

Long Beach Transit Strategic Sustainability Plan

FINAL REPORT

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1. Data to measure LBT's baseline emissions and sustainability status is derived from Fiscal Year (FY) 2018 records (July 1, 2017 - June 30, 2018). This data includes mobile fleet fuel consumption, roster for both revenue and non-revenue vehicles, and facility gas, waste and electricity consumption.

2. Recommendations for social and economic sustainability indicators in the scenario planning are primarily drawn from a series of informational interviews conducted with LBT executives, managers and Board of Directors. Recommendations for environmental sustainability indicators are based on planned vehicle procurement plans and informational interviews with LBT executives, managers and Board of Directors.

3. The baseline emissions as measured in the report are calculated in compliance with the APTA guidelines. These guidelines have been developed as part of APTA's Sustainability Commitment Program. LBT can use the methodology included in this report to draft its application to APTA.

Executive Summary

Strategic Sustainability Plan for Long Beach Transit (LBT). This plan has been developed for LBT to respond to its sustainability objectives and complement its recent Strategic Plan. To prepare this plan, during the fall of 2018 and spring of 2019, the research team reviewed LBT documents, conducted research on selected topics, interviewed executive management, Board members and managers in the agency, as well as held a workshop with executives and management in the spring of 2019.

LBT is a major public transit agency in the county of Los Angeles with over 23 million boardings during FY 2018, and over 800 employees. With a service area covering over 100 square miles, LBT provides fixed-route, paratransit, and water taxi services. It has two major operating facilities in the city of Long Beach, and a fleet of 249 buses. LBT is a city of Long Beach municipal public benefit corporation governed by a Board of Directors. LBT's President and CEO is Kenneth McDonald, who is supported by Deputy CEO Debra Johnson, and an executive and management team.

Broader Government Context of Sustainability Practices in Transit for LBT. Sustainability practices have broad support at federal, state, regional and local contexts. Especially important for LBT is California's commitment to climate change policy and action with its Global Warming Solutions Act (AB 32, 2006) and its Sustainable Communities and Climate Protection Act (SB 375, 2008). These legislations, and subsequent associated ones, including its cap and trade program, have placed California at the forefront of environmental and climate policy and action. SB 375 focuses on reducing GHG emissions by reducing vehicle miles traveled (VMT) through several land use and transportation strategies. Of particular importance for LBT is the legislative focus on policies that improve community access and proximity to transit. California's commitment to reduce GHG emissions responds to dual objectives: reducing the global threat of climate change, and improving regional air quality. For the Los Angeles-Long Beach metropolitan area, improving air quality is essential since, according to the American Lung Association that tracks air pollution in metropolitan areas on an annual basis, this metropolitan area ranks #1 in the nation for the worst ozone pollution, and #5 for particulate emissions. Both types of emissions are associated with asthma and other associated conditions.

The City of Long Beach. After Los Angeles, Long Beach is the second-largest city in the metropolitan region with a population of over 478,000, with higher densities than prevailing county densities, slightly lower income (\$58.3K vs. \$61K for county), lower homeownership rate (40 percent vs. 52.4 percent), and a lower average salary than the county's (\$57K vs. \$66K for the county). The city of Long Beach has a commitment to sustainability, having established a Sustainability City Commission in 2007, which is actively engaged in promoting sustainability in the City's programs and operations. Although the city did not experience significant higher density housing development from 2010-2018, it amended its land use plans in the spring of 2018 to allow higher-density development along transit and high-quality bus corridors, and in

2018 had major projects underway that could add approximately 2,000 residential units to its housing stock. Other development projects under current review could add another similar amount of housing in the near future. This opens up opportunities for LBT to extend transit services.

CalEnviroScreen Results for Long Beach. The State of California has developed CalEnviroScreen as a tool to identify communities with significant pollution burdens and vulnerabilities. CalEnviroScreen identifies many census tracts in Long Beach with the highest pollution and population vulnerabilities. As a result of this environmental screening, the state has designated most of the city and adjoining communities as Disadvantaged Communities. The Disadvantaged Communities designation makes areas eligible for community improvements projects, including transit improvements, from the state's cap and trade proceeds.

American Public Transportation Association (APTA). APTA is the major association of transport agencies in the US. In 2009, APTA initiated a voluntary Sustainable Commitment Program for transit agencies, similar to US Green Building Council's LEED rating system for buildings. Over 100 transit agencies have sustainability commitments through this program. This report uses APTA's guidelines for transit sustainability.

Agency Perspectives on Sustainability. Chapter 2 reports on the set of interviews with agency executives, management team and Board of Directors. These interviews focused on eliciting their views on important aspects of sustainability for the agency, on the easiest aspects to implement at LBT, and the most important to implement in LBT. Environmental aspects, especially changing the bus fleet to zero-emission vehicles (ZEVs) was identified by those interviewed as most important, followed by economic and workforce concerns.

APTA's Approach to Sustainability Improvements in Transit. Chapter 3 outlines the requirements for initial sustainability recognition from APTA. These include adopting sustainability as core strategic objectives of the organization, and identifying a sustainability champion or manager with appropriate human resources and/or financial resources and mandate, as well as establishing an employee outreach program. A sustainability inventory of the organization, focused on environmental indicators is required with the application for recognition. This initial inventory needs to be updated annually and reported to APTA.

Environmental Indicators. Chapter 4 identifies the environmental indicators that APTA uses. These include water use, criteria air pollutants, GHG emissions, and GHG savings, electricity, fuel, and recycling levels/waste. Using FY 2018 data, the chapter estimates emissions for mobile and stationary sources at LBT, which yield a total of 13,825 CO₂e metric tons, with mobile sources contributing 92 percent of total emissions. Transit agencies are credited with the vehicle trips displaced by transit trips. For FY 2018, displaced CO₂e emissions by transit trips amounted to 12,265 metric tons, thus reducing LBT's CO₂e baseline emissions to 1,560 metric tons.

Social and Economic Sustainability. Chapter 5 focused on a wide range of social and economic sustainability indicators, including: community engagement, economic impact, employees and workforce, financial management, mobility and accessibility, and safety and emergency preparedness. It describes LBT best practices in these areas, and identifies 3-5 year and 5-10 year goals. For example, under community building and engagement practices, best practices include: the number of dedicated staff to this objective, the types of specific outreach provided, the types of customer service feedback used, and the findings from the most recent report; LBT's comprehensive operational analysis branded the Systemwide Transit Analysis and Reassessment (STAR) Initiative; and outreach and partnership with various institutions. Goals identified in this area include expanding partnerships and initiatives to promote equity and social justice. In the area of employment and workforce, best practices identified include current retention strategy, fair hiring practices, performance management programs, and workforce engagement. Goals identified include developing a strategy for hiring bus operators, and establishing apprenticeship programs. In the financial management area, many best practices were identified, including the fiscal integrity of LBT's operations and capital budgets, long-term fiscal planning, recognized by a recent award for its annual budgets, as well as its lack of debt. Goals identified in this area include prioritizing sustainability in its CIP and incorporating climate resilience into its capital planning.

Future Scenarios. To provide LBT with strategic, sustainability options for the next 10-15 years, Chapter 6 develops two sets of scenarios: for the mid-2020s decade, and for the mid-2030s decade (Scenarios 1 and 2); as well as one set of scenarios more ambitious than the other in their efforts to reduce CO₂e emissions (the two A scenarios are less ambitious, and the two B scenarios are more ambitious). The scenarios focused on the GHG emissions (measured in CO₂e metric tons) of the fleet and major LBT facilities. The results for Scenarios 1A and 1B show significant reductions in CO₂e emissions from the FY 2018 baseline of 13,825 CO₂e metric tons. Under every scenario developed, LBT's plans to change its fleet to ZEVs has the most dramatic effect on its carbon emissions footprint. The footprint for mobile emissions shrinks to 1,061 CO₂e metric tons under Scenario 2A. Further reductions to LBT emissions can be obtained by the installation of solar panels in its facility parking lots and buildings, bringing LBT's total carbon footprint to 347 CO₂e metric tons. These figures do not take into account the carbon emissions credit that transit agencies currently obtain due to the replacement of vehicle trips by transit trips. Taking into account such an adjustment, LBT's sustainability efforts would yield a negative amount close to the FY 2018 baseline emissions of the agency.

Concluding Remarks. Chapter 7 summarizes the results of the scenario exercise and notes the many practices LBT engages in to improve its social and economic sustainability. It discusses how the report can be used to apply for APTA recognition status and elaborates on the role of the sustainability program manager needed for the success of LBT's sustainability efforts. A concluding note highlights the current challenges facing transit agencies at a time of rapid technological change, e.g., increasing automation, the challenge of ride-hailing companies, and the opportunity for the Sustainability Manager to track and educate the agency on current research, public strategies and experimentation.

Chapter 1. Introduction

1.1. Long Beach Transit (LBT)

Founded in 1963, LBT is a major public transit agency in the county of Los Angeles, with over 23 million boardings during FY 2018. Its service area covers over 100 square miles, providing services to southeastern Los Angeles County and northwestern Orange County. With 800 employees, LBT provides fixed-route, paratransit and water taxi services. It has two operating facilities and a fleet of 249 buses. See Figure 1 below for its system map.

Figure 1. LBT System Map



Source: LBT (2019). Budget Book FY 2020, p. 9.

LBT is a City of Long Beach municipal public benefit corporation that is governed by a seven-member Board of Directors appointed by the Mayor of Long Beach, and confirmed by the City Council. Two other non-voting members serve as designees of the Long Beach City Manager. LBT's President and CEO, Kenneth McDonald is supported by a Deputy CEO, Debra Johnson, a management team that includes five executives and a general counsel. Basic statistics are included in Table 1 below.

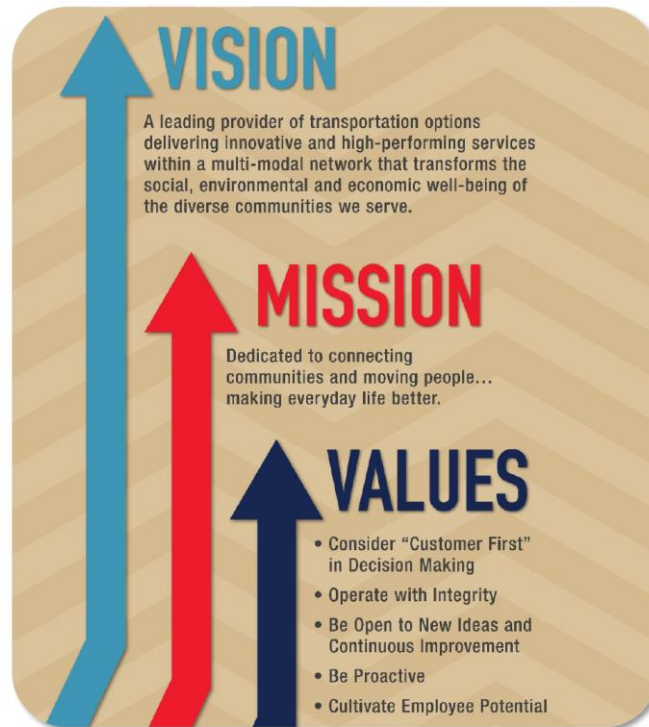
Table 1. Long Beach Transit FY 2018/2019 Basic Statistics

FY 2018 Customer Boardings	23.8 million	FY 2019 Operating Budget	\$98.02 million
FY 2018 Vehicle Miles Traveled	7.7 million	FY 2019 Capital Budget	\$38.37 million
Number of Routes	35	Fleet	249 vehicles

Source: LBT web page, Facts and Figures: <https://ridelbt.com/about-us/#facts-and-figures>

LBT recently developed a strategic plan, stressing its organizational goals, key performance indicators and strategic priorities. Its strategic priorities include improving safety and service quality, exercising financial accountability, fostering employee engagement, enhancing customer experience and promoting community and industry focus. See Figure 2 for LBT's Vision, Mission and Values.

Figure 2. Long Beach Transit's Vision, Mission and Values in its Strategic Plan



Source: Long Beach Transit (2018) *LBT Organizational Focus*, p.18

1.2 A Strategic Sustainability Plan for LBT

This strategic sustainability plan has been developed for LBT to respond to its sustainability objectives and to complement its Strategic Plan.

LBT has already taken several major steps to become a sustainable transit agency. Its commitment is clear from the decisions made about its bus fleet—by 2020, all of LBT's bus fleet will be zero-emission vehicles. It has also provided its staff with Environmental and Sustainable Management System (ESMS) training, and undertaken several sustainability initiatives over the past decade.

In order to obtain agency information relevant for this plan, the research team conducted a series of initial interviews with top management in the fall of 2018, and subsequent interviews with the Board of Directors, as well as reviewed relevant agency information and agency documents. The research team conducted another set of follow-up interviews in the winter of 2018-19 and conducted a workshop with management staff in the spring of 2019.

1.3 Sustainability as a Major Focus for LBT: The Broader Government Context of Sustainability Policies

Sustainability policies, especially, environmental sustainability policies, are supported at the federal, state and local levels. At the federal level, environmental sustainability has been a key goal of the Federal Transit Administration (FTA) which has supported transit agencies in implementing such policies through grants, research, technical assistance, and policy leadership, for example, through its Clean Fuels Grant program (FTA 2016)¹.

California's Commitment to Climate Action. Sustainability policies are of great importance in California and in the Los Angeles region. The State demonstrated its commitment to reduce greenhouse gases by passing its 2006 Global Warming Solutions Act (AB 32). This act has a goal of reducing California's GHG emissions to its 1990 emissions level by 2020, in effect, a reduction of 174 million metric tons. This comprehensive law has been implemented through a broad range of policies, including:

- Low Carbon Fuel Standard (LCFS) launched in 2011, which required refineries and distributors to meet declining targets for carbon emissions of fuels sold (e.g., higher ethanol content or CNG);
- Vehicle GHG standards (AB 1493 approved in 2004) aimed to reduce CO₂ (this legislation was a model for the federal standards);
- Zero-Emission Vehicle (ZEV) regulations, which had a rocky start, but the renewed program aims to put 1.5 million ZEVs on California roads by 2025;

¹ Federal Transit Administration (2016). FTA Activities that Promote Environmental Sustainability. Retrieved 6/3/2029 from <https://www.transit.dot.gov/regulations-and-guidance/environmental-programs/transit-environmental-sustainability/fta-activities>

- Cap and trade program, which caps emissions from industries (first utilities; in 2015 emissions caps were extended to transportation fuels), and sets a market for trading allowances with other companies;
- Renewables Portfolio Standard, which required utilities to increase their renewable energy sources to 33 percent by 2020, and more recent legislation requires a 50 percent renewables mix by 2030.

Through this set of programs, California met its 2020 goals four years early in 2016.² Reaching this goal early, however, did not stop the state's ongoing commitment to combat climate change. In 2016, the state passed SB 32 to reduce California's emissions 40 percent below 1990 levels by 2030. The state agency in charge of implementing the state's climate change legislation and its programs is the California Air Resources Board (CARB).

