CALIFORNIA ENERGY COMMISSION

California Energy Commission

Low Carbon Fuel Production Program

FINAL PROJECT REPORT

Rialto Bioenergy Phase 3: Expanded Renewable Natural Gas Refueling

Prepared for: California Energy Commission

Prepared by: Rialto Bioenergy Facility, LLC

Gavin Newsom, Governor

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PREFACE

California's on-road transportation sector accounts for roughly 41 percent of the state's greenhouse gas (GHG) emissions, and when oil production and refining are included, it is nearly 50 percent. The Low-Carbon Fuel Production Program (LCFPP), funded by the Budget Act of 2018, as amended by Senate Bill 856 (Committee on Budget and Fiscal Review, Chapter 30, Statutes of 2018), provides grants to California's vehicle fuel production industry to reduce GHG emissions associated with transportation use and advances the purposes of Assembly Bill 32 (Pavley and Núñez, Chapter 488, Statutes of 2006) and Senate Bill 32 (Pavley, Chapter 249, Statutes of 2016).

The LCFPP is funded through the California Climate Investments which is administered by the California Air Resources Board and uses Cap-and-Trade funds to prioritize projects that will reduce GHG emissions, strengthens the local economy, and improves public health and environment, particularly in disadvantaged communities. The LCFPP focuses on commercial renewable fuel production with ultra-low-carbon potential of 30 gCO2e/MJ or lower, production capacity greater than one million DGE and considers priority populations defined by SB 535 and AB 1550.

The CEC issued Solicitation GFO-19-601 "Low-Carbon Fuel Production Program" to expand low carbon fuel production capacity. In response to GFO-19-601, the recipient submitted an application that was proposed for funding in the CEC's Notice of Proposed Awards on January 21st, 2020, and the agreement was executed as LCF-19-004 on April 30th, 2020.

ABSTRACT

The Recipient, Rialto Bioenergy Facility, LLC (Recipient), in cooperation with a project team consisting of W.M. Lyles Co., Anaergia Technologies, LLC, and Momentum, sought to expand the capacity of the existing Rialto Bioenergy Facility (Facility). When fully operational, this new commercial-scale system will expand the Facility's capacity of 2.5 diesel gallon equivalent (DGE) installed by two previous CEC grants (ARV-17-019 and ARV-18-029) with an additional 2.4M DGE for a combined 4.9 DGE per year of carbon negative renewable natural gas (RNG). The first phase of the project, funded partly by ARV-17-019, established an initial Carbon Intensity (CI) score for the Facility of -58 gCO2e/MJ. The second phase, funded partly by ARV-18-029, added a biogas conditioning skid and saw the Carbon Intensity (CI) score drop to -65 gCO2e/MJ. The latest CI score following the installation of the third phase, funded partly by this grant LCF-19-004, has increased to -57 gCO2e/MJ. This increase is due to unscheduled downtime with the biogas upgrader which required some gas to be flared. These issues have been resolved and the CI score is expected to start dropping again. These CI scores are only estimates based on available data collection and will need to be confirmed by California Air Resource Board (CARB) and reviewed with the Facility's RNG broker Element Markets. The Recipient has executed feedstock agreements and offtake agreements to both receive required feedstock for the project and sell the RNG produced at the facility. When operational, the Facility will convert 300 tons/day of regionally available food / organic waste from municipal solid waste sourced from processing facilities such as Waste Management's Sun Valley Recycling Park into carbon negative RNG for use as a transportation fuel.

The Facility has successfully started operations and, with agreement of the California Energy Commission, has collected production data, including throughput, operating hours, Class A soil production, and RNG production.

Keywords: renewable natural gas, renewable fuel, biofuel, solid waste, Rialto Bioenergy Facility, Anaergia, Low Carbon Fuel Production Program

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Note: If needed, insert a blank page so that the Table of Contents begins on the right.

TABLE OF CONTENTS

Page

Acknowledgments i

Preface ii

Abstract iii

Table of Contents v

List of Figures vii

List of Tables vii

Executive Summary 1

LCF-19-004: RBF Phase 3 Summary 1

CHAPTER 1: Introduction 5

1.1 Project Overview 5

1.2 Project Goals 6

1.3 Project Objectives 6

1.4 Relevance to Key Parties 6

Chapter 2: Project Context 8

2.1 Project Team 8

2.1.1 Rialto Bioenergy Facility, LLC 8

2.1.2 Anaergia Services, LLC 8

2.1.3 Anaergia Technologies, LLC 8

2.1.4 W.M. Lyles Co. 8

2.1.5 Momentum 9

2.2 Project Location and Disadvantaged Communities 9

2.3 Renewable Natural Gas Production (RNG) in California 11

2.4 Key Barriers to RNG Production in California 11

2.5 Project Need and Technical Merit 12

2.6 Project Benefits 13

Chapter 3: Project Approach 16

3.1 Project Approach 16

3.2 Final Project Elements 16

3.3 Tasks and Key Deliverables 16

Chapter 4: System Design 18

4.1 System Summary and Flow Diagram 18

4.2 Food Waste from MSW 18

4.3 Feedstock Cleaning 19

4.4 Anaerobic Digestion 19

4.5 Biogas Cleaning, Upgrading, and Compression 19

4.6 Drying 20

Chapter 5: Project Implementation and Results 21

5.1 Project Design and Construction 21
5.2 Project Timeline Summary 26
5.3 Commissioning 27
5.4 Project Operations 28
5.4.1 Throughput, Usage, and Operations Data 28
5.4.2 Normal Operating Hours, Uptime, and Downtime 28
5.4.3 Feedstock Supply Summary 28
5.4.4 Maximum Fuel Production Capacity 28
5.4.5 Class A Soil Production 29
5.4.6 Waste from Production Processes 29
5.5 RNG Production, Quality, and Standards 29
5.5.1 RNG Carbon Intensity 29
5.5.2 RNG Fuel Price 29
5.5.3 RNG Production and Diesel Displacement 30
5.5.4 Low Carbon Fuel Standard and Renewable Fuel Standard 31
5.5.5 Duty Cycle of Current Fleet and Future Vehicle Acquisitions 31
5.6 Project Economics 31
5.6.1 Project Jobs and Economic Development 31
5.6.2 Facility Financials Summary 32
5.7 Environmental Impact 33
5.7.1 Greenhouse Gas Emissions 33
5.8 Facility Operations 33
5.8.1 Title 24 Standards 33
5.8.2 Potential Economic Development and Expansion 33
Chapter 6: Project Outreach 34
Chapter 7: Lessons Learned and Conclusions 35
7.1 Key Lessons 35
7.2 Conclusions 36
Attachment A: Incoming and Outgoing Throughput Data 0
Glossary 0

LIST OF FIGURES

Page

Figure 1: Rialto Bioenergy Facility 1
Figure 2: Top View of the Anaerobic Digester 3
Figure 3: Rialto Bioenergy Facility Location 5
Figure 4: Project Flow Diagram 5
Figure 5: Rialto Bioenergy Facility Location 9
Figure 6:CalEnviroScreen Emissions 10
Figure 7: SB 535 and AB 1550 Communities 10
Figure 8: Project flow Diagram 18
Figure 9: Third Train upgrader looking South to North 21
Figure 10: Biomethane and Third Train looking East to West 22
Figure 11: Electrician making Communication connections at Emergency Flare 22
Figure 12: Commissioning of RTO 23
Figure 13: Power and Communications Connections to Water Distribution Skid 23
Figure 14: Piping Installation at Biomethane Upgrader 24
Figure 15: Underground Biomethane Piping being installed 24
Figure 16: Piping connections to Gas Train Assemblies 25
Figure 17: Injection Point 25
Figure 18: OPS Rejects Collection 29
Figure 19: RNG Fuel Price 30
Figure 20: RNG Fuel Production and Projection 30

LIST OF TABLES

Page

Table 1: Grants, Rebates, and Incentives 14
Table 2: Fund Distribution 14
Table 3: GHG Reductions by Material Type 15
Table 4: Project Milestone Summary 26
Table 5: Grant Deliverables Summary 26
Table 6: Fuel Production Capacity 28
Table 8: Diesel Displacement 31

Table 9: Grant Invoice Summary 32
Table 10: Air Emissions Summary 33

Note: If needed, insert a blank page so that Executive Summary begins on the right.

