

Technical Appendix C: Greenhouse Gas Reduction Assumptions

Protected Bikeways

GHG Reduction Estimate Method	A two-step methodology was used to calculate the anticipated greenhouse gas emission reduction. The first step was to determine a percentage decrease in current motor vehicle trips that the protected bikeways will cause. This was done by measuring the travel mode split of existing roadways with protected bikeways, which found that 3.85% of trips taken on select roadways with protected bikeways were by bicycle. The second step calculates the reduction in vehicle miles traveled on the proposed street segments this measure will upgrade, based on this mode split and existing motor vehicle traffic figures, and the common conversion factor of 8,887 grams of CO ₂ emissions per gallon of gasoline consumed to achieve the annual mtCO ₂ e avoided, as recommended by the EPA Greenhouse Gases Equivalencies Calculator . The calculations only consider the length of the roadway to be upgraded itself, rather than the length of actual trips, and therefore likely underestimates the impact. The permanence of concrete curb-separated bikeway design ensures that the investment will be durable, ensuring permanent reduction in vehicle miles traveled on the subject roadways.
Models/Tools Used:	Not applicable
Measure Implementation Assumptions:	<p>Assumptions include:</p> <ul style="list-style-type: none"> • City contractors are available and possess the capacity to design and build proposed bikeways within three years • Estimated, associated repaving needs of the roadway beyond protected bikeways are properly budgeted
GHG Reduction Estimate Assumptions:	<p>Assumptions include:</p> <ul style="list-style-type: none"> • The share of motor vehicle trips to be reduced on roadways enhanced with protected bikeways will be 3.85% - equivalent to an average, current mode split of four protected/off-street bikeways - greater than the current mode split. • The average fuel efficiency of motor vehicles for which trips are substituted will be 23 miles per gallon in 2025 and increase 1 mile per gallon per year through 2050.
Reference Case Scenario (GHG Emissions or Activity Level)	The reference case scenario is based on projected “business as usual” GHG emissions scenario, under the assumptions mentioned above. In the BAU scenario, the mode split will not change in the future, due to the absence of changes to the streets’ designs.
Measure-Specific Activity Data:	Annual Average Daily Traffic counts for people biking vs. driving vs. walking on subject streets.
GHG Emissions Reduced	<p>2025-2030: 1,676 mtCO₂e</p> <p>2025-2050: 7,567 mtCO₂e</p> <p>For annual calculations, please see Appendix D – GHG Emissions Reduction Spreadsheet.</p>

Bike Share Expansion

GHG Reduction Estimate Method	<p>To determine the impact of adding more bicycles and stations and extending the service area on greenhouse gas emission reduction, the number of anticipated trips taken on the new vehicles over their lifetimes was estimated. This was based on an average current number of trips taken per bike. This factor increases 5% each year to reflect the assumed “network effect” of increasing rates of ridership. This is then multiplied by the average trip length and by a car-replacement factor of 0.37. The resulting vehicle miles traveled figure was divided by the national average fuel economy to determine the number of gallons of fuel avoided, which was multiplied by the common conversion factor of 8,887 grams of CO₂ emissions per gallon of gasoline consumed, as recommended by the EPA Greenhouse Gases Equivalencies Calculator, to calculate total carbon equivalent emissions saved.</p> <p>To determine the impact of the electric vans used for servicing field operations, e-van usage was compared to a business-as-usual case using an internal combustion engine van. The number of vehicles miles traveled per van was calculated and divided by the fuel efficiency (city miles) of a current Ford Transit van - 15 mpg - to determine the number of gallons of fuel avoided, which was multiplied by the emissions factor of 0.008887 to calculate total carbon equivalent emissions saved.</p> <p>To determine the impact of the solar panels, an estimate of the annual production of the proposed solar system in MWh was obtained from a solar vendor using the Helioscope solar PV system design software. These MWh were then placed in the CIRIS tool the City uses biannually to measure GHG emissions citywide. Using MWh as the “Activity data”, the tool multiplies that data by an emissions factor which includes an Entergy New Orleans grid-specific factor for CO₂ and then uses the EPA’s eGRID emissions factor for CH₄ and N₂O to produce a total amount of CO₂ equivalent in metric tons.</p>
Models/Tools Used:	<ul style="list-style-type: none"> • Helioscope solar PV system design software • CIRIS tool
Measure Implementation Assumptions:	<p>Assumptions include:</p> <ul style="list-style-type: none"> • Solar panel system installed within year 1 • E-van charging infrastructure in place in year 1 and running on solar • In-field charging stations reliably installed year 2 • Ready availability of next-generation bicycles to purchase • The average shared bike lifetime will last five years
GHG Reduction Estimate Assumptions:	<p>Assumptions include:</p> <ul style="list-style-type: none"> • The number of trips per bike per day is assumed to increase over time from 2024 due to the network effect of increased rates of ridership • Average trips lengths are assumed to stay steady at 1.5 miles • The car trip replacement factor of 37%, based on the North American Bike and Scooter Share Association data, is assumed to stay consistent throughout the grant period • The average fuel economy of vehicles whose trips are being displaced is assumed to grow one mile per year through 2034 • Purchased bicycles are assumed to have a five-year life span • E-vans are assumed to have a 15-year lifespan