California's Sustainable Communities and Climate Protection. Another important piece of California legislation focused on environmental sustainability, SB 375, the Sustainable Communities and Climate Protection Act, was passed into law in 2008, following the Global Warming Solutions Act. SB 375 is aimed at the characteristics of the urban environment, and sustainable communities are identified as a mix of Smart Growth/Compact Communities/Transit-Oriented strategies that include higher-density, land use mix, network connectivity of streets, transit access, and regional accessibility to jobs and housing. The goal of SB 375 is to reduce GHG emissions by reducing vehicle miles traveled (VMT), since vehicle travel is the primary mode of travel in California. Several meta-analysis of research providing evidence of the effect of increasing density, land use mix, street connectivity, transit provision, etc., on VMT have demonstrated that such increases decrease VMT.³ The effect of increasing density or other features of urban form or mobility have been recognized as important urban GHG mitigation strategies by the most recent IPCC assessment of climate change.⁴ Although the effects of increasing density or acting on only one feature of urban form or mobility are modest, experts agree that combining several of these strategies can reduce VMT by 25 percent or more.⁵ One of the important features of the urban environment that is conducive to reductions in VMT, and thereby GHG emissions, is access and proximity to transit. In this way, LBT's transit service is essential to achieving the goals of SB 375. This law emphasizes the importance of linking transit provision to local and regional land use development plans and projects.

² Barboza and Lange (July 23, 2018) "California hit its climate goal early — but its biggest source of pollution keeps rising." *Los Angeles Times*. <https://www.latimes.com/local/lanow/la-me-adv-california-climate-pollution-20180722-story.html>

³ Ewing, R. and R. Cervero. 2010. "Travel and the Built Environment." *Journal of the American Planning Association* 76 (3): 265–94. <https://doi.org/10.1080/01944361003766766>; Salon, D., M. G. Boarnet, S. Handy, S. Spears, and G. Tal. 2012. "How do local actions affect VMT? A critical review of the empirical evidence." *Transportation Research Part D: Transport and Environment* 17 (7):495-508. doi: 10.1016/j.trd.2012.05.00645

⁴ Seto K. C., S. Dhakal, A. Bigio, H. Blanco, et al. 2015. Human Settlements, Infrastructure and Spatial Planning. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

⁵ Transportation Research Board and National Research Council. 2009. *Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions -- Special Report 298*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/12747>.

SB 375 requires the 18 regional transportation agencies in California, each of which encompass several counties, and whose primary mission had been to plan and manage state and federal funds for regional transportation improvements, to develop regional Sustainable Communities Strategies or Plans with their constituent local governments. Such plans are required to meet GHG reduction targets set every four years by CARB. CARB has designated a special board, the Regional Targets Advisory Committee, which has the power to set targets for each of the 18 regional agencies every four years. The Board's staff reviews these plans and decides whether each of the metropolitan planning organizations is set to meet the 2020 and 2035 goals to reduce emissions to the levels identified in the legislation. California, through SB 375, requires regional transportation organizations to reduce their GHGs emissions with certain targets by 2020 and 2035 by linking their land use and transportation to reduce vehicle miles traveled.

The Southern California Association of Governments (SCAG) is the metropolitan planning agency for the Los Angeles region. SCAG's planning area includes all of the Los Angeles-Long Beach Consolidated Statistical Area. SCAG is the largest metropolitan planning organization (MPO) in the state (including six counties, 191 cities, and over 18 million residents). Among the objectives in SCAG's 2012 plan of importance for LBT was increasing the percentage of housing within High Quality Transit areas (served by express bus, light rail or subway) from 40 percent to 51 percent.⁶ SCAG's 2016 plan continues the emphasis on increasing multi-family housing along High Quality Transit areas.⁷

1.4 The Connection between GHG Emissions and Air Pollution

California's commitment to reduce GHG emissions with the goal of reducing the global climate impacts of GHG emissions is an important global commitment since, as of 2017, California was ranked as the 5th-largest economy in the world, with a Gross State Product of \$2.747T, trailing only U.S., China, Japan and Germany.⁸ But California's commitment to climate change action is not only an altruistic commitment, it is also important for the state's public health. California's legislation focused on reducing GHG emissions has a direct connection to regional air pollution. Vehicular emissions are a major source of atmospheric GHGs, but they are also responsible for ground-level pollutants. As Figure 4 makes clear, gasoline or diesel fuel vehicles emit several types of pollutants, including particles (e.g., PM_{2.5}), NO_x, SO_x, VOCs, CO, as well as toxics that directly impact local and regional health. Exposing NO_x and VOCs to sunlight generates ozone.

In its 2013 assessment of ozone's impacts on health, the U.S. Environmental Protection Agency concluded that ozone pollution causes respiratory harm, by worsening asthma, COPD, and

⁶ California Environmental Protection Agency, Air Resources Board. 2013. Facts about California's Sustainable Community Plans. <https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-and-climate-protection-program>

⁷ SCAG. 2016. *The 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy*. Adopted April 2016. <http://scagrtpscsc.net/Documents/2016/final/f2016RTPSCS.pdf>

⁸ Fuller, T. 2018. The Pleasure and Pain of Being California, the World's 5th Largest Economy. *NY Times*, 5/27/2018. <https://www.nytimes.com/2018/05/07/us/california-economy-growth.html>

inflammation; is likely to cause early death and cardiovascular harm; may cause harm to the central nervous system, and may cause reproductive and developmental harm.⁹

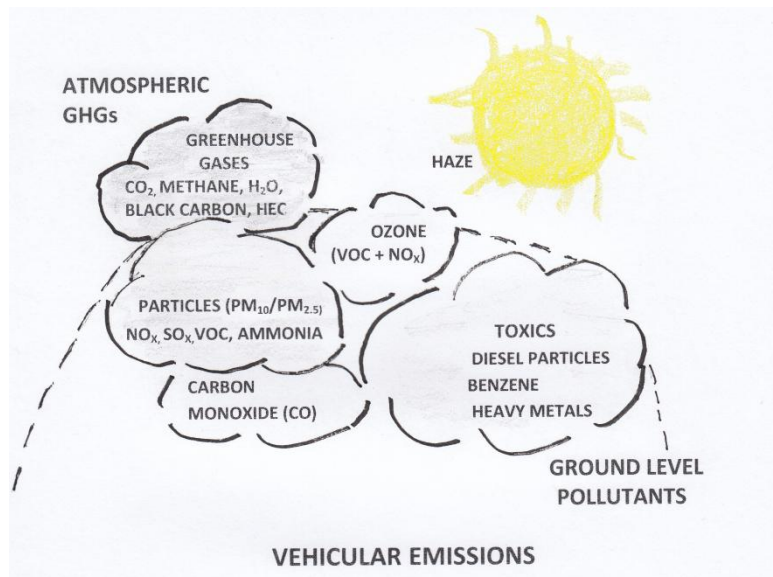


Figure 3. Vehicular Emissions as the Source of GHG emissions and Ground Level Pollutants

The Los Angeles-Long Beach metropolitan region continues to have severe air pollution problems. The American Lung Association, in its 2019 *State of the Air* annual report ranked the Los Angeles-Long Beach region as the #1 region in the country for ozone pollution, and #5 for PM 2.5 pollution. By acting to reduce GHG emissions through its climate action plans, California is also acting to reduce its regional air pollution problems.

1.5 Brief Profile of the City of Long Beach

This section reviews basic population characteristics of the City of Long Beach, especially as they relate to LBT, as well as several links with city agencies of importance to LBT's efforts to improve its sustainability.

The table below provides basic information on the City of Long Beach as of 2018, and compares this information to Los Angeles County's statistics. The statistics indicate that the City of Long Beach has a slightly younger population, a smaller household size and smaller median household income. An important difference, especially from the perspective of transit choice, is the higher density in the city, almost four times the county density, which facilitates transit provision. Also important are lower median household income and home ownership rates, characteristics which can be associated with higher transit use.

⁹ American Lung Association. 2019. State of the Air 2019, p. 38 <https://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2019-full.pdf>

Changes in transit mode choices since 2000 are also important for LBT. Drive-alone car choice in 2018 remains at 75 percent, while journey-to-work carpools decreased from 14 percent to 9 percent, and public transit decreased from 7 percent to 6 percent from 2000 to 2018 (with an increase in 2010 to 8 percent). The greatest change during this period is in the "Other mode" of journey-to-work. This changed from 4 percent in 2000 to 10 percent in 2018. "Other mode" refers to bicycle, pedestrian and home-based employment. Also important are the statistics of households who do not own a vehicle (10 percent) and those households who own only one vehicle (39 percent)¹⁰ (SCAG 2019, 18-19).

Table 2. Comparison of City of Long Beach Demographics to Los Angeles County 2018

Characteristics	Long Beach City	Los Angeles County	Comments
<i>Total Population</i>	478,561	10,283,729	
<i>Population Density (population per sq. mi.)</i>	9,516	2,518	Much higher density than the county, almost 4 times higher
<i>Median Age in Years</i>	34.3	36.0	Younger population
<i>Hispanic</i>	42.8 percent	48.4 percent	Smaller percentage of Hispanic population than the county's
<i>Non-Hispanic White</i>	27.6	26.5	Slightly higher percentage than county's
<i>Non-Hispanic Asian</i>	13.0	14.3	Slightly lower percentage than county's
<i>Non-Hispanic Black</i>	12.4	7.9	Higher percentage of Non-Hispanic Black population
<i>Non-Hispanic American Indian or Alaskan Native</i>	0.3 percent	0.2 percent	Similar percentage
<i>All other non-Hispanic</i>	3.9 percent	2.7 percent	Slightly higher
<i>Average Household Size</i>	2.8	3.0	Slightly smaller household size than the county's
<i>Median Household Income</i>	\$58,314	\$61,015	Slightly lower household income than the county's
<i>Home Ownership Rate</i>	40 percent	52.4 percent	Significantly lower homeownership rate than the county's
<i>Drive Alone to Work</i>	74.8 percent	73.7 percent	Slightly higher percentage driving alone to work than the county's
<i>2017 Ave. Salary per Job</i>	\$57,150	\$66,037	Average salary in city almost \$9K lower than the county's average

Source: SCAG (2019). *Profile of the City of Long Beach*. p. 3 <https://www.scag.ca.gov/Documents/LongBeach.pdf>

Also important to note is that the City of Long Beach trailed the county's number of multi-family units permits issued in 2018. While the county had a rate of increase per 1,000 residents of 1.6 permits, the City of Long Beach's rate increased by only 0.2 permits per 1,000 residents.¹¹

¹⁰ SCAG (2019). *Profile of the City of Long Beach*. p. 3 <https://www.scag.ca.gov/Documents/LongBeach.pdf>

¹¹ SCAG (2019). *Profile of the City of Long Beach*. p. 14 <https://www.scag.ca.gov/Documents/LongBeach.pdf>

City of Long Beach's Commitment to Sustainability. The City's commitment to sustainability is evident from its Sustainable City Commission, established in 2007. The Commission, whose members are appointed by the Mayor, meets once a month to discuss major initiatives of city departments. LBT also reports to the Commission on a regular basis on its plans related to sustainability. As LBT increases its sustainability efforts, it may benefit from ongoing participation on the Commission.

Transportation and Land Use Functions in the City of Long Beach. The connection between LBT and various city departments with a transportation emphasis is strong. LBT regularly meets and confers with the Departments of Public Works and of Development Services ensuring ongoing collaboration on transportation planning projects, complete streets, and major developments.

The city did not experience significant higher density housing from 2010-2018 according to SCAG's profile of the city of Long Beach.¹² In March of 2018, however, the city amended its land use plans and zoning to allow higher-density development along transit and high-quality bus corridors. In addition, the city had major projects under way in 2018 that could add approximately 2,000 residential units to the city's stock of housing at different densities, and many other projects are currently undergoing review that could add about another 2,000 units in the next few years, as well as major commercial development projects. Interviews with several executives at LBT indicated that the agency has established relations with developers and the city to ensure appropriate transit options for such developments. With increasing development and the city's zoning changes under way, it is important for LBT to continue its efforts to coordinate with the city and major developers to improve transit options for higher-density developments. As discussed above, higher density development projects along high-quality transit corridors are central to SCAG's 2016 Sustainable Communities Strategy.

Recent Changes in Land Use and their Implications for LBT Major Facility Sites. The changes that the city of Long Beach approved in 2018 for land use and zoning also have implications for LBT's two major facility sites. In the new regulations, LBT's 1963 E. Anaheim Street facility (eight acres), or LBT1, is located in Council District 6. Under the new city classification, LBT1 is located in an NSC-M zone, which can be developed as a Neighborhood Serving Center or Moderate Density Corridor, at a height of five (5) stories. The 6860 Cherry Ave. facility (10 acres), or LBT2, is located in Council District 9. LBT2 is located in a Neo-Industrial zone, with a height limit of 65 feet. The western side of Cherry Avenue remains a single family and low-density zone. Based on the new zoning, both sites have redevelopment potential. The LBT1 site, given its proximity to downtown, has a potential for redevelopment to accommodate housing on part of the site. Neo-Industrial zones encourage innovative start-up businesses, such as creative design offices in arts, engineering, science, technology, media, education and information businesses. Limited retail and live-work units could also be included in this zone.¹³

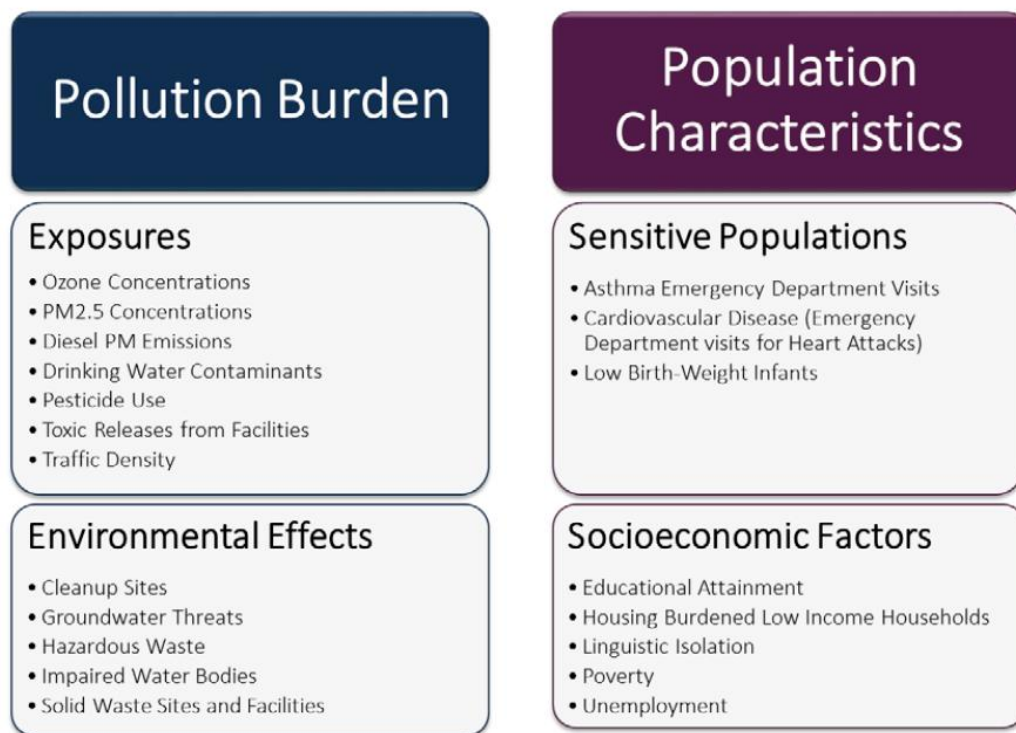
¹² SCAG. 2019. Profile of the City of Long Beach. p. 14, <https://www.scag.ca.gov/Documents/LongBeach.pdf>

¹³ City of Long Beach. 2018. Neo Industrial PlaceType. Urban Design Element, p. 54. *City of Long Beach General Plan*. Retrieved from: <http://www.longbeach.gov/globalassets/city-news/media-library/documents/lue/march-2018/urban-design-element-council-approved-march-2018>

1.6 CalEnviroScreen, Disadvantaged Communities and their Significance for LBT

The State of California has developed a tool to identify California communities with significant pollution burdens and vulnerabilities called CalEnviroScreen¹⁴, which characterizes census tracts in California according to their environmental pollution burden, e.g., air quality, such as ozone and PM_{2.5}, proximity to toxic or solid waste sites, and indicators of social vulnerability, such as incidence of asthma and cardiovascular disease, as well as socioeconomic factors, such as housing burdened low-income households, poverty and linguistic isolation. The tool is then used to rank all census tracts in the state combining the tract's pollution burden and the population characteristics associated with their resident population vulnerabilities. See Figure 5 for the various environmental and population indicators included in CalEnviroScreen.

