CPRG GHG Technical Appendix

## Introduction

As stated in the workplan narrative document, because about a third of California’s waste stream is made up of organic waste and landfills are the third largest source of methane emissions in California, it is critical that the State focuses on both diverting organic waste and improving landfill operations to tackle waste sector emissions from multiple angles. Due to the multidecadal time frame required for landfilled organic material to break down, the emissions reductions from diverting organic material in one year are realized over the course of several decades. Combined with the fact that methane is a powerful GHG and short-lived climate pollutant, near-term action is crucial to avoid locking in future landfill methane emissions.

To that end, CalRecycle proposes to expand upon its existing experience implementing the [California Climate Investments (CCI) Organics Grant Program](https://www.caclimateinvestments.ca.gov/organics-grant-program) within the waste sector. This program provides grants to support California’s organics recycling infrastructure by expanding existing capacity or establishing new facilities to reduce the amount of California-generated source-separated green materials and food materials being disposed in landfills and create value-added products such as compost and bioenergy. Eligible projects will develop **new or expanded composting, co-digestion, and anaerobic digestion facilities** that divert source-separated green and food materials from landfills and make value-added products such as compost and renewable energy. CalRecycle is requesting $100 million, which is expected to fund 10-14 organic waste recycling projects at a proposed $10 million maximum award size.

## GHG Reduction Estimate Methods

GHG reductions estimates contained in this application are calculated using the [US EPA Waste Reduction Model (WARM) Tool Version 16](https://www.epa.gov/warm/versions-waste-reduction-model#v16) (completed calculator tool is included in this application, file name ‘CalRecycle CPRG WARM Tool v16.xls’). As identified in the [WARM Model documentation](https://www.epa.gov/system/files/documents/2024-01/warm_management_practices_v16_dec.pdf), the WARM tool includes the impacts of the following, see Warm Model documentation for more details:

|  |  |  |
| --- | --- | --- |
| **Landfilling Base Case (p.6-2)**   * “CH4 emissions from anaerobic decomposition of biogenic carbon compounds; * Transportation CO2 emissions from landfilling equipment; * Biogenic carbon stored in the landfill; and * CO2 emissions avoided through landfill gas-to-energy projects” | **Composting (p.4-1)**   * “Collecting and transporting the organic materials to the central composting site. * Mechanical turning of the compost pile. * Non-CO2 GHG emissions during composting (primarily CH4 and N2O). * Avoided fertilizer offset from direct application of compost. * Storage of carbon after compost application to soils” | **Anaerobic Digestion (p.3-1)**   * “Transport of materials * Preprocessing and digester operations * Biogas collection and utilization * Curing and land application * Fugitive CH4 and N2O emissions” |

Inputs and assumptions used in the WARM calculator tool are outlined below, and are based on data from CalRecycle’s substantial experience selecting and awarding grant projects, including the recent Circular Economy Organics Grant Program Cycle 7 (ORG7), which awarded over $130 million composting and anaerobic digestion projects and related infrastructure. Note that while the estimates contained in this application are projections, when implemented CalRecycle will require reporting of actual data from grantees and will work closely with CalEPA to appropriately calculate and document any and all required data.

First, CalRecycle calculated expected tons of diverted organic waste based on data from CalRecycle’s recent ORG7 grant awards. Of these awards, a subset of six awarded composting projects and six awarded anaerobic digestion projects were selected from ORG7 based on applicability to the proposed eligibility of this measure. These projects were awarded $46.4 million and $51.4 million in CalRecycle funding, respectively, and the additional capacity added because of these awards is approximately 403,000 tons per year for composting and 260,000 tons per year for anaerobic digestion. We then calculated a “tons of capacity per dollar” metric from this dataset for each project type, and multiplied this by the proposed CPRG awards budget of $60 million for composting and approximately $34,440,000 for anaerobic digestion. This results in an estimated 521,000 tons per year of added composting capacity and 174,000 tons per year of anaerobic digestion capacity built as a result of this measure, or 695,000 tons total per year.

Next, CalRecycle utilized these metrics as well as the inputs below to calculate the GHG impacts of the proposed measure utilizing the US EPA WARM Tool Version 16 as follows:

**WARM Tool Inputs and Assumptions:**

“Analysis Inputs” tab:

1. Column H row **74: 695,000** (total baseline tons of mixed organics landfilled)
2. Column T row **74: 521,000** (tons of mixed organics diverted to composting)
3. Column U row **74: 174,000** (tons of mixed organics diverted to anaerobic digestion)
4. Electricity grid mix: **'California'** (projects will be located in California)
5. Source Reduction: **'Current mix'** (default value)
6. LFG Controls: **'LFG Recovery'** (California landfills are required to have LFG collection)
7. Energy Recovery: **'Flare'** (most California landfills do not have energy recovery)
8. Gas Collection: **'California regulatory collection'** (projects will be located in California)
9. K Rate: **'Dry'** (the vast majority of CA waste is disposed at landfills that receive less than 20” of precipitation)
10. Digestion Type: **'Dry'** (required due to selection of mixed organics input)
11. Digestate Handling: **'Cured'** (conservative assumption)
12. Transport distances: **'Default’** (default value)

## GHG Emissions Reduced

The change in greenhouse gas emissions reductions from this proposal is estimated to be approximately **123,000 MTCO2e per year** at full implementation, equivalent to removing almost 26,000 passenger vehicles from the road.

In order to calculate 2025-2030 and 2025-2050 cumulative GHG reductions and cost effectiveness, CalRecycle needed to develop a timeline for CPRG subgrant-awarded project implementation. To do this, CalRecycle prepared a detailed workplan timeline for grant cycle implementation and award, which is included in the workplan narrative document, and analyzed data from previously awarded project workplans. As a result, we expect that, on average, projects will begin full operation in Q3 2027. This results in an assumption of approximately 3.5 years of operation through 2030, and 23.5 years of operation through 2050. However, some investments made using grant funds will be infrastructure with an operational life of approximately 10-years before refurbishment (e.g., holding tanks, in-vessel digesters, and heavy-duty equipment such as tub grinders and screeners), while site improvements, concrete pads, and other structures have a much longer operational life. In the interest of taking a conservative approach, CalRecycle is estimating 10 years of full operation in the 2025-2050 timeframe, reducing to half the throughput attributed to CPRG investments through 2050 (an additional 13.5 years).

Detailed, unrounded results are shown in the table below:

|  |  |  |
| --- | --- | --- |
| **Diversion and GHG Results** | | |
| Projected Annual Diversion | 695,171 | Tons/Year |
| Tons Diverted -Total - 2025-2030 | 2,433,099 | Tons |
| Tons Diverted - Total - 2025-2050 | 11,644,119 | Tons |
| **GHG Impact - Annual** | **(123,001)** | **MTCO2e/year** |
| **GHG Impact - Cumulative - 2025-2030** | **(430,504)** | **MTCO2e** |
| **GHG Impact - Cumulative - 2025-2050** | **(2,060,269)** | **MTCO2e** |
| Cost Effectiveness (Tons) - 2025-2030 | $38.82 | $/Ton |
| **Cost Effectiveness (GHGs) - 2025-2030** | **$219.37** | **$/MTCO2e** |
| **Cost Effectiveness (GHGs) – 2025-2050** | **$45.84** | **$/MTCO2e** |