EXECUTIVE SUMMARY

The Rialto Bioenergy Facility (Facility) is a project funded by several state agency grants along with private investment from the recipient Rialto Bioenergy Facility, LLC (Recipient). The Facility is part of a three-phase project, funded in part by the California Energy Commission. ARV-17-019 was the initial phase that revitalized a mothballed biosolids drying facility (RBF Phase 1); the purpose was to replace old equipment with new, proven technology with the end goal to produce 880,000 diesel gallon equivalent (DGE) per year of renewable natural gas (RNG). ARV-18-029, the second phase, sought to expand the goals of the initial phase by expanding the system to add a second biogas conditioning skid and produce an additional 1.62M DGE—for a total of 2.5M DGE/yr of RNG. LCF-19-004, the third phase, continued the expansion of the Facility by adding additional capacity with a third biogas conditioning skid that will produce 2.4M DGE of RNG for a total of 4.9M DGE. Because the projects are interconnected, the data collected will be distributed proportionally to each grant based on the DGE goals of each grant.

Figure 1: Rialto Bioenergy Facility

Source: Rialto Bioenergy Facility, LLC

This report solely focuses on the aspects of the project funded by the Recipient and the LCF-19-004 grant; it is referred to throughout the report as Rialto Bioenergy Facility Phase 3 (RBF Phase 3). The Recipient received $5,000,000 in funding through Agreement LCF-19-004 from the Energy Commission and matched that with $5,000,000 in cost share, for a total project budget of $10,000,000. Construction started in Q1 2018 and ended in Q2 2020. Commissioning of the equipment purchased was completed in Q4 2020.

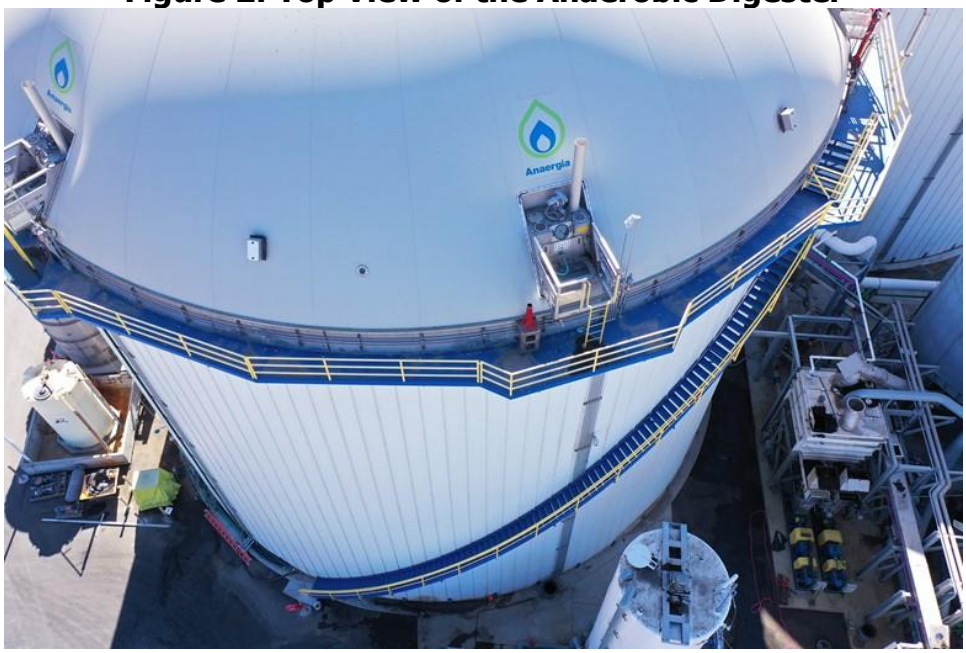
LCF-19-004: RBF Phase 3 Summary

The Recipient, in cooperation with a project team consisting of W.M. Lyles Co. (WML), Anaergia Technologies, LLC, and Momentum, sought to expand the capacity of the existing Rialto Bioenergy Facility in the third phase of a three-part project. In the first phase grant ARV-17-019, the Recipient along with its affiliate Anaheim Energy, LLC initiated a multi-phase project to

restore and upgrade a mothballed biosolids drying facility. ARV-17-019 helped fund the initial biogas conditional skid with the capacity to produce 880,000 DGEs of RNG. In ARV-18-029, the project team expanded upon the existing Facility to install new equipment that can produce RNG from municipal solid waste (MSW) to increase capacity by an additional 1.67M DGE for a total of 2.5m DGE. This Phase 3 project, associated with grant LCF-19-004 is a continuation of the facility's expansion to commercial scale with a third biogas conditioning skid that will increase the capacity by 2.4M DGE. When fully operational, this new commercial-scale processing system will produce 4.9M DGE per year of carbon negative RNG. RBF Phase 1 established an initial Carbon Intensity (CI) score of -58 gCO2e/MJ and with the increased capacity of RBF Phase 2 the CI score reached -65 gCO2e/MJ. The latest CI score following RBF Phase 3 has increased to -57 gCO2e/MJ. This increase is due to unscheduled downtime with the biogas upgrader which required some gas to be flared. These issues have been resolved and the CI score is expected to start dropping again. These CI scores are only estimates based on available data collection and will need to be confirmed by California Air Resource Board (CARB) and reviewed with the Facility's RNG broker Element Markets. There is a discrepancy with the objective CI score of -187 gCO2e/MJ and the current score of -57 gCO2e/MJ. The forecast -57 gCO2e/MJ provided in the Recipient's final report uses CARB's 2020 Tier 1 Organic Waste calculator. CARB's model currently offers -0.377 kg of CO2e per kg of wet food waste intake) and does not allow for any credits associated with biochar production. This discrepancy in the emissions credits is the primary reason for the difference between the projected -187 gCO2e/MJ in the biochar application and today's findings. By expanding the facility, RBF Phase 3 aligns directly with the Low Carbon Fuel Production Program's funding initiatives and meets SB 1383 requirements that communities and recycling services divert 75 percent of the state's organic waste from landfills by 2025. The objectives of RBF Phase 3 were to:

- Convert biogas generated from 300 tons/day of organic waste extruded from municipal solid waste (MSW) into 960,000 scf/day (2.4 million DGE/yr) of RNG plus a Class A fertilizer product;
- Produce RNG that will achieve an ultra-low carbon intensity value of -187 g CO2e/MJ as previously calculated by Lawrence Berkeley National Laboratory (LBNL);
- Deliver the RNG to the UCOP, Southwest Gas, and additional vehicle fleets in California through Element Markets, via a direct facility-to-grid pipeline connection, currently under construction;
- Supply RNG to vehicle fleets for transportation use under existing, contracted agreements with UCOP, Southwest Gas, and Element Markets;
- Reduce net annual GHG emissions by approximately 80,970 MT CO2e;
- Reduce on-road emissions to support clean air goals;
- Directly invest in local disadvantaged and low income communities to create new jobs and provide extensive new community services; and
- Deeply leverage prior and ongoing investments in the Rialto Bioenergy Facility to provide an exceptional return on Energy Commission investment while maximizing new RNG production capacity.