Bike Share Expansion (cont.)

Reference Case Scenario (GHG Emissions or Activity Level)	The reference case scenario is based on projected “business as usual” GHG emissions scenario, under the assumptions mentioned above. In the BAU scenario, the number of motor vehicle miles traveled in the City of New Orleans remains unchanged, gasoline-powered vans are used for field operations, and electricity to power warehouse operations and recharging of e-bike batteries continues to use electricity from the local power grid.		
Measure-Specific Activity Data:	<ul style="list-style-type: none"> • Number of active fleet bicycles in service • Number of and average length of bike share trips • Bicycle vehicle miles traveled • Blue Bikes for All users 		
GHG Emissions Reduced	Sub-measure	2025-2030 (mtCO₂e)	2025-2050 (mtCO₂e)
	Bicycle fleet expansion	1,360	1,809
	E-vans	394	1,423
	Solar electric system	288	1,248
	Total	2,042	4,480
	For annual calculations, please see Appendix D – GHG Emissions Reduction Spreadsheet.		

E-Bike Rebates

GHG Reduction Estimate Method	The emissions reduction was estimated by calculating anticipated number of motor vehicle miles that rebate program participants will substitute with e-bike trips. According to a report of Denver’s 20222 Ebike Incentive Program results , rebate participants rode their bikes an average of 26 miles per week, replacing 3.4 round trips by motor vehicle. To determine the number of miles of motor vehicle trips substituted for by e-bikes, then, we calculate 26 miles per week x 52 weeks per year, then divide by the average fuel efficiency of motor vehicles to achieve gallons of fuel avoided. This number is multiplied by the common conversion factor of 8,887 grams of CO ₂ emissions per gallon of gasoline consumed to achieve the annual mtCO ₂ e avoided, as recommended by the EPA Greenhouse Gases Equivalencies Calculator
Models/Tools Used:	Not applicable
Measure Implementation Assumptions:	Assumptions include: <ul style="list-style-type: none"> • Sufficient consumer demand for 2500 subsidized e-bikes exists among New Orleans residents • Local bike shops have the capacity to supply 2,500 e-bikes over the five year grant period
GHG Reduction Estimate Assumptions:	Assumptions include: <ul style="list-style-type: none"> • New Orleans residents will displace an average of 26 vehicle miles per week

E-Bike Rebates (cont.)

