analysis.
5. In the long-term, COTA will need to purchase renewable electricity from off-site sources. There are currently several options to do so, including virtual power purchase agreements (vPPAs), physical power purchase agreements (pPPAs), and the purchase of renewable energy credits (RECs) or GHG offsets. Each of these types of off-site renewable energy contracts has pros and cons. While these can be used to assist in achieving interim progress goals, we recommend prioritizing investment in internal operational improvements first.
6. Conduct a study of facility electrification needs. While it is currently possible to purchase renewable natural gas (RNG), we anticipate that RNG will be limited in the future, and that natural-gas fired hot-water and space heating equipment will likely need to convert to be electric. An electrification study can be included within the scope of an energy audit, or in a separate study.
7. Evaluate costs and benefits of off-site renewable electricity purchasing options, including evaluating a REC contract, vPPA, and pPPA options. Offsite options will be available for purchase in any given year, and often will create a net incremental cost to COTA's energy supply. Because of this, we recommend that COTA focus its capital on Facilities and Fleet upgrades first and use off-site renewable energy as a way to meet emissions goals in later years, but only to the extent necessary.
8. Conduct a waste assessment to identify all waste streams generated, capture and record current management practices, and select waste streams for which opportunities for improvement should next be investigated.
  - a. Contact waste collaborators involved in the City of Columbus Climate Action Plan, particularly SWACE and Public Health, to identify a point of contact with whom to work moving forward. These groups leading the city's efforts should be able to provide resources and guidance to COTA.
  - b. Adopt a measurement metric of tons per year for all waste streams

- c. For waste streams not currently tracked in tons, reaching out to the contractor handling those materials should be the first step in identifying a tracking method.
  - d. Establish protocols to capture and record all waste stream and recycling in tons by 2024. We recommend adding waste data to Portfolio Manager to consolidate energy, water, and waste data tracking in one location. This will help facilitate comprehensive capture of waste management across the organization while also allowing COTA to assess site waste trends at specific facilities. Profiles for McKinley and Fields already exist in Portfolio Manager for compliance with the City of Columbus Benchmarking Ordinance.
  - e. Once waste tracking is in place, identify the current diversion rate and set near and long-term landfill waste reduction goals that align with the achievement of zero landfill waste by 2045.
9. Contact the Ohio EPA to identify which of their existing grant opportunities could fund any of these waste related activities and their application timetable. Specifically seek insights on the benefit and impact of internal educational efforts and what resources the Ohio EPA might have to support such an event
10. Create a list of stops and shelters located in "littered" or "extremely littered" street, as identified by the city's litter index. Work with community partners, such as Public Service and SWACO, to coordinate efforts to improve conditions.
11. Identify water usage tracking protocols, end uses of water, target areas for usage reduction, and update the interim goal
  - a. Establish a water end use breakdown that identifies what portion of water usage across the building portfolio is attributed to different uses such as bus washing, lavatories, etc.
  - b. Identify large water use areas to investigate opportunities for water savings and specify water reduction initiatives to pursue.
  - c. Update interim goal to be a technically and financially achievable percent reduction from the 2013 baseline as informed by the end use breakdown analysis.
  - d. Establish protocols to capture and record all facility water use by 2024.
  - e. Begin tracking water use for all meters using Portfolio Manager. This will help facilitate comprehensive capture of water use across the organization while also allowing COTA to assess site water use and trends at specific facilities.



## 6.3. EMPLOYEE ENGAGEMENT

### 6.3.1. SUMMARY

A key component of every organization is its people and COTA is no exception. Every employee at COTA can impact progress towards or against the goals outlined in this plan. Activating the power of COTA employees by prioritizing what it wants to accomplish and progress towards the goals will not only help COTA achieve its targets but engage employees on meaningful work that extends beyond their core job duties. Recommendations for leveraging employee engagement to execute this sustainability plan will be informed by engaging with the ERGs and gaining insights for operational and maintenance teams. The plan will outline avenues to engage employees on the sustainability plan such as leveraging the employee resource groups (ERGs) and volunteer opportunities as means of socializing and advancing the goals of the plan. Representation from several COTA departments including those below will be pursued:

- Marketing and Communications
- EDI
- Grants

### 6.3.2. ACTION ITEMS

The next steps in pursuing sustainability across all performance categories within this management area are:

1. Conduct a survey to assess how COTA employees commute to work. Findings from this survey will inform adjustments to the emissions calculation that is currently being used.
2. Investigate how company travel is currently captured and develop a strategy to incorporate the associated emissions into the emissions metric.
3. Determine EDI metrics and begin tracking.
4. Increase women in transportation by 10% in support of the Mobility XX initiative.

## 6.4. CUSTOMER ENGAGEMENT

### 6.4.1. SUMMARY

Engaging with riders on the sustainability efforts of COTA can both support COTA with achieving its goals and create a positive affiliation of COTA from its riders. Through this engagement, riders and COTA customers will better understand what COTA is doing to advance sustainability and EDI within their organization and out in the community. This engagement can also help to support educating COTA riders on the importance of addressing climate change and the important steps they are taking by choosing public transit. Recommendations outlined in this plan will seek to engage customers on supporting the objectives of the plan while supporting more sustainable behaviors of COTA customers.

Marketing, customer experience, program management, route planning, research, and operators will be key players in customer engagement and community relations. This team should also work with the other management areas to broadcast sustainability successes and progress towards the goals.

Though customer engagement will promote all performance categories and broadcast sustainability successes at COTA, this action area will be mostly focused on ridership, waste, and EDI. Promoting and increasing ridership advances carbon reductions in the community by reducing emissions from individual cars. A focus on waste can help empower riders to properly dispose of waste and keep the common spaces like bus stops clean. Finally, emphasizing EDI ensures that those who rely on COTA for transportation are represented during planning so that COTA can continue to better serve and connect disadvantaged communities to important resources such as work, grocery stores, and medical care facilities. Representation from several COTA departments including those below will be pursued:

- Marketing and Communications
- EDI
- Customer Experience
- Route Planning
- Operators
- Grants

### 6.4.2. ACTION ITEMS

The next steps in pursuing sustainability across all performance categories within this management area are:

1. Conduct a survey to facilitate generation of a mode shift factor for use in capturing impact of increased ridership on regional emissions goals. This process has already been initiated.
2. Broadcast key points of the sustainability plan and progress already made. Key items include the net-zero emissions by 2045 goal and the \$10 million dollars in savings achieved in Franklin County because of avoided adverse health effects from the transition from diesel to CNG buses.



## 6.5. COMMUNITY RELATIONS/STAKEHOLDERS

### 6.5.1. SUMMARY

COTA is a critical member of the central Ohio community. As such, COTA can be responsive to sustainability goals set by the City of Columbus and other community organizations, even if the goals are less material to COTA. Such a pursuit will require a strategy to decarbonize current operations with an awareness of how achievement of regional goals might require sizable expansion of current operations. For example, one tactic for decarbonizing Columbus and other central Ohio cities may be a dramatic increase in use of public transit. This ridership need for regional decarbonizing could possibly outstrip COTA's own internal ridership increase goals.

COTA will need to outline an approach to activate and engage with key organizational stakeholders throughout the region not only to advance its own sustainability plan, but to leverage COTA's sustainability plan to help to achieve the goals and priorities across the region. This includes, engagement, education and awareness, public policy advocacy and lobbying. Through this engagement, every community that COTA rides through should understand what COTA is doing to help make their community healthier, more environmentally friendly, just, and equitable. Representation from several COTA departments including those below will be pursued:

- Capital planning
- Vehicles
- Route Planning
- Economic Development
- Grants

### 6.5.2. ACTION ITEMS

The next steps in pursuing sustainability across all performance categories within this management area are:

1. Contact mode shift collaborators involved in the City of Columbus Climate Action Plan, particularly Public Service and MORPC, to identify a point of contact with whom to work moving forward. These groups, leading the city's efforts, should be able to provide resources and guidance to COTA. COTA should have an active role in dialogue with the City and MORPC on economic development, density planning, and transit planning in the region.
2. Contact waste collaborators involved in the City of Columbus Climate Action Plan, particularly SWACO and Public Health, to identify a point of contact with whom to work moving forward.
3. Contact water collaborators involved in the City of Columbus Climate Action Plan, particularly MORPC and Public Utilities, to identify a point of contact with whom to work moving forward.
4. Continue engagement in collaborative engagement in regional development through LinkUS, Columbus Downtown Development Corporation, and other initiatives.
  - Assist in completion of 3 regional high-capacity rapid transit lines developed within LinkUS to support City's Climate Action Plan Goals.
5. Work towards internal DBE spending goals.

# SUPPLEMENT A: METRIC CALCULATIONS GUIDE

This supplement contains instructions on the methodologies that will be used to calculate the metrics used to track progress across various Performance Categories. Annual tracking of metrics not currently captured in COTA processes is needed for several performance categories. Within each data tracking initiative, we identify the management area tracking responsibilities could be assigned to. Alternately, if COTA were to create a sustainability manager position these responsibilities could also be assigned to that individual.

- Vehicle emissions—Mobile Assets
- Facility emissions—Stationary Assets
- Waste tracking—Stationary Assets
- Water tracking—Stationary Assets

Finally, as COTA continues to build out its organization wide data system, adding the capture of these metrics should be explored to automate the process. If done it would reduce annual goal tracking efforts and offer useful feedback to the Management Area teams as they make decisions and assess impacts.

## 7.1. GHG EMISSIONS

COTA's total GHG emissions come from various action areas within the organization. The calculation methodology for tracking GHG emissions was developed to incorporate inputs already captured for annual submissions to the NTD. In this section we outline the process to generate updated metrics for monitoring.

The vehicle fleet is currently comprised of three categories, the buses, mobility vehicles, and nonrevenue vehicles. Mileage and fuel data for the buses and mobility vehicles is currently submitted to the NTD on the "Revenue Vehicle Inventory" form. Fuel consumption data can then be converted to GHG emissions using value obtained from the AFLEET<sup>47</sup> tool from Argonne National Laboratory.

<sup>47</sup>[https://greet.es.anl.gov/afleet\\_tool](https://greet.es.anl.gov/afleet_tool)

**Table 15: BUS GHG EMISSIONS CALCULATION**

TERM	VALUE UNITS	VARIABLE	REFERENCES
Diesel Bus Gallons	1,736,791 gge	D_g	NTD Revenue Vehicle Inventory
CNG Bus Miles	2,151,660 gge	C_g	NTD Revenue Vehicle Inventory
Diesel GHG Intensity	27.4358lb-CO2e/gge	D_i	AFLEETs Well-to-Wheels – Diesel
CNG GHG Intensity	18.7233lb-CO2e/gge	C_i	AFLEETs Well-to-Wheels – CNG (North America NG)
Tonnes	2,200tonne/lb-CO2		
GHG Emissions	39,971lb-CO2e/mile		$(D\_g \times D\_i + C\_g \times C\_i) / 2,200$

**Table 16: MOBILITY GHG EMISSIONS CALCULATION**

TERM	VALUE UNITS	VARIABLE	REFERENCES
Diesel Mobility Gallons	311,136 gge	D_g	NTD Revenue Vehicle Inventory
Gasoline Mobility Miles	21,561 gge	G_g	NTD Revenue Vehicle Inventory
Diesel GHG Intensity	27.4358 lb-CO2e/gge	D_i	AFLEETs Well-to-Wheels – Diesel
Gasoline GHG Intensity	23.5226 lb-CO2e/gge	G_i	AFLEETs Well-to-Wheels – CNG (North America NG)
Tonnes	2,200 tonne/lb-CO2		
GHG Emissions	4,111 lb-CO2e/mile		$(D\_g \times D\_i + G\_g \times G\_i) / 2,200$

While there are other methods of calculating emissions for COTA's revenue vehicles, utilizing GHG intensity conversions based upon fuel use by vehicle type, allows these same factors to be used in estimating the GHG impact during decision making about vehicle purchases and service changes resulting from expanding routes.

Fuel consumption is not recorded for nonrevenue vehicles, but annual mileage is. After obtaining annual mileage data for 2020, this was used with the vehicle total by type and associated miles per gallon (mpg) data obtained from the Alternative Fuels Data Center<sup>48</sup> to estimate annual fuel consumption in gallons. This value was then converted to GHG emissions using factors from the EPA<sup>49</sup>.

**Table 17: NON-REVENUE VEHICLE GHG EMISSIONS CALCULATION**

TERM	AUTOS UNITS	VARIABLE	REFERENCES
Ford Explorer SUV (AWD)	20 vehicles	V	NTD Service Vehicle Inventory
Total Miles for all vehicles	280,845 mile/year	M	2020 Average from COTA
Miles per gallon	21.4 mile/gallon	mpg	EPA Automotive Trends Report
Annual Gallons	13,130 Gallons/year	AG	AM / mpg

<sup>48</sup><https://afdc.energy.gov/data/10310>

<sup>49</sup><https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle>

The nonrevenue GHG calculations are based upon conversion factors based upon gallons of fuel. Consequently, if COTA can directly capture fuel consumption for nonrevenue vehicles throughout the year, this calculation could be based upon fuel use.

Facility GHG emissions are based upon utility consumption taking place at the locations that comprise COTA's building portfolio. Annual electricity and natural gas use were obtained from spreadsheets maintained by COTA staff. It is critical to note that the annual totals must exclude energy associated with vehicle fueling. Currently this means removing both the electric and natural gas meters associated with the compressed natural gas fueling stations. Since this equipment is served by its own meters, this is a simple process. As COTA installs and uses EV charging equipment, the electricity consumption associated with BEBs will need to also be separated, either through independent metering or the electricity use captured at each charger. The annual totals for electricity are then converted using factors available from eGRID<sup>50</sup> and the EIA<sup>51</sup> respectively.

**Table 18: FACILITY ELECTRICITY GHG EMISSIONS CALCULATION**

TERM	VALUE UNITS	VARIABLE	REFERENCES
Annual Electricity Use 1	3,093,100 kWh/year	Elec	Utility Bills
Carbon Intensity of Electricity	1.074 lb-CO2e/kWh	Cie	eGRID - RFC West
Tonnes	2200 tonne/lb-CO2		
GHG Emissions	6,392 Tonne-CO2e/year	GHG	$Elec \times Cie / 2,200$

It is important to note that the eGRID conversions represent the GHG associated with standard electric grid interconnection. It is important to note that COTA is within the RFC West region of PJM's grid. Since 2009, when eGRID first began capturing the GHG intensity of the electricity grid, the RFC West region has seen a reduction of roughly 30% in GHG intensity as generation assets have been transitioned to both renewable and natural gas generation assets. This system improvement has resulted in emissions reductions for COTA facilities electricity consumption.