Figure 2: Top View of the Anaerobic Digester



Source: Rialto Bioenergy Facility, LLC

The objectives of RBF Phase 3 were partially met as follows:

- As of December 2021, 175,606.41 DGE of RNG has been produced over a period of 12 months of ramp up operations. Projected production for 2022 is 2.4M DGE.
- As of December 2021, the Facility diverted 32,609.7 tons (total) of organic waste from landfills (15,972.1 tons associated with RBF Phase 3) during 12 months of ramp up operations, and will reach full capacity at 182,000 tons per year starting in 2022 (89,142.9 tons associated with RBF Phase 3). Based on the ramp-up schedule, the Facility is expected to achieve its full commercial design potential.
- Has achieved an anticipated CI score of -57 gCO2e/MJ.
- Delivered and supplied RNG to UCOP, Southwest Gas through Element Markets for vehicle fleets
- As of December 2021, 4,256 MTCO2e has been offset, with a projected offset of 23,828 MTCO2e.
- Reduced on-road emissions to support clear air goals
- Directly invested in local disadvantaged and low-income communities to create new jobs and provided extensive new community services
- Deeply leveraged prior and ongoing investments in the Rialto Bioenergy Facility to provide an exceptional return on Energy Commission investment while maximizing new RNG production capacity.

The expansion of this flagship project continues to establish California as the epicenter of RNG production from the organic fraction of MSW. By adding an additional skid to an already existing and successful system, RBF Phase 3 was able to increase the cost-effectiveness of the overall system while producing added benefits such as reduced CI scores, further elevating the Facility to a commercial-scale, viable, and replicable project. The CEC funding of this project was critical

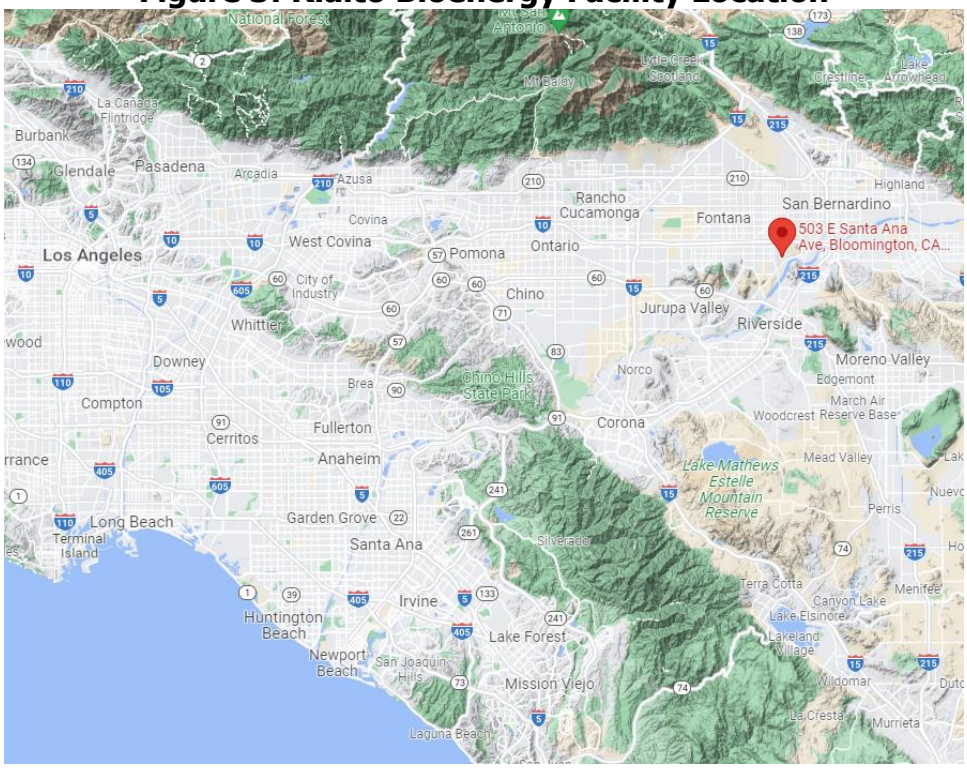
to its success. The investment by the state into the project at the beginning phases of a larger multistage project demonstrated the potential of converting organic fraction of MSW into RNG and was critical in attracting more traditional private funding. In addition to aligning with the current goals of SB 1383, this project is an example that producing RNG from feedstocks such as MSW is an impactful and viable solution that will help California thrive in the current climate crisis.

CHAPTER 1: Introduction

1.1 Project Overview

The Recipient, in cooperation with a project team consisting of WML, Anaergia Technologies, LLC, and Momentum, sought to expand the existing bioenergy facility located at 503 East Santa Ana Ave., Rialto, CA 92316.

Figure 3: Rialto Bioenergy Facility Location

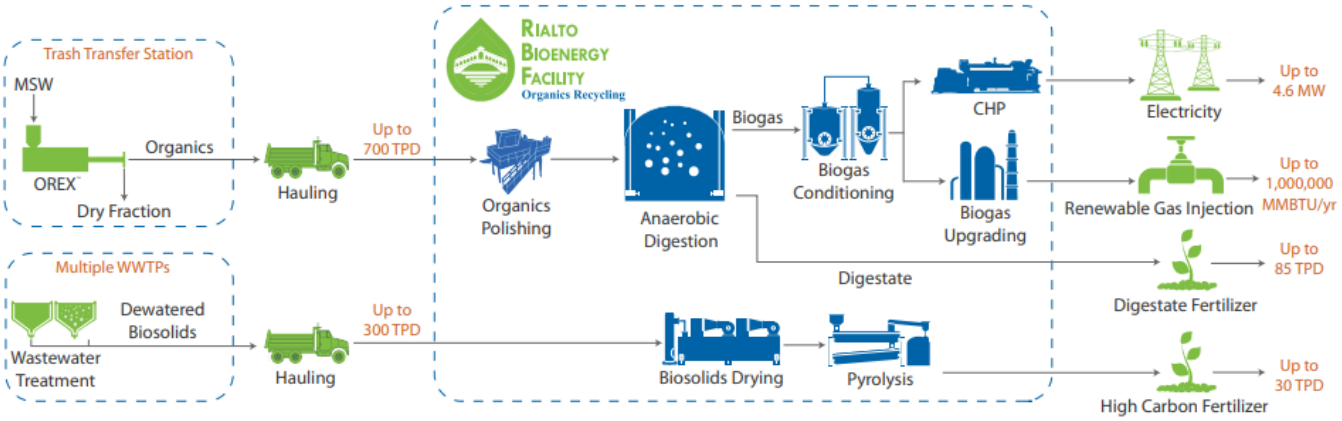


Source: Google Maps

In the previous two grants ARV-17-019 and ARV-18-029, the Facility was in the beginning of a multi-phase project to restore and upgrade a mothballed bioenergy facility. ARV-17-019 helped fund the initial biogas conditioning skid with a capacity to produce 880,000 DGEs of RNG. ARV-18-029 installed additional equipment to increase the capacity to 2.5M DGE. Phase 3 will further increase capacity with an additional 2.4M DGE for a final a capacity of 4.9M DGE.