Reference Case Scenario (GHG Emissions or Activity Level)	The reference case scenario is based on projected “business as usual” GHG emissions scenario, under the assumptions mentioned above. In the BAU scenario, the number of motor vehicle miles traveled in the City of New Orleans remains unchanged.
Measure-Specific Activity Data:	<ul style="list-style-type: none"> • Number of rebates granted per year • Survey data: pre-rebate bicycle miles ridden • Survey data: One-year post rebate bicycle miles ridden
GHG Emissions Reduced	<p>2025-2030: 4,592 mtCO₂e</p> <p>2025-2050: 10,305 mtCO₂e</p> <p>For annual calculations, please see Appendix D – GHG Emissions Reduction Spreadsheet.</p>

Benchmarking Program Support

GHG Reduction Estimate Method	The emissions reductions for the Benchmarking Program Support were modeled based on 2022 electric use data provided by Entergy New Orleans (ENO) from a recently released Demand Side Management study . With this data broken down by sector (commercial, residential, industrial) and sub-sector (healthcare, warehouse, office, etc), the data was then converted from Gigawatt Hours to Megawatt Hours and then inputted into a New Orleans specific emission calculator, using an emissions factor of 388 pounds of CO ₂ /MWH, with an additional .000508 MTCO ₂ /MWH for Methane and .000721 CO ₂ /MWH of NO ₂ provided by the EPA eGrid emissions factors for these co-pollutants. Once the sub-sector specific MWH were converted to metric tons of CO ₂ and other gasses, the values for each building sub-sector were used as a baseline for subtracting assumed reductions annually until 2050.
Models/Tools Used:	A custom spreadsheet model using data and methods outlined above was used to calculate emissions reductions. A CIRIS (City Inventory Reporting & Information System) tool developed for New Orleans through the Global Covenant of Mayors for Climate & Energy was used to create New Orleans specific CO ₂ figures based on the local emissions factor.
Measure Implementation Assumptions:	<p>Key assumptions for the management and implementation for the measure include:</p> <ul style="list-style-type: none"> • The first two years of the program will likely include buildings over 50,000 sq ft, while years 3-5 and onward will include a lower threshold, estimated at 20,000 sq ft - totaling approximately 1,270 buildings between both size thresholds.

Benchmarking Program Support (cont.)

GHG Reduction Estimate Assumptions:	<p>Key assumptions for modeling emissions reductions include:</p> <ul style="list-style-type: none"> Building sub-sectors selected for the model include a majority of buildings that are over 20,000 square feet, this may account for a higher rate of electric use and related emissions Different building sub-sectors have different rates of energy use reduction over time, for example, Healthcare buildings will only reduce energy use by 3% over the entire 25 year period while large office buildings will have reductions around 9%. (DataTrends Benchmarking and Energy Savings (energystar.gov)) There is a steady rate of reduction annually, with the first two years modeled with half the annual rates of reduction to account for lag in compliance 						
Reference Case Scenario (GHG Emissions or Activity Level)	<p>The reference scenario for this model is electric energy use from the year 2022, as reported by Entergy New Orleans. The key assumptions for the reference case include:</p> <ul style="list-style-type: none"> A consistent local emissions factor of 388 lb/MWH Consistent annual loads based on 2022 data across building sectors 						
Measure-Specific Activity Data:	Building Sub Sector	GWH of Electricity	MWH of Electricity	Metric Tons of CO ₂ *	Assumed Rate of Reduction	Reduction Rate Y1-Y2	Reduction Rate Y3-2050
	Apartment/Condominiums	446	446,000	79,042	10%	0.21%	0.44%
	Industrial	530	530,000	93,929	10%	0.21%	0.44%
	Warehouse	69	69,000	12,229	9%	0.19%	0.38%
	Colleges/Universities	149	149,000	26,407	10%	0.21%	0.44%
	Healthcare	294	294,000	52,104	3%	0.07%	0.12%
	Lodging	398	398,000	70,536	4%	0.09%	0.17%
	Large Office	686	686,000	121,576	9%	0.19%	0.37%
	Retail (food)	87	87,000	15,419	10%	0.21%	0.44%
	Retail (non-food)	261	261,000	46,256	11%	0.23%	0.46%
	*Includes Methane and No ₂ in the totals						
GHG Emissions Reduced	<p>2025-2030: 8,611 mtCO₂e</p> <p>2025-2050: 41,223 mtCO₂e</p> <p>For annual calculations, please see Appendix D – GHG Emissions Reduction Spreadsheet.</p>						