By 2045, 100% of COTA's electricity will need to come from emission free sources, which may be achieved within the electricity grid itself. As COTA manages pursuit of interim goals over time, sourcing emission free electricity through supplier contracts is one avenue for achieving desired progress towards 2045 goals.

**Table 19: FACILITY NATURAL GAS GHG EMISSIONS CALCULATION**

TERM	VALUE UNITS	VARIABLE	REFERENCES
Annual Natural Gas Use	91,530 mmBtu/year	NG	Utility Bills
Carbon Intensity of Natural Gas	116.65 lb-CO2e/mmBtu	Cie	Energy Information Administration
Tonnes	2200 tonne/lb-CO2		
GHG Emissions	4,853 Tonne-CO2e/year	GHG	$NG \times Cie / 2,200$

<sup>50</sup><https://www.epa.gov/egrid>

<sup>51</sup>[https://www.eia.gov/environment/emissions/co2\\_vol\\_mass.php](https://www.eia.gov/environment/emissions/co2_vol_mass.php)

Moving forward, sourcing renewables or low carbon suppliers for both the electric and natural gas utilities will be an important avenue for reducing emissions and achieving interim emissions reduction goals. While decarbonization of the electricity grid is expected to continue and accelerate in the coming decades, COTA could choose to set up supplier contracts for both utilities to purchase 100% emission free sourced energy. This would foster increased emissions reduction and offer another avenue for staying “on track” with 2045 goals. Such supplier contracts may or may not come at a cost premium.

Finally, we used the following equation to estimate emissions related to employees commuting.

**Table 20: MOBILITY GHG EMISSIONS CALCULATION**

TERM	UNITS	VARIABLE	CALCULATION
Vehicles	784 vehicles	V	
Miles per day	16 Miles/vehicle	M	
Days per week	5 days/week	D	
Weeks per year	20 weeks/year	W	
Annual Miles	1,254,400 mile/year	AM	$V \times M \times D \times W$
Miles per gallon	24.2 mile/gallon	Mpg	
Annual Gallons	51,835 Gallons/year	AG	$AM / AG$
CO2 per gallon	19.6 lb-CO2/gal	Cpg	
Tonnes	2200 tonne/lb-CO2		
GHG Emissions	461.8 Tonne-CO2e/year	GHG	$AG \times Cpg / 2,200$

While this component of GHG emissions is small, we believe it is useful as an opportunity for employee engagement. This could include pursuit of a survey to capture this value more accurately and direct efforts to increase staff awareness and promote this initiative. Over time, this employee emission contribution will also need to incorporate business-related travel. While this is an important future step it is not as critical as in the near term as other objectives.

Once total have been generated for each of these action areas, they can be totaled.

**Table 21: TOTAL GHG EMISSIONS**

ACTION AREA	SUB-CATEGORY	GHG (TONNE-CO2E/YEAR)
<i>Vehicle Fleet</i>	Bus	39,756
	Mobility	4,107
	Service Vehicle	195
<i>Facility</i>	Electricity	6,392
	Natural Gas	4,853
<i>Employee</i>	Travel	462
<b>TOTAL</b>		<b>55,764</b>

This total can then be divided by the annual vehicle miles submitted to the NTD. These miles represent the total vehicle miles occurring for the revenue vehicles over the course of a year.

**Table 22: CALCULATING ANNUAL GHG EMISSIONS PER VEHICLE MILES**

TERM	VALUE	UNITS
Annual Vehicle Miles	18,845,406	miles
GHG Emissions	55,764	tonne-CO2e/year
GHG Emissions Metric	6.51	lb-CO2e/mile-year

## 7.2. POLLUTION EMISSIONS

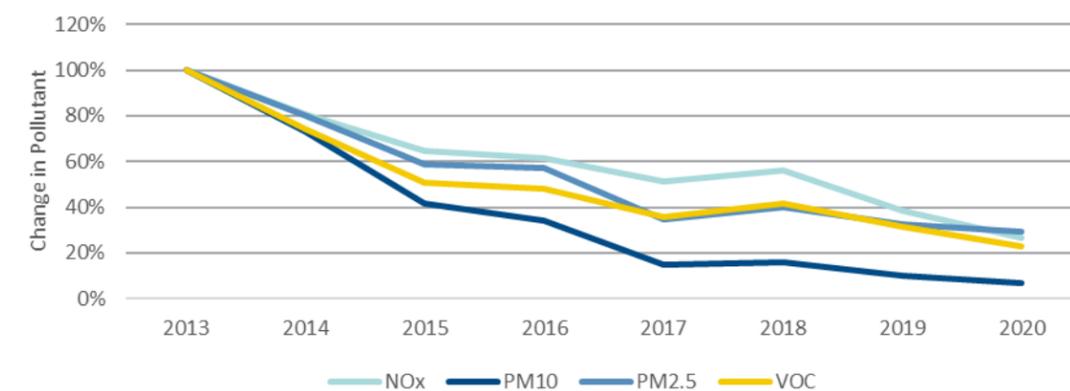
COTA’s total pollution emissions were generated using the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET)<sup>52</sup> Tool developed by Argonne National Laboratory. Using data on vehicle type, model year, mileage, and fuel consumption the AFLEET tool was used to estimate the quantity of the following types of air pollution emitted by COTA vehicles annually:

- Carbon Monoxide (CO)
- Nitrogen Oxides (NOx)
- Particulate Matter with a diameter of 10 micrometers and smaller (PM10)
- Particulate Matter with a diameter of 2.5 micrometers and smaller (PM2.5)
- Volatile Organic Compounds (VOCs)
- Sulfur Oxides (SOx)

The pollution estimates presented in this plan were generated using a combination of annual NTD data and vehicle information monitored by COTA. Vehicle data was aggregated by vehicle model year for input into the AFLEET tool.

While each of these pollutants are important, noted by their inclusion in the AFLEET tool, PM2.5 was selected as the targeted pollutant upon which tracking efforts are focused. It is important to note that four of the six of these pollutants are largely in alignment.

**Figure 49: PERCENT POLLUTION OF 2013 BENCHMARK**

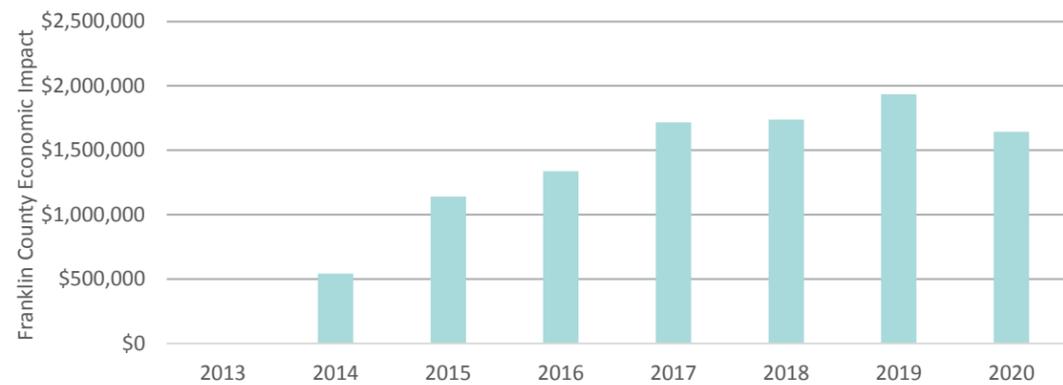


<sup>52</sup>[https://greet.es.anl.gov/afleet\\_tool](https://greet.es.anl.gov/afleet_tool)

It is important to note that during this timeframe there are differences in vehicle miles traveled which will impact the validity of comparing the annual aggregate of pollution totals. Consequently, the pollution metric selected is divided by annual vehicles miles to account for this variation. Over this same period, carbon monoxide levels increased as a result of transition to CNG coaches from diesel. Sulfur oxides were reduced but not at the same levels of these other pollutants.

An additional step to quantify pollution impacts is the use of the EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)<sup>53</sup>. Using values generated with the AFLEET tool as inputs, along with identification of the region (Franklin County, Ohio) and sector (Off-Highway). Using COBRA to run a scenario for each year using a 7% discount rate, annual cost per mile was generated. These annual values were then used to extrapolate the savings achieved since 2013.

**Figure 50: ECONOMIC IMPACT OF POLLUTION REDUCTIONS IN FRANKLIN COUNTY**



**Pollution reductions have resulted in over \$10 million dollars in regional savings since 2013.** Capturing this secondary impact of emissions reductions provides an important understanding of the impact this initiative has on the greater community and should be continued moving forward.

### 7.3. ESTIMATING HEALTH EFFECTS OF POLLUTION

The information contained in this section was issued as a memorandum on February 14, 2022. The metric being tracked for COTA's pollution emissions goal is gram particulate matter 2.5 (PM 2.5) per revenue vehicle mile. PM 2.5 emissions were estimated for multiple areas of operations including the bus fleet, mobility fleet, non-revenue fleet, employee commuting, and facility natural gas use. This was done using the Alternative Fuel Life-cycle Environmental and Economic Transportation (AFLEET) Tool developed by Argonne National Laboratory.

In addition to these PM2.5 emissions vehicle pollution emissions, several other pollutants were also tracked for the bus and mobility fleets. This was done because these fleets:

- Constitute the greatest contributions to emissions.
- Have experienced sizable changes in fuel sourcing since 2013.
- Have emissions that are exhausted into the community.

<sup>53</sup><https://www.epa.gov/cobra>  
<sup>54</sup><https://greet.es.anl.gov/afleet>

In addition to PM2.5, the AFLEET tool generates pollution estimates for carbon monoxide (CO), nitrogen oxides (NOx), particulate matter 10 (PM10), volatile organic compounds (VOCs) and sulfur oxides (SOx). The annual totals for the estimated pollution emissions can be seen in the table below.

**Table 23: ANNUAL POUNDS OF POLLUTION FOR VARIOUS COMPOUNDS**

YEAR	CO	NOx	PM10	PM2.5	VOC	SOx
2013	139,384	202,105	2,828	2,979	11,791	471
2014	229,954	163,614	2,076	2,389	8,759	453
2015	314,317	130,637	1,185	1,753	6,001	452
2016	380,658	124,609	961	1,702	5,657	469
2017	381,826	104,005	424	1,039	4,225	475
2018	495,422	113,927	448	1,191	4,889	485
2019	470,321	77,221	291	971	3,713	464
2020	365,888	54,183	192	876	2,721	353

### ESTIMATING ANNUAL COST OF EMISSIONS PER MILE

The next step in estimating cost impacts is to input the pollution totals generated in the AFLEET into the EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)<sup>55</sup>. During this process the web edition was used. To generate costs, the location selected was Franklin County Ohio, the sector selected was "Off-highway", and the following input in tons were generated from the AFLEET results. A discount rate of 7% was applied.

**Table 24: ANNUAL TONS OF POLLUTION FOR VARIOUS COMPOUNDS**

YEAR	PM 2.5	SO2	NOX	VOC
2013	1.49	0.24	101.05	5.90
2014	1.19	0.23	81.81	4.38
2015	0.88	0.23	65.32	3.00
2016	0.85	0.23	62.30	2.83
2017	0.52	0.24	52.00	2.11
2018	0.60	0.24	56.96	2.44
2019	0.49	0.23	38.61	1.86
2020	0.44	0.18	27.09	1.36

The COBRA tool requires inputs of pollutants in units of tons. Within the you are required to select whether the inputs are a reduction or increase in pollution. For our purposes, since we were only generating single scenarios for each annual period, that input is moot. This is because our goal was to quantify the total health effects in dollars associated with the total pollution for each annual period.

<sup>55</sup><https://www.epa.gov/cobra>

An example of the webpages output for the 2013 data can be seen below:

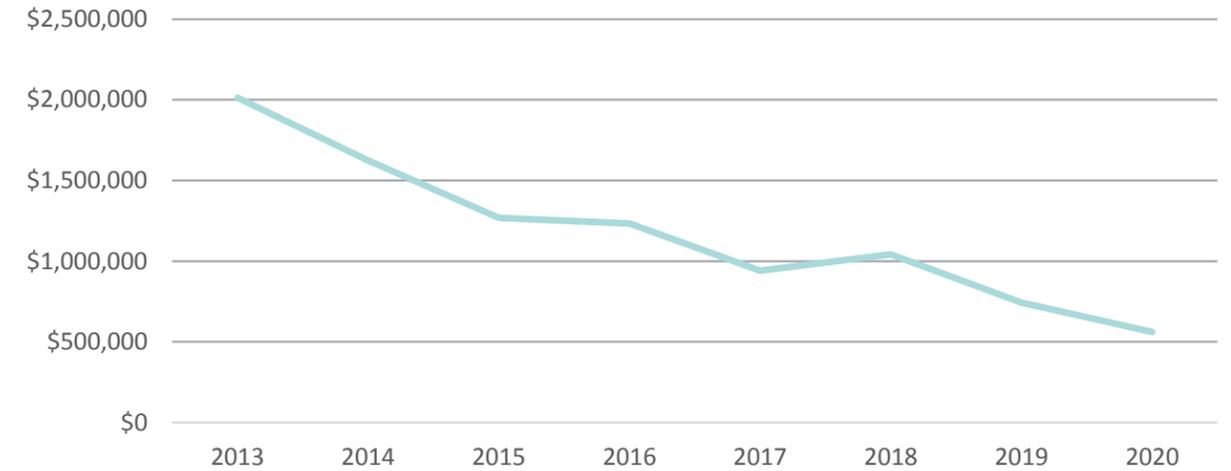
**Figure 51: 2013 COBRA HEALTH EFFECTS SUMMARY**