Figure 4. Pollution and Population Indicators Incorporated in CalEnviroScreen 3.0



Source: Cal EPA and OEHHA. 2017. CalEnviroScreen 3.0 Update, p. 13.

See also the official maps designating the height and place zones for the two major LBT facilities, in Council District 6 and Council District 9 official maps:

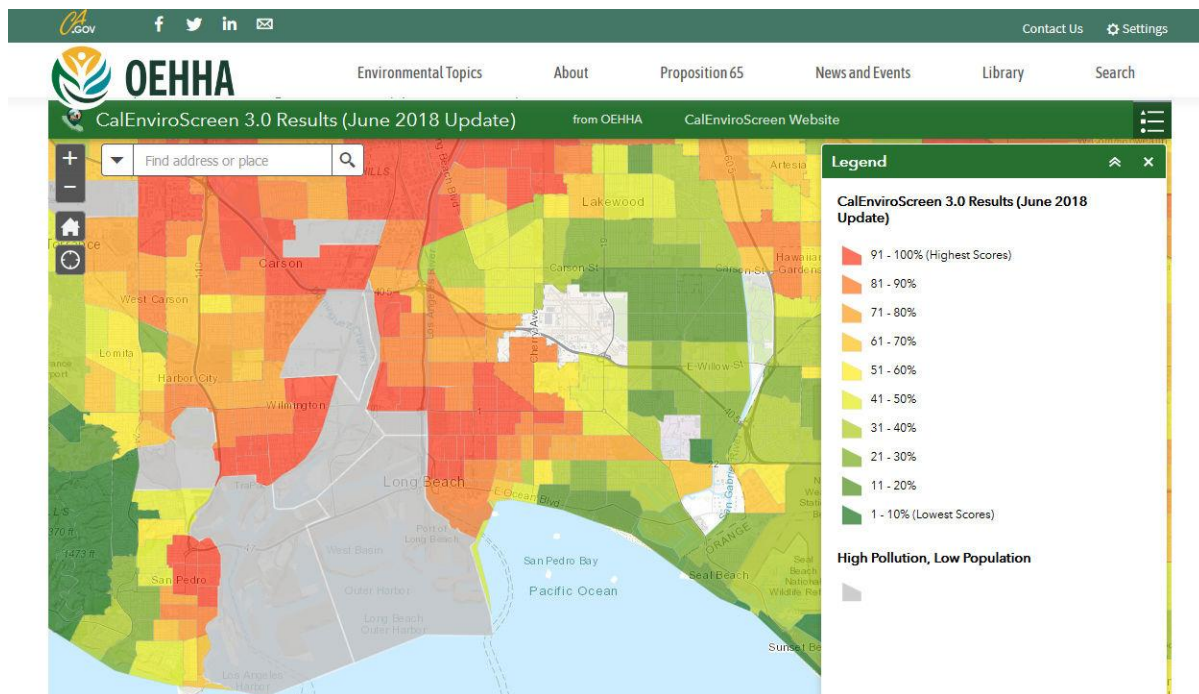
City of Long Beach. *Long Beach 2040 General Plan. Land Use and Urban Design Elements*. Final Council Adopted Maps (March 2018) by Council District. Retrieved from: <http://www.longbeach.gov/pages/city-news/long-beach-general-plan-update-is-here/council-districts-march/>

¹⁴ CalEPA, OEHHA. 2017. "CalEnviroScreen 3.0 Update to the California Communities Environmental Health Screening Tool January 2017." January 2017.

<https://oehha.ca.gov/media/downloads/calenviroscreen/report/ces3report.pdf>.

See Figure 6 below for a mapping of Long Beach and its environs, where colors represent relative burden, with the deep shade of red representing the most vulnerable census tracts combining highest pollution burdens and population vulnerabilities. The data for each census tract is available for each type of pollutant and each type of demographic characteristic.

Figure 5. CalEnviroScreen Map of Long Beach and Surrounding Areas



Source: California OEHHA. 2019. CalEnviroScreen. Retrieved from: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>

To generate the map above that combines pollution burdens and population vulnerabilities, CalEnviroScreen provides a raw score, e.g., for census tract 6037570502 (see Table 3 on p. 11 also), the raw score is 69.77. This score enables the ranking of all census tracts in the State, as well as a percentile range. In addition to this mapping and classification, which identifies areas with high pollution burdens and/or population vulnerabilities, OEHHA provides Excel spreadsheets of the data. Table 3, on p. 12, just provides total percentiles for the Pollution Burden and the Population Characteristics for the top ten environmental burdened census tracts in Long Beach, but information on each of the pollutants and population characteristics is also available in the data spreadsheets. CalEnviroScreen provides easy to access tools that enable local agencies and community groups to identify areas that are vulnerable to environmental harms and that house vulnerable populations.

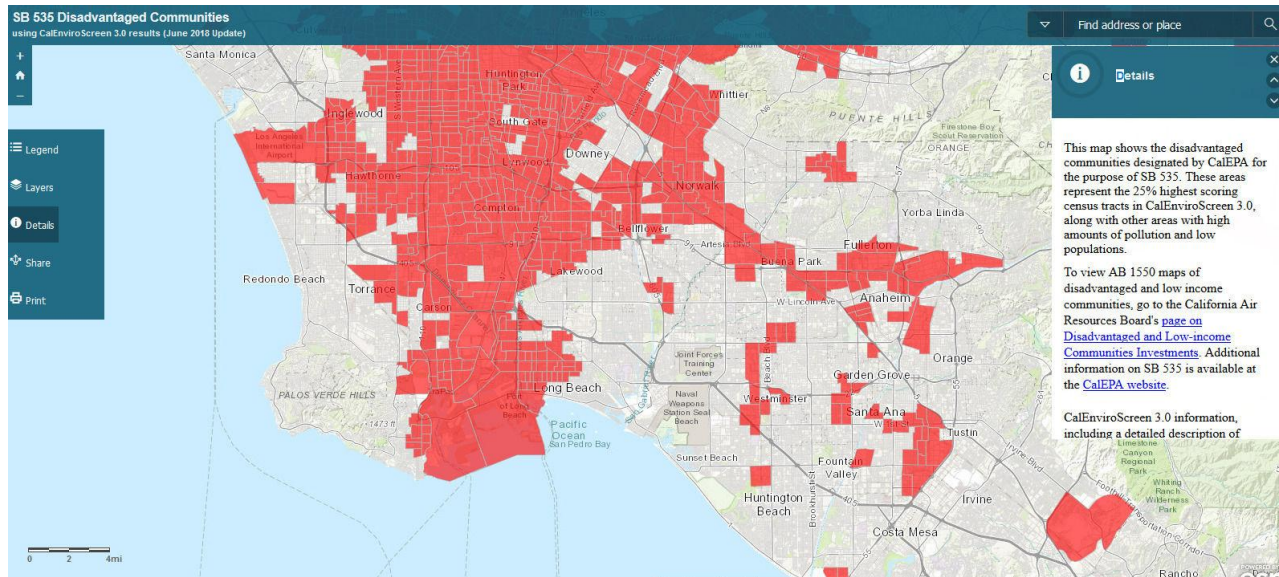
Table 3. Top 10 Environmentally Burdened Census Tracts in Long Beach in 2018

Census Tract	CalEnviroScreen 3.0 Score	CalEnviroScreen 3.0 Percentile Range	Pollution Burden Percentile	Population Characteristics Percentile	Total Population	California County	Approximate Zip Code	Nearby City (to help approximate location only)
6037570502	69.77	95-100% (highest scores)	97.40	94.31	6616	Los Angeles	90805	Long Beach
6037570301	67.72	95-100% (highest scores)	93.91	97.02	7330	Los Angeles	90805	Long Beach
6037575401	67.20	95-100% (highest scores)	91.92	98.06	5155	Los Angeles	90813	Long Beach
6037572800	66.79	95-100% (highest scores)	91.40	98.03	839	Los Angeles	90810	Long Beach
6037575801	64.47	95-100% (highest scores)	89.68	97.40	2446	Los Angeles	90813	Long Beach
6037570202	63.99	95-100% (highest scores)	98.08	84.82	6415	Los Angeles	90805	Long Beach
6037572301	62.87	95-100% (highest scores)	98.33	81.60	3833	Los Angeles	90810	Long Beach
6037575802	62.21	95-100% (highest scores)	83.34	98.70	5167	Los Angeles	90813	Long Beach
6037570402	62.14	95-100% (highest scores)	95.22	88.72	3496	Los Angeles	90805	Long Beach
6037573201	61.46	95-100% (highest scores)	85.49	97.19	4930	Los Angeles	90806	Long Beach

Source: OEHA (2018) CalEnviroScreen 3.0 Data and Additional Materials. ces3results <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>

In addition, CalEnviroScreen is directly related to California's Global Warming Act (AB 32) in that two subsequent laws, the Greenhouse Gas Reduction Fund (SB 535, De León) passed in 2012, which requires that 25 percent of the proceeds from Cap and Trade auctions provide a benefit to disadvantaged communities, and AB 1550 (2016, Gomez) requiring that 25 percent of proceeds from the fund be spent on projects located in disadvantaged communities. The state uses CalEnviroScreen to identify Disadvantaged Communities for such investments, and has designated all census tracts that rank in the top 25 percent of environmentally burdened census tracts in the state as Disadvantaged Communities.¹⁵ See Figure 7 below for a mapping of disadvantaged communities in Long Beach and surrounding areas.

Figure 6. California Disadvantaged Communities in Long Beach and Surrounding Areas



¹⁵ The state also included 22 census tracts that scored in the highest 5 percent of CalEnviroScreen Pollution Burden but that did not an overall score in the top 25 percent due to population characteristics. See CalEPA 2017, Designation of Disadvantaged Communities Pursuant to SB 535 (De León). <https://calepa.ca.gov/wp-content/uploads/sites/6/2017/04/SB-535-Designation-Final.pdf>

Source: SB 535 Disadvantaged Communities Using CalEnviroScreen. June 2018 update.
<http://oehha.maps.arcgis.com/apps/View/index.html?appid=c3e4e4e1d115468390cf61d9db83efc4>

Note the extent that the City of Long Beach and surrounding areas fall within the most disadvantaged areas in the state. While the red census tracts in Figure 6 represent the tracts in the state with the highest environmental vulnerabilities rating 91 percent and above, in Figure 7, the census tracts identified in red are tracts with ratings in the top 25 percent across the state. Thus, while several census tracts in the City of Long Beach rate among the most environmentally burdened tracts in the state, LBT's broader service areas are, to a large extent, designated as Disadvantaged Communities and are eligible for investment from Cap and Trade auction proceeds.

CalEnviroScreen and Disadvantaged Communities ratings document by census tract both existing pollution burdens and population vulnerabilities. Pollution burdens associated with vehicular emissions can be reduced by increasing public transit trips, and population characteristics such as high percentages of elderly or school age populations could represent transit service opportunities for LBT. Thus, areas designated as Disadvantaged Communities can benefit from Cap and Trade State grants to enhance transit options for such communities.

1.7 The Role of the American Public Transportation Association (APTA) in Transit Sustainability

APTA is the major organization of public transit agencies in the US, providing "advocacy, innovation, and information sharing".¹⁶ In 2009, APTA began its voluntary Sustainability Commitment Program for transit agencies. Through this program, transit agencies voluntarily commit to implement processes to achieve greater sustainability in environmental, social, and economic aspects of their operations.¹⁷ The program recognizes outstanding sustainability achievements that meet specific criteria through its Sustainability Commitment Program. Depending on level of achievement, transit agencies can be recognized as Platinum, Gold, Silver or Bronze level certifications.¹⁸ Over 100 transit agencies have made sustainability commitments through the program.

Sustainability is widely recognized as having three interconnected aspects, environmental, social and economic. It is often defined as development or activities that balance the three Es,

¹⁶ APTA. 2018a. About APTA. Retrieved May 4, 2018 from <https://www.apta.com/about/Pages/default.aspx>

¹⁷ APTA. 2011. Transit Sustainability Guidelines. March 31, 2011. APTA-SUDS-CC-RP-004-11 Retrieved on May 7, 2018 from: <https://www.apta.com/resources/hottopics/sustainability/Documents/Transit-Sustainability-Guidelines.pdf>

¹⁸ APTA. 2016. Sustainability Commitment: Transit Agencies. Overview. March 9, 2016. Retrieved on 5/16/2018 from: <https://www.apta.com/resources/hottopics/sustainability/Documents/APTA%20Sustainability%20Commitment%20Overview.pdf>

environment, equity, and economy.¹⁹ APTA has identified major indicators of these three aspects as it applies to transit. Environmental indicators that APTA has identified include: water use, air pollution, GHG emissions, energy use, waste and recycling, operating expense per unlinked passenger trip and vehicle revenue mile, unlinked passenger trip per capita in service area of operation, VMT per capita in service area of operation.²⁰ Social and economic indicators include: community building and engagement, economic impact, employees and workforce, financial indicators, mobility and accessibility, safety and emergency preparedness.²¹

APTA's guidelines for transit sustainability guided the preparation of this sustainability plan for LBT, which focuses on developing a strategic plan to achieve overall sustainability in LBT's plans and operations over the next 10-15 years. To prepare the plan, through interviews with LBT management and Board members, and review of agency documents, the study team identified areas for improving the sustainability of the agency. The next step was to take stock of where the agency stood with respect to major aspects of sustainability in the transit field. To do this, the study team obtained baseline information on the major indicators of transit sustainability as identified by APTA.

