

Calculation Method for Emission Reduction Estimates from Standalone Anaerobic Digestion Projects¹

Both the GHG emission reductions and air pollutant emission estimates from Standalone AD projects are estimated as the difference between the baseline sending the organic materials to a landfill versus digesting those materials using a dedicated digester. Equation 11 estimates the GHG reductions and Equations 12 through 16 estimate the criteria and toxics emissions.

The estimates for GHG reductions were calculated using the California Air Resources Board (CARB) Benefits Calculator tool developed for the CalRecycle Organics Programs shown in the GHG Emissions Reduction Calculations Spreadsheet included in the Project Narrative Attachment section of this application. Although the calculator includes a 10-year projection, the annual GHG reduction figure was extrapolated to determine the net GHG reduction through 2050. A copy of the calculator and its methodology is included in this application package.

The CARB Benefits Calculator estimates GHG reductions resulting from various project types for processing organic waste. For the READ Facility, the “Standalone Anaerobic Digestion Project” type was selected. This section will describe the methodology and assumptions associated with this project type, taken from the calculator’s quantification methodology documentation. Further references can be viewed in the footnoted document. Additionally, the attached CARB Benefits Calculator.xlsx shows each calculation and related assumptions.

¹ https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/calrecycle_organics_finalqm_6-15-20.pdf

Equation 11. GHG Emission Reductions from Standalone Anaerobic Digestion

$GHG_{SAD} = (FS_{SAD} - RES_{SAD}) \times ERF_{SAD}$		
<i>Where,</i>		<u>Units</u>
GHG_{SAD}	= Net GHG benefit from standalone AD	MT CO ₂ e
FS_{SAD}	= Amount of feedstock diverted to standalone AD	short tons
RES_{SAD}	= Amount of standalone AD residual material that is screened out before digestion	short tons
ERF_{SAD}	= Emission reduction factor for standalone AD projects based on final use of biomethane (vehicle fuel, onsite electricity, or injection into natural gas pipeline).	MT CO ₂ e/ short ton

Equation 12. Criteria and Toxics Emission Reductions from Standalone Anaerobic Digestion Avoided Diesel Usage (Remote Benefit)

$CT_{ADR,SAD} = DP_{SAD} \times (FS_{SAD} - RES_{SAD}) \times CE \times (TEF_{Diesel} - TEF_{AF}) \times FE \times \frac{1}{454}$		
<i>Where,</i>		<u>Units</u>
$CT_{ADR,SAD}$	= Criteria and toxic emission reductions from replacement of diesel with renewable fuel (renewable natural gas (RNG), dimethyl ether (DME), or hydrogen)	lb pollutants
DP_{SAD}	= Amount of biomethane available to offset diesel fuel usage (if applicable)	gallons of diesel eq./ short ton
FS_{SAD}	= Amount of feedstock diverted to standalone AD	short tons
RES_{SAD}	= Amount of standalone AD residual material that is screened out before digestion	short tons
CE	= Conversion efficiency from RNG to DME or hydrogen	%
TEF_{Diesel}	= Transportation emission factor of diesel	g/mile
TEF_{AF}	= Transportation emission factor of alternative fueled vehicle	g/mile
FE	= Fuel efficiency	miles/gallon
$1/454$	= Conversion factor from g to lb	lb/g

Equation 13. Criteria and Toxics Emission Reductions from Standalone Anaerobic Digestion Usage of Grid Power (Remote Benefit)

$$CT_{Grid,SAD} = (EP_{SAD} \times (FS_{SAD} - RES_{SAD}) \times ERF_{grid}) - (EU_{grid} \times (FS_{SAD} - RES_{SAD}) \times ERF_{grid})$$

<i>Where,</i>		<u>Units</u>
$CT_{Grid,SAD}$	= Criteria and toxic emission reductions from avoided grid electricity and electrical demand from processing waste	lb pollutants
EP_{SAD}	= Facility electricity production that is sent to the grid for electricity generation projects (if applicable)	kWh/short ton
FS_{SAD}	= Amount of feedstock diverted to standalone AD	short tons
RES_{SAD}	= Amount of standalone AD residual material that is screened out before digestion	short tons
ERF_{grid}	= Grid criteria and toxic emission reduction factors	lb/kWh
EU_{grid}	= Electricity consumption to process waste material	kWh/ short ton

