

Technical Appendix

GHG Emissions Calculations for Each Project: Methodologies and Assumptions Energize Omaha

Home Electrification Program

This program includes two tiers of service (Electrification Tier and the Electrification + Solar Tier) for subject households. The Electrification Tier will provide electrification upgrades to transition from using natural gas stoves to electric stoves and transition natural gas furnaces to an air source heat pump for 1,200 homes. The Electrification + Solar Tier will provide the same upgrades as the Electrification tier, with the addition of an on-site solar array for 150 homes.

Electrification emission reductions calculations for 1,200 homes (240 homes annually) in the Electrification Tier and 150 homes (30 homes annually) in the Electrification + Solar Tier are calculated as follows:

- Electrification upgrades are anticipated to eliminate the subject property's natural gas consumption.
- Natural gas use reduction per home upgraded, therefore, is estimated based on the City of Omaha average household natural gas consumption based on the City's most recent GHG inventory.
- The average natural gas savings in therms anticipated is then multiplied by the natural gas emission factor provided by the US EPA GHG Emission Factors Hub.
- Conversely, the conversion to all electric energy will result in an increase in annual electric consumption. According to the Electrification Futures Study by the National Renewable Energy Laboratory, residential sector electrification can be anticipated to result in a 20% increase in electricity demand (using the medium scenario)
<https://www.greentechmedia.com/articles/read/widespread-electrification-could-increase-u-s-electricity-consumption>).
- Using the projected increase in electricity consumption can be multiplied by the City of Omaha average household electricity consumption based on the City's most recent GHG inventory to project the average increase in electricity use. This average electricity consumption increase in kWh anticipated is then multiplied by the reported Omaha Public Power District's electricity CO₂-e emission factor and the sum is subtracted from the projected natural gas emission savings.

The formula used to calculate the annual emission reduction for each year's installed electrification upgrades is:

$$(((\text{Average Omaha residential natural gas use} \times \text{US EPA GHG Emission Factor Hub natural gas emission factor})) - ((\text{Average Omaha residential electricity use} \times 20\% \text{ anticipated increase}) \times \text{local electric emission factor})) \times \text{annual share of homes upgraded (240+30)}.$$

Solar emission reductions calculations associated with solar array installations for 150 homes (30 homes annually) Electrification + Solar Tier homes are calculated as follows:

- The average solar array to be installed is anticipated to be 8KW with a specific power ratio of 1250 kWh/kw producing 10,000 kWh annually. This average annual onsite solar energy generation is then multiplied by the reported Omaha Public Power District's electricity CO₂-e emission factor.

The formula used to calculate the annual emission reduction for each year's installed electrification upgrades is:

(Average anticipated solar array annual kWh production x local electric emission factor) x annual share of homes upgraded (30).

For cumulative emissions reductions, the achieved annual energy savings and emissions reductions for previous years' installations are understood to continue each subsequent year.

Omaha Climate Solutions Challenge Award

This program establishes an awarded dollar value tied to a minimum proven recurring annual emissions reduction potential of the selected submission. The maximum dollar value to be accepted will be \$500 per recurring annual MT of GHG emissions reduction. A total of \$10,000,000 is anticipated to be awarded. Dividing the total anticipated award to the maximum dollar value per recurring annual MT of GHG emissions reduction results in a minimum anticipated recurring annual emissions reduction of 20,000 MT CO₂-e.

For cumulative emissions reductions, the first two years of the grant period are not anticipated to result in emissions due to the anticipated timeline of project solicitation, verification, award, and installation. Annual emission reductions for this measure are anticipated to begin in year three of the grant implementation.

Omaha Saves

Smart Thermostats Rebate

This measure is an expansion of an existing program provided by Omaha Public Power District (OPPD). Based on information from the OPPD, the Smart Thermostats Rebate results in an average savings of 12% for natural gas use and as much as 15% for electricity use. These average savings percentages can then be applied to the City of Omaha average household natural gas and electricity consumption based on the City's most recent GHG inventory. The average natural gas savings in therms and average electricity savings in kWh can then be multiplied by the natural gas emission factor provided by the US EPA GHG Emission Factors Hub and the reported Omaha Public Power District's electricity CO₂-e emission factor respectively. **The formula used to calculate the annual emission reduction for each year's installed electrification upgrades is:**

((Average Omaha residential natural gas use x anticipated average savings (12%) x US EPA GHG Emission Factor Hub natural gas emission factor)) + ((Average Omaha residential electricity use x anticipated average savings (15%) x local electric emission factor))) x annual share of smart thermostat rebate installations (3,000 units).