The study then examined several policy options for the agency to improve its sustainability, in terms of new projects, operational changes, and new training. At a workshop conducted with the executive leadership and management teams, the study team presented several options for future strategies, and obtained feedback.

1.8 Organization of this Report

This introductory chapter provides a brief profile of LBT, reviews the larger sustainability context in the state, and draws the link between climate action and reducing air pollution. This is followed by a brief profile of the City of Long Beach, especially, its pollution burdens and population vulnerabilities, and discusses California's major method for identifying such vulnerabilities, CalEnviroScreen. It then discusses the role that APTA can play in providing guidelines and recognizing LBT's sustainability efforts.

The remainder of this report is organized as follows. Chapter 2 summarizes the results of interviews with LBT executives, managers and Board members that probed for their views on agency sustainability priorities and efforts at LBT. Chapter 3 reviews APTA's sustainability indicators and process for obtaining recognition from the association. Chapter 4 summarizes the

¹⁹ Blanco, H. and D. Mazmanian. 2014. Chapter 1. The sustainable city: introduction and overview. In D. Mazmanian and H. Blanco (eds.) *Elgar Companion to Sustainable Cities. Strategies, Methods and Outlook*. Cheltenham, UK and Northampton, MA, USA: Edward Elgar.

²⁰ APTA. 2016. Sustainability Commitment: Transit Agencies. Overview. March 9, 2016. Retrieved on 5/16/2018 from:
<https://www.apta.com/resources/hottopics/sustainability/Documents/APTA%20Sustainability%20Commitment%20Overview.pdf>

²¹ APTA. 2018b. Social and Economic Sustainability for Transit Agencies. April 16, 2018. APTA SUDS-CC-RP--005-18. Retrieved on May 8, 2018 from <https://www.apta.com/resources/standards/Documents/APTA%20SUDS-CC-RP-005-18.pdf>

findings on LBT's environmental sustainability based on APTA's environmental inventory methodology. This is supplemented in Appendix 1 with an inventory following APTA's methodology and updated in April 2019. Chapter 5 summarizes findings on LBT's social and economic sustainability indicators based on APTA's guidelines. In Chapter 6, based on current conditions, two sets of scenarios or sets of options for achieving greater sustainability over the next 10-15 years are presented. The study estimates that the first set of scenarios can be achieved by 2025 and the second can be implemented by 2035, if not sooner. Chapter 7 provides a summary of findings and identifies next steps for the agency.

Appendix 1 provides the full calculations for the environmental baseline for an application to APTA for sustainability recognition. Appendix 2 provides the calculations for scenarios installing solar on parking lots and buildings in LBT properties. Appendix 3 provides the method used to calculate solar emissions offsets, and Appendix 4 provides a list of executives and managers interviewed for this report.

Chapter 2. Agency Perspectives on Sustainability

The project interviewed LBT's Executive Leadership team and managers (21) and Board members (9) on what they thought were important aspects of sustainability for LBT, the greatest challenges in sustainability that the agency faced, the easiest aspects of sustainability that LBT could improve, and the most important aspects of sustainability that the agency could improve.

2.1 Important Aspects of Sustainability: LBT Management and Board Views

Environmental Aspects of Sustainability. While several managers/Board members emphasized the importance of all aspects of sustainability, environmental, social and economic, about two-thirds of the group interviewed emphasized environmental aspects of sustainability. LBT's plan to change the composition of the fleet by increasing its battery-electric buses (BEBs) from 10 to 100 over the next few years was mentioned by over a third of those interviewed. The potential of installing solar power on LBT facilities was also mentioned several times. Ensuring the sustainability of LBT facilities as well as of the infrastructure for BEBs were also identified as important for the agency.

Economic and Fiscal Aspects of Sustainability. The financial sustainability of the agency, given the declining transit ridership in the region as well as in LBT, and its reliance on government funds and grants from several sources, was identified as a major sustainability concern by many managers interviewed. Other economic and fiscal issues of importance to LBT's sustainability raised by the group interviewed included: the need to address changing mobility options, e.g., Uber/Lyft, shared bikes, scooters; and collective bargaining challenges, including more sustainable work assignments for operators.

Social Sustainability Issues. Ensuring access to transit for lower-income and disadvantaged populations was identified as a prime objective of social justice and social sustainability in the transportation field. Also mentioned were exploring new transit options for Transit Oriented Developments (TODs) and for new, higher-density developments in the city. Being sensitive to environmental justice issues was also identified as directly relevant to social aspects of sustainability issue at LBT.

Overall, most managers and Board members identified environmental sustainability issues as most important aspects of sustainability for the agency. The economic sustainability of the agency was the second-most mentioned aspect of sustainability mentioned by managers and Board members. Fewer managers and Board members mentioned social aspects of sustainability.

2.2 Greatest Challenges for LBT

Declining Ridership. Many managers expressed concern with declining ridership. They also made several suggestions to increase ridership, including: special outreach to increase ridership among seniors, students, and on weekends; improving customer experience on buses and at bus stops; making transit more attractive to young professionals by increasing service frequency schedules on certain routes; doing a free-ride pilot; right-sizing the fleet: 20', 30' or 40' vehicles

or minivans. Someone noted that promoting sustainability should be the theme for the next campaign to promote ridership.

Funding Issues. Funding issues were brought up as a challenging issue by many LBT managers and Board members. Among those interviewed, there was a widespread understanding that funding for new technology, e.g., BEBs, and, in general, for capital projects was available from various agencies. Major concerns brought up were the cost of labor and pension liabilities. A manager noted that operating costs make up 70-75 percent of the budget, and that this makes it difficult to make cuts in the budget.

Changing Technology. The use of BEBs and CNG buses were identified as a challenge, in that such changes in technology required capacity for supporting the new technology, including in-house expertise to support such technologies, as well as funding. Other managers noted that LBT was well-positioned in technology, and that it was important for the agency to maintain its leadership in this area, especially as such technologies decrease emissions and increase customer satisfaction. Several managers noted that the requirement to retain buses purchased with federal funds for 12 years could delay the transition to new cleaner bus technology. A couple of managers noted the importance of investing in sound technology, since, for example, the capacity of charging stations is rapidly changing.

Several managers brought up the need for retraining operators and mechanics to drive and maintain electric buses, and one noted that operators have problems driving BEBs.

Several managers and Board members brought up that an important future consideration for the agency was the development of autonomous buses and vans. In 2018, FTA initiated research on the potential for autonomous buses and vans and is providing demonstration grants for testing such technologies.²² California has already permitted several companies to test autonomous cars, and CA DMV is in the process of passing a regulation to allow the testing of self-driving light-duty trucks (under 10,001 lbs.) on public roads.²³

Creating a Culture of Sustainability. Several managers pointed out that having everyone on board with the same culture of sustainability was not easy at LBT, and that it would require some training, since some people at LBT had been at the agency for many years, and were resistant to change. Another manager pointed out that the biggest challenge was to find staff, time and people to improve sustainability at the agency, and in particular, to ensure leadership for such a sustainability initiative. Another issue raised in the interviews was the issue of prioritizing—what to do first.

2.3 Aspects of Sustainability Easiest to Improve at LBT

Increasing the Use of More Sustainable Technologies. The use of more sustainable technologies, such as battery-electric or zero-emission buses and the potential for solar

²² FTA 2018. Transit Automation Research. <https://www.transit.dot.gov/automation-research>.

²³ CADMW (2019). Auto Light-Duty Motor Trucks (Delivery Vehicles). Proposed Regulations. https://www.dmv.ca.gov/portal/wcm/connect/d9f88791-6219-4fe2-b0a5-777576c984c8/avldmt_NoticeofProposedAction.pdf?MOD=AJPERES&CVID=

installations on its facilities were noted by the largest segment of managers and Board members as easiest sustainability measures to implement at LBT. Also noted was the need for training to service the new technologies, and it was suggested that LBT could start an apprenticeship for mechanics to maintain the new vehicles and/or infrastructure.

Developing a Sustainability Plan. The second-largest number of responses on which aspects of sustainability would be the easiest to implement at LBT were focused on the sustainability process itself. The need to expand the new campaign to the entire LBT community, as well as outside the agency was noted. A manager indicated that the campaign needed to be supported internally and externally given declining ridership. Other managers noted the importance of monitoring the process, measuring what the baselines are, providing a report card on successes and failures, and then working to improve these. Several managers pointed out that there is a need for education on environmental sustainability for operators as well as supervisors to increase productivity and opportunities for advancement. Managers noted several facility improvements such as lighting, cardboard recycling, default printing on both sides, as measures that could be easy to implement. Also, the opportunity for incorporating sustainability goals in all programs as well as procurement policies was noted. Another manager, however, noted the importance of finding staff time and people to improve sustainability at the agency.

Several responses pointed out that LBT implemented an earlier sustainability campaign (referring to a sustainability program started at LBT during 2009-2011), but that not everyone is aware of that experience, and, that, as a result, all low-hanging fruit has already been implemented, and that people have taken these efforts for granted.

Improving Customer Experience. Improving the customer experience on buses and at bus stops was indicated as an easy to implement sustainability goal. Also related was a recommendation to make transit more attractive to young professionals by increasing the frequency of service from 15 minutes to 10 minutes.

Closer Working Relationship with the City. Several managers and Board members noted that LBT could easily develop a closer working relationship with the city. With the increased rate of new development in the city, and the city's plans for street and traffic improvements, it becomes even more important for the city and LBT to coordinate their plans.

2.4 Most Important Aspects of Sustainability for LBT to Improve

Transform the LBT Fleet to ZEVs. The greatest agreement among managers and Board members on the most important sustainability initiative for the agency was to continue the plan to change the LBT fleet to Zero-Emission Vehicles (ZEVs). This transition would occur over the next 10-15 years contributing to improving the air quality in the region and take advantage of state and county funding for non-polluting and innovative technology.

Solar Photovoltaic (PV) Installations. The installation of solar PV on the parking lots of LBT facilities was recommended by several managers. It was noted that installing solar panels on the rooftops of older buildings will likely require structural analysis and supports. Maintaining the

LBT facilities in good repair, improving information technology (IT) in the facilities, as well as the fleets, were also indicated as important environmental objectives.

Workforce Sustainability. Several managers and Board members noted a number of concerns about the workforce important to address. These included issues of recruitment, training, and retention. A closer and ongoing connection with the unions, and not just at contract time, was pointed out as important for the agency. Managers mentioned the difficulty of recruiting operators, especially with the new competition for drivers from Uber and Lyft, the operator jobs do not seem to be as attractive. Once hired, operators face 12-hour schedules with a four-hour break in between two four-hour driving shifts and minimum wages during the training period. Also noted was the importance of training and of retraining operators and mechanics for the new technology.

Financial Sustainability. Many managers expressed concerns about agency funding, and expressed a need to better understand funding, goals, and initiatives. They noted the decline in public transit ridership (although this is a wider trend throughout the SCAG region), and were concerned about the implications for funding.

Closer Partnership with the City of Long Beach. On a more positive note, several managers and Board members pointed to the recent upzoning in many parts of the city and the dozens of new higher-density projects in the planning stage and the opportunities these provide for a closer collaboration with the city. This collaboration could result in new or expanded transit services for LBT. Also noted as important for LBT's future is a closer coordination with the city's transportation and traffic services, to ensure that transit has priority in the city's plans for complete streets along key corridors.

Addressing the Challenge of Ride-Hailing Companies. Several managers interviewed indicated the need to develop a strategy to either partner with ride-hailing companies (Uber/Lyft) or emphasize the benefits of transit over these ride-hailing companies. Improving communications channels and marketing campaigns to promote the use of LBT in the communities it serves were identified as important strategies.

Crafting a Sustainability Plan for LBT. Several interviews identified elements of a sustainability plan for the agency. These included: learning from previous efforts, education on sustainability, developing a program that focused not just on ZEVs and green energy options, but also on an "In-House Sustainability Program" that focused on recycling, increasing use of electronic rather than paper documents, and reporting on progress in meeting goals, reminders. The emphasis, according to one manager, should be on developing a proactive rather than a reactive program, including an emphasis on employee sustainability, such as a health and fitness program. A sustainability plan, one of the managers indicated, should improve communication in the agency between managers and the workforce. Another manager suggested that sustainability education could begin with the individual, through a program for reducing individual carbon footprints.

2.5 Summary

Overall, managers and Board member identified environmental and economic aspects of sustainability as important aspects of sustainability, especially, the plans to transition the fleet to ZEVs over the next dozen years. Also recognized as important were issues regarding ridership, and agency funding sources.

The greatest challenges brought up included issues of declining ridership and funding, as well as recognizing the demands that changing technology makes on the labor force and facilities, and of creating a culture of sustainability in the agency.

Responses on the easiest aspects of sustainability to implement in the agency emphasized continuing on the path of increasing the use of sustainable technology, improving customer experience, forging a closer connection with the city, and developing a sustainability plan for the agency.

There was wide agreement that most important for the agency was to continue transitioning the fleet to ZEVs, and to develop solar PV on the facilities. Workforce sustainability, especially as it concerns operators, as well as working towards greater financial sustainability, were also noted as most important for the agency. Closer partnerships with the city, and addressing competition from ride-hailing companies were also identified as most important. The development of, and elements of a Sustainability Plan for the agency were regarded as a major way for the agency to address the challenges that LBT faces.

Chapter 3. APTA's Approach to Sustainability Improvements in Transit

3.1 Why is APTA Recognition Important?

APTA's recognition is nationwide, adding to the national recognition of a transit agency in this area of concern. California and LA County, LA Metro and SCAG are all committed to sustainability and climate change action, and thus such recognition will be consistent with these other government agencies' efforts.

3.2 APTA's Sustainability Commitment and Entry-Level Status Core Principles

The following are identified by APTA as requirements for recognizing a transit agency as on the path to sustainability:

1. Adopt Sustainability as a core strategic objective of the organization
2. Identify a sustainability champion with appropriate human resources and/or financial resources and mandate
3. Establish an employee outreach program for staff to show:
 - a. how staff can help achieve goals
 - b. organization's progress towards goals
4. Undertake a sustainability inventory of the organization measuring the following:
 - Water usage
 - criteria air pollution emissions
 - GHG emissions and GHG savings
 - energy use (electricity, fuel)
 - recycling levels/waste
 - operating expense
 - unlinked passenger trips per capita in service area of operations
 - VMT per capita in service area of operations (APTA Sustainability Commitment)²⁴

APTA's first requirement is to adopt sustainability as a core strategic objective of the organization. This could be accomplished by inserting phrases in LBT's strategic vision and values, to read, for example: A leading provider of transportation options delivering innovative and high-performing services within a multi-modal network that transforms the social, environmental and economic well-being, *that is, the sustainability* of the diverse communities we serve. The italicized phrase would be the added phrase to LBT's current vision statement that could partially meet this requirement from APTA.

