

## Technical Appendix C

### Livingston Green Initiative

The Livingston Green Initiative provides the following Technical Appendix to address the EPA grant requirements. In addition, the coalition has provided a GHG emission reduction calculation spreadsheet that will provide full details on the calculations for each measure included in the application. [See GHGcalcs\\_Livingston County.](#)

#### Measure-Specific Documentation:

##### GHG Reduction Estimate Method:

Livingston County worked with the Genesee/Finger Lakes Regional Planning Council to engage a technology and climate change consultant, Climate Action Associates (CCA), to support the development of the Technical Appendix and the GHG reduction calculations for the Livingston Green Initiative implementation measures. CCA is a primary plan contributor to the Genesee/Finger Lakes Region Priority Climate Action Plan (PCAP), and provides support to energy programs including the New York State Energy Research and Development Authority (NYSERDA) Clean Energy and Climate Smart Communities programs.

GHG estimate methods use EPA emission factors stationary fuels and EPA's 2022 EGRID baseload emissions factors for grid electricity for the NYUP grid region. GHG methods use EPA emission factors stationary fuels and EPA's 2022 EGRID baseload emissions factors for grid electricity for the NYUP grid region. For full details on methods used, [see GHGcalcs\\_Livingston County spreadsheet.](#)

##### Models/Tools Used:

The CPRG Model for this coalition application was developed by CCA. Full details on models and tools used to develop the GHG emission reduction estimates by CCA can be referenced in the [GHGcalcs\\_Livingston County spreadsheet.](#) The model independently quantifies each subcomponent of the application, with calculations referring to sub models for EV charging, heat pumps, and sidewalks. Benefits were developed as savings on an annual basis.

**Transportation Strategy 1(E):** will assist with the transition to zero emission vehicles and equipment for municipal and private fleets, by expanding EV charging infrastructure for municipal and public access, for the Town of Lima and Village of Livonia, and the addition of UEVs for the Town of Lima.

- Models and tools used include Electric Vehicle Carbon Reduction Ratios (CRR), and the CPRG project model developed by CCA. Refer to the [GHGcalcs\\_Livingston County spreadsheet](#) for multiple references to publicly available tools.
- **Buildings & Infrastructure Strategy 1(B):** will advance the decarbonization of buildings and infrastructure by implementing energy efficient heat pumps and geothermal energy networks for municipal buildings, and pilot net-zero buildings, for the Towns of Avon and Lima, and Village of Livonia. (See also Strategy 3(A))
  - Use of Heat Pump Carbon Reduction Ratios and the CPRG project model.

- **Buildings & Infrastructure Strategy 1(F) and 3(C):** 1(F) will advance the decarbonization of buildings and infrastructure by expanding the purchase of renewable electricity for municipal facilities, and install renewable energy at facilities (solar) for the Town of Lima. 3(C) will help by developing a region-wide strategy to expand solar everywhere, with an emphasis on low- and moderate-income households; the addition of solar to the Town of Lima Highway building is part of this measure.
  - Use of PV Watts Calculator <https://pvwatts.nrel.gov/pvwatts.php>
  - Use of EIA US Commercial Sector electricity consumption by major end uses, 2022 and the CPRG project model developed by CCA.
- **Buildings & Infrastructure Strategy 1(G):** will advance the decarbonization of buildings and infrastructure by reducing the water and GHG emission of water and sewer infrastructure through efficiency upgrades and leakage emissions initiatives with the Livingston County Water & Sewer Authority. This measure supports all coalition applicants.
  - Livingston County Water and Sewer Authority (LCWASA) will be using the Leakage Emissions Initiative (LEI) methodology, which annually calculates a “carbon balance” in conjunction with leakage reduction initiatives, to track metric tons of carbon emissions avoided as a result of the leakage reduction intervention. **See Attached**
- **Building and Infrastructure Strategy 3(A):** will help to provide tools and strategies that reduce energy efficiency barriers in buildings and infrastructure, by incentivizing building envelope insulation efforts and energy efficient purchases. This measure supports all coalition applicants.
  - Use of Heat Pumps Carbon Reduction Ratios (CRR), and Heating Season Performance Factors (HSPF) and the CPRG project model developed by CCA.
- **Economy-wide Strategy 3(B) and 4(C):** will create healthy and sustainable communities by encouraging redevelopment of areas targeted for infill that are within public transit or walkable neighborhoods. 4(C) will promote smart growth and mobility-oriented development to reduce vehicle miles traveled, by instituting an ADA compliant retrofit program for sidewalks in the Town of Lima and Village of Livonia.
  - GHG benefits calculated per mile of newly installed sidewalk based on connectivity benefits using the California Air Resources Board (CARB) adopted methodology and the CPRG project model developed by CCA.