For cumulative emissions reductions, the achieved annual energy savings and emissions reductions for previous years' installations are understood to continue each subsequent year.

Residential Weatherization Rebates

This measure is an expansion of an existing program provided by Omaha Public Power District (OPPD). The program supports improved weatherization measures like improving home insulation or window replacement. Based on information from OPPD adding attic insulation through this rebate is anticipated to reduce energy consumption by 20%, while replacing windows with high efficiency windows through this rebate is anticipated to reduce energy consumption by 25%-30%. Calculations for emissions reductions assume 25% rebate utilization for window replacement and 75% utilization

for improved insulation. The average savings percentages for each of these can then be applied to the City of Omaha average household natural gas and electricity consumption based on the City's most recent GHG inventory. These average natural gas savings in therms and average electricity savings in kWh can then be multiplied by the natural gas emission factor provided by the US EPA GHG Emission Factors Hub and the reported Omaha Public Power District's electricity CO₂-e emission factor respectively. **The formula used to calculate the annual emission reduction for each year's installed electrification upgrades is:**

$$[(((\text{Average Omaha residential natural gas use} \times \text{anticipated average savings for window replacement (25\%)} \times \text{US EPA GHG Emission Factor Hub natural gas emission factor})) + ((\text{Average Omaha residential electricity use} \times \text{anticipated average savings for window replacement (25\%)} \times \text{local electric emission factor}))) \times \text{annual share of window replacement rebate utilization (325 homes)})] + [(((\text{Average Omaha residential natural gas use} \times \text{anticipated average savings for insulation upgrade (20\%)} \times \text{US EPA GHG Emission Factor Hub natural gas emission factor})) + ((\text{Average Omaha residential electricity use} \times \text{anticipated average savings for insulation upgrade (20\%)} \times \text{local electric emission factor}))) \times \text{annual share of window replacement rebate utilization (975 homes)}]$$

For cumulative emissions reductions, the achieved annual energy savings and emissions reductions for previous years' installations are understood to continue each subsequent year.

Energy Efficiency Assistance Program (EEAP)

This measure is an expansion of an existing program provided by Omaha Public Power District (OPPD) providing energy efficiency upgrades to households. Based on information from OPPD the EEAP program averages 18% reduction in energy savings (heating & cooling costs). The average savings percentages for each of these can then be applied to the City of Omaha average household natural gas and electricity consumption based on the City's most recent GHG inventory. These average natural gas savings in therms and average electricity savings in kWh can then be multiplied by the natural gas emission factor provided by the US EPA GHG Emission Factors Hub and the reported Omaha Public Power District's electricity CO₂-e emission factor respectively. **The formula used to calculate the annual emission reduction for each year's installed electrification upgrades is:**

$$(((\text{Average Omaha residential natural gas use} \times \text{anticipated average savings (18\%)} \times \text{US EPA GHG Emission Factor Hub natural gas emission factor})) + ((\text{Average Omaha residential electricity use} \times \text{anticipated average savings (18\%)} \times \text{local electric emission factor}))) \times \text{annual share of smart thermostat rebate installations (56 homes)}.$$

For cumulative emissions reductions, the achieved annual energy savings and emissions reductions for previous years' installations are understood to continue each subsequent year.

ReNew Omaha

Residential Group Purchase + Solar Rebates

This measure implements a broad campaign to increase and incentivize residential solar array installations. The program is designed to result in 94 or more residential solar arrays installed annually. The average solar array to be installed is anticipated to be 7.5KW with a specific power ratio of 1250 kWh/kw producing 9,375 kWh annually. This average annual onsite solar energy generation is then multiplied by the reported Omaha Public Power District's electricity CO₂-e emission factor. **The formula used to calculate the annual emission reduction for each year's installed electrification upgrades is:**

(Average anticipated solar array annual kWh production x local electric emission factor) x annual share of homes participating in the program (94).

For cumulative emissions reductions, the achieved annual energy savings and emissions reductions for previous years' installations are understood to continue each subsequent year.

Institutional / Commercial Group Purchase + Solar Rebates

This measure implements a broad campaign to increase and incentivize institutional and commercial solar array installations. The program is designed to result in 50 or more institutional solar arrays installed annually plus an initial 1.725 MW array for the Henry Doorly Zoo. The average solar array to be installed (excluding the Henry Doorly Zoo array) is anticipated to be 40KW with a specific power ratio of 1250 kwh/kw producing 50,000 kWh annually. This average annual onsite solar energy generation is then multiplied by the reported Omaha Public Power District's electricity CO₂-e emission factor. **The formula used to calculate the annual emission reduction for each year's installed electrification upgrades is:**

((Average anticipated solar array annual kWh production x local electric emission factor) x annual share of institutions/commercial sites participating in the program (50))+(Henry Doorly Zoo anticipated solar array annual kWh production x local electric emission factor).