LBT executives will need to identify funding and resources for designating a sustainability champion in the agency with sufficient resources to carry out the responsibilities of a

²⁴ APTA. 2016. Sustainability Commitment: Transit Agencies. Overview. March 9, 2016. Retrieved on 4/16/2019 from:
<https://www.apta.com/resources/hottopics/sustainability/Documents/APTApercent20Sustainabilitypercent20Commitmentpercent20Overview.pdf>

Sustainability Manager. Once the sustainability manager has been appointed, LBT can apply to APTA for recognition by using the sustainability inventory prepared for this report, and contained in Chapters 4 and 5, and in Appendix 1. If the application to APTA occurs within the year, the LBT can use the data in this report without revision for its application to APTA. Chapters 4 and 5, and Appendix 1 follow APTA's guidelines and processes for calculating the environmental and social and economic inventory.

Once APTA recognizes LBT's sustainability efforts, the agency will need to update its inventory and identify goals for improvement on a yearly basis. As a result, a major responsibility of the LBT Sustainability Manager will be to collect inventory data on an annual basis. This inventory and its updates could also serve as a major source of information for the internal sustainability reports and updates for staff and Board members.

3.3 APTA's Process for Calculating Environmental Indicators

This report adopted APTA's process for calculating the environmental indicators, and used LBT FY 2018 data pertaining to:

- Mobile fleet composition, fuel usage, and mileage
- Water, gas, and electricity usage and expenditures
- Recycling and waste tonnage

It applied APTA's *Recommended Practice* and the Climate Registry's *2018 Default Emissions Factors* to calculate total metric tons of CO₂ equivalent (CO₂e) generated by mobile and stationary sources of GHG, criteria air pollutants, etc. A detailed breakdown is available in Appendix 1.

APTA's Environmental Sustainability Indicators for LBT include:

1. Water Usage
 - a. Bus wash; facility potable water use
 - b. Does not include pollutant discharge metrics
2. Criteria Air Pollutant Emissions
 - a. EPA Diesel Emissions Quantifier Tool
 - b. For diesel and CNG vehicles
3. GHG Emissions and Savings
 - a. Savings under "Transportation Efficiency Effect"
4. Energy Use
5. Recycling and Waste

3.4 APTA's Guidance on Social and Economic Indicators

This report also uses APTA's Guidance on Social and Economic Indicators for Social Sustainability (2018)²⁵, including indicators on community building and engagement, economic

²⁵ APTA. 2018. Social and Economic Sustainability for Transit Agencies. April 16, 2018. APTA SUDS-CC-RP--005-18. Retrieved from <https://www.apta.com/resources/standards/Documents/APTA%20SUDS-CC-RP-005-18.pdf>

impact, employees and workforce, mobility and accessibility, financial, as well as safety and emergency preparedness. A description of these indicators and LBT's efforts in these areas are developed and expanded in Chapter 5.

Chapter 4. LBT's Environmental Indicators and Inventory

Sustainability, as discussed, has three aspects, environmental, social and economic. In this chapter, we discuss the environmental aspects of sustainability for LBT. We have used APTA's Sustainability Recognition Guidelines to develop LBT's profile.

4.1 Environmental Indicators

In accordance with APTA guidelines, the following Environmental Indicators were measured as part of the agency's baseline greenhouse gas emissions:

Environmental Indicators
<i>Water use</i>
<i>Criteria air pollutants</i>
<i>GHG Emissions and GHG Savings</i>
<i>Energy use</i> Electricity Fuel Recycling levels/waste

Three of APTA's environmental indicators are already measured by LBT and reported to the National Transit Database (NTD) as per NTD's annual metrics reporting requirements. As such, they have not been calculated as part of this Sustainability Plan. These are as follows:

Environmental Indicators
<i>Operating expense per unlinked passenger trip and vehicle revenue mile</i>
<i>Unlinked passenger trips per capita in service area of operation</i>
<i>VMT per capita in LBT service area of operation</i>

4.2 Estimate of GHG Emissions of the Current LBT Fleet

Baseline data for conditions analysis was derived from FY 2018 Utilities and Fuel Consumption Data for both LBT's fleet and facilities. Mobile fleet data was derived from LBT's fuel dispenser actuals²⁶ and included fleet composition by fuel type, usage, and model year and fuel usage and mileage per vehicle per day. Facilities data was derived from utility bills for electricity, water, and natural gas annual consumption by facility and use. See Figure 7 for a breakdown of GHG

²⁶ Conversation with Steven Jorgensen, Maintenance Analyst, LBT on April 2, 2019.

emissions by mobile and stationary sources at LBT, and Table 5 for emission totals by type of fleet and stationary sources.

GHG metrics included in this sustainability plan are measured in metric tons of CO₂e emitted. Total metric tons of mobile and facility emissions for methane (CH₄) and Nitrous Oxide (N₂O) were converted into CO₂e measures through steps developed by APTA and conversion factors reported by the Climate Registry. Formulated Excel worksheets that detail the calculation steps for developing these metrics are included in Appendix 1.

Figure 7. Total FY 2018 GHG Emissions

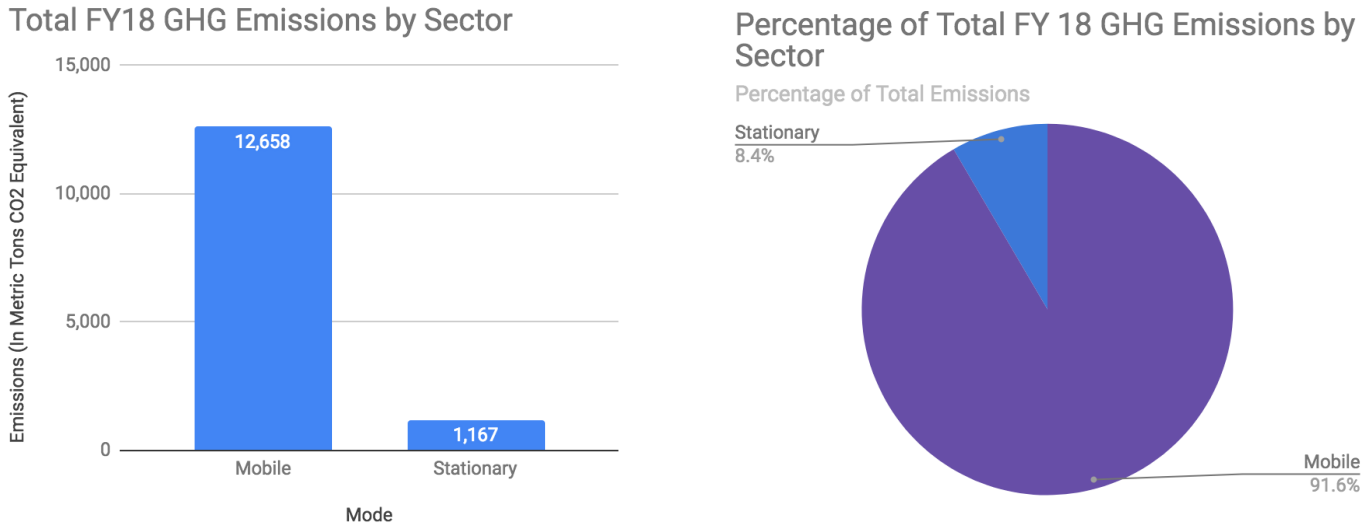


Table 4. LBT GHG Mobile Emissions by Source in CO₂e FY2018

FY 2018 Long Beach Transit CO₂ Mobile Emissions Baseline	
Emissions Source	Total CO₂ Emissions (In Metric Tons of CO₂ Equivalent)
CNG	429
Diesel	4,061
Gasoline	8,100
Electricity	67
Total Mobile CO₂e Emissions	12,658
FY 2018 Long Beach Transit CO₂e Stationary Emissions Baseline	
Electricity	1,003
Natural Gas	164
Total Stationary CO₂e Emissions	1,167
Total Scenario FY 2018 Emissions	13,825

The total FY 2018 Metric Tons of CO₂e generated last year was 13,825 tons. The mobile fleet is the dominant contributor to GHG Emissions due predominantly to the diesel and gasoline powered vehicles in the fleet. Facilities emissions are primarily driven by electricity uses.

APTA Guidelines also recommend calculating the automobile emissions displaced by the use of transit. A Land Use Benefit Calculator (“the calculator”) is an Excel-based sketch-modeling tool (available at www.TRB.org/main/blurbs/172110.aspx) designed to allow transit agencies to estimate the transportation efficiency effect, or the land-use benefits of their existing or planned transit projects and activities. The 2018 Passenger Miles Traveled and Mode Shift Factor are input into the equation to determine the emissions displaced. See Table 5 below. (Please see Appendix 1 for more details on the methodology behind GHG emissions calculations).

Table 5. LBT Transportation Efficiency Effect FY2018

Transportation Efficiency Effect					
2018 NTD Passenger Miles Traveled (a)	Mode Shift Factor (b)	Displaced VMT (c=a*b)	2018 Average Fuel Economy (d)	Gasoline Saved (e=c/d)	Displaced CO₂e Emissions (in metric tons) (f=e*Gasoline Carbon Conversion Factor)
73,821,438	0.48	35,360,469	25.4	1,392,144	12,265

Adjusted for displaced CO₂ emissions, the FY2018 Emissions Baseline for LBT is calculated in Table 6.

Table 6. LBT CO₂e Total Emissions Baseline Including Transportation Efficiency Effect

FY 2018 Long Beach Transit CO₂e Total Emissions Baseline	
Emissions Source	Total CO₂ Emissions (In Metric Tons of CO₂ Equivalent)
Mobile Fleet	12,658
Stationary Facilities	1,167
Transportation Efficiency Effect	-12,265
Total FY 2018 CO₂e Emissions	1,560

4.3 Discussion of Findings

As evident from Figure 8 and Table 4 on page 24, over 90 percent of LBT's CO₂e emissions are from mobile sources--the LBT fleet. This amounted to 12,658 CO₂e metric tons for FY2018. Adding the emissions from stationary sources at LBT facilities to the mobile sources amounts to a total of 13,825 metric tons of CO₂e.

The emissions from transit facilities are adjusted to take into account how transit trips displace vehicle trips. This adjustment is typically referred to as the "Transportation Efficiency Effect." Table 5 calculates this effect for LBT's FY 2018 total emissions. Table 6 shows how, in the case of LBT, the transportation efficiency effect reduces LBT's CO₂e emissions for FY 2018 to 1,560 metric tons.

Chapter 5. Social and Economic Sustainability at LBT

LBT has the opportunity to introduce new standards for designing and operating sustainable practices. Sustainable transit includes indicators that address internal and external social and economic impacts. This section identifies the agency's current practices that promote sustainability efforts, and offers new goals that the agency can work towards for the next five to 10 years. The following indicators are discussed: community engagement, economic impact, employees and workforce, financial, mobility and accessibility, and safety and emergency preparedness.

5.1 LBT Community Building and Engagement: Current Practices

Community engagement is integral for the agency to improve customer experience, demonstrate goodwill and build trust in the community. Through partner collaborations, LBT can enhance ridership outreach and communicate social benefits of transit to non-customers.

LBT Best Practices

- ***Dedicated Staff:*** LBT currently has a dedicated staff focused on community engagement, which includes three full-time staff and college interns.
- ***Community Outreach:*** Currently, a variety of communication methods are used to engage the public about the agency and to provide customers with regular updates via newspapers, advertisements, and weekly social media posts. LBT also participates in local community events throughout the year, with summer season being the most active time. The following are annual community events in which LBT participates by hosting a booth to provide information about routes and services, and passes and fares.
 - Summer Movies on the Beach
 - Veterans Day Parade; Martin Luther King Jr. Parade; Pride Parade and Festival
 - Free rides days on Election Day and New Years Eve
- ***Community-Specific Outreach:*** LBT has identified specific community-based outreach strategies that are most appropriate to use for a given community. For Spanish-speaking communities, outreach is generally performed at on-site locations throughout the year. For student-focused outreach, LBT visits college campuses to share information about TAP cards and also promotes student discounts via digital media. For the senior citizen population, outreach is targeted on-site. Outreach strategies to different communities are tailored in a way that recognizes varying values, customs and priorities.
- ***Customer Service Feedback:*** The 2018 Customer and Community Evaluation Survey report²⁷ provides LBT with feedback on the agency's performance from existing and potential customers. The findings from the report are intended to help inform the

²⁷ Long Beach Transit Customer and Community Evaluation Survey Final Report FY 2018.

agency on priority areas. Major findings include:

- Nearly 98 percent of customers rated service as good or excellent. Nearly 50 percent of respondents reported they might consider riding the bus.
 - The most preferred service improvement for customers was *more buses/increased frequency*. The lowest-rated service attribute was *security onboard*.
 - The most frequently cited reason for using LBT was for work and for school.
 - Potential service changes which could positively impact ridership are *increased service frequency* and *expanded service to include new/unserved destinations*.
 - Demographically, LBT customers are predominately students, identify as Latino and female.
- ***LBT's Systemwide Transit Analysis and Reassessment (STAR) Initiative:*** To design a medium-term and longer-range set of improvements to its transit routes and frequency of service, the agency initiated a comprehensive operational analysis branded as the STAR Initiative (2016-2018) to incorporate extensive community input into community priorities for proposed transit improvements including frequency of bus services, simple and easy to understand routes and schedules, expanded and accessible transit to anywhere in the city of Long Beach, and express service to West LA, Downtown LA and Orange County.²⁸ The community involvement process included 40 events and over 1,200 participants including:
 - stakeholder meetings and presentations
 - pop-up events in various communities
 - online surveys
 - five community meetings
 - ***Partnerships and Collaboration:*** The agency has established long-term partnerships with community-based organizations that serve transit riders throughout the city. Examples include:
 - LA Symphony. LBT provides free transit for youth and arts programs
 - LGBTQ Center. LBT provides free transit to connect youth to social services
 - CSULB. In this partnership, LBT offers low-cost bus transportation for all CSULB students, staff and faculty.
 - 2nd Street Belmont Shore Business Association. This partnership with local businesses aims to increase visibility and to promote transit options for large employers in Belmont Shore.
 - LBT Connected Seniors Program. LBT provides senior TAP cards and training to help senior citizens gain the confidence to ride public transit.

²⁸ Long Beach Transit. 2019. LBT Systemwide Transit Analysis and Reassessment (STAR) Initiative. Retrieved from: <http://lbtstar.com/documents/>

5.2 LBT Community Building and Engagement Goals

Based on social and economic indicators identified in APTA's Sustainability Guidance, and interviews with LBT's management team, we have identified the following goals that the agency can pursue to attain greater sustainability in the next few years.