### Measure Implementation Assumptions:

Full details on measure implementation assumptions used to develop the GHG emission reduction estimates by consultant, CCA, can be referenced in the **GHGcalcs\_Livingston County spreadsheet**. See the spreadsheet for all benefit impact assumptions that are referenced to an appropriate EPA, DOE, EIA, CARB, NYSERDA, or NREL reference.

- **Transportation Strategy 1(E):** will assist with the transition to zero emission vehicles and equipment for municipal and private fleets, by expanding EV charging infrastructure for municipal and public access, for the Town of Lima and Village of Livonia, and the addition of UEVs for the Town of Lima.
  - For the EV charging stations in the Town of Lima and Village of Livonia, the benefits estimated are based on total charge expected delivered by year based on an assumption of 4 hours of daily use, and level II and III chargers are assumed to be the same. The ZEV reduction is based on vehicles being replaced rather than new purchases.
- **Buildings & Infrastructure Strategy 1(B):** will advance the decarbonization of buildings and infrastructure by implementing energy efficient heat pumps and geothermal energy networks for municipal buildings, and pilot net-zero buildings, for the Towns of Avon and Lima, and Village of Livonia. (See also Strategy 3(A))
  - For the Town of Avon water source heat pump replacement, it is assumed that the ground source heat pumps will eliminate gas used for heating in the building, estimated at 90% of metered gas. It assumes that the Town can continue quarterly maintenance and computer systems operations of the units.
- **Buildings & Infrastructure Strategy 1(F) and 3(C):** 1(F) will advance the decarbonization of buildings and infrastructure by expanding the purchase of renewable electricity for municipal facilities, and install renewable energy at facilities (solar) for the Town of Lima. 3(C) will help by developing a region-wide strategy to expand solar everywhere, with an emphasis on low- and moderate-income households; the addition of solar to the Town of Lima Highway building is part of this measure.
  - For the Town of Lima solar installation on the Highway building, it assumes that the Town will meet minimum size requirements to allow the Town to obtain full cost savings. The proposed solar PV systems could potentially generate well over 100% of the Town's total current electric consumption annually. The excess generated electricity would be sold back to the utility provider which would result in positive cash flow to the Town.
- **Buildings & Infrastructure Strategy 1(G) and 3(A):** 1(G) will advance the decarbonization of buildings and infrastructure by reducing the water and GHG emission of water and sewer infrastructure through efficiency upgrades and leakage emissions initiatives with the Livingston County WASA. 3(A) will help to provide tools and strategies that reduce energy efficiency barriers in buildings and infrastructure. This measure supports all coalition applicants.
  - For the Town of Lima lighting retrofits, it is assumed that lighting is 9.3% of electricity energy used (DOE/CBEC's), and that energy will be reduced by 50% through conversion to LEDs.
- **Economy-wide Strategy 3(B) and 4(C):** 3(B) will create healthy and sustainable communities by encouraging redevelopment of areas targeted for infill that are within public transit or walkable

neighborhoods. 4(C) will promote smart growth and mobility-oriented development to reduce vehicle miles traveled, by instituting an ADA compliant retrofit program for sidewalks in the Town of Lima and Village of Livonia.