The Facility receives feedstock in the form of organic waste extracted from MSW using an Organics Extrusion Press (OREX™) system installed at the Waste Management Materials Recovery Facility in Sun Valley, in addition to organic waste from Republic Services and liquid waste from Athens Services. Key components installed at the Facility include an Organics Polishing System (OPS™), an innovative High-Solids Anaerobic Digester (HSAD), and biogas cleaning and compression equipment. RBF Phase 3 specifically funded the system installation, a gas conditioning system, natural gas pipeline extension and interconnection, and a natural gas monitoring system. The biogas upgrading system includes a fully integrated, three-stage membrane system with upstream biogas polishing and gas compression.

Figure 4: Project Flow Diagram



This diagram shows the inputs and outputs of the Facility.

Source: Rialto Bioenergy Facility, LLC

1.2 Project Goals

The overarching goal of RBF Phase 3 was to expand production of low-carbon biomethane (i.e., RNG) from MSW-derived organic / food waste for blending into California's transportation fuel supply.

1.3 Project Objectives

The objectives of RBF Phase 3 were the following:

- Convert biogas generated from 300 tons/day of organic waste extruded from municipal solid waste (MSW) into 960,000 scf/day (2.4 million DGE/yr) of RNG plus a Class A fertilizer product;
- Produce RNG that will achieve an ultra-low carbon intensity value of -187 g CO2e/MJ as previously calculated by Lawrence Berkeley National Laboratory (LBNL);
- Deliver the RNG to the UCOP, Southwest Gas, and additional vehicle fleets in California through Element Markets, via a direct facility-to-grid pipeline connection, currently under construction;
- Supply RNG to vehicle fleets for transportation use under existing, contracted agreements with UCOP, Southwest Gas, and Element Markets;
- Reduce net annual GHG emissions by approximately 80,970 MT CO2e;
- Reduce on-road emissions to support clean air goals;
- Directly invest in local disadvantaged and low income communities to create new jobs and provide extensive new community services; and
- Deeply leverage prior and ongoing investments in the Rialto Bioenergy Facility to provide an exceptional return on Energy Commission investment while maximizing new RNG production capacity.

1.4 Relevance to Key Parties

RBF Phase 3 is directly relevant to multiple parties in California showing that the vision laid out in SB 1383 can be achieved and that the project is successful and replicable on a commercial scale. Key parties for whom the project is relevant include the following:

- State regulators and energy/fuels managers seeking to further develop in-state production of renewable biofuels, including RNG.
- State decisionmakers and lawmakers working to achieve California's statutory goals surrounding GHG emissions reduction and the transition to a renewable energy-based economy.
- Waste managers and waste haulers seeking to better manage or expand the diversion of MSW to follow SB 1383 requirements.
- Cities that may be interested in adopting similar technology at their own MSW sites to meet SB 1383 compliance.
- Fleet Managers that are seeking to convert their hauling or class 8 vehicles to low-NO_X RNG vehicles

Chapter 2: Project Context

2.1 Project Team

2.1.1 Rialto Bioenergy Facility, LLC

The Recipient is the owner and operator of the Facility, has also secured an additional $13 million in CEC grants to help fund the project. Rialto Bioenergy Facility, LLC staff maintains a working knowledge and understanding of all facilities and systems included at the Facility site. This includes all existing equipment, facilities, and access areas that would be used to support RBF Phase 3 as well as basic maintenance and operational requirements of the facility, permits and permitting requirements, and utility information. Parent company Anaergia Services, LLC is responsible for the staffing, function, and operation of the site.

2.1.2 Anaergia Services, LLC

The Recipient's and Rialto Bioenergy Facility, LLC's parent company is Anaergia Services, LLC, which is headquartered in Carlsbad, California. Anaergia Services, LLC's ultimate parent company is Anaergia, Inc. (Anaergia), a global leader in the production of clean energy, fertilizer, and recycled water from virtually any waste stream, offering the widest range of maximized resource recovery technologies for the municipal, industrial, commercial, and agricultural markets. The company's portfolio of mature wastewater and food waste management technologies includes digester retrofit enhancement equipment that enables co-digestion of biosolids and other feedstocks while increasing digester capacity and throughput without a corresponding increase in the physical size of the system; organics pre-treatment systems to separate difficult-to-remove contaminants; and organics extrusion systems that extract 90% of the putrescible organic fraction from municipal solid waste.

2.1.3 Anaergia Technologies, LLC

Anaergia Technologies, LLC is the sister company of Recipient and Rialto Bioenergy Facility, LLC. Anaergia Technologies, LLC served as a subcontractor to W.M. Lyles in this grant as an equipment provider.

2.1.4 W.M. Lyles Co.

W.M. Lyles Co. (WML) served as the general contractor on the project, overseeing all construction and construction-related activities. WML is a Fresno-based, heavy civil and utility construction contractor, with more than 70 years of experience including hundreds of successful infrastructure, energy, and environmental/wastewater construction projects throughout California. The company maintains expertise in the redevelopment and upgrading of existing industrial sites. WML is an exceptionally well-respected leader in contracting in California for the installation of pipelines and other underground utilities, as installed under the project. WML focuses strongly on integrity, relying on a team of experienced industry leaders who work closely with their clients to ensure delivery of highest quality, schedule and budget performance, safety, and value-added insight and service. WML served as the general contractor for three Anaergia projects, including the Victor Valley Wastewater Authority projects in 2014 and 2020, exhibiting strong technical, scheduling, and cost performance abilities.

2.1.5 Build Momentum, Inc.

Momentum provided grant administration and commercialization support for the project. Momentum (formerly Grant Farm) inspires, manages, and executes campaigns for entrepreneurial and forward-thinking organizations around the globe. Since 2005, the company's team members—professionals in engineering, law, finance, policy, accounting, and business acceleration—have helped more than 300 high-profile public and private clients plan, develop, and finance $5 billion+ in transformative advanced technology projects. Momentum manages projects for a variety of clients—from technology startups to Fortune 500 companies, NGOs, and public agencies.