Health Endpoint <sup>i</sup>	Change in Incidence <sup>i</sup> (cases, annual)		Monetary Value <sup>i</sup> (dollars, annual)	
	Low	High	Low	High
Mortality *	0.124	0.280	\$1,203,885	\$2,732,503
Nonfatal Heart Attacks *	0.013	0.125	\$2,053	\$19,074
Infant Mortality	0.001	0.001	\$16,686	\$16,686
Hospital Admits, All Respiratory	0.032	0.032	\$1,107	\$1,107
Hospital Admits, Cardiovascular **	0.032	0.032	\$1,626	\$1,626
Acute Bronchitis	0.221	0.221	\$136	\$136
Upper Respiratory Symptoms	3.986	3.986	\$170	\$170
Lower Respiratory Symptoms	2.808	2.808	\$76	\$76
Emergency Room Visits, Asthma	0.085	0.085	\$48	\$48
Asthma Exacerbation	4.098	4.098	\$304	\$304
Minor Restricted Activity Days	113.150	113.150	\$9,919	\$9,919
Work Loss Days	19.438	19.438	\$3,891	\$3,891
<b>📊 Total Health Effects</b>			<b>\$1,239,902</b>	<b>\$2,785,541</b>

## HEALTH EFFECTS TRENDS

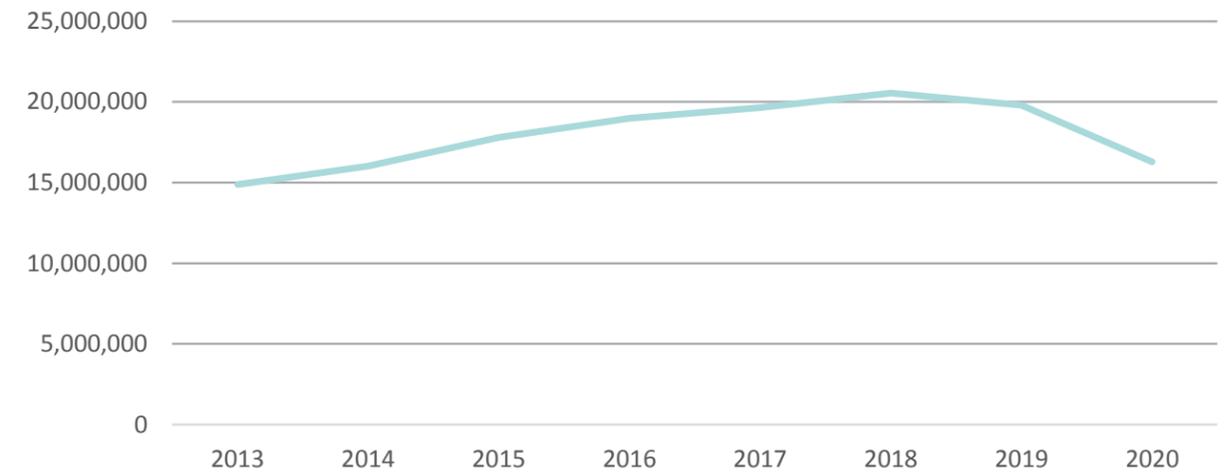
For the purposes of our efforts the average of the low and high totals were generated to assess trends over time.

**Figure 52: AVERAGE TOTAL ANNUAL HEALTH EFFECTS**



As can be seen the overall costs, as calculated using the COBRA tool, have seen dramatic reductions over the past eight years. Before using these trends to estimate the reductions of health impacts, looking at the variance of the annual vehicle miles is an important step.

**Figure 53: ANNUAL REVENUE VEHICLE MILES**



This trend shows that annual revenue vehicle miles was generally increasing up until the pandemic. While health effects costs decreased over this same period, accounting for the change in vehicle miles will better capture the health effects savings.

To do this the health costs per revenue vehicle miles was generated for each year. The reduction in cost per mile for each year relative to the benchmark year of 2013 was calculated. This reduction in health costs per mile can then be multiplied by the annual revenue miles to estimate the annual cost savings. These values are all captured in the table below.

**Table 25: HEALTH EFFECTS SAVINGS ESTIMATES**

Average Health Cost	Revenue Vehicle Miles	Health Costs per Revenue Vehicle Mile	Savings per Revenue Vehicle Mile	Annual Savings Estimate
\$2,012,722	14,876,928	\$0.1353	\$0.0000	\$0
\$1,623,296	16,017,669	\$0.1013	\$0.0339	\$543,759
\$1,268,688	17,807,199	\$0.0712	\$0.0640	\$1,140,475
\$1,232,703	18,988,409	\$0.0649	\$0.0704	\$1,336,267
\$940,217	19,643,162	\$0.0479	\$0.0874	\$1,717,336
\$1,041,115	20,539,809	\$0.0507	\$0.0846	\$1,737,746
\$743,251	19,794,081	\$0.0375	\$0.0977	\$1,934,720
\$560,855	16,289,980	\$0.0344	\$0.1009	\$1,643,041
				<b>\$10,053,343</b>

Using this methodology, **the total health savings from 2013–2020 is just over \$10 million dollars.**

## 7.4. RIDERSHIP

Passenger miles are currently collected and submitted to the NTD on an annual basis. Consequently, this metric should be acquired from those personnel and processes used to submit data to the NTD. This process may be in transition as internal data structures are being developed and evolved.

## 7.5. WASTE & WATER

Metric generation for both the waste and water performance categories will be built out based upon the recommended studies identified within this plan. At this time, research has indicated great benefit from using Energy Star Portfolio Manager<sup>56</sup> to store and monitor trends for both waste and water. Developed by the EPA, Portfolio Manager is a free benchmarking tool that was created to support facility management of energy, water, and waste.

Currently, the City of Columbus' Energy and Water Benchmarking Ordinance<sup>57</sup> requires use of this tool to report performance on some of the larger buildings in COTA's portfolio. Because it must already be used for these purposes, and because the tool itself was designed to help facilitate data consolidation and reporting for energy, waste, and water, it serves as an efficient tool to support these efforts in a consolidated manner.

## 7.6. RESILIENCY AND BUSINESS CONTINUITY

Uninterrupted operations can be quantified in a wide variety of ways. At the current time, the ideal metric for capturing resiliency had not yet been identified. Consequently, further engagement should be pursued to work with the appropriate departments to identify an already existing metric that captures resiliency for use in this initiative.

<sup>56</sup><https://www.energystar.gov/buildings/benchmark>

<sup>57</sup><https://www.columbus.gov/sustainable/benchmarking/>

# SUPPLEMENT B: EXTERNAL STAKEHOLDER ENGAGEMENT INTERVIEWS

During creation of this sustainability plan, identification, and review of various literature internal to COTA as well as from regional and national entities was necessary to ensure awareness of established efforts pertinent to the sustainability plan.

Additionally, specific regional entities were selected for engagement in discussion regarding the opportunities and goals the plan should center around. The purpose of these interviews was to inform COTA on outside perspectives many partners might have about the plan and its direction.

## 8.1. INTERNAL DOCUMENTS

### 8.1.1. COTA STRATEGIC PLAN

COTA's vision is "to move every life forward." This strategic plan articulates the initiatives driven from COTA's mission, vision, and guiding principles. The strategic plan will guide the operational plan and execution in the future.

Initiatives are categorized by COTA's guiding principles:

- Improve the customer experience
- Provide mobility options
- Achieve organizational excellence
- Prioritize the use of data and analytics

A strategy for engagement with opportunities lays out how to prioritize activities across three categories. Early opportunities have minimal investment and can be realized in under a year. Improvement projects are mid-length, 1–5 years, with moderate operational investment. Transformation indicates a significant operational investment in time and dollars where the benefits can be realized in more than 5 years. The initiatives are in figures blank through blank below.

The COTA strategic plan identifies initiatives base upon their four guiding principles. The focus of many of these initiatives focuses on equity, diversity, and inclusion, but sustainability was not written into this plan.

### 8.1.2. COTA SUSTAINABILITY REPORT

COTA's 2021 Sustainability Report outlines how the guiding principles of improving the customer experience, providing access to mobility options, achieving organizational excellence, and prioritizing the use of data and analytics connect sustainability. COTA states that their most important role in sustainability is to create a world-class transit system that their customers love. In this document, the term "sustainability" includes environment, diversity, safety, and resiliency within the organization and community.

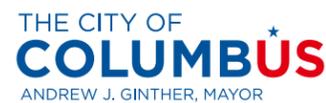
In alignment with the charter Mayor Andrew Ginther signed to work towards the objectives of the Paris Agreement for climate change in 2017, COTA committed to the following goals:

1. Achieve 100% sustainable and renewable energy and alternative fuels by 2025
2. Implement green procurement and purchasing
3. Achieve net zero carbon by 2050
4. Promote health by achieving the American Public Transportation Association's (APTA) Safety and Health Seal and the Global Biorisk Advisory Council (GBAC) Accreditation
5. Upgrade all COTA facilities to healthy building standards

To attain these goals, COTA plans to develop an environmental management system, devote personnel and financial resources to implement action items, create sustainability policies, and electrifying the non-revenue fleet.

COTA has already taken the first steps to sustainability by creating a report to track sustainability progress and goals, reducing particulate matter by 1.32 tons, reducing NOx by 14.98 tons, committing to purchasing 10 electric buses in 2022, recycling cardboard and scrap metal, collecting rainwater to wash buses, and beginning the convert lights to LED over the next five years.

## 8.2. REGIONAL INITIATIVES AND PARTNERS



### 8.2.1. CITY OF COLUMBUS CLIMATE ACTION PLAN

When the United States withdrew from the Paris Climate Agreement, Mayor Ginther recommitted Columbus to the Global Covenant of Mayors for Climate & Energy. The climate action plan (CAP) aims to reduce greenhouse gas (GHG)

emissions, implement equitable solutions to adapt future impacts, and build local resilience in response to a changing climate that is threatening vitality, livability, and prosperity of the community.

Columbus has been tracking municipal and community GHG emissions since 2013 which will serve as the baseline year to evaluate progress towards the target to be carbon neutral by 2050. Although overall emissions are on the decline, transportation emissions are rising. Single occupancy vehicles account for the majority of transportation emissions with the average household in Columbus having 2 cars and 81% of commuters traveling alone to work.

The CAP lists several initiatives to reducing GHG emissions and provide a blueprint to achieve the 2050 carbon neutrality goal. Of the CAP initiatives, COTA is specifically listed as a supporting agency for the following goals:

#### 1. LEAD AGENCY

- Increase Transit Use

#### 2. IMPLEMENTING PARTNER

- 10.3 Promote medium/heavy duty zero emission vehicles
- 11.1 Implement comprehensive multi-modal network
- 11.2 Reduce single occupant vehicle miles traveled
- 11.4 Support Active Transportation Infrastructure



### 8.2.2. LINKUS

<https://linkuscolumbus.com>

LinkUs is an implementation initiative created to address the future of key regional corridors in central Ohio and the communities they serve. The leading agencies engaged in the initiative include COTA, MORPC, Franklin County, and the City of Columbus. LinkUS is working to develop mobility corridors in a consistent, replicable, and comprehensive way across central Ohio.



### 8.2.3. OHIO EPA

<https://epa.ohio.gov>

The Ohio Environmental Protection Agency is a state agency whose goal is to protect the environment and public health by ensuring compliance with environmental laws by combining programs that previously had been scattered throughout several state departments. Of particular note are the technical support and funding grants available to assist initiatives COTA will undertake when pursuing the sustainability plan.



### 8.2.4. MORPC SUSTAINABLE 2050 REGIONAL SUSTAINABILITY AGENDA

MORPC (Mid-Ohio Regional Planning Commission) is a voluntary association of Central Ohio governments and regional organization that serves 15 counties. This regional sustainability agenda is an avenue for MORPC to provide a framework to pursue sustainable goals throughout the region. Goal areas include improving air quality, protecting and preserving natural resources, improving residents' quality of life, and promoting robust and inclusive sustainable growth.

The MORPC Sustainability Advisory Committee addresses regional issues affecting environmental sustainability and quality of life including air quality, energy, local food, water resources, trails, materials use, growth, and planning. COTA will maintain an awareness of any new targets identified and where opportunities for collaboration exist.

## 8.3. NATIONAL ENTITIES

### 8.3.1. AMERICAN PUBLIC TRANSPORTATION ASSOCIATION (APTA)

<https://www.apta.com>

APTA is a nonprofit international association that provides a wide variety of supports to its members. APTA offers a variety of resources to support transit agencies pursuing sustainability. While two have been identified here, continual awareness of their offerings will prove useful during the plan.

ATPA Standards Development Program created a guiding document titled “Quantifying Greenhouse Gas Emissions from Transit”.<sup>58</sup> This document was used to establish the emissions benchmarking used within the plan. Additionally, this guide provides specific instructions for generating a mode shift factor, which is critical in quantifying the emissions impact resulting from increased ridership.

APTA’s sustainability commitment program for transit agencies provides a framework for goal setting, peer benchmarking, and recognition.<sup>59</sup> As COTA executes its sustainability plan, it will be establishing practices required for recognition in the program and building upon previous efforts. Current efforts will likely put COTA above the entry signatory level to pursue one of four levels of recognition.

### 8.3.2. FEDERAL TRANSIT ADMINISTRATION (FTA)

<https://www.transit.dot.gov>

The FTA provides financial and technical assistance, oversees safety measures, and helps develop research to assist local public transit systems across a wide range of technologies. This includes providing grants and resources to transit agencies. COTA will continue its engagement with the FTA and various supports it provides throughout implementation of the sustainability plan.

### 8.3.3. U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

<https://www.epa.gov>

The EPA’s mission is to protect human health and the environment. This mission aligns directly with COTA’s sustainability goals and their impacts on cleaner air, land, and water. One aspect of the EPA’s efforts is to provide grants and training as well as rules and policy. COTA will continue its engagement with the EPA and the supports it provides throughout implementation of the sustainability plan.

<sup>58</sup>[https://www.apta.com/wp-content/uploads/Standards\\_Documents/APTA-SUDS-CC-RP-001-09\\_Rev-1.pdf](https://www.apta.com/wp-content/uploads/Standards_Documents/APTA-SUDS-CC-RP-001-09_Rev-1.pdf)

<sup>59</sup><https://www.apta.com/research-technical-resources/sustainability/apta-sustainability-commitment/>

## 8.4. REGIONAL PARTNER INTERVIEWS

COTA’s pursuit of this sustainability plan will impact the Columbus region and play a role in assisting achievement of broader regional goals and objectives around sustainability. Consequently, various regional entities were engaged in interviews to obtain insights and perspectives from outside of COTA on its role in collaborative regional transformation. These outside perspectives serve to illuminate areas of opportunity where regional support exists and potential partners in initiatives whose success depends upon a broader regional partnership. At a societal level, de-carbonizing transit will require desirable and functional alternatives to the current paradigm, which are single passenger vehicles (SPVs).