- The Town of Lima has identified the underlying assumptions and risks for the sidewalk expansion project:
  - EUVs must be available in the supply chain
  - Charging stations at the highway department from previous DEC grant award application number DEC01-ZEVIN-2022-00265 must be completed
  - Winning bidder must be able to install the sidewalk system expeditiously recognizing that snow and rain events along with concrete availability may delay the construction
  - People employed at GCC Campus, Bristol ID Technologies, Shrier – Martin, Culligan and Corby’s Collision will walk to and from work once the sidewalk is complete
  - People will walk to exercise, lunch and shop downtown; walk to and from the businesses and destinations using the sidewalks when complete

**GHG Reduction Estimate Assumptions:** Full details on GHG reduction estimate assumptions used to develop the GHG emission reduction estimates by consultant, CCA, can be referenced in the **GHGcalcs\_Livingston County spreadsheet**. See the links below and the spreadsheet for all benefit impact assumptions that are referenced to an appropriate EPA, DOE, EIA, CARB, NYSERDA, or NREL reference. For calculation of total project GHG benefits for the application, the following were assumed: percent phase out of 50%, 15 year equipment lifetime, and total effective implementation phases down to 50% starting in 2040. These assumptions only impact the long range benefits estimate that have some degree of uncertainty already.

- **Energy Systems and Infrastructure Analysis:** <https://greet.anl.gov/>
- **Transportation Energy Data Book:** <https://tedb.ornl.gov/>
- **Current industry standard, SAE J2841:** <http://avt.inel.gov/pdf/EVProj/EVProjectUtilityFactorVolt.pdf>
- US Department of Energy: [Weatherization Assistance Program | Department of Energy](#)
- SCEP: [Weatherization Assistance Program | Department of Energy](#)
- EIA: <https://www.eia.gov/energyexplained/electricity/use-of-electricity>
- NREL Cool Roof Resource Guides for Federal Agencies: chrome-extension://efaidnbmnnnibpcjpcglclefindmkaj/https://www.nrel.gov/docs/fy09osti/46305.pdf
- NREL PV Watts Calculator: <https://pvwatts.nrel.gov/pvwatts.php>
- California Air Resources Board (CARB): chrome-extension://efaidnbmnnnibpcjpcglclefindmkaj/https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/pedestrian\_facilities\_technical\_041519.pdf
- MDPI Heat Pump Performance: <https://www.mdpi.com/2071-1050/11/18/5087>
- IWA: [Water-Loss-SG-White-Paper-on-Leakage-Emissions-Initiative.pdf \(iwa-network.org\)](#)

## Reference Case Scenario:

Full details on reference case scenarios used to develop the GHG emission reduction estimates by consultant, CCA, can be referenced in the [GHGcalcs\\_Livingston County spreadsheet](#).

- **Buildings & Infrastructure Strategy 1(B) and 3(A):** will advance the decarbonization of buildings and infrastructure by implementing energy efficient heat pumps and geothermal energy networks for municipal buildings, and pilot net-zero buildings, for the Towns of Avon and Lima, and Village of Livonia. 3(A) - will incentivize building envelope insulation efforts and energy efficient purchases by supporting investments in certified energy-efficient appliances, heating and cooling equipment, indoor and outdoor lighting, and building products to replace older less efficient equipment. Support programs for end-of-use energy efficiency measures such as building envelope insulating, mold abatement, asbestos removal, and hazard remediation in all existing buildings.
  - The installation of replacement VRF heat pumps for the Town of Avon utilized the Heat Pump Carbon Reduction Ratio (CRR) and Reduction Ratios Scenario.

### Reduction Ratios - Scenario makers

RRs allow for a quick estimate of GHG benefits by replacing fossil fuel heating with air, ground, and wastewater source heat pumps. When a furnace or boiler burns fuel, only a portion of the energy in the fuel is delivered to the building, the rest is lost to exhaust. The percent of total energy delivered to the building is called the energy realization efficiency (ERE). The steps for making RRs:

- Calculate the amount of energy in a fossil fuels burned in heating appliances being replaced.
- Use the ERE to calculate the actual amount of energy used by the building, excluding the energy lost through exhaust.
- Use the Coefficient of Performance for the heat pump to determine how much grid electricity is needed to supply the equivalent amount of heat to the building.
- Calculate the GHG emissions from the original amount of fossil fuel, and the emissions from the new amount of grid electrify needed.
- Calculate the Reduction Ratio (RR) by dividing fossil fuel GHG emissions by the electricity GHG emissions and use the them to estimate savings.
- For example, if you move 10% of domestic heat from fuel oil boilers to ASHPs, multiple the GHG emissions from the boilers by fuel oil to ASHP RR to estimate GHG reduction. RRs vary based on how clean the electricity grid is, and how efficient the heat pump is.

