Appendix-1

SECTION 2

Methodologies

Estimated food waste (FW) = (number of students) x (food waste per student in pounds) x (conversion ratio pounds to ton)

FW= 2,301,968 x 39.2 x 0.0005 = 45,119 tons

Estimated methane emissions (ME) = food waste x 0.065 (metric ton CH4/metric ton FW)

ME = 45119 x 0.065 = 2,933 metric ton of CH4

Estimated CO2e = ME x 32 CO2e

CO2e = 2,933x 32 = 93,847 CO2e

- The number of students was provided by Region-1 ESC.
- Food waste per student was from the WWF.
- Methane per ton of food waste is from the EPA.
- Methane to Carbon dioxide conversion is from the EPA.
- Population projected growth rate in South Texas (0.676%) is based on the U.S. Census 2012-2022.

Table 1A Estimated Schools GHG reductions from 2025 through 2050

	Number of Students	Food Waste Generated in Tons	Metric Ton of Methane from Food Waste	Metric Tons of CO2e
			65 ton	65 ton
Base year	*1,021,411*	*20,020*	*1,301*	*32,532*
2025	1,028,312	20,155	1,310	32,752
2026	1,035,259	20,291	1,319	32,973
2027	1,042,253	20,428	1,328	33,196
2028	1,049,294	20,566	1,337	33,420
2029	1,056,383	20,705	1,346	33,646
2030	1,063,520	20,845	1,355	33,873
2031	1,070,705	20,986	1,364	34,102
2032	1,077,939	21,128	1,373	34,332
2033	1,085,221	21,270	1,383	34,564
2034	1,092,553	21,414	1,392	34,798
2035	1,099,934	21,559	1,401	35,033
2036	1,107,365	21,704	1,411	35,270
2037	1,114,846	21,851	1,420	35,508
2038	1,122,378	21,999	1,430	35,748
2039	1,129,961	22,147	1,440	35,989
2040	1,137,595	22,297	1,449	36,232
2041	1,145,280	22,447	1,459	36,477
2042	1,153,018	22,599	1,469	36,724
2043	1,160,807	22,752	1,479	36,972

2044	1,168,650	22,906	1,489	37,221
2045	1,176,545	23,060	1,499	37,473
2046	1,184,493	23,216	1,509	37,726
2047	1,192,496	23,373	1,519	37,981
2048	1,200,552	23,531	1,530	38,238
2049	1,208,663	23,690	1,540	38,496
2050	1,216,829	23,850	1,550	38,756
2025-2050	**1,216,829**	**570,769**	**37,100**	**927,499**

*****Projections are based on U.S. Census 2012-2022 population growth rate in South Texas (0.676%)

Estimated Municipal organic waste generated is based on the 100 ton per day composting plant over the period 2025-2050.

Organic waste by municipality = (100 ton/day x 365) x 26 years =949,000

Mt of CH_4 per ton of waste = 0.065 mt   949,000 x 0.065 = 61,685 CH_4 mt

Mt of CO_2e = 32 x mt of CH_4 61,685 x 32 =1,973,920 CO_2e mt

Table 2A Estimated Municipalities GHG reductions from 2025 through 2050

	Organic Waste Generated in Tons	Metric Tons of Methane from Food Waste	Metric Tons of CO2e
		65-ton CH4/1000-ton waste	65-ton CH4/1000-ton waste
McAllen	949,000	61,685	1,973,920
Pharr	949,000	61,685	1,973,920
Edinburg	949,000	61,685	1,973,920
Brownsville	949,000	61,685	1,973,920
Corpus Christi	949,000	61,685	1,973,920
San Antonio	949,026	61,687	1,973,974
2025-2050	5,694,052	370,113	11,843,628

Table 3A Transportation cost of waste

Transportation cost waste	
Distance traveled annually[1]	25,000
Distance travelled daily during a school year (180 days)	100
Fuel consumption per trip (3 miles per gallon)[2]	33
Cost of fuel/ truck (1) $3.748 Brownsville/Harlingen MSA[3]	$125
number of trucks trips needed (30,000 pounds hauled per truck)[4]	18,479
Total fuel consumption in gallons	615,967
Total fuel consumption in $	$2,308,643