Interviews were conducted with staff from the following regional entities:

1. City of Columbus
2. Mid-Ohio Regional Planning Commission
3. Franklin County
4. Ohio State University
5. Ohio Environmental Council
6. City of Hilliard

### 8.4.1. SUMMARY OF INSIGHTS

The feedback provided was grouped into areas of opportunity, needs, and challenges. Below we present a compilation of the feedback within based upon which category they best fit under:

#### 1. OPPORTUNITIES

- a. Support was voiced for big bold transformative initiatives
  - i. CNG is a step in the right direction, but more is needed; stakeholders noted that CNG vehicles still pollute.
  - ii. Regional solution will require expansion of transit in orders of magnitude; stakeholders are more concerned with the region’s total transportation emissions than COTA’s emissions in particular. Meaning, COTA’s potential to be a tool for decarbonization is of highest concern.
  - iii. Implementation of reduced emission vehicles, such as BEB adoption, should be mindful of the optics of access and which communities are impacted.
  - iv. Emission reductions have positive regional outcomes.
- b. Cross agency coordination will be critical to align development efforts with route mapping and expansion. For example, it was noted that public transit stops are not currently considered in residential development discussions.
- c. Shifting development from urban sprawl to concentrated corridors that facilitate various alternatives to SPV.
- d. Collaborate with agencies with certification processes to gain recognition and leverage partner resources.

- e. Increased desirability from expanded services resulting from more frequent service and reduced travel times.
  - i. Transit services can reduce parking demand and congestion.
  - ii. Transit can be a key player in supporting regional business operations through access to both customers and the workforce
  - iii. Interface with other transportation initiatives such as expanded bike access.
- f. Collaboration on public needs can reflect positively on COTA while assisting with regional crises such as inclement weather, emergency response, and vaccine clinic access during the pandemic.

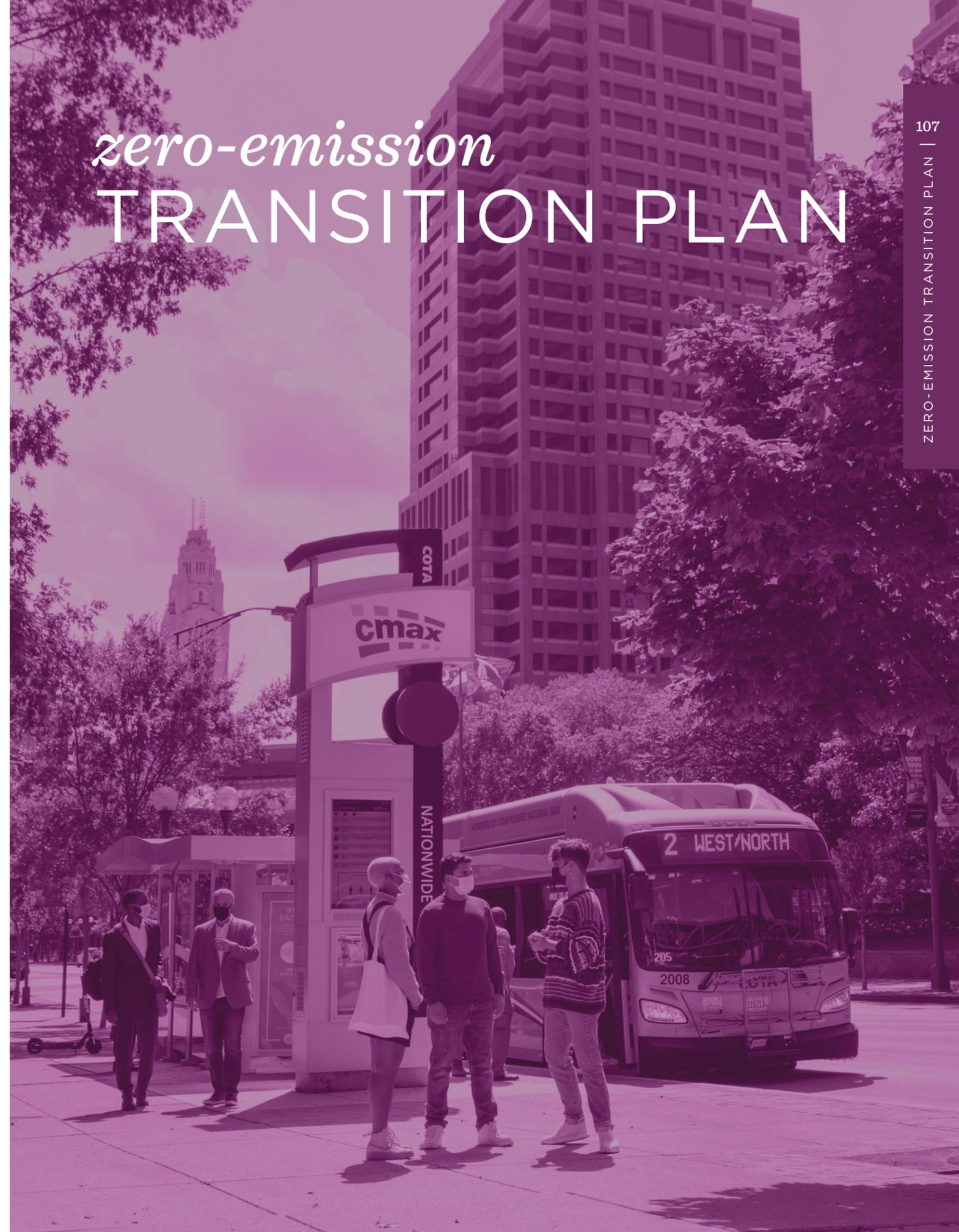
## 2. NEEDS

- a. Initiatives must incorporate equitable community engagement, particularly equity, diversity, and inclusion.
- b. Community engagement and involvement is critical, especially around EDI targets
  - i. Developing an effective vernacular to identify needs and convey constraints.
- c. Clear identification of who on COTA staff serves as liaison to various external agencies would be helpful.
- d. Key to successful expansion is connecting work centers to workers, including first and last mile solutions.
- e. Involvement from bedroom communities to facilitate broader solutions.

## 3. CHALLENGES

- a. Eliminating regional transportation emissions will require unprecedented interagency collaboration.
- b. COTA isn't viewed as leading in sustainability and there is little understanding of current progress and its positive impacts.
- c. COTA is viewed as the key player of emissions outcomes and partners feel hampered
- d. Recognition that the bold transformative change desired requires funding.
- e. Regional goals will require massive buildout of transit capabilities as an alternative to SPVs.
- f. Perception that public view of transit is option of last resort and for some the less desirable option.

# zero-emission TRANSITION PLAN



# zero-emission TRANSITION PLAN

On December 1, 2021, the Federal Transit Administration issued a letter<sup>60</sup> notifying pertinent agencies that a new requirement had been added for eligibility within numerous existing grant programs. This requirement is a Zero-Emission Transition Plan (ZETP). This document was generated for the Central Ohio Transit Authority (COTA) to fulfill that requirement. It is built upon various existing initiatives and resources which will be referenced within this plan.

The requirements identified within this letter can be seen below:

- Demonstrate a long-term fleet management plan with a strategy for how the applicant intends to use the current request for resources and future acquisitions.
- Address the availability of current and future resources to meet costs for the transition and implementation.
- Consider policy and legislation impacting relevant technologies.
- Included an evaluation of existing and future facilities and their relationship to the technology transition.
- Describe the partnership of the applicant with the utility or alternative fuel provider.
- Examine the impact of the transition on the applicant's current workforce by identifying skill gaps, training needs, and retraining needs of the existing workers of the applicant to operate and maintain zero-emission vehicles and related infrastructure and avoid displacement of existing workforce.

This notification letter further indicated that its intent was to provide information in advance of a Notice of Funding Opportunity (NOFO) for the impacted programs. This NOFO is expected to contain further detail on exactly what will be required. Consequently, a focused investment of resources to generate COTAs ZETP before such requirements are known could result in an unnecessary application of resources.

Fortunately, this requirement manifested while efforts were underway at COTA to create a sustainability plan. This plan encompasses sustainability goals that include emissions but also extend more broadly to promote organizational sustainability beyond this one area. The GHG emissions goal being adopted is to be net-zero pounds of carbon dioxide equivalent per annual vehicle mile (lbs-CO<sub>2</sub>e/ mile) by 2045. Consequently, that effort was establishing a substantial foundation for this ZETP requirement. This document serves as a starting point for that effort and is a compilation of resources generated within the creation of the sustainability plan that are expected also serve as supporting documentation for the ZETP.

<sup>60</sup><https://www.transit.dot.gov/regulations-and-programs/dear-colleague-letters/fta-dear-colleague-letter-fleet-transition-plan>

## 9.1. INTRODUCTION

COTA's mission is to provide solutions that connect people to prosperity through innovation, dedication, and teamwork. As society has increased its focus on eliminating emissions, transportation agencies across the nation have identified the need to de-carbonize operations. This is because transportation comprises 29% of total U.S. greenhouse gas emissions.<sup>61</sup> While public transportation is only one part of the transportation sector, agencies will need to establish emission free operations to eliminate their contribution to climate change. Furthermore, to achieve transportation emission reductions across society, regional governance, planning, and resources will be needed to support expansion of existing transit services to meet regional goals and facilitate zero-emissions mobility for all citizens.

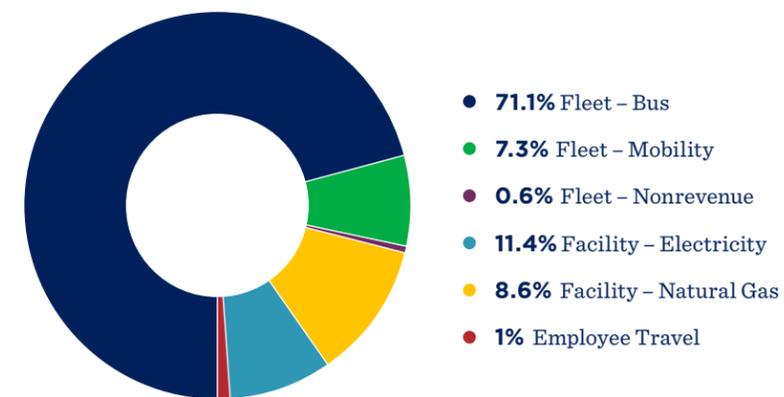
Within COTA's Sustainability Plan, a goal of net-zero greenhouse gas emissions within all operations by 2045 has been identified. This will be measured in pounds (lbs) of CO<sub>2</sub>e per revenue vehicle mile. Emissions are normalized by revenue vehicle miles in this metric to ensure reductions are being achieved as services vary. This will ensure a correct understanding of emission reductions as routes and services change due to transit system growth or unforeseen challenges such as the recent pandemic.

Such an initiative will require a plan to facilitate transition from traditional fossil fuel sources towards emission-free vehicles and facilities. COTA's began its journey in 2013 with the addition of CNG vehicles within its bus operations. Moving forward, COTA is pursuing the acquisition of battery electric buses (BEBs) to further reduce operational emissions. While the current plan identifies an aspirational goal of 100% EVs in 2035, this target will be continually evaluated and revised based upon changing economics, emergent technologies, and EV technology's ability to meet resiliency and business continuity objectives. While there is confidence in the value of including EVs in its vehicle portfolio, ongoing investigation is being conducted to assess the optimal proportion of BEBs in the long term.

## 9.2. EMISSIONS SUMMARY

To engage with emissions reductions from an organizational view, an understanding of what portions of operations are generating emissions can help facilitate strategic investment for the greatest impact. The figure below presents the breakdown of GHG from 2019.

**Figure 54: BREAKDOWN OF COTA'S ANNUAL GHG EMISSIONS IN 2019**



This breakdown shows that the majority of COTA's current emissions are associated with its bus fleet (71%), facilities second (20%), and the mobility fleet third (7.3%). This understanding should allow prioritization of resources and efforts to begin engagement with the major contributors and opportunities related to each.

<sup>61</sup><https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

As can be seen in Figure 55, COTA's existing efforts towards transitioning the bus fleet away from diesel vehicles assisted in achieving organizational GHG reductions of 11% since the baseline year of 2013. This achievement includes fleet GHG reductions, increases in facility GHG emissions, and electrical grid GHG reductions that occurred between 2013 and 2020. These comprehensive GHG reductions occurred before the 2045 goal was established and reflects the agencies existing awareness and pursuit of improvement. While GHG reductions have been achieved since 2013, these achievements are slightly behind the time trend needed to achieve a 2045 Net-Zero Emissions goal.

**Figure 55: CURRENT STATUS OF GHG GOAL**



Several changing factors impacted emission reductions since 2013. These include:

**1. GHG CHALLENGES**

- a. COTA has experienced a 28% increase in facility GHG emissions. This resulted from the expansion of facilities needed for services as well as increased facility energy consumption required to meet safety requirements of the CNG fleet. Due to the emissions associated with electricity and natural gas, this resulted in increased energy and GHG emissions at the organizational level.
- b. The COVID-19 pandemic resulted in reduced revenue vehicle miles in 2020 of 19% when compared to the previous three years. This increased the greenhouse gas metric of lbs-CO2e/revenue vehicle mile as non-varying emissions sources, like building energy, remained relatively constant but were divided by a substantially lower revenue vehicle mile value.

**2. GHG SUCCESSES**

- a. The fleet achieved a 17% reduction in GHG emissions since 2013, largely due to the transition to CNG vehicles.
- b. The EPA tracks GHG emissions from the electrical grid in its Emissions & Generated Resource Integrated Database (eGRID).<sup>62</sup> Within eGRID, the portion of the electric grid COTA and Columbus are connected to, RFC West, has seen a 30% reduction in GHG intensity of electricity. This reduction has occurred because RFC West has experienced a shift in its generation assets towards reduced or zero GHG emission sources. This means that on average, using 1 kWh of energy in 2021 has 30% lower GHG emissions associated with it when compared to using 1 kWh in 2013.