2.2 Project Location and Disadvantaged Communities

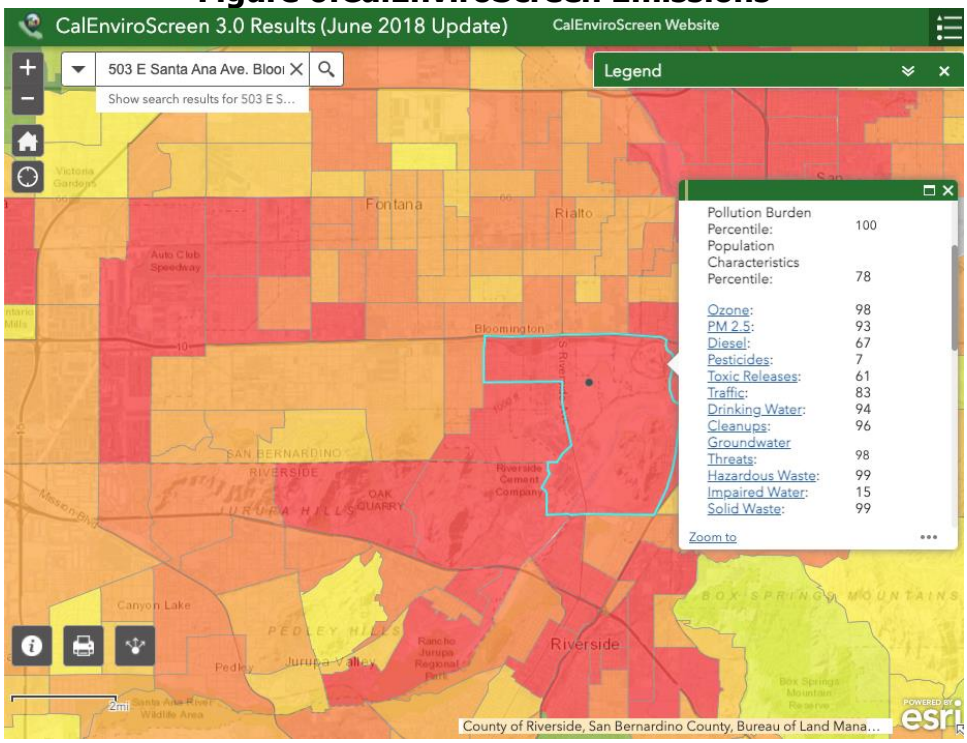
RBF Phase 3 is located at 503 East Santa Ana Ave., Bloomington, CA 92316.

Figure 5: Rialto Bioenergy Facility Location

Source: Google Maps

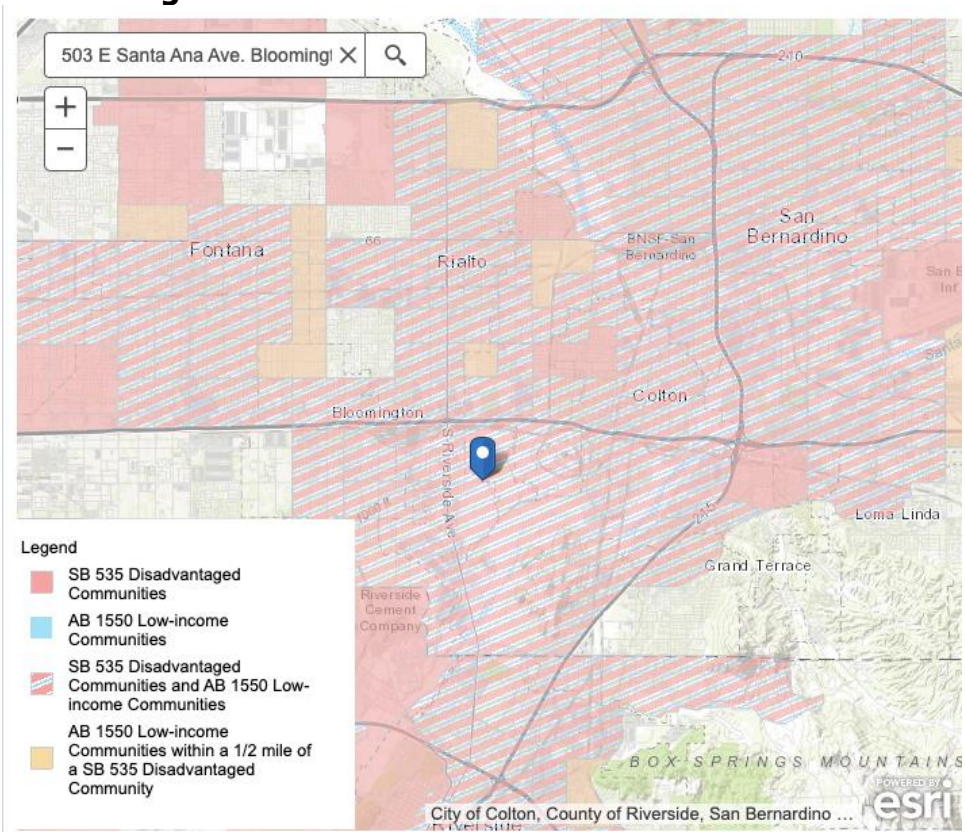
RBF Phase 3 is located in and provides direct benefits to a local community that, according to CalEnviroScreen 3.0, is classified as an SB 535 Disadvantaged Community (DAC) and an AB 1550 low-income community as shown in Figure 5. With a CalEnviroScreen 3.0 percentile range of 96 to 100%, the census tract where the Facility is located carries a pollution burden score of 100 and a population characteristic score of 92. Factors where the community scored especially poorly include hazardous wastes (99), solid waste (99), groundwater threats (97), ozone (96), cleanup sites (96), drinking water (94), and PM2.5 (93).

Figure 6:CalEnviroScreen Emissions



Source: California Office of Environmental Health Hazard Assessment

Figure 7: SB 535 and AB 1550 Communities



Source: California Air Resources Board

2.3 Renewable Natural Gas Production (RNG) in California

The processes and technologies installed at the Facility directly contribute to its ability to compete in the California's commercial marketplace for biofuels while also increasing in-state biofuels production. California ranks first in the nation in biogas production potential, with a total of 322 operational biogas systems as of 2021. Of these, 30 treat food waste. However, the potential to treat food waste as well as the organic fraction of MSW and other biomass feedstocks is significantly greater than existing capacity. According to the American Biogas Council, enough feedstock is available in state to support over 1,100 additional biogas production facilities.[1] In addition, none of the biogas production facilities in California, and only one in the nation, use RNG for vehicle fuel.[2] Demand for RNG, which can easily be incorporated into CNG fuel stocks, is strong because many public and private fleets strive to reduce GHG and criteria air pollutant emissions. RNG also has the potential to be used for renewable power generation in place of fossil natural gas to provide renewable electricity without the need to invest significant land and capital into land-intensive forms of renewable energy, such as solar power.

California also produces large quantities of wastewater biosolids each year with 723,000 dry metric tons. Only about 36% meet the Class A standards used for soil amendment. The remaining 64% of biosolids is used as Class B soil amendment (20% of total), landfill daily cover (19%), landfill disposal (13%), surface disposal (3%), incineration (3%), or other uses (6%).[3] Class B biosolids are coming under increasingly stringent regulations in California, which increasingly restricts their land application. Therefore, a growing market is available for technologies that can convert low-grade wastewater biosolids into a higher value beneficial use.

2.4 Key Barriers to RNG Production in California

RNG is an important part of California's approach to reducing greenhouse gas emissions across the state. RNG achieves key initiatives to address methane emissions from various wet organic feedstocks, including food waste, green waste, and dairy manure. Although the environmental benefits for RNG are well defined, there are significant market barriers that constrain RNG facility development. The first and foremost is low-cost fossil natural gas. Since 2017, when this project was initially proposed, the industrial price of fossil natural gas has averaged $7.54/thousand cubic feet ($7.27/MMBtu).[4] RNG is used in the market for the same applications of fossil natural gas and therefore needs to compete in the marketplace with this option for businesses.