[1] https://afdc.energy.gov/data/10309

[2] https://www.nrel.gov/docs/fy01osti/29073.pdf

[3] https://gasprices.aaa.com/?state=TX#state-metro

[4] https://www.wastequip.com/blog/finding-right-garbage-truck-your-fleet-needs

CO2 emissions5,6	6,271

- The distance traveled annually is from the department of energy. (https://afdc.energy.gov/data/10309)
- Fuel consumption for refuse trucks is from the National Renewable Energy Laboratory. (https://www.nrel.gov/docs/fy01osti/29073.pdf)
- Cost of fuel is from the American Automobile Association (AAA) (https://gasprices.aaa.com/?state=TX#state-metro)
- The number of trips is calculated based on the amount of waste generated and the hauling capacity of refuse trucks. (https://www.wastequip.com/blog/finding-right-garbage-truck-your-fleet-needs)
- Estimated CO2 emissions are based on the Energy Information administration (EIA) and the National Renewable Energy Laboratory (https://www.eia.gov/environment/emissions/co2_vol_mass.php) (https://www.nrel.gov/docs/fy01osti/29073.pdf)

Table 4A Cost effectiveness of GHG reduction using 24-hour composting technology from 2025 to 2030

	Organic Waste Generated in Tons	Metric Tons of Methane from Food Waste	Metric Tons of CO2e	Cost of Systems	Cost of Systems over the 2025-2050 period
		65-ton CH_4/1000-ton waste	65-ton CH_4/1000-ton waste		Discount rate 5.48%
Composting systems	1,436,996	93,404	2,932,991	$161,479,500	$72,088,239
Diesel Consumption	273,311	87	2,782	-	
Cost of diesel per ton hauled	($8.33)	($10.96)	($0.35)	($1,024,370)	($1,024,370)
Labor cost	$9.38	$144.17	$4.59	$13,478,400	$13,478,400
Energy consumption	$6.38	$98.12	$3.12	$9,173,782	$9,173,782
Composting system cost 2025-2030/ton.	$50.17	$771.07	$24.56	-	
Sub-Total	***$57.60***	***$1,002.41***	***$31.92***	***$183,107,312***	***$93,716,051***
Compost @ 20% of waste (in tons)	287,399	-			
Revenue per ton (@ $0.50/lbs.)	$200.00	$3,076.95	$97.99	$287,399,200	$287,399,200
Net revenue (Revenue - cost)	**$142.40**	**$2,074.54**	**$66.07**	**$104,291,888**	**$193,683,149**
Annual ROI				**10.76%**	**19.99%**

[5] https://www.eia.gov/environment/emissions/co2_vol_mass.php
[6] https://www.nrel.gov/docs/fy01osti/29073.pdf

*Cost of equipment funded by the CPRG grant.

† Annually amortized cost of the equipment over a 6-year period (2025-2030) at 5.48% discount

- Labor cost is based on 6 workers (at $20/hour each) and 2 technicians (at $30/hour each) per composting plant for the period 2025-2030.
- Energy consumption is based on 80kwh per ton of waste (Provided by Solserv, Sweden).
- Estimated compost produced is 20% of waste processed.
- The sale price of compost is assumed to be $0.50 per pound (comparable compost prices vary between $30 (Dr. Connie's Solution) to $50 per pound (Supersoil)).

Assumptions for the GHG reductions and cost-effectiveness of GHG reductions

Data and Assumptions

- TEA Regions 1, 2, and 20 ESCs provided School enrollment data by Region, County, School District, and Enrollment.
- The World Wildlife Organization estimates food waste per school student per year (39.2 pounds)[7].
- Estimates of methane per ton of food waste is from Biocycle and the EPA (65 kg)[8].
- Conversion rate of Methane to CO_2e is from the IEA[9].
- Diesel consumption per mile for refuse trucks is from NREL[10].
- The cost of diesel per gallon is from the American Automobile Association (AAA)[11].
- Labor cost is estimated at $20/h per laborer and $30/h per technician.
- We assume full-time employment for all the employees (40 hours x 53 weeks), which is 2,080 hours.
- Energy consumption was provided by Solserv, Sweden, 80kwh/ton.
- Cost of energy was obtained from EIA[12].
- Waste to compost conversion rate was obtained from Solserv, Sweden.
- The growth rate of the school-age population was obtained from the US. Census 2012-2022.