<sup>62</sup><https://www.epa.gov/egrid>

**9.3. LONG-TERM FLEET MANAGEMENT PLAN**

The full transition to zero-emissions operations requires the pursuit of a portfolio of zero-emission vehicles and energy sources to support facility operations and fueling. This includes vehicle assets used for bus services, mobility services, and non-revenue vehicles that support the rest of the fleet's operations. It also includes stationary assets in the form of facilities that house the staff who service and support COTA's mission. Based upon the emissions breakdown illuminated in Figure 54, the greatest contributor to GHG emissions and thus a focus of engagement lies with transitioning the bus fleet.

While the immediate focus for reducing emissions is not the mobility and non-revenue vehicles, COTA's team will continue to monitor available replacement technologies for these vehicles. COTA's team is engaged in identifying and pursuing alternative fuel sources for the mobility fleet and has met with some manufacturers to investigate potential options. At this time, no commercially available EV options that meet FTA requirements could be identified for these vehicles. Because technology options for mobility vehicles are just starting to become available, and are not yet fully commercialized, COTA will re-evaluate mobility vehicle options on a regular basis. This could happen as part of regular job responsibilities for specific COTA staff, or, as part of the 5-year Sustainability Plan update.

Non-revenue vehicles contributed less than 1% of COTA's GHG emissions in 2019. Due to its small contribution, resources will be focused on other larger GHG contributors in the near term. If non-revenue vehicles fueling can be conducted outside of fueling operations for the larger bus fleet, then the transition to EV non-revenue service vehicles can be pursued as soon as locations for charging are available and replacement equivalents are identified. This would require these vehicles have compatibility with the available charging cabinets. Availability of EV alternatives for the non-revenue fleet will determine when they can be transitioned to zero-emissions in the long term. Once established, a well-planned charging schedule will be beneficial to coordinate fueling. Non-revenue vehicle charging at COTA bus facilities can be assessed once bus charging schedules are developed. In the near term, hybrid vehicles can increase fuel economy by between 25% and 33%,<sup>63</sup> reducing emissions while supporting operational needs. Hybrid vehicles are currently being pursued to replace some existing vehicles that are at end of life. Because of the high public visibility of specific non-revenue vehicles, prioritization of zero-emission replacements may be desirable in those cases.



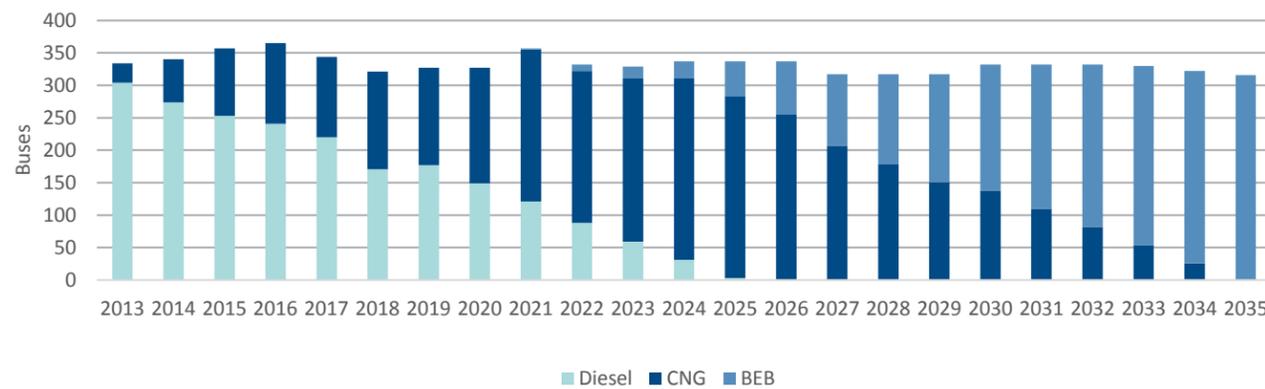
<sup>63</sup><https://www.carsdirect.com/car-buying/fuel-economy-comparison-hybrid-vs-diesel-vs-gas>

As previously presented in Figure 54, COTA's bus fleet is the primary contributor of GHG within COTA's operations. The bus fleet is currently comprised of diesel, CNG, and the two new BEBs that were recently obtained. Decarbonizing this portion of the fleet will require continued elimination of diesel within the portfolio. To do this COTA plans to fully leverage the already built out CNG infrastructure through its end of life, which is 15 years. All while expanding charging infrastructure to facilitate expanded incorporation of BEB's. Together this fleet mix will need to provide for all COTA's service offerings, which will likely expand in the long term.

To provide near term guidance on bus fleet investment strategies, we developed a model that can be used to assess the economics of bus fleet investment through 2035. This model was based upon recent cost trends for vehicles, fuels, maintenance, and fueling infrastructure. Currently, an aspirational pursuit of electric vehicles is outlined in this model to quantify the impacts of such a strategy. It has already been recognized that there are technical obstacles to pursuing this forecast and investigation has already begun to better inform the feasibility of this aspirational goal. This aligns with the Sustainability Plan's active process of reevaluation and engagement that will allow navigation of changing technologies and economics. This will be particularly critical during the coming decades as many critical components required of zero-emission fleets will be experiencing accelerated and dynamic evolution.

Figure 56 shows the quantity of diesel, CNG, and BEB vehicles through 2035 within this model. In the model, COTA purchases 46 more CNG vehicles by 2025, and then begins purchasing 28 BEBs per year from 2025 to 2035. This will require the installation of additional charging cabinets between 2027 and 2035 at McKinley. The addition of 3 pantographs is also assumed in the near term, which will enable one cabinet to charge three buses during each nightly fueling operation.

**Figure 56: BUS PORTFOLIO BREAKDOWN BY VEHICLE TYPE**



Based on this vehicle acquisition strategy, COTA will have additional EV charging capacity needs in 2026 which could be met through pursuit of a new utility feed at McKinley. Additional charging capacity will also be required at Fields by 2030 to facilitate 22 additional charging cabinets. This timetable also requires navigation of other constraints required by federal funding mechanisms including the 20% spares ratio.

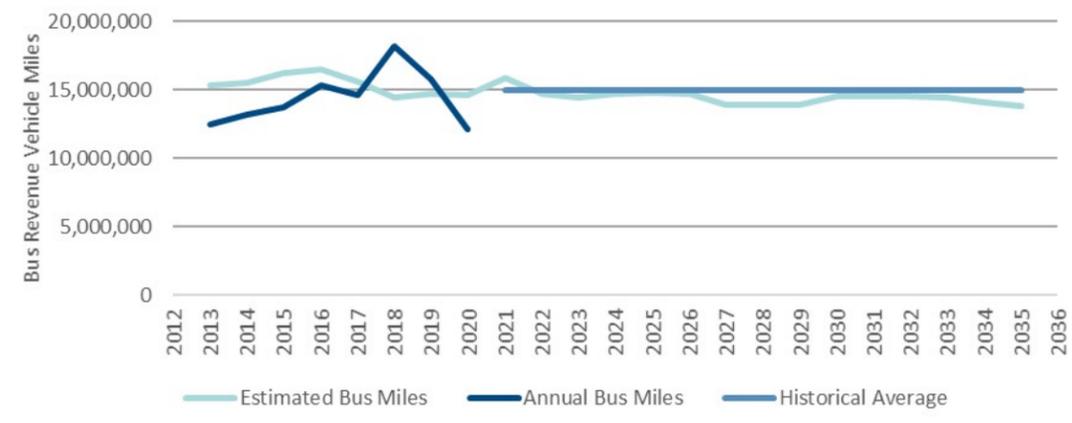
This proposed strategy will be further analyzed in the 2022 to identify options to meet charging needs with a combination of depot and on-route charging, or to pursue an alternative vehicle portfolio makeup.

**9.3.1. TECHNICAL VIABILITY**

The immediate fueling obstacle to expanding BEB operations within COTA are electrical capacity limitations at the bus facilities. The power requirements for using depot chargers for the full bus fleet cannot be accommodated on current electrical utility services. Through engagement with the utility, there is capacity that can accommodate some charging cabinets at the current time which is summarized below:

1. Capacity limitations restrict the number of EV charging cabinets that can be added at COTA facilities and thus the number of BEBs that can be fueled in the near term:
  - a. EV Charging capacity is limited to 34 cabinets within current service connections at existing facilities
    - i. 20 cabinets at McKinley
    - ii. 14 cabinets at Fields (2 already installed)
  - b. Additional connections can be pursued with both electric utilities, AEP Ohio and Columbus Department of Power. The cost of new service connections and the additional charging capacity they would offer is being pursued.
2. Based upon the make and model of BEBs being acquired at the current time, 2 buses can be charged using the same depot charging cabinet during overnight fueling operations between 7 PM and 5 AM.
  - a. Maximizing available capacity to support depot charging at McKinley and Fields will enable charging for 68 BEBs
    - i. 40 BEBs at McKinley
    - ii. 28 BEBs at Fields
  - b. On-route charging using a pantograph would likely increase depot charging capability by at least one vehicle per charger per night. The location of on-route charging would determine how many BEBs service could be aligned to enable the added range and reduced overnight fueling this capability would allow. Future projections currently assume the addition of 3 pantographs would enable depot charging to support 3 BEBs per cabinet.
  - c. BEB vehicles are still new to COTA with the first 2 BEBs having arrived in 2021. Investigating actual charging needs will be established for identification of actual charging capabilities per charger based upon actual operations. Maximizing the number of buses that could be fueled per depot charger would minimize the cost of the capacity buildout required for expanding the EV proportion of the bus portfolio.
3. Vehicle range differs between vehicle technologies. Consequently, BEB buses may not be able to replace CNG buses on specific routes without additional planning and fueling infrastructure. The vehicle range for each vehicle type used in the model are seen below:
  - a. Diesel buses – 46,000 miles per year
  - b. CNG buses – 44,000 miles per year
  - c. BEB buses – 39,000 miles per year
4. The annual revenue vehicle miles that can be provided within this bus portfolio transition is constrained by BEB vehicle range and on-route charging. Between 2013 and 2021, an average of 15.4 million annual revenue miles of bus service were provided. The current model projects an average of 14.4 million annual revenue miles of bus service, 7% below historical levels. This indicates that, based upon current ranges assumptions, additional buses will be needed to maintain service at previous levels. A chart of these trends can be seen below.

**Figure 57: HISTORY AND PROJECTIONS OF BUS ANNUAL REVENUE MILES**



While COTA is actively navigating its long-term path towards zero-emissions, the following near-term steps will be pursued:

1. Installation of the maximum number of EV charging cabinets within current service capacity by 2023.
  - a. Adding 10 cabinets at McKinley 2022
  - b. Adding 10 cabinets at McKinley 2023 for a total of 20
  - c. Adding 12 cabinets at Fields 2022 for a total of 14
2. Include on-route charging in the near term within concentrated vehicle corridors including the planned BRT routes associated with the LinkUS initiative. This will allow direct assessment of these systems capabilities in leveraging fueling outside of overnight fueling periods at locations other than the bus facilities.
  - a. 3 on-route charging pantographs were added by 2025. It is assumed this increases the charging capability for all EV Cabinets from 2 to 3 buses every night.
  - b. The number selected ensures all BEBs in the fleet can be scheduled to utilize on route charging during daily operations.
3. Determine the maximum charging cabinet and capacity requirement at the McKinley facility, whose CNG fueling system will reach end of life first.

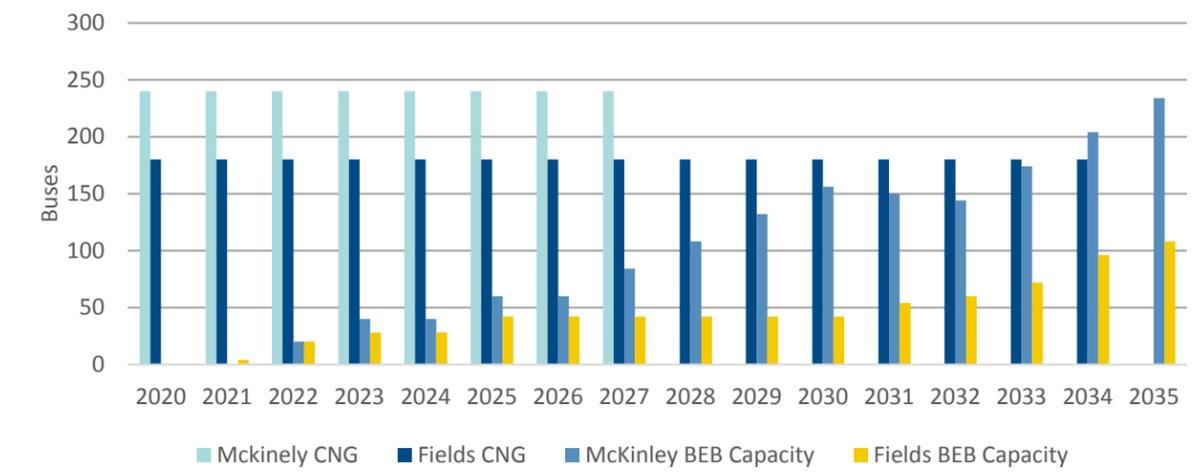


Current long-term planning is based upon the aspirational forecast of BEB expansion. The projected fueling capacity at both the McKinley and Fields facilities was generated assuming the following actions:

1. An additional 10 MW feed is obtained at the McKinley facility in 2026 which adds capacity for up to 58 additional EV cabinets
2. 8 cabinets are added annually to McKinley between 2027 and 2035
3. Capacity for an additional 8 cabinets will exist at McKinley after decommissioning of the CNG plant based upon initial interval analysis of that meter.
4. This proposed expansion of BEB within the fleet additionally requires:
  - a. Additional capacity not yet accounted for either at Fields or another facility
  - b. Planning to ensure electric vehicle fueling is established in a way to fulfill operational resiliency requirements.