3-5 years

- **Training:** Provide training for employees involved in customer engagement that covers topics in diversity, inclusion, and cultural awareness. LBT has equal employment opportunities (EEO) training and diversity training for all employees, except for customer service clerks.²⁹
- **Expand Partnerships:** LBT has identified specific community groups they hope to create new partnerships with: Cambodian community members, and Spanish-speaking communities, as well as partnerships with management of new development projects and major employers in the region.³⁰
- **Alternative Data Collection Methods:** In the past, informal focus groups have been conducted as an alternative approach to collect feedback about the agency's operations and performance.³¹ With dedicated staff time and resources, LBT can utilize this approach on a periodic basis to connect customer-facing employees, existing customers, and the management team to discuss current challenges and possible goals.

5-10 years

- **Advocacy:** LBT could collaborate and support community groups working on issues related to community displacement and rising housing costs. Through these community partnerships, LBT could leverage community-based organizations capacity to engage community on transit-related issues while providing resources to do so.
- **Promote Equity and Social Justice:** LBT could establish equity and social justice advisory groups to help inform and create strategies that help mitigate community displacement or rising housing costs.

5.3 LBT Employees and Workforce: Current Practices

Employment recruitment and retention, especially for bus operators, have been identified by LBT as one of the most challenging internal goals. Sustainable organizations need to establish policies and programs supportive of effective workforce culture.

²⁹ Written response and in-person interview with Mike Gold on Feb. 21, 2019

³⁰ In-person interview with Mike Gold on Feb. 21, 2019.

³¹ In-person interview with Mike Gold on Feb. 21, 2019.

LBT Best Practices

- ***Retention Strategies:*** LBT has numerous benefit packages. Health care (medical, dental, vision) is reviewed on an annual basis. Salaries and benefits provided at other transit agencies are reviewed periodically to ensure that salaries and benefits are competitive.
 - LBT has a college student internship program whereby it hires qualified interns to work alongside professionals to gain real-world knowledge and to participate in special projects across various departments. LBT's internship program has been very successful at enhancing professional development. Since the program's inception, interns have been hired as employees or have moved on to substantial positions with other organizations.
 - LBT provides a tuition reimbursement program to staff employees interested in expanding their education. LBT's tuition reimbursement program is based on tuition costs at California State University, Long Beach (CSULB) and provides up to \$3,200 per year.

- ***Fair Hiring Practices and Employee Accommodations***
 - LBT has a job description template that is continuously evolving. Job descriptions are read by Human Resources, the Executive Director of Employee and Labor Relations, and the Deputy CEO. The interview process consists of panels and interview questions are developed by the hiring manager and a representative of the Human Resources department for use during the interview.
 - LBT reviews all applications and responds to every applicant on the status of their applications. Even if a candidate is not selected, LBT provides possible recommendations to other opportunities. Additionally, the new onboarding tool has allowed more flexibility to candidates as they are now able to complete all paperwork electronically. This expedites the recruitment time, allowing LBT to go through all the pre-employment and new hire documents quickly.
 - LBT engages in an interactive process with operators who become disabled and can no longer obtain a Class B license to determine if they are able to perform the duties of other open positions within the organization. LBT also reviews situations on a case-by-case basis to determine if it can make reasonable accommodations for employees who may become disabled, such as job modifications for those not requiring a Class B license, or those with a Class B license who may be able to perform another position with reasonable accommodations.
 - LBT has partnerships with Pacific Gateway, EDD, Long Beach/Signal Hill Workplace and surrounding cities to help individuals facing employment barriers find job opportunities and training with the agency. Organizations provide support to individuals facing employment barriers including veterans, and individuals with disabilities. LBT partners and attends career fairs, provides resume building workshops and interview etiquette to help individuals on the

job market find employment.

- ***Performance Management Program***

- LBT is in the process of implementing an electronic performance evaluation program for staff employees.
- Bus operators are reviewed for technical skills. LBT employs an external firm that performs quality assurance audits on bus operators much like “secret shopper.” This firm also conducts "mystery calls" with customer service staff.
- Most of LBT’s employees are unionized, and LBT follows disciplinary procedures in line with its contracts with the Amalgamated Transit Union (ATU) and the American Federation of State, County and Municipal Employees (AFSCME). The Human Resources department attends disciplinary hearings for represented employees, and works with managers on presentation of discipline for non-represented employees.
- There are many programs throughout the year to recognize employees, such as, but not limited to, employee-of-the month, department recognition, spotlight in LBT’s newsletter, safety board and annual awards program.
- Organization goals cascade to department goals and then to individual goals. Employees are rated on performance of individual goals, which is one segment of their performance evaluation.

- ***Workforce Engagement***

- HR in conjunction with the healthcare broker and insurance provider have "lunch and learn" sessions, providing pop-up eye care clinics; healthy meal preparation; lunch-and-learn sessions, wellness fairs, as well as on-site chiropractic services.
- LBT values training and development, employee recognition, employee involvement, provides an Employee Assistance Program that is free to all of its employees, has a behavioral component to its healthcare program, has offered various wellness programs internally for its employees, including an annual health fair, flu shots, and biometric feedback, and is in the process of creating and implementing an inter-departmental committee of Wellness Champions for its Corporate Wellness Initiative.

5.4 LBT Employees and Workforce Goals

3-5 Year Goals

- ***Strategy for hiring bus operators.*** Hire a Staff Analyst in Human Resources to determine the gaps and issues in the employee hiring and retention process, identify

- organizational trends, and provide financial analysis.³²
- ***Establish an apprenticeship program*** to help support professional development for employees, including bus operators.³³
 - As training for certain work changes due to technology advances, provide the educational support in-house or fund scholarships for outside training. Tuition reimbursement can also be extended to bus operators.
 - Provide education for soft skills, such as business writing.

5-10 Year Goals

- ***Continue strong relationships with unions.***

5.5 LBT Financial Sustainability

Financial sustainability enables an agency to operate responsibly and ensures the reliability of transit services to its customers. In addition to fiscal responsibility, an agency should also ensure that its investments and procurement strategies are also sustainable.

5.5.1 Fiscal Responsibility: Best Practices³⁴

- ***Fiscal Integrity.*** LBT maintains fiscal integrity of its operating and capital budgets. The agency accomplishes this by ensuring an annual balanced budget which is defined as having ongoing operating costs that do not exceed the amount of its incoming revenue and maintaining no debt by continuing to fund future operating capital needs on a pay-as-you-go basis with available formula allocated and discretionary grants.
- ***Long-Term Financial Planning.*** LBT's long-term financial planning includes financial forecasting of revenues and expenditures, using various assumptions about economic conditions, historical trends and industry indicators. The results of this forecast facilitate proactive discussions and a long-range perspective for decision making.
- ***Annual Budget Process.*** LBT presents an annual budget to the Board of Directors for approval and adoption. The budget development process is initiated by assessing current operations, short-term and long-term plans to arrive at budget objectives and capital strategic focus for the next fiscal year to serve as LBT's budget focus. Budget objectives and assumptions are formulated and shared with LBT's Executive Leadership Team (ELT) and managers to kick-off the start of the budget season. Interdepartmental meetings are held to ensure that the departments develop a comprehensive budget plan that adheres to the budget objectives. Operating budget proposals are reviewed by the CEO, Deputy CEO and Executive Director of Finance and Budget. Capital budget proposals are reviewed by the Key Performance Indicator (KPI) Team and final recommendations are presented to the CEO, Deputy CEO and Executive Director of Finance and Budget. A series of meetings are held for review, feedback and final approval of budget numbers.

³² In-person interview with LaVerne David on Feb. 21, 2019

³³ In-person interview with LaVerne David on Feb. 21, 2019

³⁴ Information based on Lisa Patton, Executive Director/VP, Finance and Budget and Rhea Morallos, Comptroller written comments on financial sustainability indicators dated 3/13/2019.

Staff presents the final budget to the Board of Directors for approval and adoption. The adopted budget is managed throughout the fiscal year. A review of the financial statements which includes comparative analysis of actual revenues and expenditures versus budget are done on a monthly basis. The financial statements are then reported to the Board of Directors by the Executive Director/VP of Finance and Budget.

- **Annual Audits.** LBT's financial data are subjected to annual and mandated audits by Federal, State and Local governments. One of the organizational goals of LBT is to complete audits and receive an audit report with an unqualified opinion and no findings. LBT recently completed its FY2018 annual financial audit conducted by Windes, Inc. and received an audit report with an unqualified opinion and no findings.
- **Awards for Financial Reporting.** In addition, LBT was awarded the Certificate of Achievement for Excellence in Financial Reporting by the Government Finance Officers Association (GFOA) for the 28th consecutive year in FY 2017. The GFOA also presented LBT for the first time with a Distinguished Budget Presentation Award for its Annual Budget for FY 2018.³⁵
- **LBT's Capital Improvement Plan (CIP).** LBT's CIP process identifies revenues allocated to LBT using the Transit Funds Allocations (Funding Marks) provided by LA County Metro, the Regional Transportation Planning Agency (RTPA). The annual Capital Call for Projects process includes project managers identifying the assets that are due for replacement or rehabilitation through a capital request form, which includes the year the asset was acquired/placed in service, the useful life and the current condition of the asset. As of October 2018, in accordance with FTA's State of Good Repair (SGR) requirements, the agency has a Transit Asset Management Plan (TAM) which documents and guides and informs the agency's maintenance and replacement program. Annually, as a part of the preparation process for the capital call for projects, the Executive Leadership Team (ELT) meets with the Capital program team to define the capital investment strategy for the upcoming year. The capital requests are then tied to those strategies.
- **LBT's CIP seeks to Maintain the Value of Assets and Infrastructure.** Although there are often more capital improvement needs than available funding, the Capital Planning and Grants Department seeks a number of competitive grant sources annually. In addition, LBT's asset management and state of good repair strategy is documented in its Transit Asset Management(TAM) Plan of October 2018.
- **LBT Manages and Measures Metrics to Evaluate Fiscal Performance.** Long Beach Transit's Key Performance Indicator (KPI) initiative brings together analysts, data managers from different departments across the organization to measure and analyze the performance of the agency. The KPIs that the agency has identified support the corporate strategic priorities. Each KPI has a specific

³⁵ See also LBT. 2018. *FY2019 Budget Book*; LBT. 2019. *FY2020 Budget Book*. Also, *LBT Comprehensive Annual Financial Report FY2018*.

target set each year and progress is measured against that target. The team's purpose includes communicating the agency's performance results to managers and directors to aid in decision making. The team's responsibility is also to collaborate with one another to identify the cause of trends and potential solutions. Currently, the performance results are compiled and presented to leadership quarterly. In addition, LBT conducts salary surveys. LBT also manages and measures metrics to track share of state or federal grant dollars needing local dollar match in capital programs and budgets. The grant guidance identifies the local match required for any specific state or federal grant. At the time of the capital planning process, a planning spreadsheet is developed based on the projects requested and the funding source identified by the Capital Planning team to fund that project. Once projects and funding are approved, the federal, state and associated local dollars are entered into the agencies' financial management system (Ellipse) where grant and project funding is managed.

- ***LBT has no debt.***

5.5.2 LBT Fiscal Responsibility Goals

3-5 Years

- ***Prioritize Sustainability.*** LBT can define and implement a capital improvement plan to prioritize sustainability initiatives.
- ***Incorporate Climate Resiliency.*** LBT can integrate climate resiliency into capital planning, state of good repair and asset management systems by developing an agency resiliency plan, completing climate risk assessments, and developing design standards for climate resiliency for all capital projects.

5.5.3 Sustainable Investments: Current Practices

- ***Influence on TODs.*** LBT influences transit-oriented development (TOD), and transit-oriented communities (TOCs) through its marketing efforts as well as its public-private partnerships. LBT is an active member of various industry associations, such as American Public Transportation Association (APTA), and the California Transit Association (CTA) which promote transit-oriented development. LBT is involved with many working groups at the federal, state and regional levels centered upon strengthening and improving the connections between land use development and public transportation.
- ***Investing in Sustainable Capital Projects.*** LBT invests in sustainable capital projects similar but not limited to alternatively fueled fleets, energy-efficient facility design and upgrades, energy-generating systems, renewable energy systems, nonrevenue fleet improvements, and efficiency changes to service. The LBT Board of Directors has established policy that directs staff to seek funding opportunities that will support investments in alternatively fueled revenue and non-revenue vehicles as well as

supporting infrastructure and energy conservation activities related to its facilities.

- ***LBT has obtained Innovative Competitive Grant Funds.*** Two examples include a Low and No Emission Vehicle Grant in 2016 for \$1.17 million and another in 2011 for Transportation Investment Generating Economic Recovery for \$6.7 million.
- ***LBT plans Capital Improvement Projects that target access to jobs and education.*** For example, Route 22 expansion grant, although funded through an operating grant, targets access to jobs and education. Customer amenities program that include signage, benches, shelters, purchase of replacement buses also aim to improve access to jobs and education.

5.5.4 Sustainable Investments Goals

3-5 Years

- ***Use the grant funds that LBT has already obtained to install LBT's first solar PV project.***
- ***Identify Potential Grant Funding for Installing Solar PV on LBT1 and LBT2 parking lots and buildings.*** Once identified, apply for grants.
- ***Continue to Apply for Capital Funds to Convert the LBT fleet to ZEVs.***

5.5.5 Procurement Strategies: Current Practices

- ***Life-Cycle Cost Analysis in Procurements.*** LBT includes life-cycle cost and total cost of ownership as part of procurement bids in bus procurements.
- ***LBT is Starting to Implement Procurement Practices to Improve Quality of Goods/Services Purchased.***
- ***LBT uses Cost-Benefit Analysis.*** Through the capital call process, LBT performs cost-benefit analyses to inform capital and operating investment strategies.

5.5.6 Procurement Goals

3-5 Years

- ***Analyze major supplier and partner data to identify the location and sustainability of goods and services purchased by LBT.*** Such studies could identify the relative distances of goods or services provided, as well as the raw materials, finished goods, equipment, repair, etc.

5-10 Years

- ***Develop green procurement strategies based on supplier and partner data.*** Such a strategy can take into account sustainable distances of source of materials or services and/or develop supplier performance evaluations to influence environmental impact reductions of contracted or procured goods and services.
- ***Develop circular economy criteria***³⁶ for major capital purchases to incentivize ZEVs and solar PV companies to collect and refurbish their products or major parts of their products.

5.6 Mobility and Accessibility

APTA's guidelines define mobility as the ability to physically move about the community, while accessibility focuses on one's ability to reach destinations. While many aspects of mobility and accessibility have been covered in Sections 5.1-5.2 Community Building and Engagement, in this section, we focus on affordability, access and multi-modal connectivity.