Energy Realization Efficiency		Energy	GHG (MTCDE)
Natural Gas (ERE)	80%		
Fuel Oil (ERE)	70%		
ASHP COP	2.5		
GSHP COP	4.5		
Wastewater, supply heat COP (WW - heat)	8		
Natural Gas	1	MMBTU	0.0531
Fuel Oil	1	MMBTU	0.0742
required energy gas	0.8	MMBTU	
required energy fuel oil	0.7	MMBTU	
Required Electricity (natural gas to ASHP)	0.32	MMBTU	0.0109
Required Electricity (natural gas to GSHP)	0.177778	MMBTU	0.0061
Required Electricity (natural gas to WW-heat)	0.1	MMBTU	0.0034
Required Electricity (Fuel Oil to ASHP)	0.28	MMBTU	0.0095
Required Electricity (Fuel Oil to GSHP)	0.155556	MMBTU	0.0053
Reduction Ratios			
natural gas to ASHP			79%
natural gas to GSHP			89%
natural gas to WW heat			94%
Fuel oil to ASHP			87%
Fuel oil to GSHP			93%
Geothermal Loops			91%
natural gas to GSHP			50%
WW Heat			50%

## Measure –Specific Activity Data:

Full details on measure-specific activity data used to develop the GHG emission reduction estimates by consultant, CCA, can be referenced in the [GHGcalcs\\_Livingston County spreadsheet](#). A framework for setting common benchmarks and articulating specific data will be established pending Coalition review of available tools.

- **Transportation Strategy 1(E):** will assist with the transition to zero emission vehicles and equipment for municipal and private fleets, by expanding EV charging infrastructure for municipal and public access, for the Town of Lima and Village of Livonia, and the addition of UEVs for the Town of Lima.
  - The installation of EV charging stations in the Town of Lima and Village of Livonia will displace GHG emissions, at 6.15 MTCDE/port. The addition of two electric sidewalk vehicles to the Town of Lima’s fleet anticipates a reduction ratio of 82% if moving from gasoline to electric and 77% if moving from diesel to electric.
- **Buildings & Infrastructure Strategy 1(B):** will advance the decarbonization of buildings and infrastructure by implementing energy efficient heat pumps and geothermal energy networks for municipal buildings, and pilot net-zero buildings, for the Towns of Avon and Lima, and Village of Livonia. (See also Strategy 3(A))
  - The geothermal heating and cooling improvements in the Village of Livonia will eliminate gas used for heating in the building, estimated at 90% of metered gas.
- **Buildings & Infrastructure Strategy 1(F) and 3(C):** 1(F) will advance the decarbonization of buildings and infrastructure by expanding the purchase of renewable electricity for municipal facilities, and install renewable energy at facilities (solar) for the Town of Lima. 3(C) will help by developing a region-wide strategy to expand solar everywhere, with an emphasis on low- and moderate-income households; the addition of solar to the Town of Lima Highway building is part of this measure.
  - The installation of new roof top solar equipment will generate a 110,405 KWh / year to be utilized by the Town of Lima. Calculated annual KWh production from planned array using NREL PVWatts, <https://pvwatts.nrel.gov/pvwatts.php>
- **Buildings & Infrastructure Strategy 1(G) and 3(A):** 1(G) will advance the decarbonization of buildings and infrastructure by reducing the water and GHG emission of water and sewer infrastructure through efficiency upgrades and leakage emissions initiatives with LCWASA. 3(A) will help to provide tools and strategies that reduce energy efficiency barriers in buildings and infrastructure. This measure supports all coalition applicants.
  - The installation of replacement VRF heat pumps for the Town of Avon will eliminate gas used for heating in the building, estimated at 90% of metered gas. Benefits estimates with ASHP carbon reduction ratio with update NY Grid carbon mix.