For cumulative emissions reductions, the achieved annual energy savings and emissions reductions for previous years' installations are understood to continue each subsequent year.

Green Omaha

Tree Planting Program

This program is designed to plant at least 500 trees annually. Carbon sequestration calculations are based on USDA Forest service Tree Canopy values for State of Nebraska of 3.532 MT CO₂-e annual sequestration per acre of canopy coverage (base USDA research: https://www.itreetools.org/documents/559/i-Tree_Canopy_Carbon_Storage_and_Sequestration.pdf) New trees planted are anticipated to be 1"-2" caliper trees with an average 20 square feet of canopy cover. Applying the USDA Nebraska sequestration rate per acre to new tree canopy cover results in an initial sequestration rate of 0.0016 MT annually each. **This value is then applied to the annual new tree installation count for first year of growth carbon sequestration.**

Carbon sequestration for future years for all trees are based on an anticipated canopy growth rate based on an average mature tree canopy coverage of 30' diameter at year 25 (2050) (<https://leafnetworkaz.org/resources/Documents/Average%20Tree%20Size%20table.pdf>) and assumed intervening growth rates of 20% for first 5 years, 15% for years 6-20 and 10% for years 20 and beyond.

Sequestration for initial year planted:

(Average new tree canopy coverage x USDA average sequestration rate for State of Nebraska)x new trees planted per year (500).

Sequestration for subsequent years following planting:

Sequestration for initial year planted x 1.2 for each of the first 5 years of growth, x 1.15 for each year for years 6-20, x 1.1 for each year for years 21 and beyond.

Native Grasses

This program is designed to convert 75 acres of existing turf to native prairie grass. Average carbon sequestration rates per acre are based on the study “Linking prairie carbon sequestration and other co-benefits to the voluntary carbon market. Pilot Project: Midewin National Tallgrass Prairie” which studied prairie restorations in Wilmington, IL (https://skemman.is/bitstream/1946/9755/1/Garcia_Alvarez_MA_Thesis.pdf). **The formula for annual carbon sequestration is:**

Annual prairie grass installation acreage x average carbon sequestration rate per acre.

For cumulative emissions reductions, the achieved annual energy savings and emissions reductions for previous years’ installations are understood to continue each subsequent year.

Omaha Lawns to Legumes

This program is designed to incentivize conversion of existing turf lawns to native prairie grass through a rebate program. The program links rebate payments provided to participants based on a square footage of native prairie grass conversion. The total acreage of native prairie grass conversion can then be calculated by dividing the total annual payment allowance by the average rebate payment per square foot of conversion. Average carbon sequestration rates per acre are based on the study “Linking prairie carbon sequestration and other co-benefits to the voluntary carbon market. Pilot Project: Midewin National Tallgrass Prairie” which studied prairie restorations in Wilmington, IL (https://skemman.is/bitstream/1946/9755/1/Garcia_Alvarez_MA_Thesis.pdf). **The formula for annual carbon sequestration is:**

Annual prairie grass installation acreage incentivized x average carbon sequestration rate per acre.

For cumulative emissions reductions, the achieved annual sequestration and emissions reductions for previous years’ installations are understood to continue each subsequent year.

Sustain Omaha Planning Department Staffing and Grant Management

One of the annual functions anticipated in the Sustain Omaha effort is the creation, maintenance, and promotion of the Climate Action Toolkit for engagement in household and business reduction actions. The Toolkit will provide a range of actions a household can do to align with the CARP goals. The toolkit will be developed based on a model used in other communities throughout the US. Based on past Toolkit programs it can be anticipated that annual GHG emissions per participating household can range from 1 to 6 MT CO₂-e. The average household annual emissions reduction is anticipated to be the median of that range, or 3.5 MT CO₂-e annually. **The formula for annual GHG emissions reductions is:**

Annual new households participating in program x average household annual emissions reduction.

For cumulative emissions reductions, the achieved annual energy savings and emissions reductions for previous years’ installations are understood to continue each subsequent year.

Table 1: Referencing the larger PCAP document, each project proposed for the CPRG has been evaluated for its replicability and scalability to the larger MAPA.