5.6.1 Mobility and Accessibility Best Practices

- ***LBT has maintained the affordability of transit fares.*** The agency has not raised fares since 2010.
- ***LBT Incorporates Several Practices that extend Mobility and Accessibility.*** These include: extending transfer times during off-peak hours; implementing inter-operability with other transportation providers; implementing discounted fare programs for K-12 and college students, e.g., a discount program with CSULB and Long Beach City College; and implementing income-based fare programs, i.e., Low-Income Fare is Easy (LIFE) program with Metro. LBT has partnered with various Senior communities as well as high schools and colleges to educate these communities on access/availability of discounted fares. LBT has ongoing outreach with the Long Beach Area Convention Center Bureau, Downtown Long Beach Alliance and Midtown Business District to promote ridership. The agency has removed barriers to access discount fare programs for seniors and students by partnering with nonprofit organizations and other agencies that are already involved in providing income verified services, mobile registration to move to job sites, etc. In addition, LBT works closely with the City of Long Beach and local developers to identify transit improvements and to ensure coordination with the city on bike improvements and the e-scooter program.

³⁶ The Ellen MacArthur Foundation provides a rich set of materials defining the circular economy and its application to various sectors, including transportation. See <https://www.ellenmacarthurfoundation.org/>

5.6.2 Additional Mobility and Accessibility Goals

3-5 Years

- *Develop a communication plan that expresses the combined cost of housing and transit.* Such a communication plan can compare a range of housing and transit costs in typical households to the same housing costs and vehicle ownership and use.
- *Study the feasibility of partnering with a ride-hailing company to address gaps in LBT system.*

5.7 Safety and Emergency Preparedness

This section covers safety culture within the workplace, security awareness to protect against malicious intent and emergency preparedness.

5.7.1 LBT Safety Best Practices:

- *LBT's safety culture*

Safety culture is promoted throughout the agency. One of LBT's strategic priorities is to improve safety and service quality, and a monthly report is presented to the Board of Directors. This is emphasized at agency meetings, where executives and managers take turns to begin each meeting with a safety message that is relevant and informative for the participants. Another of LBT's values is to "be proactive" by identifying problems and seeking solutions.

- Safety is brought to the forefront by the following training for employees: Safety training sessions are presented by the Safety Officers during on-boarding, and the training department also gives safety training (OSHA). Employees are taught many aspects of safety from office safety to road safety and OSHA compliance.
- Bus Operators and Supervisors receive eight hours of refresher training annually mandated by the state of California, "State Mandated Annual Refresher Training (SMART)." Although not mandated by the state, maintenance personnel receive safety and refresher training annually.
- LBT adopted the 5S program, initiated by the maintenance department, with a message that "everything has a place and everything in its place." Key areas of the facility are marked appropriately where employees and/or members of the general public may not enter. Posters are provided for work areas, and cautionary signage is affixed. LBT maintains material safety data sheets for work products.
- LBT's Training Department gives an eight-hour OSHA class to new maintenance employees. Also, it provides job specific training to mechanics, custodians, facilities personnel, maintenance supervisor and utility workers.
- The following are certain roles that ensure safety culture within the agency:
 - The Safety Officer chairs a safety committee that meets on a regular basis that is made up of inter-departmental representatives.

- The Environmental Health and Safety Manager (EH&S) chairs the Emergency focus group and Emergency committee meetings.
 - The EH&S Manager attends emergency planning meetings sponsored by the City of Long Beach.
- ***LBT's Effective Safety Communication***
 - When a preventable accident or injury occurs involving a bus operator, the safety officer and/or workers' compensation representative sends an email to the employee's supervisor, which is designed for coaching and counseling for the employee and the employees of each supervisor's groups. The email is discussed with the employee in person and with other operators on the shift concerning unsafe actions and/or behaviors. In addition, safety messages are displayed on electronic monitors in the operator's lounge and the maintenance lounge.
 - Various media sources, such as posters, signs, and banners are used to provide safety information. The Safety department also puts on two safety blitzes per month. These are held at different locations and times of the day, where they talk to roughly 150 employees face to face.
 - LBT delivers current and relevant security information through bulletin boards and on Safety Monitors. LBT receives security-related reports from staff via phone calls, emails and suggestion boxes. LBT receives information concerning chronic security-related challenges on the system from Bus Operators and Supervisors via a "police service request" form submitted to the agency system security officer.
 - LBT provides security awareness training to all new employees during orientations, to Bus Operators and Maintenance personnel via their SMART sessions and through a multi-disciplinary mentor program that intermediate-level Bus Operators attend. LBT delivers security awareness training to staff, managers and executives via periodic emails and monthly and quarterly meetings designed for this purpose.
 - LBT conducts system wide security-related risk assessments on an ongoing basis as required in the System Security Program Plan (SSPP).

5.7.2 LBT Emergency Preparedness Best Practices

- LBT employees are first-line responders for emergency situations, and, as such they have a representative(s) as floor warden(s). Floor wardens and emergency responders receive training in many things, such as, but not limited to earthquake, flooding, inclement weather, first aid, and following a chain of command for notification and action during an emergency.
- The administrative offices and maintenance departments have emergency first-aid kits. In addition to the kits, the administrative offices are equipped with automated external defibrillators (AEDs). First line responders and members of the emergency committee are trained in first aid and how to use the AEDs. LBT

first responders are also trained on cardiopulmonary resuscitation (CPR). Locations of emergency equipment, such as the AEDs are marked on the escape route floor plans posted throughout the office. Floor wardens are identified on a name plate outside their offices.

- LBT has an emergency focus group and an emergency committee comprised of floor wardens, and other designated positions. Floor wardens have a duffel bag with safety equipment, such as a hard hat, and keys to the LBT emergency trailers and equipment. Departments have an emergency manual (a copy which is also kept in the duffel bag) that provides home and cell phone numbers and chain of command in an emergency.
- LBT has quarterly walk-throughs at its facilities by its insurance company safety team, which identifies potential hazards, photos them, and reports them to the Safety Manager. The Safety Manager addresses issues with departments, which are given 90 days to remedy any items reported.
- The Maintenance Supervisors also participate in safety walk-throughs of the maintenance shop area and the outside parking lot area of the property at the beginning of their shift; they also log it into the supervisor log book.
- The Facilities supervisor also participates in a safety walk throughout the property, inside and outside the property lines. In addition, LBT has a custodian that is assigned to clean (lot sweeper) the parking lot area and is always looking for items to report, such as trip and fall hazards.

5.7.3 LBT Emergency Preparedness Goals

3-5 Years

- Finalize the Emergency Situation Transportation Services Transit Emergency Plan Memorandum of Understanding (MOU) with the City of Long Beach. This is being processed internally with Risk Management, Transit Service Delivery, with review by the organization's general counsel and DCEO.³⁷
- LBT' is currently studying options for regional participation with other transit agencies to incorporate climate resiliency actions into existing emergency preparedness plans. Once the study is completed, join the best option to ensure that LBT emergency plans incorporate climate resiliency.³⁸
- LBT's Transit Service Delivery Department is currently researching TransMAC, a mutual-aid agreement to aid transit providers in emergency situations. Once the research is completed, make decision

³⁷ Written Response by Duane Zertuche (2nd round interviews received early Jan. 2019)

³⁸ Written Response by Duane Zertuche (2nd round interviews received early Jan. 2019)

about joining TransMac.³⁹

- LBT is in the process of hiring a consultant to do a gap analysis of what LBT currently does that fits the FTA's Safety Management Systems (SMS) framework, and what yet needs to be done. Once the consultant has completed the study, ensure that LBT addresses any gaps in LBT practices to fulfill SMS requirements.⁴⁰

³⁹ Written Response by Duane Zertuche (2nd round interviews received early Jan. 2019)

⁴⁰ Written Response by Duane Zertuche (2nd round interviews received early Jan. 2019)

Chapter 6. Future Scenarios

To provide LBT with strategic, sustainability options for the next 10-15 years, this study developed two sets of scenarios: for the mid-2020s decade, and for the mid-2030s decade (Scenarios 1 and 2), as well as one set of scenarios more ambitious than the other in its efforts to reduce CO₂e emissions (the two A scenarios are less ambitious, and the two B scenarios are more ambitious).

6.1 Scenarios 1A and 1B

The scenarios are focused on the estimated CO₂e emissions per year that LBT could reduce given recommended practices. As indicated, this scenario planning effort is focused on two primary time frames: Scenarios 1A and 1B detail two sets of recommended sustainability practices that LBT could adopt by 2020-25; Scenarios 2A and 2B will detail two sets of recommended sustainability practices that LBT could adopt by 2035. Scenarios 1A and 2A assume recommended changes without the installation of solar panels to offset electricity consumption, while Scenarios 1B and 2B assume solar panel installation. Please see Appendices 2 and 3 for more details on the methodology behind GHG emissions calculations. The proposed scenarios in this section are primarily focused on environmental sustainability, with some discussion of social and economic sustainability.

Scenario 1A

- Improvements to the emissions rate for Southern California Edison's (SCE) eGRID electricity generation. SCE has formally announced plans to increase the percentage of their electricity needs supplied by renewable sources, which is anticipated to reduce the emissions rate used to calculate CO₂e emissions per kilowatt hours (kWh) generated. These efficiency improvements are expected to reduce the emissions burden of electricity consumption by LBT. See eGRID Emissions Factors Projections for further information.
- The procurement of an additional 100 BEBs, with a corresponding 1:1 phasing out of diesel and gasoline-fueled buses. These 100 additional BEBs are already on LBT's official procurement strategy within this time frame. We assume that the total number of vehicles remains the same (342) through all of the proposed scenarios.

Scenario 1B

- Assumes the same recommendations as in Scenario 1A, with additional ones, as described below.
- Conversion of all non-revenue vehicles (53) into electricity-fueled or zero-emission equivalents. Several of the non-revenue vehicles are heavier-duty vehicles that, at present time, have no electric equivalents. However, we assume here that the technology will be available in our 3-5 year time window. Emissions for electric vehicles are measured using a vehicle's kWh/mile rate; these rates for hypothetical future vehicles are devised using averages from other existing electric vehicles of similar size and horsepower.
- Installation of solar panels over the parking lots of both LBT1 and LBT2. Installation over the parking lots was recommended for the 2020-2025 scenarios as opposed to installation over facilities; facility installation will be assumed for Scenario 2B.

Figure 9. Scenario 1A Emissions by Sector

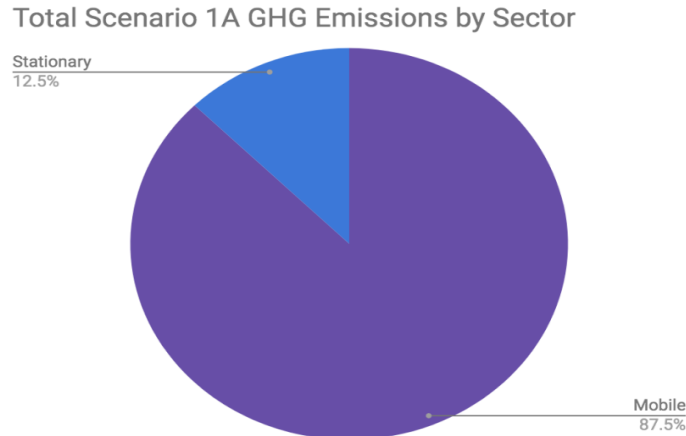
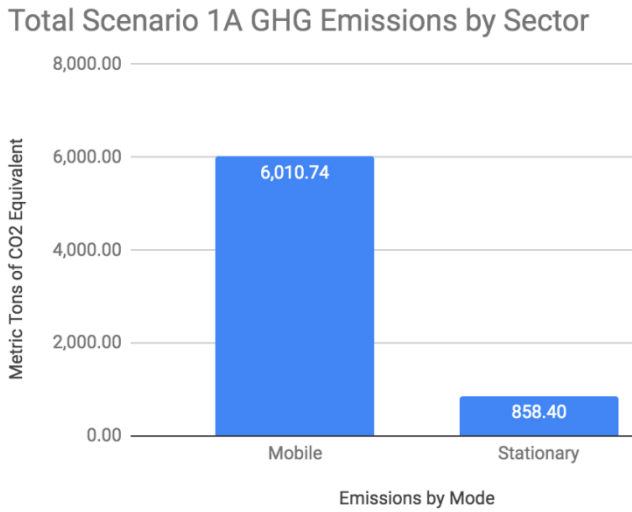


Table 7. Scenario 1A Mobile, Stationary and Total Emissions Baseline

Scenario 1A CO ₂ e Mobile Emissions Baseline	
Emissions Source	Total CO ₂ Emissions (In Metric Tons of CO ₂ Equivalent)
CNG	429
Diesel	74
Gasoline	5,036
Electricity	471
Total Mobile CO₂e Emissions	6,011
Scenario 1A CO ₂ e Stationary, Mobile and Total Emissions Baseline	
Electricity	694
Natural Gas	164
Total Stationary CO₂e Emissions	858
Total Scenario 1A Emissions	6,869

Figure 10. Scenario 1B Emissions by Sector

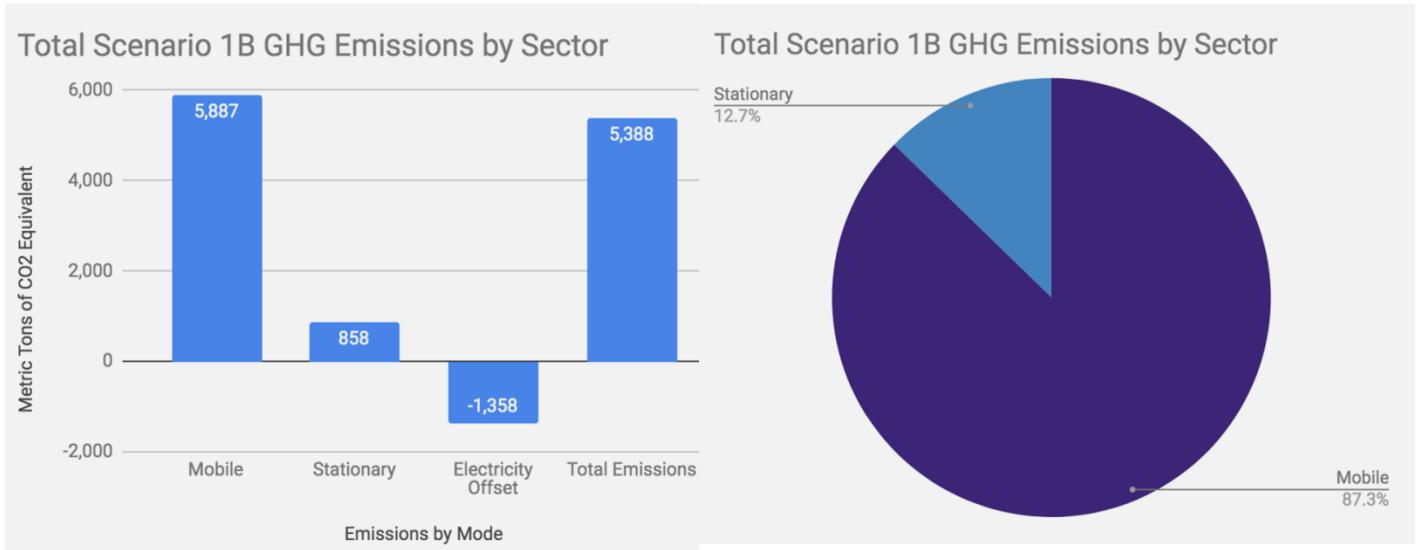


Table 8. Scenario 1B Mobile, Stationary and Net Emissions Baseline

Scenario 1B CO₂e Mobile Emissions Baseline	
Emissions Source	Total CO₂ Emissions (In Metric Tons of CO₂ Equivalent)
CNG	429
Diesel	0
Gasoline	4,754
Electricity	704
Total Mobile CO₂e Emissions	5,887
Scenario 1B CO₂e Stationary, Mobile and Net Emissions Baseline	
Electricity	694
Natural Gas	164
Total Stationary CO₂e Emissions	858
Total Scenario 1B Emissions	6,746
Scenario 1B Solar Emissions Offset	-1,358
Net Scenario 1B Emissions	5,388

The results for Scenarios 1A and 1B show significant reductions in CO₂e emissions from the FY 2018 baseline of 13,825 CO₂e metric tons (See Table 4). Assuming the same ridership for LBT in 2025, and the application of the same Transportation Efficiency Effect of 12,265 CO₂e metric tons (see Table 5), Scenario 1A would yield a negative 5,396 CO₂e metric tons or, in effect, in

this scenario LBT could be credited with displacing this amount of emissions. Under the same accounting, Scenario 1B would be credited with displacing an even greater amount of emissions. However, it is not clear that the Transportation Efficiency Effect would be still employed in 2025 or 2030, and thus, this calculation was not included in the tables.