- The building envelop improvements in the Town of Lima assumes a reduction of 15% savings across all energy uses referencing DOE's weatherization Assistance Program documents suggesting 10-30% savings.
- The Town of Lima retrofit/replacement of lighting and all four Town facilities assumes lighting is 9.3% of electricity energy use (DOE/CBEC's), and that energy will be reduced by 50% through conversion to LEDs. Given that the lighting is older, the lighting usage percent is probably higher than the 2022 tables since LEDs are standard now. Benefit estimate is therefore conservative. <https://www.eia.gov/energyexplained/electricity/use-of-electricity>.
- LCWASA estimates that by 2030, 500 metric tons of carbon savings could be achieved from reducing 120 MG of annual leakage down to 30 MG of annual leakage. That estimate is based on LCWSA water consumption and usage assuming LCWSA pulls power from plants that have around an 850g per kwh emissions rate, which is standard for most natural gas plants. Not only will there be less carbon emissions over 100 metric tons of carbon per year, inherently there will also be 250,000 kwh of power savings each year and 60 – 90 MG of water conservation each year. By 2050, 3000 metric tons of carbon emissions will be avoided.
- **Economy-wide Strategy 3(B) and 4(C):** 3(B) will create healthy and sustainable communities by encouraging redevelopment of areas targeted for infill that are within public transit or walkable neighborhoods. 4(C) will promote smart growth and mobility-oriented development to reduce vehicle miles traveled, by instituting an ADA compliant retrofit program for sidewalks in the Town of Lima and Village of Livonia.
  - For the sidewalk installation in the Town of Lima and Village of Livonia, GHG benefits were calculated per mile of newly installed sidewalk based on connectivity benefits using the California Air Resources Board (CARB) adopted methodology. This method projects 2.34 GHG savings/mile of new sidewalk.

## GHG Emissions Reduced:

Full details on each GHG reduction measure and measure-specific estimated annual and cumulative GHG emission reductions can be referenced in the [GHGcalcs\\_Livingston County spreadsheet](#).

Total Project GHG Benefits for the Application																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Cumulative GHG Reductions (MTCDE)		Metric Tons of Carbon Dioxide Equivalent (MTCDE) is the unit of GHG savings used in this application. MTCDE is 1000 kg of CO2-e																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
2025 - 2030	1,018.26																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
2025 - 2050	4,151.38																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Phase in / Out Schedule		Cumulative benefits accrue every year. Building envelop work is considered permanent, but equipment like heat pumps expired when equipment needs to be replaced. Roughly half of the investment in this project is based on equipment that will expire and so total effective implementation phases down to 50% starting in 2040. These assumption only impact the long range benefits estimate that have some degree of uncertainty already.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Equipment Lifetime	15																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Percent to phase out	50%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Total Annual Benefits	195.82																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Year	% Implemented	Annual GHG Benefits	Cumulative Benefits																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

The following table shows the cumulative Metric Tons of Carbon Dioxide Equivalent (MTCDE) for 2025-2030 and 2025-2050.

The following table shows the GHG calculations for each measure by task and includes the GHG savings per year. The full table with methodology and assumptions for calculations are included in Attachment [\[redacted\]](#). Total annual project GHG benefits are 195.82 MTCDE.

Based on the phase in/out schedule as outlined in the [GHGcalcs\\_Livingston County spreadsheet](#) that projects equipment expiration over time, exact calculations for GHG reductions per measure for time periods 2025-2023 and 2025-2050 were not available. Cumulative GHG reductions for all measures combined were calculated as:

1018.26 MTCDE/period 2025-2030

4151.38 MTCDE/period 2025-2050.



GHG Benefits by Measure						
Municipality/ Organization	CPRD Project Component	Applicable PCAP measures	PCAP Sector	CPRD Project Component - Details	GHG Calculations	GHG Savings (MTCDE/Year)
T of Lima	Solar on DPV garage	<b>Building Strategy 3C-</b> Develop a region-wide strategy to expand solar everywhere, with an emphasis on low- and moderate-income households. <b>Building Strategy 1F-</b> Expand purchase of renewable electricity for municipal facilities, and install renewable energy at facilities.	Electricity Generation/ Power	Siemens will install a new 31.64 roof-mounted solar photovoltaic system on the roof of the DPV Garage.	Calculated annual K/wh production from planned array using NREL PVWatts, and estimate benefits as a replacement of grid electricity. PVWatts estimates installation will generate 110,405 K/wh / year. See Calculation References tab. <a href="https://pvwatts.nrel.gov/pvwatts.php">https://pvwatts.nrel.gov/pvwatts.php</a>	12.8308
T of Lima	VRF heating & cooling system for Town Hall	<b>Building Strategy 1B-</b> Implement air-source heat pumps and geothermal energy networks for municipal buildings, and pilot net-zero buildings. <b>Building Strategy 3A-</b> Incentivize building envelope insulation efforts and energy efficient purchases by supporting investments in certified energy-efficient appliances, heating and cooling equipment, indoor and outdoor lighting, and building products to replace older less efficient equipment. Support programs for end-of-use energy efficiency measures such as building envelope insulating, mold abatement, asbestos removal, and hazard remediation in all existing buildings.	Buildings and Infrastructure	Siemens will design and install a new VRF heating and cooling system for the Town Hall building. Demo existing heating boiler. Furnish and install 20 ton heat pump condensing unit, 22 ton heat recovery condensing unit, (30) indoor heat pumps and programmable wireless controls for units. Furnish & install a new ERV unit with duct heater, a new outdoor energy recovery unit, a new DOAS unit with heat recovery wheel to provide make-up air to	Assume in VRF heat pumps will eliminate gas used for heating in the building, estimated at 90% of metered gas. Benefits estimates with ASHP carbon reduction ratio with update NY Grid carbon mis- See Heat Pump Reduction Ratio tab	26.7379
T of Lima	Bldg. envelope improvements- door & overhead door weather stripping, roof-wall interface sealing, attic insulation, door replacement. All buildings.	<b>Building Strategy 3A-</b> Incentivize building envelope insulation efforts and energy efficient purchases by supporting investments in certified energy-efficient appliances, heating and cooling equipment, indoor and outdoor lighting, and building products to replace older less efficient equipment. Support programs for end-of-use energy efficiency measures such as building envelope insulating, mold abatement, asbestos removal, and hazard remediation in all existing buildings.	Buildings and Infrastructure	Siemens Industry will implement building envelope improvements at 4 Town facilities including door and overhead door weather-stripping, roof-wall interface sealing, attic insulation, and door replacement.	Assumes reduction of 15% savings across all energy uses referencing DOE's weatherization Assistance Program documents suggesting 10-30% savings - See Weatherization Reference Tab. We use 15% savings to be conservative. Removes Lighting energy since this is counted in next measure. Removes 90% of gas from Town Hall because that is addressed in Heat Pump Measure.	10.9107