Project Type	Replicable	Scalable
Home Electrification	Yes: Technology exists; other MAPA region organizations can replicate projects	Yes, but limited because once a home has been electrified, it is likely to stay that way
Omaha Climate Solutions	Yes: Other cities can use the Omaha Climate Solutions Hub as a model	Yes: Once pilot projects demonstrate success, the potential for project growth and implementation in the larger MAPA area are possible
Smart Thermostats	Yes: Technology exists and is easily available	Yes: but limited because once a home has transitioned to a smart thermostat, no additional gains can occur
Expansion of Residential Weatherization Rebates	Yes: Technology exists; once other cities have the trained staff and can offer offsets for the upfront costs, and residents can begin implementing	Yes: If cities have the trained workforce and can offer financial offsets for LIDAC
EEAP Expansion	Yes: Many cities have EEAP and with assistance can expand this program	Yes, this can be scaled up to the OPPD service territory after the City of Omaha needs have been met
Residential Group Solar Purchase and Solar Rebate	Yes: Many cities throughout the US have similar programs	Yes, this can be scaled up to the OPPD service territory after the City of Omaha needs have been met
Institutional and Commercial Group Solar Purchase (including Henry Dooly Zoo Pilot Project)	Yes: Many cities throughout the US have similar programs for commercial group projects and the Zoo array can serve as a model for other similar situations	Yes: the group purchase for commercial has room to grow once program is in place. While there is only one zoo, the array could be a model for other similar situations in the region
Tree Planting in Parks and Right of Way	Yes: This project can serve as a model for other cities, especially those in the MAPA region	Yes, to a point: The total possible acreage of parks and right of way that have been planted limit scalability of this project
Native Grass Plantings in Parks, OPS and Right of Way	Yes: This project can serve as a model for other cities, especially those in the MAPA region; Anticipated all OPS (Omaha Public School) campuses will use this project	Yes, to a point: The total possible acreage of parks, OPS campuses and right of way that have been planted limit scalability of this project

Omaha Lawns to Legumes	Yes: Other cities in the MAPA region can use this project as a model	Yes, to a point: The total possible residential acreage limits the scalability of this project
Planning Department and Grants Management	Yes: Other cities in the MAPA region can use this project as a model	No: Though the amount of people engaged and reached may increase over time, more positions are not anticipated for the OCAS and web-based toolkits are generally not considered scalable

Table 2: The Omaha Climate Action and Resilience Plan team has made extensive community engagement efforts through the first round of plan development. This effort has included a plan focused website, community survey, equity listening sessions, virtual and in-person public meetings, meetings with a community planning team, a community stakeholder focus group meeting, and several additional engagement events. The table below details engagement efforts and estimated participants.

Engagement	Date	Participants
Website	Launched October 18, 2023	5,600 visits
Survey	October 18, 2023 – January 31, 2024	2,279 responses
Equity Listening Sessions	February 2 and 3, 2024	40 participants
Planning Team Meetings	November 2023 through the present	Up to 95 participants
Community Stakeholder Focus Group Meeting	January 18, 2024	94 attendees
Virtual Public Meeting	February 12, 2024	57 attendees
In-Person Public Meetings	February 15 and 17, 2024	86 attendees
University of Nebraska Sustainability Summit	November 15, 2023	90 attendees
Environmental Justice Listening Session by Spark CDI	November 29, 2023	7 attendees
Girls Inc. Presentation	January 22, 2024	17 attendees
Seed Sharing Event	February 10, 2024	200-300 attendees
Climate Resilience Institute’s Symposium at University of Nebraska – Lincoln	February 27, 2024	50 attendees
ModeShift Virtual Discussion on ongoing Climate Action and Resilience Plan Efforts	February 28, 2024	25 attendees

Table 3: Mapping of PCAP of the Omaha-Council Bluffs Metropolitan Statistical Area Climate Action Measures (pages 40-45 of PCAP) to the proposed CPRG Projects. Deleted Mobile Combustion, Waste Management, Local Foods & Agriculture and Waste and Wastewater sectors and programs/action items found in original PCAP which do not apply to this CPRG proposal.