Equation 14. Avoided Flare Criteria and Toxics Emissions from Standalone Anaerobic Digestion (Remote Benefit)

$$CT_{flare,SAD} = (FS_{SAD} - RES_{SAD}) \times ERF_{flare}$$

<i>Where,</i>		<u>Units</u>
$CT_{flare,SAD}$	= Criteria and toxic emission reductions from avoided grid electricity and electrical demand from processing waste	lb pollutants
FS_{SAD}	= Amount of feedstock diverted to standalone AD	short tons
RES_{SAD}	= Amount of standalone AD residual material that is screened out before digestion	short tons
ERF_{flare}	= Flare criteria and toxic emission reduction factors	lb/short ton

Equation 15. Criteria and Toxics Emissions from Processing of Diverted Material for Standalone Anaerobic Digestion (Local Benefit)

$$CT_{proc,SAD} = ((FS_{SAD} - RES_{SAD}) \times DU_{proc} \times EF_{equip}) + ((FS_{SAD} - RES_{SAD}) \times RNGU_{proc} \times EF_{boiler})$$

<i>Where,</i>		<u>Units</u>
$CT_{proc,SAD}$	= Criteria and toxic emissions from processing waste	lb pollutants
FS_{SAD}	= Amount of feedstock diverted to standalone AD	short tons
RES_{SAD}	= Amount of standalone AD residual material that is screened out before digestion	short tons
DU_{proc}	= Diesel usage to manage waste at the digester	gallon/short ton
EF_{equip}	= Off-road diesel equipment criteria and toxic emission factors	lb/gallon
$RNGU_{proc}$	= RNG usage to generate heat in a boiler to manage waste at the digester	scf/short ton
EF_{boiler}	= Boiler criteria and toxic emission factors	lb/scf

Equation 16. Criteria and Toxics Emissions from Electricity Generation at a Standalone Anaerobic Digestion Facility (Local Benefit)

$$CT_{elec,SAD} = (FS_{SAD} - RES_{SAD}) \times AF_{SAD} \times 0.00102 \times EF_{gen}$$

<i>Where,</i>		<u>Units</u>
$CT_{elec,SAD}$	= Criteria and toxic emissions from onsite production of electricity	lb pollutants
FS_{SAD}	= Amount of feedstock diverted to standalone AD	short tons
RES_{SAD}	= Amount of standalone AD residual material that is screened out before digestion	short tons
AF_{SAD}	= Amount of fuel production per ton of waste	scf/short ton
0.00102	= Conversion of scf to MMBtu	MMBTU/scf
EF_{gen}	= Electricity generation device criteria and toxic emission factor	lb/MMBTU

Feedstock diverted

	Net GHG Benefit (MTCO2e)			Total
	Gross	Net		
2025	9,333	8,400	2,016	12,096
2026	9,333	8,400	2,016	
2027	9,333	8,400	2,016	
2028	9,333	8,400	2,016	
2029	9,333	8,400	2,016	
2030	9,333	8,400	2,016	
2031	9,333	8,400	2,016	52,416
2032	9,333	8,400	2,016	
2033	9,333	8,400	2,016	
2034	9,333	8,400	2,016	
2035	9,333	8,400	2,016	
2036	9,333	8,400	2,016	
2037	9,333	8,400	2,016	
2038	9,333	8,400	2,016	
2039	9,333	8,400	2,016	
2040	9,333	8,400	2,016	
2041	9,333	8,400	2,016	
2042	9,333	8,400	2,016	
2043	9,333	8,400	2,016	
2044	9,333	8,400	2,016	
2045	9,333	8,400	2,016	
2046	9,333	8,400	2,016	
2047	9,333	8,400	2,016	
2048	9,333	8,400	2,016	
2049	9,333	8,400	2,016	
2050	9,333	8,400	2,016	

PROJECTED ORGANIC MATERIAL FLOW CHART