T of Lima	Retrofit/replace all interior/exterior lighting at 4 T facilities (T Hall, T Court, T Lib, T Hwy garage)	<b>Building Strategy 3A-</b> Incentivize building envelope insulation efforts and energy efficient purchases by supporting investments in certified energy-efficient appliances, heating and cooling equipment, indoor and outdoor lighting, and building products to replace older less efficient equipment. Support programs for end-of-use energy efficiency measures such as building envelope insulating, mold abatement, asbestos removal, and hazard remediation in all existing buildings.	Buildings and Infrastructure	Siemens Industry will retrofit/replace all lighting (interior and exterior) in 4 Town facilities. Includes removal and proper disposal of existing lighting, installation of new lighting, retrofit remain linear T8 and T12 lighting fixtures and any older or damaged LED-lamped fixtures in all buildings	Assumes Lighting is 9.3% of electricity energy us (DOE/CBEC's), and that energy will be reduced by 50% through conversion to LEDs. <a href="https://www.eia.gov/energyexplained/electricity/guide-to-electricity.php">https://www.eia.gov/energyexplained/electricity/guide-to-electricity.php</a> Given then the lighting is older, the lighting usage percent is probably higher than the 2022 tables since LEDs are standard now. Benefit estimate is therefore conservative.	0.8524
T of Lima	Sidewalk construction	<b>Transportation Strategy 4C-</b> Institute a regional ADA compliant retrofit program <b>Economy-wide Strategy 3B-</b> Encourage redevelopment of areas targeted for infill that are within public transit or walkable neighborhoods.	Transportation	NYS Route 15 Sidewalk - Phase II. Gale Road to Town Line. Length of sidewalk = 7,800 ft	GHG benefits calculated per mile of newly installed sidewalk based on connectivity benefits using the California Air Resources Board (CARB) adopted methodology. See sidewalks tab for references and calculations.	3.4602
T of Lima	EV Charging stations	<b>Transportation Strategy 1E-</b> Expand EV charging infrastructure in municipal lots and private parking lots/garages at points of interest (centers of employment, schools, grocery stores etc.), and incentives residential charging.	Transportation	Installation (5) Level 2 EV Charging Stations for public and fleet vehicles	Benefits estimated based on total charge expected delivered by year based on an assumption of 4 hours of daily use. Total charge is converted to a VMT of a passenger BEV, and that equivalent VMT is considered reduced usage of gasoline in an LDV @ 22mpg. See EV charging benefits model tab for references and calculations. For simplicity, methods for level II and III is assumed to be the same. <b>Claims credit for reductions displacing gasoline vehicles with EVs, assuming providing charging enables those benefits. Can lead to double</b>	30.7602
V of Livonia	Sidewalk expansion	<b>Transportation Strategy 4C-</b> Institute a regional ADA compliant retrofit program <b>Economy-wide Strategy 3B-</b> Encourage redevelopment of areas targeted for infill that are within public transit or walkable neighborhoods.	Transportation	Remove and install 5' wide ADA compliant sidewalks, replace concrete stairs, 4.1 miles of sidewalks	GHG benefits calculated per mile of newly installed sidewalk based on connectivity benefits using the California Air Resources Board (CARB) adopted methodology. See sidewalks tab for references and calculations. Benefits will need to be adjusted for how much sidewalk is new vs being replaced, TBD.	9.6034

