

Technical Appendix for Priority Methane Reduction Projects in Virginia

This technical appendix provides a comprehensive overview of the calculations, methodologies, assumptions, and tools employed to estimate greenhouse gas (GHG) emission reductions. Additionally, it outlines any observable changes in air co-pollutants associated with each measure and project included in the Virginia Department of Environmental Quality's (DEQ's) Priority Methane Reduction Projects Grant application. The DEQ has a vested interest in promoting cleaner air, reducing high potency Green House Gasses (GHG) emissions from coal mines and landfills as well investing in food waste prevention and compost programs to divert food waste from landfills. Supporting calculations for these programs are included in the file *GHGcalcs_VADEQ.xlsx*.

VA Methane Program 1 Fugitive Coal Mine Methane Capture & Utilization: The GHG calculations for this program are based on the need for ~25 wells at 500 MCFD removal at 50% methane to reach target of 1 MMtCO₂e/yr. This assumes the project will be at 70%+ efficiency, with a target of \$1.3/kWh installed capex. This also assumes the installation of wells and coal mine methane (CMM) technology occurs is phased January 2027 to May 2030 (29 months or 2.42 years) and GHG reductions are scaled accordingly (41% of target reductions of 1 MMtCO₂e/yr are realized in 2027, 82% are realized in 2028, and 100% in 2029 and 2030). The target of 1 MMtCO₂e/yr is assumed to be achieved annually starting 2031 through 2050.

VA Methane Program 2 Landfill Methane Capture & Utilization: Using the U.S. EPA Landfill Methane Outreach Program (LMOP) database¹ DEQ identified both "Future Potential" and "Candidate" sites (as defined by LMOP) for capture and/or landfill gas to energy systems. DEQ selected the largest landfill from a waste in place perspective within this group (the Augusta County Service Authority Landfill) and found a case study from LMOP for a similarly sized landfill that installed a capture and electricity project (the Frederick County Regional Landfill²). By assuming similar annual GHG reductions achieved and electricity generation and costs between the projects (as reported through the most recent LMOP database), proportioned by landfill size (waste in place tons) DEQ estimated both GHG reductions (from capture and reuse of the methane) and from potential reductions in avoided power generation. DEQ estimated a cost per ton reduction for this example project at the Augusta Landfill by converting the Frederick County Landfill capital costs to 2024 dollars and assuming the same cost (given the similar landfill size) for both projects.³ This cost per ton was applied to the total available program subaward budget of \$8,897,757 to estimate GHG reductions, assuming projects resulting from the program start fully capturing and using methane in January 2029.

VA Methane Program 3 Food Rescue and Composting: DEQ used the ReFED Solutions Database to calculate a cost per metric ton CO₂e reduction for Virginia (see Figure 1 below).

¹ <https://www.epa.gov/lmop/lmop-landfill-and-project-database>

² <https://www.epa.gov/lmop/landfill-gas-energy-project-data#frederick>

³ <https://www.scsengineers.com/scs-press-release/scs-engineers-helps-frederick-county-regional-landfill-convert-its-greenhouse-gases-into-energy-and-income/>

Figure 1. Results for Virginia in ReFED Solutions Database

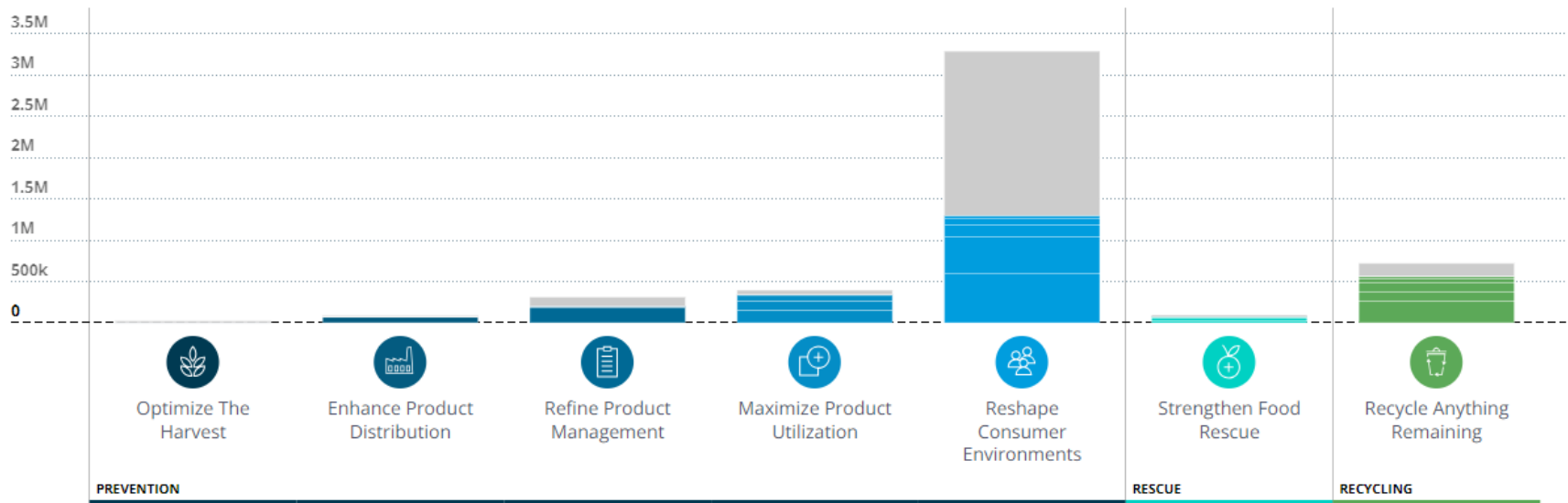
ion-database?capital_type=public&dataView=total&indicator=total-mtco2e-avoided&state=VA

Explore solutions to food waste

ANNUAL CLIMATE IMPACT POTENTIAL OF FOOD WASTE SOLUTIONS

MTCO2E

● REMAINING OPPORTUNITY



Impact Metric:

Net \$ Tons **Climate** Water Meals Jobs

Stakeholders:

All Stakeholders ▼

Data View:

Total ▼

Food Type:

All Food Types ▼

Capital Type:

Public ▼

States:

Virginia ▼

The methodology for estimating annual implementation costs and GHG emission reduction estimates, which represent GHG reduction potential across supply chains, are available online from ReFED:

- https://docs.refed.org/methodologies/solutions_database/net_financial_benefit.html#net-financial-benefit
- https://docs.refed.org/methodologies/solutions_database/ghg_reduction_potential.html#ghg-reduction-potential

This cost per ton was estimated by developing a weighted (by tons of food waste reduced) average cost per metric ton of CO₂e reduced for the three types of actions covered in this project, including reshaping consumer environments, strengthening food rescue, and recycling anything remaining. The cost per ton was applied to 4.5 years (assuming equal spend across 5 years) of the total CPRG requested subaward value of \$8,847,757 to estimate the costs per ton reduction for 2025-2030, assuming grantees start programs and activities in June of 2026. It is assumed that activities from CPRG funding will continue beyond the grant period due to increased interest and maintaining what will become the “new normal” for grantees through this project. As a result, continued annual GHG reductions are held constant through 2050.