Municipal Building Decarbonization

GHG Reduction Estimate Method	<p>The emissions reductions for this measure were modeled based on a combination of two professional reports conducted on behalf of the City. The first was a set of ASHRAE Level I energy audits conducted by a local firm, Green Coast Enterprises between 2016 and 2020. Those audits produced estimates of kWh savings (or avoided) for each recommended measure based on an analysis of current energy use. The second report was a solar feasibility study conducted in 2020 by C40 Cities which produced recommended rooftop solar PV system sizes (in kilowatts peak or kWp) based on an analysis of each facility which used a combination of Google Earth and NREL's PV Watts tool. The kWp for each system was then multiplied by the average solar production ratio for Louisiana (or 1,600), a formula based on industry standards for converting kWp into estimated kWh savings.</p> <p>The sum of the kWh savings (or avoided) from both the energy efficiency upgrades and the solar PV installations was then divided by 1,000 to arrive at the cumulative megawatt hours (MWh) avoided for each year under the grant.</p> <p>The MWh avoided were then placed in the CIRIS tool the City uses biannually to measure GHG emissions citywide. Using MWh as the "Activity data", the tool multiplies that data by an emissions factor which includes an Entergy New Orleans grid-specific factor for CO₂ and then uses the EPA's eGRID emissions factor for CH₄ and N₂O to produce a total amount of CO₂ in metric tons.</p>
Models/Tools Used:	<ul style="list-style-type: none"> • NREL PVWatts tool • CIRIS
Measure Implementation Assumptions:	The model assumes that implementation of each measure will be spread out over a 3 year period between 2026-2028, with the first year of implementation (2025) being design and scoping for the projects. By year 4 (2028), the model assumes all projects will be completed and that the GHG reductions will reoccur in perpetuity.
GHG Reduction Estimate Assumptions:	The CO ₂ emissions factor (388 lb/MWh) used is from 2021, which is the City's most recent year with a completed GHG inventory, and was provided directly by our local utility, Entergy New Orleans (ENO). The City Council of New Orleans regulates ENO and passed a Renewable Clean Portfolio Standard in 2021. This unique regulatory structure means that the grid supplied to customers in New Orleans is significantly cleaner than the regional averages in eGRID. In past GHG inventories, which are reviewed and approved as a part of the City's membership with C40 Cities, the City used the CO ₂ emissions factor from ENO combined with eGRID averages for CH ₄ and NO ₂ .
Reference Case Scenario (GHG Emissions or Activity Level)	The reference scenario for this model is the City's "business as usual" energy usage for the calendar year 2023 at the 41 facilities targeted for energy efficiency and solar PV installations. The BAU does not include any effect of non-CPRG federal incentives.

Municipal Building Decarbonization (cont.)