Scenarios 1A and 1B Social and Economic Strategies⁴¹

These strategies are summaries of the social and economic strategies identified in Chapter 5 as achievable within 3-5 years:

- Diversity training for customer service clerks;
- Expand partnerships, e.g., with Khmer- and Spanish-speaking community groups;
- Using informal focus groups, especially when considering service changes or LBT facilities improvements, such as the installation of solar PV on parking areas, to inform and obtain feedback on service or facility changes;
- Develop a strategy for hiring bus operators by hiring a staff analyst in Human Resources to focus on hiring and retention;
- Establish an apprenticeship program to support professional development, including bus operators;
- Prioritize sustainability initiatives in its capital improvement plan;
- Incorporate climate resiliency into capital planning, state of good repair and asset management system;
- Use grant funds already obtained to install LBT's first solar PV project;
- Identify and apply for grant funding for larger solar installations on LBT facilities;
- Analyze major supplier and partner data to identify the sustainability of goods and services purchased;
- Develop a communication plan that expresses the combined cost of housing and transit;
- Study feasibility of partnering with ride-hailing company to address gaps in LBT service;
- Complete the MOU with the City of Long Beach on Emergency Situation Transportation Services;
- Enter into a regional partnership with other transit agencies on climate resiliency actions under emergency conditions;
- Determine whether a TransMAC mutual aid agreement will further LBT's emergency preparedness;
- Complete gap analysis of how LBT practices aligns with FTA's Safety Management Systems (SMS)

⁴¹ See Chapter 5 for greater detail and background for these strategies.

6.2 Scenarios 2A and 2B

The recommended environmental sustainability practices proposed for the 2035 Scenarios are as follows:

Scenario 2A

- Expected improvements to the emissions rate for SCE's eGRID electricity generation based on SCE's commitment to moving towards renewable energy sources. See eGRID Emissions Factors Projections for further information.
- Full electrification of the vehicle fleet, with the following composition: 53 electric non-revenue vehicles, 289 BEBs for a total of 342, the total vehicle count in the baseline fleet. Several of the non-revenue vehicles are heavier-duty vehicles that, at present time, have no electric equivalents. However, we assume here that the technology will be available in our scenario time window. Emissions for electric vehicles are measured using a vehicle's kWh/mile rate; these rates for hypothetical future vehicles are devised using averages from other existing electric vehicles of similar size and horsepower.

Scenario 2B

- Assumes the same mobile fleet recommendations as in Scenario 2A.
- Installation of solar panels over the parking lots and facilities of both LBT1 and LBT2. While interviews have noted that a facility site redesign may be planned for this time frame, solar panel estimations assume solar array size based on current facilities.

Figure 11. Scenario 2A Emissions by Sector

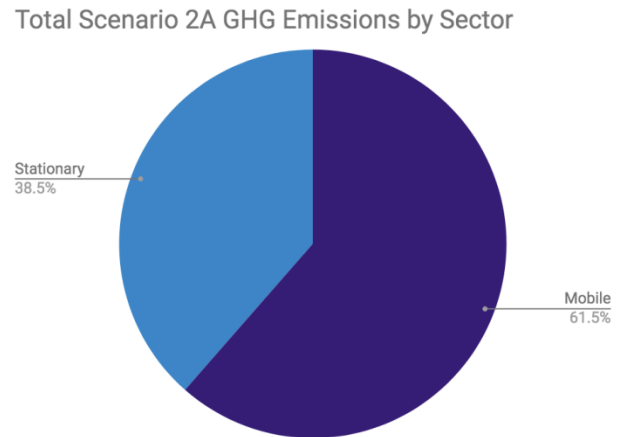
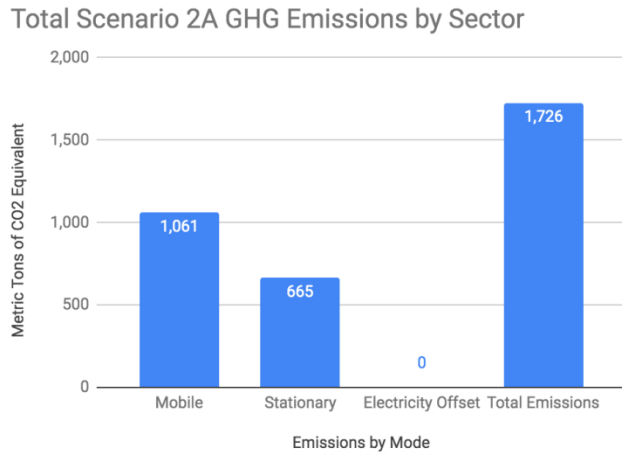


Table 9. Scenario 2A Mobile, Stationary and Total Emissions Baseline

Scenario 2A CO₂e Mobile Emissions Baseline	
Emissions Source	Total CO₂ Emissions (In Metric Tons of CO₂ Equivalent)
CNG	0
Diesel	0
Gasoline	0
Electricity	1,061
Total Mobile CO₂e Emissions	1,061
Scenario 2A CO₂e Stationary and Total Emissions Baseline	
Electricity	501
Natural Gas	164
Total Stationary CO₂ e Emissions	665
Total Scenario 2A Emissions	1,726

Table 10. Scenario 2B Mobile, Stationary, and Total Emissions Baseline

Scenario 2B CO₂e Mobile Emissions Baseline	
Emissions Source	Total CO₂ Emissions (In Metric Tons of CO₂ Equivalent)
CNG	0
Diesel	0
Gasoline	0
Electricity	1,061
Total Mobile CO₂e Emissions	1,061
Scenario 2B CO₂e Stationary and Total, and Net Emissions Baseline	
Electricity	501
Natural Gas	164
Total Stationary CO₂e Emissions	665
Total Scenario 2B Emissions	1,726
Scenario 2B Solar Emissions Offset	-1,379
Net Scenario 2B Emission	347

Scenarios 2A and 2B Social and Economic Strategies

The following are summaries of strategies identified in the discussion of social and economic sustainability in Chapter 5 as goals that could be reached by 2030-2035:

- LBT could collaborate and advocate for community groups working on issues related to community displacement and rising housing costs;

- LBT could establish equity and social justice advisory groups to inform the agency and create strategies to reduce community displacement or rising housing costs;
- Continue strong relations with labor unions;
- Develop green procurement strategies based on supplier and partner data;
- Develop circular economy criteria for major capital purchases.

6.3 Comparison of the Environmental Outcomes of Implementing Scenarios

Under every scenario developed, LBT plans to change its fleet to ZEVs has the most dramatic effect on its carbon emissions footprint. The mobile emissions footprint shrinks to 1,061 CO₂e metric tons under Scenarios 2A and 2B. Further reductions to LBT emissions can be obtained by the installation of solar panels in its facility parking lots and buildings, (Scenario 2B), bringing this scenario's carbon footprint to 347 CO₂ e metric tons. These figures do not take into account the carbon emissions credit that transit agencies currently obtain due to the replacement of vehicle trips by transit trips. Taking into account such an adjustment, LBT's sustainability efforts would yield a negative amount close to the FY 2018 baseline emissions of the agency.

Chapter 7. Summary and Next Steps

7.1 LBT Plans to Improve its Environmental Sustainability

With its plan to convert its fleet to ZEVs, LBT has taken the most consequential step in reducing its carbon footprint, as the results of the scenarios developed in Chapter 6 make clear. However, environmental sustainability concerns are broader than carbon emissions, and water, waste and criteria air pollutants are also important to monitor, reduce and recycle where appropriate. These concerns will require agencywide changes, which will benefit from broad communication and participation within the agency. These efforts could also be the basis of outreach campaigns to LBT customers and potential customers.

7.2 Challenges and Options to Improve LBT's Social and Economic Sustainability

As detailed in Chapter 5, LBT is already engaged in many practices that improve its social and economic sustainability, including many outreach efforts to the City of Long Beach, community groups, major employers and developers. Such practices will need to be continued and enhanced, especially to take advantage of the recent rezoning, and increasing development projects in the city of Long Beach.

The overwhelming majority of transit systems in the US are government subsidized, and dependent on grants and revenues from multiple-layers of government. In addition, SCAG, the metropolitan transportation planning agency for the greater Los Angeles region, including LBT, has been experiencing a decline in transit ridership.⁴² These two factors underlie the economic, and, in particular, the financial sustainability concerns which many executives, managers and Board members identified in our interviews. Responding to this trend will require increased efforts at community outreach and changes in service to attract new riders.

Another way for LBT to improve its economic sustainability, identified in Chapter 5, is to use its procurement power to provide incentives for major vendors to adopt or expand sustainability or green practices in their own companies.

Climate resilience is both an economic and a safety concern. LBT can safeguard its fleet, facilities, employees, and customers by developing a climate resilience strategy as part of its sustainability strategy.

7.3 Applying for Sustainability Recognition from APTA

The baseline emissions as measured in the report are calculated in compliance with APTA guidelines. These guidelines have been developed as part of APTA's Sustainability Commitment Program. When LBT decides to pursue APTA recognition status, the agency will be able to use the methodology included in this Sustainability Plan to draft its application.

⁴² Manville, M., B.D. Taylor, E. Blumenberg. 2018. Falling Transit Ridership: California and Southern California. SCAG: https://www.scag.ca.gov/Documents/ITS_SCAG_Transit_Ridership.pdf

In order to receive APTA’s Sustainability Recognition, applicants need to designate a Sustainability Champion within the agency, coupled with the proper human and/or financial resources, who will lead the agency’s sustainability efforts and projects. It is our understanding that LBT will pursue APTA recognition in the near future.

7.4 Role of a Sustainability Program Manager

As noted above, a sustainability manager or champion is a requirement for applying for APTA's Sustainability Recognition. A major responsibility of a Sustainability Manager for LBT will be to develop the application to APTA for recognition based on this report. Depending on when the application is submitted, the Manager may need to update the data used and analyzed in this report.

In addition to tracking the data for the sustainability indicators to be reported to APTA, the manager can develop and revise the Sustainability Plan for the agency, monitor its progress, prepare brief progress reports and inform staff (electronically) on changes, as well as on progress meeting the goals and targets identified in the Plan, hold meetings with management to keep informed on initiatives and changes, hold meetings (once a month) to inform staff about progress and changes, and obtain feedback on a periodic basis from all staff. In addition, the manager and assistants could keep track of research and demonstration projects for ZEV technology, transit partnerships with ride-hailing companies, research and grants for autonomous buses, as well as sustainability programs in other transit agencies.

Analysis of Current and Near-Future Trends

In addition to ensuring that LBT develops, monitors, and communicates a sustainability strategy, sustainability planning requires ongoing scanning of near-future trends and initiatives. This is especially important now, given rapidly developing technological changes of great significance for the agency. For example, many of the executives, managers and Board members interviewed brought up the issue of partnering with ride-hailing companies. Cities and transit agencies in the Los Angeles region are studying and experimenting with such partnerships. The City of Monrovia, for example, recently formed a partnership with Lyft to address the first-last mile problem.⁴³ An important development that requires ongoing attention is the increasing improvement of autonomous vehicles and its implications for future transit service. Many executives and managers interviewed identified autonomous vehicles as an important trend that could be useful for LBT. Autonomous bus shuttles are already being tested in various locations, and as noted in Chapter 2, the FTA has initiated research and provides ongoing guidance on the emerging technologies. There is a growing literature focused on the potential of autonomous buses and shuttles to reduce the operating costs of bus transit.⁴⁴ Recently, several research articles have been published on public transit rider attitudes to riding on automated buses without

⁴³ Monrovia's partnership with Lyft: GoMonrovia. Retrieved from: <https://www.cityofmonrovia.org/your-government/public-works/transportation/gomonrovia>

⁴⁴ Peirce, S., J. Cregger, E. Burkman, H. Richardson, E. Macheck, S. Mortensen, and K. Mahavier. 2019. “Assessing the Transit Agency Business Case for Partial and Full Automation of Bus Services.” *Transportation Research Record*, 0361198119842113.

operators. Initial findings indicate that the overwhelming majority of respondents to such surveys would be reluctant to ride such buses. These findings imply that even when fully automated, such buses may require customer service attendants.⁴⁵ This is an important research area for LBT to continue to monitor, not only because of ongoing improvements in the technology, but also because of its implications for the future labor force. A sustainability manager could partner with CSULB and other universities to develop lectures or seminars for executives, managers, board members, and staff on transit innovations and on research focused on their implications for future transit.

Sustainability, in a time of rapid change, requires ongoing research, strategy and experimentation.

⁴⁵ Dong, X., M. DiScenna, and E. Guerra. 2019. "Transit User Perceptions of Driverless Buses." *Transportation* 46 (1): 35–50; Winter, S.R., S. Rice, R. Mehta, N. W. Walters, M. B. Pierce, E. C. Anania, M. N. Milner, and N. Rao. 2018. "Do Americans Differ in Their Willingness to Ride in a Driverless Bus?" *Journal of Unmanned Vehicle Systems* 6 (4): 267–278.

Appendices (Not Included)

Appendix 1. Baseline Emissions Calculations

Appendix 2. Scenario Methodologies

Appendix 3. Solar Emissions Offset Calculations

Appendix 4. LBT Staff and Board Members Interviews for the Sustainability Plan