

Technical Appendix: Future Ready Neighborhoods Measure – GHG Documentation of Assumptions

This appendix explains the methodology and assumptions used for developing the estimated greenhouse gas (GHG) emissions reduced under the Future Ready Neighborhoods measure (hereinafter referred to as “FRNs”) listed in the Central Iowa Priority Climate Action Plan as “Reduce home fossil energy use and increase carbon sequestration through residential efficiency and ecosystem services for low-income households.”

See FRNs GHG Emission Reduction Calculation Spreadsheet – or GHGcalcs_PolkCountyIA.xlsx – for emission reduction calculations.

Methods and Assumptions

Emission Reductions Estimate Method

Data obtained from Alliant Energy’s Renewable Goals, City of Perry, Iowa-Alliant Energy partnership, City of Ames, Iowa SunSmart Community Solar program, Iowa Weatherization Assistance Program, the Des Moines Urban Forest Master Plan, the Report on the Impact of Costs of the Iowa Low-Income Weatherization Program for Calendar Year 2022, EPA’s Greenhouse Gas Equivalencies Calculator – Calculations and References, and EPA’s Avoided Emissions and generation Tool (AVERT) were used to generate measure-related activity data and GHG reduction estimates.

Models & Tools Used

AVERT version 4.2 released by the EPA was used to calculate GHG and co-pollutant emission reductions for electricity savings. For reduced fuel use and tree plantings, EPA emission factors were used to quantify reductions based on activity data assumptions for FRNs.

Measure Implementation Assumptions

The following key assumptions about measure implementation were used to quantify emissions reductions and costs for this measure.

Task assumptions: The following implementation milestones are met:

Task #	Task Description	Anticipated Milestones
1	Pursue and receive implementation funding	Spring - Fall 2024
2	Enter funding agreements with local and regional implementers	Fall 2024
3	Community engagement around measure implementation administration specifics	Fall 2024
4	Produce implementation guidance, marketing materials, and an energy audit addendum form that assesses the feasibility of the additional service offerings available under this measure	Winter 2024

5	Coordinate with volunteer organizations and institutions of higher learning on establishing training and apprenticeship programs	Spring 2025
6	Measure implementation (audits, services, and workforce training)	January 2025 – December 2029 or beyond if additional funding is secured

Cost assumptions: Average site-built single-family home statistics from the “Report on the Impacts and Costs of the Iowa Low-Income Weatherization Program for Calendar Year 2022” were used to estimate costs for implementation of weatherization offerings for Home Suites. The Des Moines Urban Forest Master Plan was used to estimate native tree and shrub planting and maintenance costs. The City of Ames, Iowa and Alliant Energy SunSmart cooperative program was used to estimate the cost of solar installation.

- Average expenditures for weatherization of a site-built single-family home: \$19,992
- Cost to plant 3800 trees per year and maintain urban trees: \$1,000,000/year
- Average cost of \$2 million per MW solar installed.

Measure lifetime: The emissions benefits associated with this measure are assumed to last at least 25 years.

Measure uptake: Because the Iowa Weatherization Program receives approximately 78,000 more applications per year than households that can be served, we assume that the FRNs program will be fully subscribed.¹

Emission Reduction Estimate Assumptions

The following key assumptions about emission reductions were used to quantify emission reductions for this measure:

- Emission factors:²
 - Home heating fuels:
 - Natural gas: $0.1 \text{ million British thermal units (mmbtu)}/1 \text{ therm} \times 14.43 \text{ kilogram (kg) Carbon (C)}/\text{mmbtu} \times 44 \text{ kg CO}_2/12 \text{ kg C} \times 1 \text{ metric ton (mt)}/1,000 \text{ kg} = \mathbf{0.0053 \text{ mt CO}_2/\text{therm}}$
 - Propane: $1/42 \text{ barrels}/\text{gallon} \times 236.0 \text{ kg CO}_2/\text{barrel} \times 1/1,000 \text{ kg}/\text{mt} = \mathbf{0.0056 \text{ mt CO}_2/\text{gallon}}$
 - Fuel Oil: $1/42 \text{ barrels}/\text{gallon} \times 426.1 \text{ kg CO}_2/\text{barrel} \times 1/1,000 \text{ kg}/\text{mt} = \mathbf{0.0101 \text{ mt CO}_2/\text{gallon}}$
 - Urban Trees: $36.4 \text{ lbs C}/\text{tree} \times (44 \text{ units CO}_2/12 \text{ units C}) \times 1 \text{ mt}/2,204.6 \text{ pounds (lbs)} = \mathbf{0.060 \text{ mt CO}_2 \text{ per urban tree planted}}$
 - Solar Production: $12,154 \text{ kWh per home} \times 852.3 \text{ lbs CO}_2 \text{ per megawatt-hour generated} \times 1/(1-0.073) \text{ MWh delivered}/\text{MWh generated} \times 1 \text{ MWh}/1,000 \text{ kWh} \times 1 \text{ metric ton}/2,204.6 \text{ lb} = \mathbf{5.067 \text{ metric tons CO}_2/\text{home}}$

AVERT Assumptions:

¹ Iowa Health & Human Services. (2024, February 9). *Weatherization Assistance FAQ*. <https://hhs.iowa.gov/programs/programs-and-services/weatherization/faq>.