Sectors and Measures directly addressed by CPRG Proposal are in bolded and underlined			
Sector	City of Omaha Strategies	Regional Implementation Measures	Identified Programs and/or Action Items
<u>Stationary Combustion</u>	<u>Increase access to building energy alternatives and increase the share of the electric utility portfolio serving the community from 35 percent to 50 percent by 2030</u>	<u>Encourage development of alternative and renewable energy options across all sectors</u>	OPPD: Hosting Capacity Analysis
			OPPD: Value of Solar Funding Analysis
			Ordinance Amendment: Energy Systems
			<u>Solar installation rebate program</u>
			<u>Solar Arrays in Parking Lots Program Development (Henry Doorly Zoo, OPS)</u>
		<u>Encourage conversion from on-site fossil fuel combustion to electrification or renewable fuels across all sectors</u>	IECC Building Code Adoption (unamended) and Maintenance
			<u>OPPD Energy Efficiency Tax Credit and Rebate Program Expansion</u>
			HERS Program Review and Expansion
	<u>Improve total Citywide building energy efficiency in all sectors by 5 percent for electricity and natural gas by 2030</u>	<u>Improve building energy efficiency across all sectors</u>	Net Zero standards for new construction
			<u>OPPD Energy Star Rebate Program expansion</u>
			LED Conversion Program
			<u>HE appliances, renewables, and weatherization training for the trades</u>
	<u>Reduce the share of the population living in energy poverty.</u>	<u>Improve access to weatherization, high-efficiency appliances, and whole-home energy solutions</u>	<u>Weatherization Assistance Program expansion</u>
<u>Greenspace and Ecology</u>	<u>Increase tree cover city-wide (and in particular in</u>		Establish City of Omaha native tree species nursery

	<u>identified target neighborhoods) from 24.9 percent to 27.9 percent by 2040</u>	<u>Increase established tree canopy on non-agricultural land across all sectors</u>	Comprehensive Plan Amendment: Ecology, Tree Canopy, Infill and Redevelopment Guidelines
			<u>Ordinance Amendment: Tree canopy, landscaping, streetscape improvements</u>
			<u>Native Omaha Ecosystems dashboard and public education platform</u>
	<u>Increase pollinator supportiveness and achieve a 10% turf replacement with native grasses and wildflowers citywide by 2040 (approximately 210 acres annually)</u>	<u>Enhance sustainable, native landscaping programs, habitats, and practices</u>	<u>Ordinance Amendment: Native species landscaping</u> , green roofs, impervious surfaces, natural topography, weeds and litter modifications
			<u>OPS: Native Prairie Conversion Program Development</u>
			<u>Pollinator Habitat Certification Program</u>
			<u>Native Omaha Ecosystems dashboard and public education platform.</u>
			<u>Native Prairies and Floodplains Colocation Program.</u>
			Dark Skies Program Development
	<u>Reduce heat island effect through citywide “dark” impervious surface coverage reduction of 10% by 2040, particularly in neighborhoods identified with higher heat island impacts (approximately 100 acres annually)</u>	<u>Encourage reductions in the impact of heat islands throughout the region, and particularly in target neighborhoods</u>	<u>Heat Island Mitigation Plan Development</u>
			<u>Tree Canopy Improvements Plan Development</u>
			Ordinance Amendment: Reduce required parking and evaluate Parking Maximums
			Solar Arrays in Parking Lots Pilot Program
			Green Roofs Design Criteria Development

	<u>Reduce invasive species and increase climate resilience and biodiversity of City's tree canopy, parks and greenspaces</u>	Encourage review and comprehension of the long-term impacts of development across all sectors	Require Environmental Impact Assessments for all new development
	<u>Ensure municipal operations and adequate emergency, health and transportation services can be maintained in a climate emergency</u>	Increase resilience of municipal buildings and infrastructure to potential impacts of climate change	<u>Municipal Solar Pilot Program</u>
			Emergency Housing Plan Development
<u>Economic Development</u>	<u>Develop equitable workforce and entrepreneur opportunities of Climate Action in the economy</u>	<u>Enable the development of innovative business practices to enact climate solutions, particularly in low income and disadvantaged communities</u>	<u>Establish and implement workforce training for renewable energy systems, HVAC installation and maintenance, and construction practices in collaboration with area trade unions</u>
	<u>Support local business operations in building marketplace climate resistance</u>	<u>Help local and small businesses be climate-impact ready</u>	<u>Support efforts of local and small businesses to develop business continuity plans during climate events</u>
	<u>Establish sustainable financing for the City's climate action implementation</u>	<u>Ensure the long-term success and commitment to enacting climate action across all sectors, and adapt to changing conditions</u>	<u>Establish a central Climate Action office to facilitate coordination, implementation, monitoring, and funding of all proposed and future climate planning actions</u>
			<u>Establish a public-facing Sustainability Hub, with dashboards and educational platforms on Climate Action</u>