Measure-Specific Activity Data:	Building	Estimated Yearly EE Savings (kWh)	Estimated Yearly Solar PV Energy Savings (kWh)
	City Hall	750,000	
	Civil Court	748,000	
	DAs Office	41,000	99,040
	Rosa Keller Library	10,000	
	NOFD HQ	9,400	
	JJIC & Juv. Court	22,500	480,000
	NO East Library	48,500	122,400
	Gallier Hall	11,250	64,800
	Algiers Library	47,000	205,600
	Algiers Court	27,250	
	Bio Control Lab	37,500	
	Criminal Court	205,000	480,000
	Norman Mayer Library	64,800	67,520
	NOPD Training Academy	260,000	43,040
	Waste Transfer Station	99,000	81,280
	Arthur Monday MSC	39,000	
	Main Library	286,000	388,640
	Robert Smith Library	57,800	
	Allie Mae Williams MSC	51,600	
	Mosquito Control HQ	47,000	256,960
	NOMA	913,000	236,480
	Oscar Medrano/RTTC	166,500	
	NOPD HQ	100,000	
	NOPD 2nd	103,000	
	NOPD Stables	160,000	
	Orleans Parish Prison	191,000	
	VA	1,250,000	
	NOPD 5th	66,000	124,800
	NOPD 7th	70,000	122,400
	NOPD 8th	122,000	
	NOPD 6th	23,000	
	Treme Rec Center	415,000	
	Joe Brown Rec Center	288,000	
	Morris Jeff Rec Center	186,000	
	Atkinson Stern Tennis	24,600	
	Lyons Rec Center	92,000	
	St. Bernard Rec Center	74,000	
	Cutoff Rec Center	80,000	
	Sanchez Rec Center	106,500	
	Stallings St. Claude Rec Center	31,000	
	Gernon Brown Rec Center	21,600	
	TOTAL	7,345,800	2,772,960
	TOTAL kWh Savings	10,119	
GHG Emissions Reduced	2025-2030: 7,173 mtCO ₂ e		
	2025-2050: 43,039 mtCO ₂ e		
	For annual calculations, please see Appendix D – GHG Emissions Reduction Spreadsheet.		

Solar for All NOLA Bridge Subsidies

GHG Reduction Estimate Method	<p>The emissions reductions for the Solar for All NOLA Subsidies were modeled based on 2022 electric use data provided by Entergy New Orleans (ENO) from a recently released Demand Side Management study. With this data broken down by residential sectors, the data was then converted from Gigawatt Hours to Megawatt Hours and then inputted into a New Orleans specific emission calculator, using an emissions factor of 388 pounds of CO₂/MWH, with an additional .000508 MTCO₂/MWH for Methane and .000721 MTCO₂/MWH of NO₂ provided by the EPA eGrid emissions factors for these co-pollutants. The MTCO₂ figures were then used as a baseline for emissions reductions.</p> <p>In order to determine emissions reductions per year, the total energy use (in MWH) was divided by the number of households to determine the average MWH usage per household. The average use per household (13 MWH) was multiplied by the number of average installs per year for each residential sub-sector. The average solar pv system in New Orleans is 8 KW and the average solar production ratio for Louisiana (or 1,600) - when multiplied, the output of an average system is approximately 12.8 MW - around the same amount of power that an average household uses annually. The total converted usage (MWH to MTCO₂) for each subsector was then subtracted by the baseline MTCO₂ figures found in earlier steps. This was done at the same rate for the first five years, with no further installs accounted for after 2030. This was done at the same rate for the first five years of the grant, with installation numbers reducing after 2030.</p>
Models/Tools Used:	<p>A custom spreadsheet model using data and methods outlined above was used to calculate emissions reductions. A CIRIS (city Inventory Reporting & Information System) tool developed for New Orleans through the Global Covenant of Mayors for Climate & Energy was used to create New Orleans specific CO₂ figures based on the local emissions factor.</p>
Measure Implementation Assumptions:	<p>Key assumptions for the management and implementation for the measure include:</p> <ul style="list-style-type: none"> • Meeting the annual goal of 280 installations
GHG Reduction Estimate Assumptions:	<p>Key assumptions for modeling emissions reductions include:</p> <ul style="list-style-type: none"> • Residential sub-sectors utilized accurately represent the types of homes that will be part of the subsidy program • There is a steady rate of adoption during the subsidy period • There is no substantial electric load growth in the residential sector • Electric use that occurs overnight is equalized by the amount of excess energy sent back to the grid via net-metering since the average solar pv system produces approximately 12.8 MW annually, and the average energy use in this subset of homes in this methodology is 13 MW.