RNG from food wastes requires multiple collection and processing steps, including the waste hauler collection routes, removal of inorganic contaminants, transportation to a central facility, and facility operation. Due to the nature of anaerobic digestion (AD) technologies, food waste cannot be processed at the same scale and volume that fossil natural gas is today.

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[1] https://americanbiogascouncil.org/biogas-market-snapshot/

[2] https://www.anl.gov/es/reference/renewable-natural-gas-database

[3] https://www.calrecycle.ca.gov/organics/biosolids#:~:text=Biosolids%20are%20the%20nutrient%2Drich,wastewater%20and%20remove%20the%20solids.

[4] U.S Energy Information Administration, California Natural Gas Industrial Price. https://www.eia.gov/dnav/ng/hist/n3035ca3m.htm

To support RNG production, California has passed landmark legislation and developed globally renowned programs to reduce the costs of food waste collection and assign value to the renewable attributes of RNG. The primary drivers of this market include:

- SB 1383 and AB 1826 require commercial organics collection and significantly eliminate the option to dispose organics in the landfill. These policies help generate cleaner volumes of organic wastes for use as feedstock for RNG.
- Low Carbon Fuel Standard provides transactable credits for transportation fuels with low carbon intensities compared to fossil fuels. This market generates revenue associated with the renewable attributes of the RNG.

Although these policies and programs have improved the market for RNG production, the market is not mature, meaning that at-scale operations have not yet been realized—increasing the costs of each step over the expected prices when the market has matured. ARV-17-019 funding, along with other agency funding, have helped reduce the capital cost of the Facility, allowing for the Facility's business model to accommodate the higher cost of feedstock in biosolids management in an immature marketplace.

2.4.1 MSW-Organics Separation and Processing

Generation of RNG from organic waste is greatly constrained by a lack of technologies that can cost-effectively separate and process food waste/organics from MSW. By providing new, effective organics separation and organic processing, Anaergia has directly addressed and helped reduce this existing market barrier. Using the Facility's technology, organics extracted from MSW can be processed and digested efficiently to produce energy.

2.4.2 Biosolids Management

Increasingly stringent regulations and lack of cost-effective wastewater biosolids management technologies are driving wastewater treatment providers to seek new solutions to biosolids management. However, most existing solutions are limited by available technology, the majority of which have high capital and operational costs due to handling requirements for Class A biosolids. The Facility provides a novel solution to biosolids management: cost-effectively generating Class A soil amendment without the need for wastewater treatment facilities to invest capital in costly treatment upgrades.

2.4.3 Limited Demonstration

The technologies have been successfully demonstrated individually but never together as a cohesive system. In addition, demonstration of several of the proposed pieces of equipment has been limited. Given the risk-averse nature of the waste and wastewater management industries, new, reliable data from the demonstration of the proposed facilities will greatly aid in the development of future similar projects.

2.5 Project Need and Technical Merit

The Facility represents the first-ever commercialization of a system that processes biosolids, MSW-extracted food/organic waste, and liquid commercial waste into RNG. Initial market evaluation completed by Anaergia prior to the start of the project identified two potential routes for replication and future commercialization. First, the Facility could be entirely replicated, using the same feedstocks to produce the same products. Due to economies of scale, Anaergia estimates that a metropolitan population of approximately 500,000 is needed to support a facility similar to the Facility. There are 107 such metropolitan areas in the United States, including 12 in California (Los Angeles, San Francisco, Riverside, San Diego, Sacramento, San Jose, Fresno, Bakersfield, Oxnard, Stockton, Modesto, and Santa Rosa metropolitan areas). Market conditions are considered most strongly favorable for large-scale facilities in California at present due to the favorable regulatory conditions discussed.

Second, the technologies could also be replicated in smaller systems, adopting only a part of the overall process chain described herein. For example, MSW-extracted food/organic waste could be used to produce RNG on a smaller scale than at the Facility, without the need for other feedstocks. Liquid commercial waste or biosolids could also be processed in similar fashion, enabling a larger number of smaller facilities to be sited near feedstock sources. Anticipated future commercialization will likely include a combination of the first and second strategies, making the system highly replicable across much of California. For smaller scale systems, the fixed cost of a dedicated digester facility may be cost-prohibitive. In these cases, wastewater treatment plants (WWTPs) can be used. There are 156 WWTPs in California with anaerobic digestion, all of which have some available capacity for co-digestion. In plants where insufficient capacity exists, Anaergia's Omnivore® system can increase capacity and enable co-digestion of multiple feedstocks using advanced mixing and robust thickening systems to turn a low-solids digester (2–3% total solids) into a high-solids digester (5–8% total solids.) On the solid waste side, there are 802 transfer stations—all candidates for Anaergia's OREX™ system, which is scalable. As a result, a large OREX™ system can provide organic feedstock for a large, dedicated digestion facility like the one proposed. If scaled down, a smaller OREX™ line can provide feedstock to one of the 156 WWTPs with existing AD infrastructure in California. Flexibility in scale and the ability to provide organic feedstock to existing or new infrastructure make the proposed technology solution highly replicable across the state.

2.6 Project Benefits

The entire Facility injected $180 million directly into California's economy during design and construction. This figure is based on total cost with a multiplier of 1.48 per dollar spent[5] to account for indirect economic activity such as raw materials, logistics, transportation, customer service, technical support, regulatory and safety specialists, distribution, professional services, and taxes. During operations, the Facility will contribute a minimum of approximately $7.5 million per year in additional statewide economic activity driven by RNG sales, tipping fees, coproduct sales, and new employment. Table 1 breaks down the various grants, rebates, and incentives the recipient used to partly finance the project.

[5] US Bureau of Economic Affairs, 2014, as cited in http://www.industryweek.com/global-economy/competitive-edge-manufacturings-multiplier-effect-its-bigger-you-think

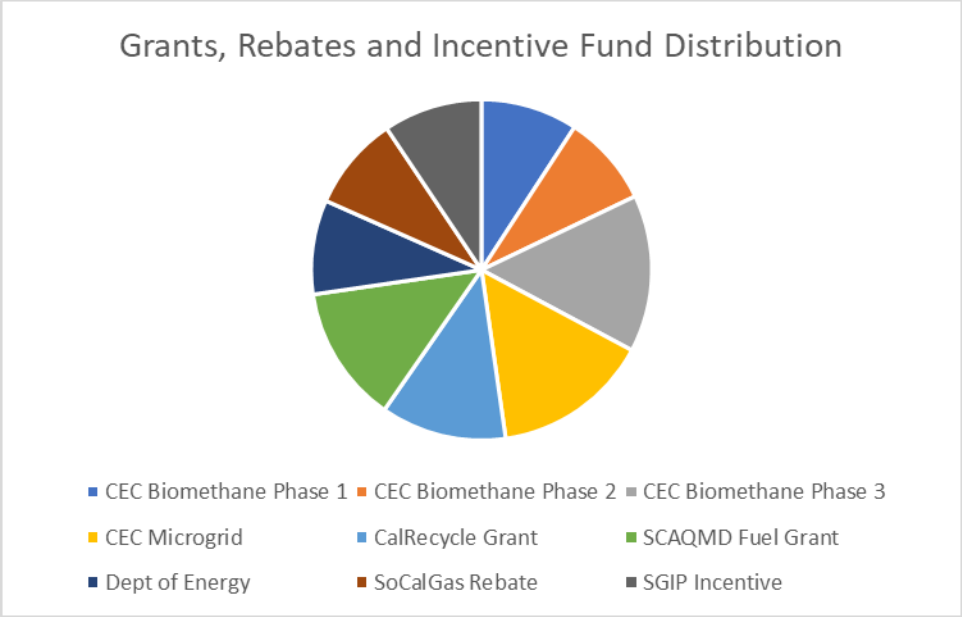
Table 1: Grants, Rebates, and Incentives