The conversion ratio from pounds to tons is 1 pound = 0.0005 ton.

SECTION 3

Table 5A Inputs, Outputs, and Outcomes

	Short-term Outputs	Short-term Outcomes	Long-term Outputs	long-term Outcomes
Tasks				
Installation of Advanced composting equipment in school cafeterias	Diverting 277,185 tons of food waste from landfills and compost it at the source	Prevent 18,017 tons of methane (450,426 CO2e) from being released into the atmosphere. Cleaner air	Diverting 1,286,349 tons of food waste from landfills and composting it at the source may be more if the program is adopted by the rest of the state and other states	Prevent 83,613 tons of methane (2,090,317 CO2e) from being released into the atmosphere. Cleaner air

[7] https://www.worldwildlife.org/press-releases/plate-waste-in-us-cafeterias-could-total-530-000-tons-per-year
[8] https://www.biocycle.net/connection-climate-calculations/
[9] https://www.iea.org/reports/methane-tracker-2021/methane-and-climate-change
[10] https://www.nrel.gov/docs/fy01osti/29073.pdf
[11] https://gasprices.aaa.com/?state=TX#state-metro
[12] https://www.eia.gov/electricity/data.php

	Reducing diesel consumption and reducing expenses for the schools and municipalities/landfills	Reduced emissions from diesel	Reduced emissions from diesel	Reduced emissions from diesel
Installation of Municipal composting facilities	Diverting 1,1 million tons of food waste from landfills	Prevent 71,175 tons of methane (1,779,385 CO2e) from being released into the atmosphere	Diverting 4.75million tons of food waste from landfills	Prevent 308,427 tons of methane (7,710,667 CO2e) from being released into the atmosphere
Compost use	Improve the distribution and application of high-quality compost to agricultural lands, school gardens, and community green spaces.	Obtaining rapid improvement in soil structure, plant health, fertility, and moisture retention" is a statement that talks about achieving fast progress in terms of the structure of the soil, the health of plants, their ability to grow, and the retention of moisture.	Widespread adoption of compost uses across multiple sectors, including more extensive agricultural operations, urban landscaping, and restoration projects.	Contribution to sustainable environmental and agricultural practices, leading to enhanced soil health, reduction in waste and greenhouse gas emissions, increased food security, and a cultural shift toward sustainability.
Implementing educational programs in schools on recycling	Initiating educational programs in schools to teach about the importance of recycling, focusing on the process, benefits, and overall environmental impact.	Increased awareness and understanding among students about the recycling process and its importance, leading to more proactive recycling behaviors in the school community.	A sustained inclusion of recycling and environmental stewardship into school curricula across the region, making recycling a fundamental part of student education.	A generation of environmentally conscious citizens who prioritize sustainability and recycling in their daily lives, leading to significant reductions in waste and increased recycling rates.
Providing training programs for school children and parents on recycling	Develop and deliver training sessions for schoolchildren and their parents on effective recycling practices, including sorting and reducing waste	Enhanced community engagement in recycling efforts, with families adopting better waste management practices at home and a collective effort	Established recycling culture within communities, where successive generations pass down and adopt recycling and waste-reduction practices	A marked decrease in community waste footprint, with high participation rates in recycling programs and a