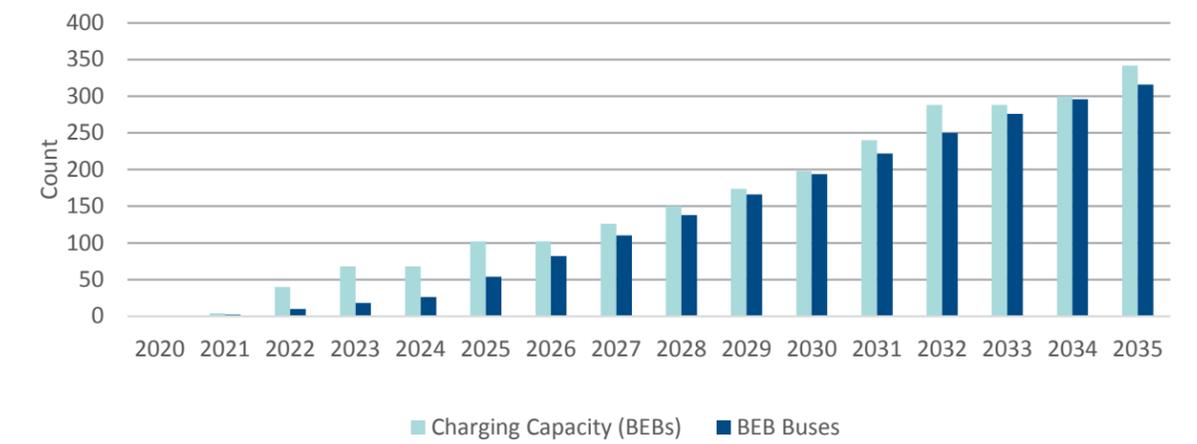
Due to the logistics of building out EV charging capabilities, beginning with a focus on the McKinley facility, allows the option of decommissioning the CNG operations in 2028 at that equipment's end of life. Based upon this buildout of charging infrastructure the fueling capacity for both CNG and BEBs can be seen in the figure below.

**Figure 58: FUELING CAPACITY PROJECTIONS BY FACILITY**



This capacity buildout aligns with the currently planned BEB purchase schedule assumed in this model. This is to ensure charging capacity is in place before vehicles have been acquired and are depended upon for service. The figure below presents the currently projected charging capacity and expected BEB vehicle counts.

**Figure 59: BEB FUELING CAPACITY VERSUS PURCHASE PROJECTIONS**

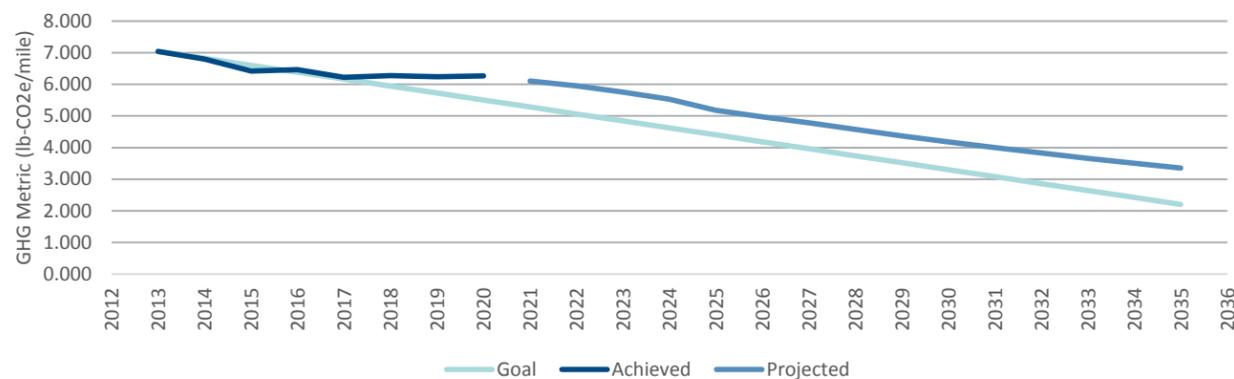


That said, additional investigation is necessary to identify the specific path and logistics of the proposed timetables. Changing EV costs and the fleet limitation requirements required for federal funding constrains vehicle transition to a limited number of buses per year, which is 28 within current planning. This highlights the importance of fully leveraging the investment already made in CNG buses in the near term.

Based upon the projected vehicle acquisition, operating miles, and associated emissions the estimated GHG projections that result can be seen below. These projections also incorporate the achievement of 15% reductions in facility energy use through efficiency measures and expected carbon reductions within the electricity grid.



**Figure 60: PROJECTED GHG METRIC ACHIEVEMENT**



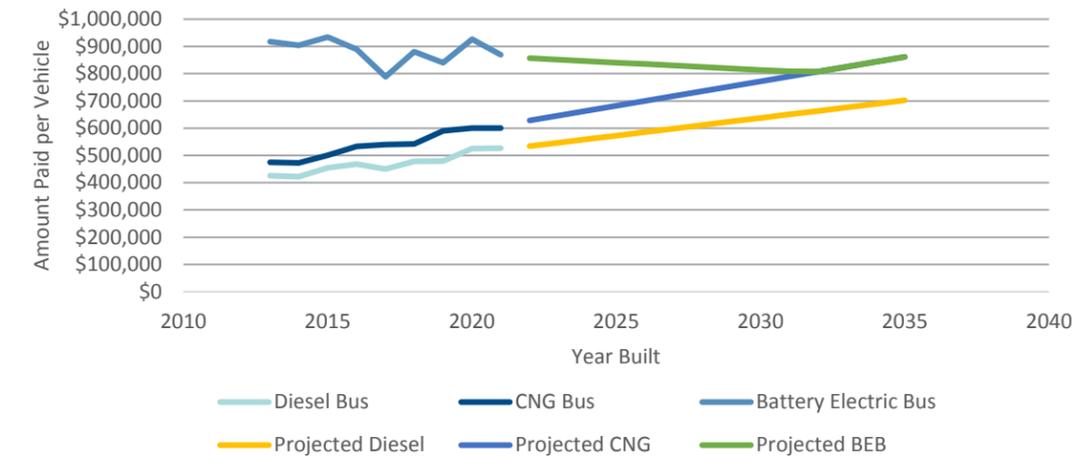
As the figure shows, additional GHG reductions are needed to stay on track with a 2045 target year. Within the process, validation of achieved reductions will be an important activity to verify actual reduction achievements as well as identify other opportunities that may be pursued during this period. The remaining margin of GHG reduction after such efforts could be achieved by contracting energy supplies for both CNG and electricity from renewable sources. For electricity, we recommend evaluating on-site renewable energy, and off-site contracting options for renewable energy content electricity. Purchasing renewable energy may come at a price premium or could save money, so while it is an option to remain “on track” we would recommend minimizing its cost in order to allow the most capital be invested in improving COTA’s capabilities through low emissions vehicles and fueling capabilities. In other words, we believe it is better for COTA to spend available capital on BEBs than on purchasing, say, renewable energy credits. Based upon our projections, sourcing 50% renewable electricity use across COTA’s portfolio through 2035 would maintain alignment with GHG reductions goals. Alternately, sourcing landfill RNG for roughly 40% of CNG fuel would also achieve the necessary reductions though 2030 before CNG fleet proportions mitigate this benefit. This illuminates the need to prioritize an understanding RNG as part of fueling strategies within natural gas contracts.

**9.3.2. ECONOMIC VIABILITY**

Comparing vehicle economics requires performance assumptions for each of the bus types used by COTA. For this analysis calculations were based on actual data from COTA’s fleets and publicly available references.

Using historical NTD data to estimate vehicle cost trends for diesel, CNG, and BEBs, as shown below with projections of future prices. The projections show that the increased premium required for purchasing electric buses diminishes in the coming years. For our analysis, once the projections for CNG and BEB vehicle costs are at parity, we apply a common cost for both.

**Figure 61: BUS PURCHASE COST**



While these vehicle pricing projections serve as a useful starting point, price volatility should be expected in this sector. COTA will monitor EV bus prices as changing market dynamics on components like batteries and their material inputs result in changing economics over time.

We also apply a 1.5% price escalation factor to fuel costs for each vehicle type to account for the potential of increased energy prices over the period analyzed, starting with known fueling prices for 2019. The expected maintenance costs for each vehicle type are held constant across the analysis.

Because the bus types being compared have different expected lifespans, an equivalent annual cost (EAC) was calculated using the net present value (NPV) of the purchase cost and total expected maintenance and fuel costs over the lifespan of the vehicle.

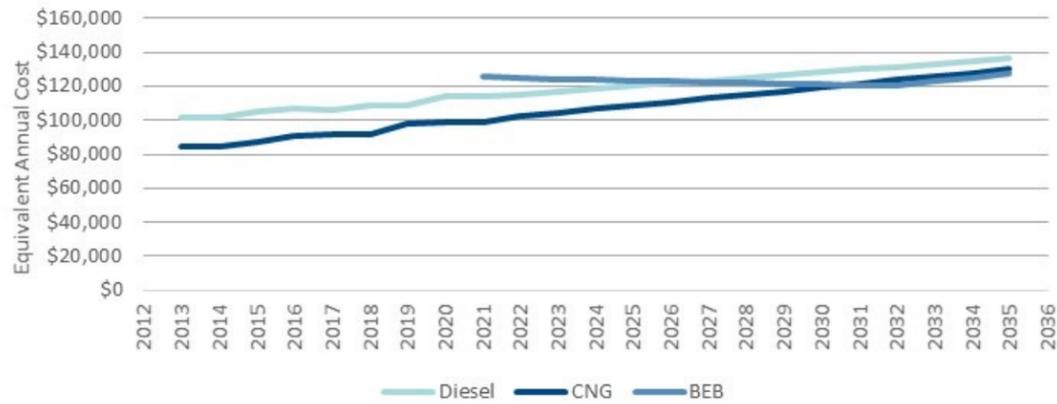
A discount rate of 5% was used for these calculations. This allows a fair comparison between the technologies as the cost of vehicle purchase, maintenance, and fueling change over time. The table below presents the changing EAC for each vehicle type on a five-year increment.

**Table 26: EQUIVALENT ANNUAL VEHICLE COSTS**

YEAR	DIESEL	CNG	BEB
<b>2015</b>	\$105,055	\$87,197	\$132,397
<b>2020</b>	\$133,810	\$98,811	\$132,033
<b>2025</b>	\$120,155	\$108,671	\$123,101
<b>2030</b>	\$128,280	\$119,385	\$120,931
<b>2035</b>	\$136,551	\$130,147	\$127,190

The assumptions made around changing purchase and operational costs results in a changing return for the proposed vehicle transition. The figure below shows the EAC trends through 2035. The EAC for BEBs begins in 2021 as a reflection of the year of the first acquisition of these EVs.

**Figure 62: VEHICLE EQUIVALENT ANNUAL COSTS OVER TIME**



This analysis indicates that in the near term there is an increased lifetime cost of the BEBs when compared to diesel, but that over time savings should occur. Savings are based upon vehicle purchase and operations and does not account for the investment required to install the electric fueling infrastructure needed to support the BEBs.

By applying the difference in EAC to the projected fleet transition plan, we can quantify the lifetime vehicle savings for this strategy. The major drivers for the difference in cost between the different bus types are:

- The difference in assumed vehicle life since each diesel bus is expected to function longer than a CNG or BEB. The 12-year equipment life currently assumed for CNGs and BEBs is based upon the minimums required by the grants used in vehicle acquisition. If longer useful life is achieved for these vehicles, the economics will improve.
- The changing costs of fueling over time. This analysis applies the same price escalation factor of 1.5% to all three fuel sources. Monitoring changing fuel prices will be important to ensure operational costs are informing long term decisions.
- The assumed charger costs obtained from COTA for this analysis vary from other costs values cited in NREL studies. Further, as EV technologies are adopted and manufacturing increases, the cost of charging equipment could come down.

Finally, a comparison of the lifetime vehicle savings can be compared to the cost of installing the fueling infrastructure for both the CNG and BEB vehicles.

**Table 27: LIFETIME SAVINGS FROM TRANSITIONING FROM DIESEL**

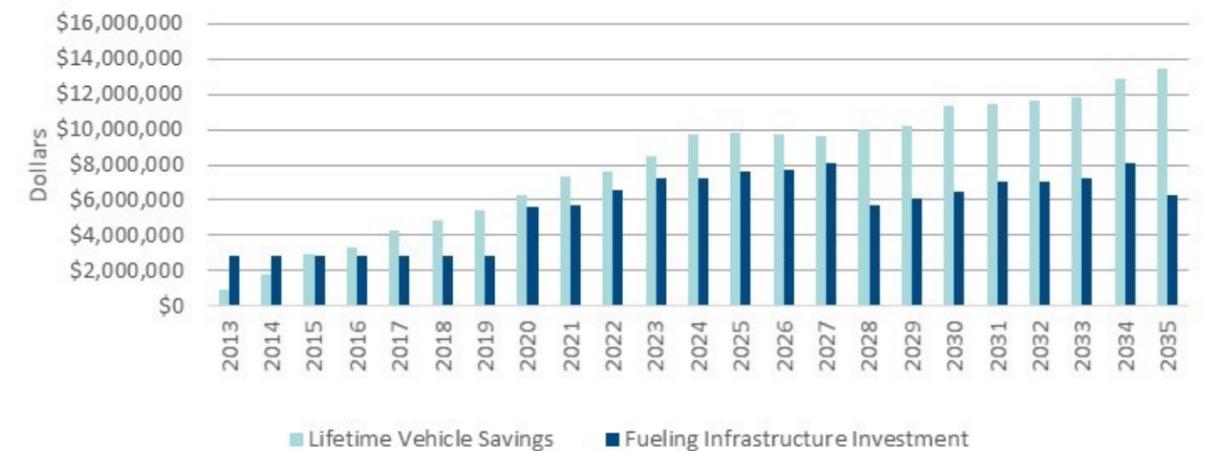
	LIFETIME VEHICLE SAVINGS	ALTERNATIVE FUELING COSTS	LIFETIME COSTS
CNG	\$52,000,000	\$84,000,000	\$32,000,000
BEB	-\$32,000,000	\$80,000,000	\$112,000,000
<b>TOTAL</b>	<b>\$20,000,000</b>	<b>\$164,000,000</b>	<b>\$144,000,000</b>

The equipment costs to support the fueling for both CNG and BEB buses are based upon COTA records and cost data from various studies. The fueling infrastructure costs for CNG buses are assumed to be equivalent at both sites and is estimated to be \$37 million based upon records provided for the Fields upgrade. Additional costs for the CNG buses include an annual support contract and increased facility utility use associated with require ventilation and safety monitoring. The expected lifespan of this equipment is 15 years. Fueling infrastructure costs for BEB buses are based upon the cost's assumptions below. The base costs cited were increased to account for professional services (30%), contingencies (35%), and unallocated contingencies (10%). It was noted that there existed high variability in charger equipment and installation costs between various NREL studies.