² U.S. Environmental Protection Agency. (n.d.). *Greenhouse Gases Equivalencies Calculator - Calculations and References*. <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>.

- AVERT Region: Midwest
- Energy Efficiency Impacts: Reductions spread evenly throughout the year
- Rooftop Photovoltaic

Reference Case Scenarios

Weatherization Measures: According to the 2020 greenhouse gas inventory prepared for the What's Next, Central Iowa? PCAP, direct residential emissions were 951,624.27 mt CO₂e per year with 15,509,822 thousand cubic feet natural gas, 17,093,369 gallons of propane and fuel oil, and 17,639,182 mmbtu of energy used per year. Electricity sector emissions resulting from residential use were 1,245,917.33 mt CO₂e per year.

Solar Installations: The cumulative emissions for 2025 to 2030, assuming 50 MW of partnerships (like the Perry-Alliant partnership, or Ames community farm) , would be roughly 250,000 mt, which brings the fraction of carbon reduction to 2.2% along with added economic benefits for low-income. The cumulative emissions reduction by 2050 would be 1,250,000 mt. This calculation is based on reduced emissions from the Ames SunSmart Community solar farm (2 MW). The 400 MW number is based on Alliant Energy's goal for Iowa solar farms.

Measure-Specific Activity Data and Implementation Tracking Metrics

Average site-built single-family home statistics from the "Report on the Impacts and Costs of the Iowa Low-Income Weatherization Program for Calendar Year 2022" were used to estimate heat (therms, gallons) and electricity savings in kilowatt hours (kWh) for implementation of weatherization offerings for FRNs.

The budget for the FRNs program (see GHG calculation spreadsheet) was used to identify the number of households that could be served and trees and shrubs planted in Central Iowa neighborhoods. Activity data assumptions used to estimate emission reductions are summarized below:

- Number of additional households served through FRNs: 1674 (approximately 335 per year between 2025 and 2029)
- Household main heating source percentages:
 - Natural Gas: 79.7%
 - Propane: 13.2%
 - Fuel Oil: 0.5%
 - Electricity: 6.6%
- First-year fuel savings per household from weatherization by main heating source:
 - Natural Gas: 278 therms
 - Propane: 324 gallons
 - Fuel Oil: 195 gallons
- First-year electricity savings per household from weatherization by main heating source:
 - Natural Gas: 891 kWh
 - Propane: 1280 kWh
 - Fuel Oil: 1292 kWh
 - Electricity: 4441 kWh
- Trees planted: 35,326 (approximately 7,065 per year between 2025 and 2029)
- Establishment of solar production annually in MW

- approximately 1MW per year between 2025 and 2029 directly from potential CPRG investment
 - 1 MW solar capacity produces electricity for 220 homes³
 - Average Midwest home creates about 17 tons of carbon emissions annually⁴
 - 1 US ton = 0.907185 metric tons
 - 1 home = 15.42 mt CO₂e
 - CO₂e saved annually per MW = 3,393 mt

The FRNs program will track the first-year energy savings (fuel and electricity), first-year energy cost savings, trees planted, and program expenditures for each year of the program to verify the emission reductions achieved from implementation of this measure.

Greenhouse Gas Emissions Reduced

Implementation of this measure is anticipated to reduce:

- 4,194 mtCO₂e in 2026,
- 8,389 mtCO₂e in 2027,
- 12,583 mtCO₂e in 2028,
- 16,778 mtCO₂e in 2029, and
- 20,972 in 2030 and each year thereafter.

This measure will reduce 268,007 cumulative mtCO₂e for the period between 2025 – 2030 and 1,358,063 cumulative mtCO₂e for the period between 2025 – 2050. If fully awarded, the reductions directly from any Phase II Implementation Grant would reduce 62,917 cumulative mtCO₂e for the period between 2025 – 2030 and 482,361 cumulative mtCO₂e for the period between 2025 – 2050, or roughly one-third of the full measure's capacity.

The planning team is working with partners to fund the full measure with private partners from across the region and will continue to do so beyond the PCAP and CPRG Phase II submissions.

³ City of Ames – SunSmart Program <https://www.cityofames.org/government/departments-divisions-a-h/electric/smart-energy/solar-energy/sunsmart-ames-first-community-solar-farm>

⁴Winneshiek County Clean Energy District <https://energydistrict.org/resources/home-energy-tips/net-zero-home/>