		toward reducing landfill waste		strong community commitment to waste reduction.
Establish gardens at the schools.	Creating school gardens where students can learn about and engage in growing vegetables and other plants, integrating principles of composting and sustainable gardening.	Engaging students with hands-on learning experiences that promote sustainability through connections to nature, food sources, and composting.	School gardens becoming integral to school environments nationwide, serving as outdoor classrooms for various subjects, including science, health, and environmental studies.	Increased appreciation for the environment and sustainability, with students applying knowledge of composting and sustainable agriculture in wider community settings, promoting local food production and reduced food miles
Importance of healthy eating nutrition	Fostering educational initiatives in schools that focus on the importance of healthy eating and nutrition while incorporating information about the environmental impact of food choices.	Improved nutritional knowledge and healthier eating behaviors among students and their families, with an increased demand for locally grown and sustainable food options.	Integrating nutrition and sustainable eating practices into standard educational frameworks influences school meal programs and community food policies.	A societal shift towards healthier, more sustainable food choices contributes to improved public health outcomes and a reduction in food production and consumption's environmental impact.
Provide training and educational programs to community gardens	increased awareness and greater participation/ community engagement	Improved health state for the population and increased physical activity. Better health outcome. Community resilience, commitment to community well-being	increased awareness and greater participation/ community engagement	Improved health state for the population and increased physical activity. Better health outcome. Community resilience,

				commitment to community well-being
Workforce Training for Manufacturing	Provided advanced manufacturing training, including additive manufacturing, robotics, PLC programming, AI, and machine learning, can upskill and reskill the existing workforce and meet the demands of a modern manufacturing environment.	Enhanced skill levels in the manufacturing workforce will lead to better job performance and increased productivity. Through this training, employees will be equipped to operate new technologies and processes, which in turn will enhance efficiency and innovation within the industry.	Establishing a highly skilled and adaptable manufacturing workforce capable of meeting the demands of future technological advancements and market needs.	Enhanced competitiveness of the high-tech manufacturing sector, enabling national and global investment, economic growth, and job creation.
Business development	Provided support for business development through training programs and establishment of facilities for green and circular economy opportunities, which includes entrepreneurship training and technical and financial resources for new businesses.	Increased small businesses that focus on promoting sustainability and economic diversification while also creating jobs and driving innovation.	Creating a supportive regulatory environment, access to capital, and a network of business support services for green economy businesses.	A thriving and sustainable business landscape contributing to the region's economic resilience, innovation capacity, and environmental sustainability
Biology/ecology lab technicians training	Training programs for biology and ecology lab technicians will be initiated. These programs will focus on the skills required for managing and operating laboratory equipment and conducting environmental testing and research.	Increased number of qualified lab technicians who can support environmental research and monitoring efforts. This will enhance the region's capacity to conduct essential research on ecology, biology, and environmental health, contributing to more informed decision-making regarding conservation and	Establishing a comprehensive network of research institutions and laboratories that are equipped with modern technology and skilled technicians.	Improved scientific research and environmental monitoring lead to better natural resource management, conservation strategies, and policy development.

		sustainability practices.		
Entrepreneurship training for green economy businesses	Equip individuals with the knowledge and skills needed to start and run successful businesses in the green economy, such as renewable energy, recycling, and sustainable manufacturing.	Expansion of existing businesses and new startups in the green economy drive innovation and sustainability. This will contribute to the region's economic growth and environmental sustainability efforts by promoting businesses that have a positive environmental impact.	Significant increase in the number and success rate of businesses in the green economy, which is supported by a culture of innovation and entrepreneurship.	Establishing sustainable business practices, creating jobs in green industries, and reducing environmental impact will contribute to achieving climate change mitigation goals.

Table 6A Evaluation matrix

Year	Evaluation Phase	Objective	Methods	Deliverables
1	Initial Implementation and Baseline Assessment	To assess the early stages of program implementation, identifying immediate challenges and opportunities for improvement.	Quantitative: Collection of baseline data on participant enrollment, initial waste diversion rates, and early indicators of community engagement. Qualitative: Interviews with program staff and initial participants to understand experiences, expectations, and perceived barriers.	Initial Implementation Report detailing setup challenges, early wins, and recommendations for adjustment. Baseline Data Report establishing key metrics for future comparison.
2-3	Mid-Term Review and Outcome Evaluation	To monitor ongoing program activities, evaluate progress towards short-term outcomes, and adjust strategies as necessary.	Quantitative: Analysis of participation rates, waste diversion metrics, and intermediate measures of community engagement and business development. Qualitative: Focus groups and surveys to gather feedback on	Mid-Term Evaluation Report summarizing findings, achievements, and areas for improvement. Outcome Evaluation Brief highlighting achieved outcomes against projected targets.