Solar for All NOLA Bridge Subsidies (cont.)

Reference Case Scenario (GHG Emissions or Activity Level)	The reference scenario for this model is electric energy use from the year 2022, as reported by Entergy New Orleans. The key assumptions for the reference case include: <ul style="list-style-type: none">A consistent local emissions factor of 388 lb/MWH, based on the 2021 emissions factorConsistent annual loads based on 2022 data across building sectors			
Measure-Specific Activity Data	Residential Sub-Sector	Single Family Detached	Duplex/ Townhome	Other
	GWH of Electricity	1,481	444	74
	MWH of Electricity	1,481,400	444,420	74,070
	Number of Buildings	113,915	31,175	5,696
	MWH/ Household	13	13	13
	Total Metric Tons of CO ₂ *	262,541	78,762	13,127
	Metric Tons of CO ₂ Per Sub-sector	478	143	24
	Number of Installs Y1-Y5	207	62	10
	GHG Emissions Reduced	2025-2030: 12,900 mtCO ₂ e 2025-2050: 77,400 mtCO ₂ e For annual calculations, please see Appendix D – GHG Emissions Reduction Spreadsheet.		

Reforestation Plan

GHG Reduction Estimate Method	The City used the i-Tree Planting Calculator , a peer-reviewed, tree benefits estimation tool from the USDA Forest Service, to estimate the amount of CO ₂ sequestered over both a 5 year period and a 25 year period for the Reforestation Plan. This produced an amount of CO ₂ sequestered in kilograms, which was then divided by 1,000 to arrive at metric tons of CO ₂ sequestered.
Models/Tools Used:	<ul style="list-style-type: none"> i-Tree Planting Calculator
Measure Implementation Assumptions:	<p>The emissions reduction model for this measure assumes the planting of an assortment of native and permitted trees for the City, including 450 live oaks, 1,200 red maples, 750 bald cypress, 600 willow oaks, 3,000 holly, and 1,500 southern magnolias. It assumes that approximately 2,500 trees are planted annually between the Department of Parks & Parkways' contractors and the non-profit tree planting grant recipients, for a total of 7,500 trees planted over the first 3 years of this grant.</p> <p>This measure assumes that all 7,500 trees planted would be an average diameter at breast height (DBH) of three inches (3 in), which is typical for both the Department of Parks and Parkways' contractors as well as the non-profit tree planting partners.</p>
GHG Reduction Estimate Assumptions:	<p>The model assumes a tree survival rate of 15% over the first 5 years and a survival rate of 35% over 25 years. Those rates are slightly higher than the ones EPA states on its GHG calculations site but is consistent with the City's planting strategy. The Department of Parks & Parkways typically plants on neutral grounds and parks where there is less risk from vehicular traffic and damage from roadwork. While non-profit tree planting partners do plant in more vulnerable areas such as along sidewalks, the City feels these survival rates represent an accurate average overall.</p> <p>The model also assumes the cumulative impact of the tree plantings over the full 5 and 25 year periods. While the trees will be planted over an initial 3 year period, the total carbon sequestration amounts don't take into account this staggered planting schedule. However, because carbon sequestration from trees increases in a non-linear manner, the City believes any decrease that might occur as a result of the staggered schedule is offset by the increasing carbon sequestration potential as the trees mature.</p>
Reference Case Scenario (GHG Emissions or Activity Level)	The reference case scenario is based on the projected "business as usual" GHG emissions scenario for the City. In the BAU scenario, no tree plantings will occur.
Measure-Specific Activity Data:	<ul style="list-style-type: none"> Count, species, and date of trees planted
GHG Emissions Reduced	<p>2025-2030: 1,099 mtCO₂e</p> <p>2025-2050: 13,688 mtCO₂e</p> <p>Annual (or absolute) amounts are unavailable due to the non-linear nature of tree plantings' carbon sequestration potential mentioned earlier.</p>