- Depot Cabinet - \$437,500<sup>64</sup>
- On-Route Pantograph Charger - \$1,312,500
- Cabinet/Pantograph Maintenance - \$4,800/year<sup>65</sup>
- Additional 10 MW (58 cabinet) AEP circuit - \$6,000,000<sup>66</sup>

For the fleet transition modeled, the lifetime vehicle savings is compared to annualized costs through 2035 for the estimated EV fueling infrastructure that will be required. These annualized costs are generated by distributing the total costs across the expected equipment life as an average value. The purpose of this comparison is providing an initial comparison between the fueling infrastructure required and the expected lifetime vehicle benefits.

**Figure 63: LIFETIME VEHICLE SAVINGS COMPARED TO ANNUALIZED FUELING INFRASTRUCTURE COSTS**



From a high level, this means that pursuing this strategy should be economically beneficial but is contingent upon the many assumptions made within this calculation. A comparison of this proposed electrification transition, as compared to a "business as usual" approach of diesel vehicles, can be seen in the next figure. It shows that initially investments are required to facilitate the necessary infrastructure to support BEB expansion but in the long-term begins to yield returns. It is important to note that this chart does not display future savings from BEBs whose useful life extends beyond 2035. It is worth noting that externalized costs, such as regional healthcare impacts, are not included in this trend.

<sup>64</sup>[https://linkuscolumbus.com/wp-content/uploads/2021/05/EWC-HCT\\_Capital-Cost-Technical-Memorandum\\_Draft\\_5.20.21.pdf](https://linkuscolumbus.com/wp-content/uploads/2021/05/EWC-HCT_Capital-Cost-Technical-Memorandum_Draft_5.20.21.pdf)

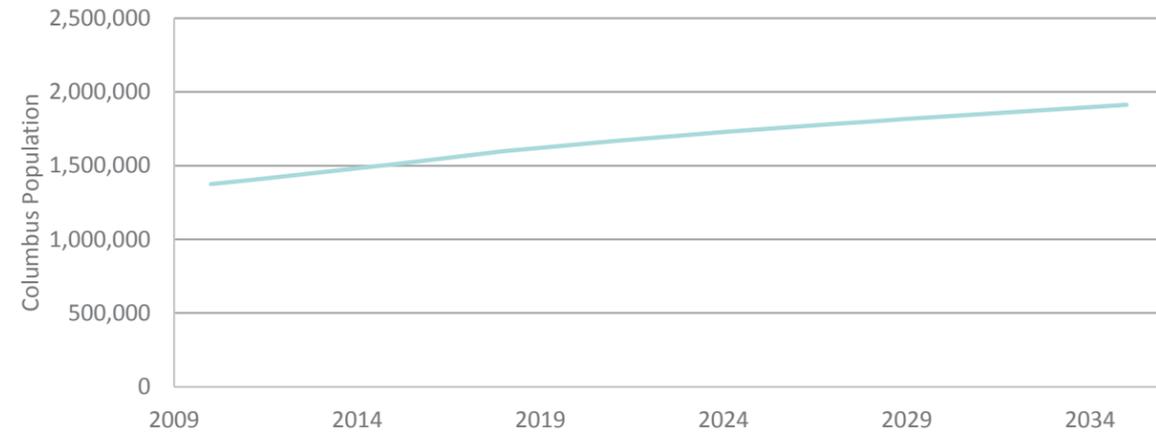
<sup>65</sup>[https://afdc.energy.gov/fuels/electricity\\_infrastructure\\_maintenance\\_and\\_operation.html](https://afdc.energy.gov/fuels/electricity_infrastructure_maintenance_and_operation.html)

<sup>66</sup>High level estimate identified during initial discussion with AEP and subject to change

### 9.4. RESOURCE AVAILABILITY

COTA's funding comes primarily from regional sales tax. From 2017 to 2020, sales tax comprised 68% of COTA's annual revenue. Since the Columbus region is projected to grow in the coming decade, as can be seen in Figure 64, there should be an associated increase in sales tax revenue.

Figure 64: PROJECTED COLUMBUS POPULATION GROWTH<sup>67</sup>



This growth rate however may not exceed the regional drive to expand and increase transit services to meet regional emissions goals like those laid out in the City of Columbus Climate Action Plan.<sup>68</sup> Consequently, collaboration with regional agencies to acquire the necessary funds to achieve zero-emissions while at the same time expanding services will be of critical importance. This is displayed within current collaboration on the LinkUS<sup>4</sup> initiative.

Funding mechanisms that have been relied upon historically, such as grants from federal agencies, will continue to be pursued. Particularly those that support zero-emission fueling infrastructure and vehicles. Below are presented several federal grant opportunities from the FTA already monitored by COTA that could apply to the acquisition of zero-carbon vehicles and the equipment that supports them:

- Low or No Emissions Bus Discretionary Program (5339c)<sup>69</sup>
- Metropolitan Planning and State Planning Research Programs (5305d and 5305e)<sup>70</sup>
- Buses and Bus Facilities Discretionary Program (5339b)<sup>71</sup>
- Buses and Bus Facilities Formula Program (5339a)<sup>72</sup>

This Zero-Emission Transition Plan is being developed to address 5339b and 5339c grants as they are explicitly cited in the letter issued by the FTA. Additionally, increased governmental and societal engagement with climate change will require substantial resources and support. This will foster new and changing opportunities of support for COTA's efforts.

<sup>67</sup><https://www.macrotrends.net/cities/22963/columbus/population>

<sup>68</sup><https://www.columbus.gov/sustainable/cap/>

<sup>69</sup><https://www.transit.dot.gov/lowno>

<sup>70</sup><https://www.transit.dot.gov/funding/grants/metropolitan-statewide-planning-and-nonmetropolitan-transportation-planning-5303-5304>

<sup>71</sup><https://www.transit.dot.gov/bus-program>

<sup>72</sup><https://www.transit.dot.gov/funding/grants/busprogram>

### 9.5. POLICY AND LEGISLATIVE IMPACTS

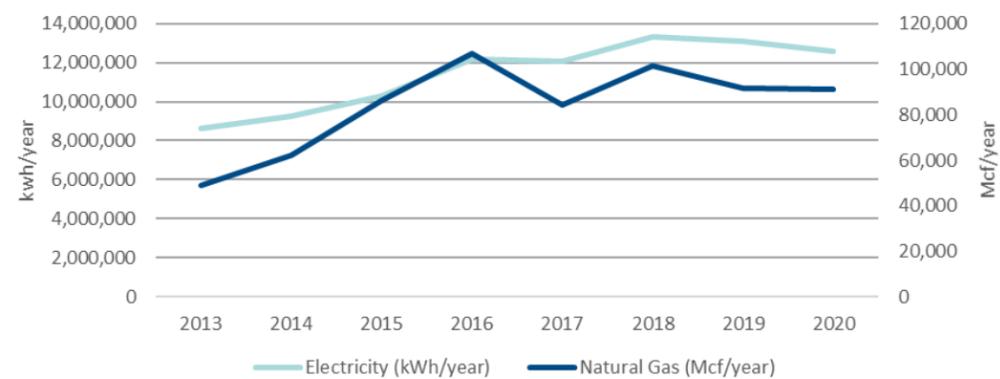
Monitoring and awareness of the changing policy landscape will be important to this initiative. Similar to the technology landscape, policy and legislation relative to climate change as well as potential requirements and support from governmental bodies is expected to take place. Some recent examples of influential actions include:

- Federal build back better legislation.
- Laws influencing utility's customer engagement and portfolio standards.
- City of Columbus' energy and water benchmarking ordinance.
- City of Columbus Climate Action Plan

### 9.6. FACILITY NEEDS AND CONSIDERATIONS

COTA's facilities are another area of critical engagement to achieve zero-emission goals. As shown in Figure 24, total energy use trends for both the electric and natural gas utilities for all COTA facilities shows an increase over the past seven years. This was driven by the addition of meters for both utility types. This included an increase in electric meters from 27 to 106 and an increase in natural gas meters from 3 to 8 between 2013 and 2020. This indicates that while there were 5 larger facilities added to the portfolio, including the Admin and Paratransit facilities, many electric meters were added across the system which are likely tied to stops and other small distributed locations.

Figure 65: FACILITY UTILITY USE TRENDS



Energy use data can be used to translate electricity and natural gas facility usage into facility emissions.

Figure 66: FACILITY GREENHOUSE GAS EMISSIONS TREND

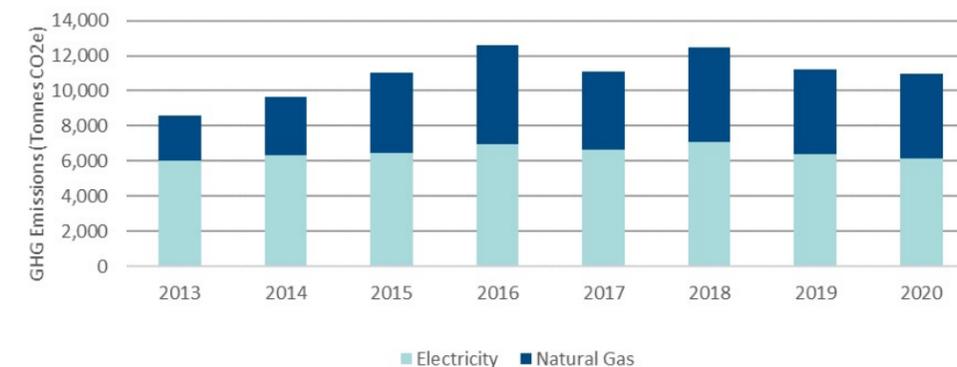
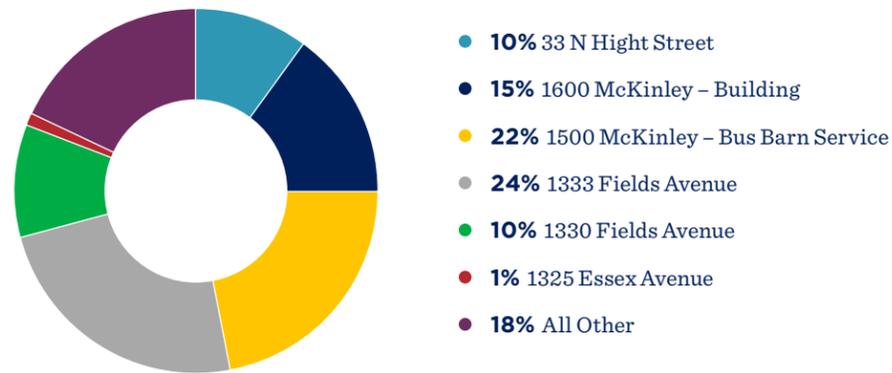
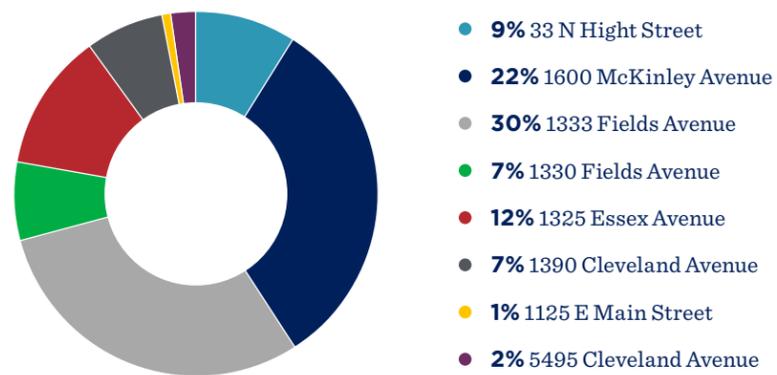


Figure 67 and Figure 68 show a breakdown of COTA's electricity and natural gas use by site.

**Figure 67: 2020 FACILITY ELECTRICITY ANNUAL USE BREAKDOWN**



**Figure 68: 2020 FACILITY NATURAL GAS ANNUAL USE BREAKDOWN**



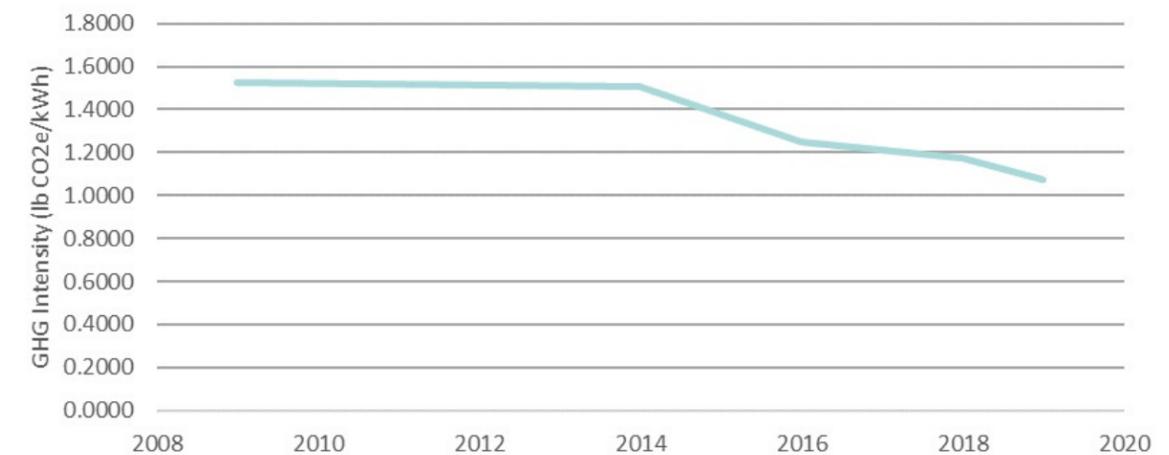
While COTA has been active in its effort to minimize facility energy use and cost, the new net-zero emission goals will require a more advanced pursuit of energy efficiency within its facilities. Across the country there are examples of zero energy buildings which illuminate the pathway towards super-efficient buildings and building design opportunities. As new buildings are added, renovations are conducted, and equipment replacements occur, including emissions as a design constraint will ensure that COTA's facility portfolio is optimized around this initiative. Incorporating onsite renewable generation is also a path for reducing electricity related GHG emissions while providing some on-site power capabilities. While it is unlikely that large COTA facilities can be self-sustaining using only on-site renewables, adding on-site assets would allow COTA to minimize utility needs while increasing the proportion of zero-emissions electricity used. Pairing on-site renewables with storage could further add to COTA's resilience. A study is currently underway that will provide initial analysis of these options within current markets and identify whether the economics indicate they should be pursued.