Grant	Amount	Purpose
CEC Biomethane Phase 1	$3,080,000	Revitalize Mothballed Bioenergy Facility to Produce 880,00 DGE of RNG
CEC Biomethane Phase 2	$2,916,620	Expand RNG Production by adding a second biogas conditioning skid to increase production to 2.5M DGE of RNG
CEC Biomethane Phase 3*	$5,000,000	Continued expansion by addition a third biogas conditioning skid increasing capacity by 2.4 DGE of RNG
CEC Microgrid	$5,000,000	Install a 2MW Microgrid System
CalRecycle Grant	$4,000,000	Fund one of the two anaerobic digesters at the Facility
SCAQMD Fuel Grant	$4,365,801	Redevelop an existing non-operational regional bioenergy facility to produce RNG for Transportation Fuel
Dept of Energy	$2,999,096	Permitting, testing, and 30% design of drying and pyrolysis systems
SoCalGas Rebate	$3,000,000	Incentive for successfully installing and operating an RNG interconnection with the SoCal Gas power grid
SGIP Incentive	$3,150,000	Incentive for installation and performance of a CHP system that includes four engines totaling 4.6 MW
Total	$33,511,517	

Source: Rialto Bioenergy Facility, LLC

* Relevant Grant

Table 2: Fund Distribution



Source: Rialto Bioenergy Facility, LLC.

RBF Phase 3 has continued to expand the Facility's production capacity. As discussed previously, RNG is currently publicly available for sale as a transportation fuel in limited quantities. When

operating at full capacity, RBF Phase 3 will produce up to 2.4M DGE of biomethane per year increasing the Facility's total capacity to 4.9M to be used for transportation fuel, making it the largest supplier of RNG derived from landfill diverted organics in California and significantly expanding existing California production capacity.

In addition to the RNG created by diverting food waste from the landfill, the project had reduced GHG emissions by 4,256 MTCO2e as of December 2021 and is on target to reduce GHG emissions by 23,828 MTCO2e per year by 2022. A further reduction per annum of at least 2,513 MTCO2e is projected due to edible food rescued and donated to High Desert Second Chance food pantry as part of the CalRecycle grant. Table 3 lists the projected reductions due to diverted food waste and edible food rescued.

Table 3: GHG Reductions by Material Type

Year	Material Type	Tons of Organic Material Diverted Per Year by Material Type (Phase 3)	Tons of Organic Material Diverted Per Year by Material Type (Facility)	GHG Reductions Per Year by Material Type (MTCO2e) (Phase 3)	GHG Reductions Per Year by Material Type (MTCO2e) (Facility)
2021	Diverted Food Waste	15,972.1	32,610	4,256	8,717
2022 onwards	Diverted Food Waste	89,142.9	182,000	23,828	48,649
2021	Edible Food Rescued	-	1,412	-	2,513
2022 Onwards	Edible Food Rescued	-	1,500	-	2,670

Source: Rialto Bioenergy Facility, LLC

From a technological standpoint, the innovative suite of technologies targeting MSW-derived food/organic waste, liquid commercial waste, and biosolids management promises to be replicable in up to 12 other major metropolitan areas in California alone, and in more than 100 such areas nationally. In addition, individual components demonstrated under the Facility will also be viable for use in smaller applications focused on a single waste stream. Therefore, by supporting early market development of these technologies, Anaergia can ultimately support the deployment of 52 additional RNG production facilities of equal size to the Facility in the state within the next two decades.

Chapter 3: Project Approach

3.1 Project Approach

The Recipient and project team designed RBF Phase 3 to produce RNG from MSW, with the goal of producing 2.5M DGE per year. RBF Phase 3 has expanded on existing CEC funded projects. It was anticipated that RBF Phase 3 would divert 300 tons/day of organic waste feedstock and in doing so eliminate 80,970 MT of carbon emissions annually.

See Chapter 4 for a description of the detailed technical processes involved in converting MSW into RNG.

3.2 Final Project Elements

For RBF Phase 3, the Recipient procured, installed, and commissioned the following project elements:

- Biogas Upgrader (see to Figure 9 and 10)
- Flare (see to Figure 11)
- Biomethane Upgrader Control Panel (see to Figure 12)
- Biomethane Upgrader Spare Parts
- Instrumentation (see to Figure 13)
- Piping and Valves for Biogas (see to Figure 14, 15 and 16)
- Natural Gas Pipeline Interconnection (see to Figure 17)

3.3 Tasks and Key Deliverables

Recipient and the project team deployed the project through the following tasks:

Task 1: Administration: With support from Momentum, Recipient oversaw administration of the project, consistent with the subtasks and deliverables identified in the scope of work.

Task 2: Facility Design and Engineering: The project team completed all documentation and drawings needed for equipment as well as final permitting and construction. Using the lessons learned from Anaergia's other projects, and from prior upgrades at the Facility site, the project team developed all the relevant engineering documents required for permit review by the City of Rialto.

Task 3: Facility Construction and Commissioning: WML completed equipment procurement (initiated after completion of 30% design drawings under Task 2) and completed construction of the project. The project team completed all subtasks and milestones consistent with traditional construction project management, including equipment and material acquisition, installation, and commissioning timelines. This phase completed construction on September 11, 2020. The project team completed commissioning RBF Phase 3 on January 28, 2021. Commissioning was completed incrementally by testing each piece of equipment before commissioning the phase. The commissioning process included checks and milestones specific to each component, all of which were validated for performance and durability.

Task 4: Outreach and Disadvantaged Community Support: The project team is has performed outreach efforts to the local community by providing tours, scholarships and other outreach events.

Task 5: Data Collection and Analysis: The project team is gathering data on a consistent basis. The Facility keeps detailed records of incoming feedstock (using truck scales), biomethane production, and RNG injected into the pipeline. These numbers are recorded on a daily or monthly basis and used to track ramp-up progress, financial records, and GHG emissions.