GHG Benefits by Measure						
Municipality/ Organization	CPRD Project Component	Applicable PCAP measures	PCAP Sector	CPRD Project Component - Details	GHG Calculations	GHG Savings (MTCDE/Year)
V of Livonia	Geothermal heating & cooling, V Office & Hwy garage	<b>Building Strategy 1B-</b> Implement air-source heat pumps and geothermal energy networks for municipal buildings, and pilot net-zero buildings. <b>Building Strategy 3A-</b> Incentivize building envelope insulation efforts and energy efficient purchases by supporting investments in certified energy-efficient appliances, heating and cooling equipment, indoor and outdoor lighting, and building products to replace older less efficient equipment. Support programs for end-of-use energy efficiency measures such as building envelope insulating, mold abatement, asbestos removal, and hazard remediation in all existing buildings.	Buildings and Infrastructure	documentation requested	Assume in ground source heat pumps will eliminate gas used for heating in the building, estimated at 90% of metered gas. Benefits estimates with a GSP carbon reduction ratio with update N1 Grid carbon mix - See Heat Pump Reduction Ratio tab	5,3471
V of Livonia	EV Charging stations	<b>Transportation Strategy 1E-</b> Expand EV charging infrastructure in municipal lots and private parking lots/garages at points of interest (centers of employment, schools, grocery stores etc.), and incentives residential charging.	Transportation	installation (6) level 2, (2) level 3 Charging Stations for public visitors in the business district and parks. Both located on Main Street, public parking lots.	Benefits estimated based on total charge expected delivered by year based on an assumption of 4 hours of daily use. Total charge is converted to a VMT of a passenger BEV, and that equivalent VMT is considered reduced usage of gasoline in an LDV @ 22mpg. See EV charging benefits model tab for references and calculations. For simplicity, methods for level II and III is the assumed to be the same. <b>Claims credit for reductions displacing gasoline vehicles with EVs, assuming providing charging enables those benefits. Can lead to double counting if credit for EVs credited elsewhere. Can be removed or modified during project.</b>	49,2163
WASA & T of Avon	Leakage initiative	<b>Building Strategy 1G-</b> Reduce the water and GHG emission of water and sewer infrastructure through efficiency upgrades and leakage emissions initiatives. <b>Building Strategy 3A-</b> Incentivize building envelope insulation efforts and energy efficient purchases by supporting investments in certified energy-efficient appliances, heating and cooling equipment, indoor and outdoor lighting, and building products to replace older less efficient equipment. Support programs for end-of-use energy efficiency measures such as building envelope insulating, mold abatement, asbestos removal, and hazard remediation in all existing buildings.	Waste, Water, and Sustainable Materials Management	Leakage Emissions Initiative (LEI): collaborative efforts of IvA and AvWVA to quantify impact of unmanaged leakage on avoidable carbon emissions; WASA is using LEI methodology to calculate carbon balance and track leakage reduction;  Phase 1: A/WVA M36 Top-Down Water Audit;  Phase 2: Level 2 Validation of Water Balance with Uncertainty Analysis;  Phase 3: Non-Revenue Water Economic Analysis;  Phase 4: Non-Revenue Water Program Design;  Phase 5: Non-Revenue Water Program Implementations (water meter replacement, main line replacement, service line replacement, pressure optimization, active leak detection, etc.)	See Cell NOTE, Modified, GHG reduction measures supplied. See WASA for more info: "2024-03-10 - CPRG Work Plan Updated".  For Methodology, see: "Leakage Emissions Initiative: Establishing a Standard Carbon Balance for Drinking Water Utilities"  GHG Reductions, 2025 - 2030: est. 500 metric tons of carbon savings achieved from reducing 120M gal of annual leakage down to 30M gal. Est. based on LCv/SA water consumption & usage assuming LCv/SA pulls power from plants that have around an 850g per kWh emissions rate, standard for most natural gas plants.  GHG Reductions, 2025 - 2025: Est. that LCv/SA alone could see more than 3K metric tons of carbon emissions avoided by 2050 related to less power consumption from leakage.  Cost Effectiveness of GHG Reductions: Less carbon emissions of over 100 metric tons of carbon/year. Inherently there will also be 250,000 kWh of power savings each yr. and 60 - 30M gal of water conservation each yr.  Documentation of GHG Reduction Assumptions: Assumes an 850g per kWh carbon intensity on power. Assumes reduction of leakage to 30 MG annually from 120 MG annually.	29,0540
T. Avon	heat pump	<b>Building Strategy 1B-</b> Implement air-source heat pumps and geothermal energy networks for municipal buildings, and pilot net-zero buildings. <b>Building Strategy 3A-</b> Incentivize building envelope insulation efforts and energy efficient purchases by supporting investments in certified energy-efficient appliances, heating and cooling equipment, indoor and outdoor lighting, and building products to replace older less efficient equipment. Support programs for end-of-use energy efficiency measures such as building envelope insulating, mold abatement, asbestos removal, and hazard remediation in all existing buildings.	Buildings and Infrastructure	Replace 11 vintage water source heat pumps with 11 heat pump units ranging from 3K-48K BTU. Replacements are 30% more efficient.  2. Continue our quarterly maintenance which we have done since 2003. 3. Continue our computer-based control of the different zones in the building to our heat and cool zones when in use by employees and or residents.	Assumes that electric-run space heating is 50% of the total use of electricity, and that will be reduced by 30% with more efficient HPs.	2,3345
County	Government Center Energy Efficiency Improvements	<b>Building Strategy 3A-</b> Incentivize building envelope insulation efforts and energy efficient purchases by supporting investments in certified energy-efficient appliances, heating and cooling equipment, indoor and outdoor lighting, and building products to replace older less efficient equipment. Support programs for end-of-use energy efficiency measures such as building envelope insulating, mold abatement, asbestos removal, and hazard remediation in all existing buildings.	Buildings and Infrastructure	The project includes installation of heating and cooling improvements in the ceiling and attic area and replacement of the existing 30 year old damaged roof with new metal cooling roof. A contractor will install insulation and weatherization improvements in the attic area to assist with and a new metal cooling roof with a solar reflectance of .67, thermal emittance of .30, and an SRI factor of 82. The project will meet the standards of the Cool Roof Rating Council.	Measure includes enhanced attic insulation and adding cool roof reflectivity. Assumes that 12.5% of electricity bill is for cooling - See EIA Energy by End use table in references tab, and that a cool roof reduces that by 15%. See NREL cool roofs resources in reference tab. For attic insulation, rather than the 15% energy benefit from full weatherization work per the WAP reference used elsewhere in this model, to be conservative assume 5% savings on gas as measure is limited to the attic	14,3122