## 9.7. UTILITY AND FUEL SUPPLIER RELATIONSHIPS

While there are clear opportunities for reducing emissions through performance improvements in both vehicles and facilities, ensuring the energy COTA uses come from zero-emission sources is a critical component of achieving net-zero carbon emissions.

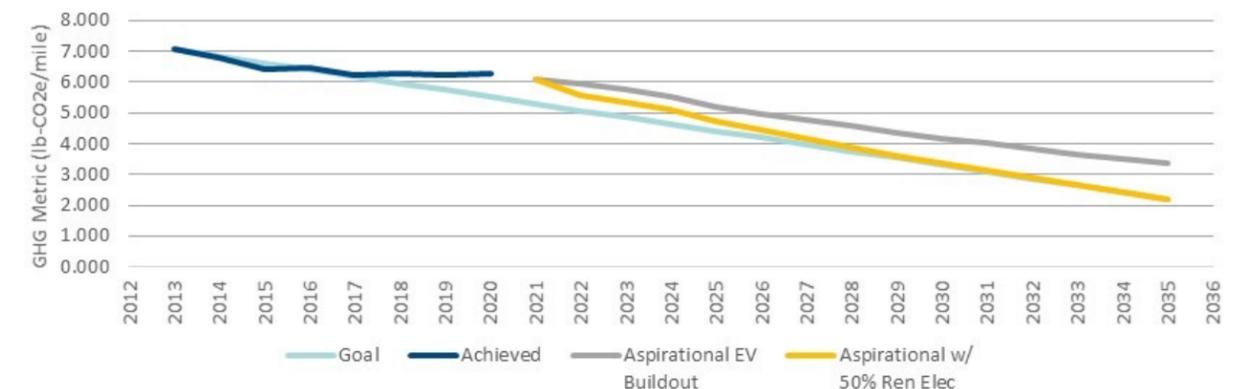
As COTA pursues its current plans to transition the bus fleet to electricity, it is important to note that for EVs to be zero-emission, their electricity consumption must be paired with renewable electricity. As has been shown, additional GHG reductions are needed to stay on track with a 2045 target year. While the electricity grid for the region COTA is in, RFC West, has reduced GHG intensity, the pace of this transition will impact progress. Additional emission reductions are achievable by contracting energy supplies for both CNG and electric buses from renewable sources.

**Figure 69: ANNUAL RFC WEST GHG INTENSITY**



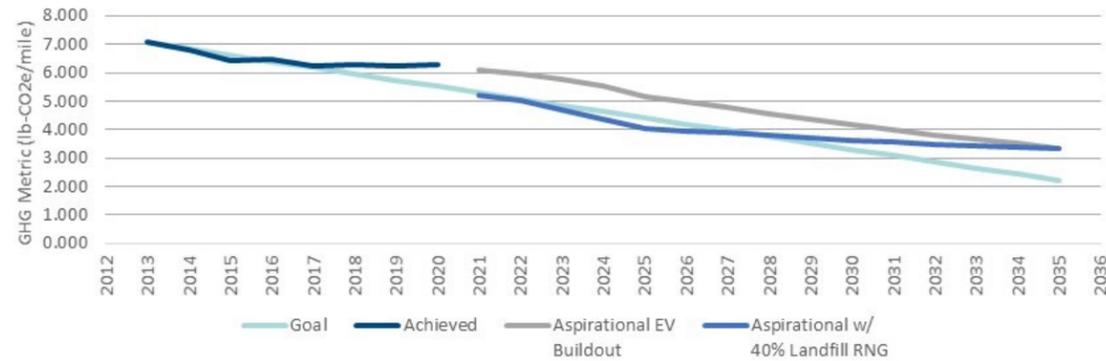
Purchasing renewable energy may come at a price premium or could save money. Consequently, evaluation of whether to leverage supplier contracts to remain "on track" should involve minimizing supplier contract costs to allow maximum capital to be available for vehicle purchase and facility improvements. In other words, it is better for COTA to spend available capital on zero-emission vehicle purchases rather than renewable energy credits. Based upon projections, sourcing 50% renewable electricity use across COTA's portfolio through 2035 would maintain alignment with GHG reductions goals. This projection can be seen below along with the GHG goal, historically achieved reductions, and aspirational EV fleet buildout.

**Figure 70: GHG REDUCTION PROJECTIONS FROM SOURCING 50% OF ELECTRICITY USE FROM ZERO-EMISSION**



Alternately, sourcing landfill RNG for roughly 40% of CNG fuel would also achieve the necessary reductions though 2030 before the planned reduction in CNG vehicles mitigates this benefit.

**Figure 71: GHG REDUCTION PROJECTIONS FROM SOURCING 40% OF CNG FUELING TO LANDFILL RNG**



This illuminates the need to prioritize an understanding RNG as part of fueling strategies within natural gas contracts. Exploration of available options for zero-emissions supplier contracts for both electric and natural gas utilities will be pursued. This should include the pricing of renewable energy certificates (RECs) and pursuit of a full understanding of the economic potential associated with the Renewable Fuel Standard for the CNG fleet.

While the focus in the next three decades will be building out EV capacity, both in charging infrastructure and vehicle acquisition, there is also opportunity in fully leveraging the investment in CNG fueling infrastructure through its end of life. The Renewable Fuel Standard<sup>73</sup> (RFS) requires a portion of US vehicle fueling to come from renewable sources. This is done by requiring fuel producers to obtain a set percentage of renewable fuel by purchasing Renewable Identification Numbers (RIN) based upon an annual requirement. A RIN is the credit for one gallon of renewable fuel. One eligible renewable fuel is renewable natural gas (RNG). Within the RFS Program, RNG is a D3 category fuel. In order to monetize RNG, an RIN must be obtained, which requires quantification of production of the RNG as well as a validated capture that this natural gas was put in a vehicle. COTA's investment in CNG fueling stations at both Fields and McKinley mean that the investment in equipment that meets the required quantification of RNG into vehicles has already been made. The value of D3 RINs over time can be seen in the figure below.

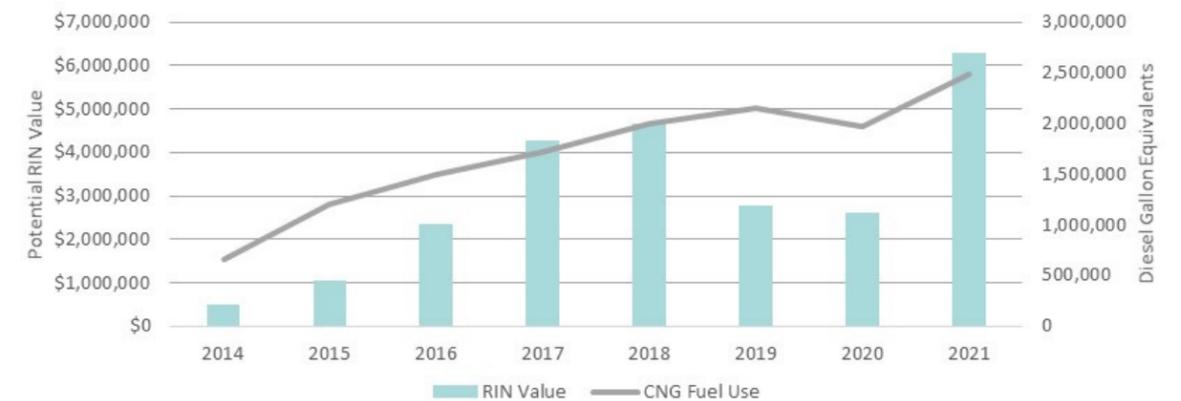
**Figure 72: D3 RIN VALUE OVER TIME**



<sup>73</sup><https://www.epa.gov/renewable-fuel-standard-program>

Based upon metered natural gas usage between 2014 and 2010, the potential RIN value within the RFS Program for COTA's CNG fueling operations can be seen below. The average value from 2018 to 2021 is just over \$4 million dollars annually. It is important to remember that this value would need to be shared with an RNG producer if COTA were able to find a partnership to leverage this value. This could come in the form of reduced natural gas costs, a portion of RIN GHG credits for COTA to claim, or a combination of both. While the addition of CNG vehicles to fleet provided positive impacts on GHG emissions, there is further potential of either economic or emissions benefits from leveraging CNG fueling operations.

**Figure 73: HISTORIC POTENTIAL VALUE OF CNG OPERATIONS WITHIN THE RFS PROGRAM**



Achieving zero GHG emissions for BEBs will require COTA to source 100% renewable sources for electricity. While improvements are being made, as stated earlier, within the electrical grid, there is the option of sourcing renewable electricity within utility supplier contracts. The availability and cost of renewable electricity supplies will be a dynamic market in the coming decades as emissions goals are being set and pursued across every sector. Consequently, ongoing assessments will be required to navigate whether COTA pursues emission goals through supplier contracts.

**9.7.1. UTILITY COLLABORATION**

Currently there is ongoing dialogue to identify opportunities for collaboration with both distribution utilities. Due to desired optics around both EDI and green initiatives, transit agencies provide incredible benefit as collaborators with electric and natural gas utilities. As initiatives are suggested and considered, it will be critical for COTA to advocate for its needs within these conversations. This will ensure that there is clear, capturable benefit for COTA to participate in the initiatives proposed by its utility partners.

## 9.8. WORKFORCE TRANSITION

To successfully transition vehicle technologies at a transit agency, staff who operate and service the vehicles must be prepared to fulfill their roles, particularly in any areas where a transition results in a change in requirements. For the coming vehicle transition, several bus systems remain unaffected and will simply follow existing training in those areas.

**Powertrain, brakes, and HVAC are the primary systems impacted by the transition to electric vehicles.** Some systems will become more simplified during conversion. New training initiatives have already been implemented in the areas of safety, PPE, and familiarization with the two coaches obtained in 2021. New Flyer, the vehicle manufacturer, is currently providing both general equipment and safety instruction. Internally COTA is developing curriculum around maintenance needs of these vehicles going forward. Currently, this is focused on preventative maintenance though over time data on actual repairs will be collected to facilitate creation of a strategy around maintenance needs.

Over time, the pertinent stakeholder departments will identify training needs as they are encountered and develop strategies to address them. The current preventative maintenance schedule is being assessed for areas where revisions are needed as the fleet is transitioned between technologies. Some training can be managed with in-house trainers while others may require the use of outside specialists. One area where outside trainers are currently used is for NFPA Arc flash safety and high voltage training.



## 9.9. ACTIVE INITIATIVES AND NEXT STEPS

The following actions are being conducted in support of this zero-emission transition plan. These activities will reinforce this plan and enable COTA to navigate the dynamic technological and economic landscape occurring over the next few decades.

### 9.9.1. ACTIONS AND RECOMMENDATIONS

Pursuit of COTA's emission goals will include the following actions:

1. COTA will continue phasing out diesel coaches as planned. Diesel phase-out will reduce COTA's bus fleets GHG intensity by more than 30% by the phase-out scheduled to be complete in 2026.
2. COTA will continue adopting battery electric buses (BEBs) so long as there is on-site charging capacity, can purchase BEBs with sufficient range, and back-up fueling/charging is available to maintain COTA's uptime goals. COTA will hit each of these technical barriers in due course and make will continually reassess whether strategies should be maintained or adjusted.
3. Based upon the aspirational electrification model currently envisioned:
  - a. In 2024, we assume COTA's facilities will reach the limit on its available electric distribution line capacity if the assumed timeline of depot charging cabinet installation is pursued. COTA will conduct a study on electric vehicle fueling strategies, alternate electric transmission and distribution line upgrade options, on-site energy reduction, on-site energy generation, and on-site storage options to increase electric charging capacity prior to 2023. This study is currently in progress and will be completed in 2022.
  - b. As COTA transitions its fleet operations to zero-emission vehicles, staff will continue to monitor and evaluate developments within the technologies available within automotive markets that would support COTA's GHG and pollution goals.
  - c. By 2029, COTA will have over 50% of its fleet converted to BEB based upon the vehicles needed to maintain current operations. At some point, COTA will be at risk of extended downtime from electricity outages. Back-up power or redundancy options are a critical consideration and are included within the electric capacity study. We further address action items to evaluate the impact of electricity outages in the Resiliency section of the Sustainability Plan.
4. Investigate renewable electricity options. This includes evaluating on-site renewable energy, off-site virtual power purchase agreements (vPPAs), off-site physical power purchase agreements (pPPAs), and renewable energy credit (REC) purchasing. On-site solar will be evaluated for the McKinley facility as part of a planned energy study of the facility. Obtaining renewable electricity through supplier contracts or RECs may increase operational electricity costs. Because of this, we recommend that COTA focus its capital on Facilities and Fleet upgrades first and use off-site renewable energy as a way to meet emissions goals in later years, but only to the extent necessary.
5. Evaluate the benefits and risks of purchasing RNG and retaining some of the RINs available to it through its use of CNG as a fuel. As we noted, COTA is creating several million dollars in RIN value per year which currently is not monetized.

6. Conduct energy studies at the major energy using facilities to identify specific energy efficiency opportunities to invest in.
  - a. Each study should identify expected facility-specific energy reduction potential.
  - b. A study is already underway at the McKinley facility.
7. Conduct a cost study of onsite renewable energy installations to assess if current economics support their pursuit at the present time. This could be included within the scope of facility energy studies, or as a separate analysis.
8. Investigate the cost of zero-emission energy sources for both vehicle fuel and facility utility supplies. This includes a renewable electricity procurement strategy, and an acquisition strategy for renewable natural gas (RNG).
9. Conduct a study of facility electrification needs. While it is currently possible to purchase renewable natural gas (RNG), we anticipate that RNG will be limited in the future, and that natural-gas fired hot-water and space heating equipment will likely need to convert to be electric.
10. Investigate how company travel is currently captured and develop a strategy to incorporate the associated emissions into the emissions metric.
11. Conduct a survey to assess how COTA employees commute to work. Findings from this survey will inform adjustments to the emissions calculation that is currently being used.

Establish improved building guidelines and requirements to minimize or eliminate emissions at existing and new facilities during renovation, new construction, and equipment replacement.