			program impact, participant satisfaction, and suggestions for improvement.	
4	Final Evaluation and Impact Assessment	To assess the long-term impact of the program on environmental sustainability, economic development, and community well-being.	Quantitative: Final evaluation of key performance indicators (KPIs) such as total greenhouse gas emissions reduced, cumulative participation and engagement metrics, and economic impact assessments. Qualitative: In-depth interviews and focus groups with a broad range of stakeholders to evaluate the program's sustainability, impact on community practices, and influence on policy.	The Final Evaluation and Impact Report provides a comprehensive analysis of the program's effectiveness and impact and recommendations for future initiatives. Policy and Practice Recommendations drawing on evaluation findings to inform stakeholders, funders, and policymakers about scalable models and best practices for replication.

SECTION 4

Economic Impact Analysis

The IMPLAN (IMpact analysis for PLANning) economic impact model is used to estimate changes in industries that are affected directly and the ripple effects (indirect and induced effects) these initial impacts have on the rest of the economy. The IMPLAN Model is a very flexible, and detailed input-output impact model system. It is also one of the most widely used economic impact modeling systems in the U.S. In addition to providing multipliers, Implan provides users with the flexibility to define industries, economic relationships, and projects to be analyzed. The IMPLAN model can be customized to reflect changes to existing industrial clusters or the establishment of new industries and assess the "ripple effects" or "multiplier effects" caused these changes. IMPLAN data is available by zip code, county, region, and state.

Data

This analysis uses data collected from the following sources:

Implan Data:

MIG's data is compiled from Bureau of Economic Analysis (BEA) Covered Employment and Wages (CEW), BEA REIS Data, BEA Output Data, National Income & Product Accounts, BEA Current Benchmark I-O Study, Consumer Expenditure Survey. The data is assembled all into a consistent accounting framework following the Definitions and Conventions of the US Input-Output Benchmark Study and the US National Income and Product Accounts. IMPLAN has a high degree of sectoral disaggregation in 509 sectors.

Table 7A Summary Tax Impact of Construction of Manufacturing Facility

	Sub-County General City	Sub County Special Districts (Schools)	County	State	Federal	Total
Direct	$10,903	$15,974	$6,972	$53,027	$670,645	$757,521
Indirect	$17,484	$25,357	$10,489	$80,015	$147,188	$280,533
Induced	$19,666	$28,523	$11,800	$90,038	$171,811	$321,838
Total	$48,052	$69,855	$29,261	$223,080	$989,644	$1,359,892

Table 8A Summary Tax Impact of Manufacturing of compost Machines

	Sub-County General City	Sub County Special Districts (Schools)	County	State	Federal	Total
Direct	$54,235	$79,303	$34,327	$265,567	$3,247,177	$3,680,610
Indirect	$71,945	$104,435	$43,412	$331,628	$980,641	$1,532,060
Induced	$90,416	$131,136	$54,250	$413,947	$788,764	$1,478,513
Total	$216,596	$314,875	$131,989	$1,011,142	$5,016,581	$6,691,183

Table 9A Summary Tax Impact of Construction of Composting facilities

	Sub-County General City	Sub County Special Districts (Schools)	County	State	Federal	Total
Direct	$54,513	$79,870	$34,858	$265,136	$3,353,226	$3,787,603
Indirect	$87,418	$126,787	$52,446	$400,076	$735,940	$1,402,667
Induced	$98,331	$142,616	$58,999	$450,188	$859,056	$1,609,190
Total	$240,261	$349,273	$146,303	$1,115,401	$4,948,221	$6,799,459

Table 10A Summary Tax Impact of Composting Operations

	Sub-County General City	Sub County Special Districts (Schools)	County	State	Federal	Total
Direct	$707,945	$1,027,011	$425,387	$3,245,682	$6,809,297	$12,215,323
Indirect	$195,028	$282,979	$117,329	$895,226	$2,072,647	$3,563,209
Induced	$190,852	$276,806	$114,513	$873,773	$1,665,693	$3,121,637
Total	$1,093,825	$1,586,796	$657,229	$5,014,680	$10,547,637	$18,900,168