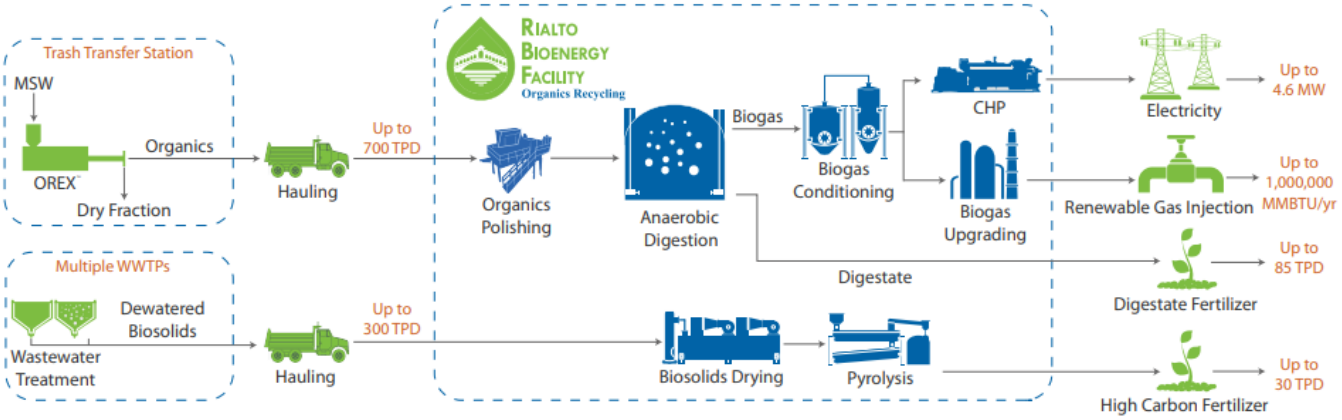
Task 6: Project Fact Sheet: The project team has developed a project fact sheet that describes the CEC-funded project and the benefits resulting from the project for the Public.

Chapter 4: System Design

4.1 System Summary and Flow Diagram

The Facility system includes an OREX™ installed at the Waste Management Materials Recovery Facility as well as an organics polishing system, an innovative High-Solids Anaerobic Digester (HSAD), and Air Liquide biogas cleaning and compression equipment that was funded by this grant.

Figure 8: Project flow Diagram



This diagram shows the inputs and outputs of the Facility

Source: Rialto Bioenergy Facility, LLC

4.2 Food Waste from MSW

The Facility receives feedstock from the innovative Anaergia OREX™ pre-processing system at the Waste Management Material Recovery Facility, a centralized location in Sun Valley. The OREX™ is the only technology capable of cost-effectively extracting the vast majority (≥90%) of putrescible organic waste from mixed MSW.

The OREX™ has been integrated into a new pre-processing "wet line" that has enabled Waste Management to send organic food waste extruded from the MSW stream to the facility. Waste Management has created route-specific waste streams containing high levels of organics to the RBF Phase 3 rather than to the landfill. Specific collection targets include Waste Management's existing customers that generate high-moisture/high-organic-content wastes. Examples include high-organics commercial and institutional food wastes as well as mixed organics/MSW sourced from multifamily residential complexes.

The waste processing line that incorporates the OREX™ operates by first shredding the incoming MSW to open bags and liberate their contents, then coarse-screening the waste to remove large non-organic materials such as cardboard and large plastic containers. The screened MSW is now concentrated with organic waste and conveyed into an in-feed chamber of the OREX™. Here, a hydraulic ram applies 4,000 pounds per square inch (psi) of pressure to the waste, extruding organics through a perforated plate.

Readily digestible and putrescible organics are forced through the holes, while residual material—mainly plastics, paper, bone, and glass—is retained. Organics are extruded as a

stackable cake with 30% solids content. The concentrated nature of the organics minimizes transportation costs and carbon footprint and eliminates the need for dilution water at the transfer station. Residual material is then ejected from the compression cylinder and prepared for further recycling and/or disposal. Meanwhile, organic feedstock is transferred to a storage bin before being loaded into trucks for transport to the Facility. Inert contaminants (glass, grit, paper, plastic fragments, and so on) typically amount to <1.5% of the extruded organics on a dry mass basis.

4.3 Feedstock Cleaning

The wet organic fraction extracted from MSW is received from the Waste Management OREX™ via truck and unloaded into receiving bins and conveyed by positive displacement pumps to an Anaergia OPS™. The Anaergia OPS™ is a two-stage system designed to remove inert contaminants from the incoming feedstock, which would otherwise become entrained in the digester or residual solids downstream. The wet organic fraction is first routed into a dynamic cyclone, which separates floatable rejects (mostly plastic films/from plastic bags that are extruded by the high pressure of the OREX™). The cleaned feedstock is next pumped into the proposed high-solids digester located at the Facility site.

4.4 Anaerobic Digestion

Cleaned food waste, along with incoming commercial liquid waste (that is, food waste) is injected into two 3,500,000-gallon anaerobic digesters, one of which was partially funded by the CalRecycle Organics Program, that operate using a 30-day solids retention time (SRT). The digesters require 0.6 MW of heat, which is provided by a combined heat and power (CHP) system. The Facility has included six Anaergia PSM 1500 high-viscosity electric mixers in each digester tank for a total of 12 mixers. These mixers enable higher digester throughput for the size of the digester by efficiently mixing high-solids/high-viscosity slurries that result from the high solids loading rates.

Conventional mixers require a digester volume three times the size of the digester at the Facility to process similar volumes of organic waste. This is because conventional mixers can only mix low-solids/low-viscosity slurries that are roughly three times lower in concentration—requiring more dilution in the feed, tripling the volume of the feed material, and therefore tripling digester volume.

4.5 Biogas Cleaning, Upgrading, and Compression

Biogas produced by the digester is transferred to an Air Liquide biogas system that was funded by RBF Phase 3 and includes biogas conditioning, membrane biogas upgrading, and RNG compression. The Biogas Conditioning Skid removes gas constituents—including water, hydrogen sulfide gas (H_2S), siloxanes, and non-desirable volatile organic compounds (VOCs)—that could otherwise foul or damage downstream equipment. The biogas conditioning skid was used as an industry-standard system capable of meeting required specifications for the subsequent membrane-based upgrading system. The membrane biogas upgrading system uses membranes to remove CO_2, O_2, and any residual water, H_2S, and other residual contaminants—producing RNG with at least 98% purity. Output from the system is compositionally ready for pipeline injection but still requires compression. The RNG Compressor brings the RNG up to

pipeline pressure—300 psig. The system is functionally equivalent to an industry-standard natural gas compressor, used widely across RNG and the fossil natural gas industry to compress the target gas to pipeline pressures.

4.6 Drying

The Facility has below-grade receiving bins and above-ground storage for biosolids. After reception and storage, biosolids will be transferred to one of two medium-temperature belt dryers. The dryers use waste heat and pyrolysis gases from the pyrolysis process as the heat sources. The dryers use no external fossil fuel for drying. The incoming biosolids can range from 24% to 30% total solids (TS) and are dried to greater than 90% TS dry pellets. The resulting product is a high-quality Class A fertilizer.

Chapter 5: Project Implementation and Results

5.1 Project Design and Construction

The Recipient and the CEC kicked off the project on May 11,2020. Since this was an expansion of an existing facility, all permits, and subcontractors were already in place. Engineering plans were completed in Q1 2020 and along with WML and Anaergia Technologies, LLC, the Recipient completed procurement of the necessary equipment in Q3 2020. Other than minor delays in the delivery of some equipment due to the COVID-19 pandemic, the construction was completed on schedule.

Figure 9: Third Train Product Compressor

Source: Rialto Energy Facility, LLC

Figure 10: Third Train Upgrader

Source: Rialto Energy Facility, LLC

Figure 11: Emergency Flare

Source: Rialto Energy Facility, LLC

Figure 12: Commissioning of RTO System for Tail Gas Treatment

Source: Rialto Energy Facility, LLC

Figure 13: Power and Communications Connections to Water Distribution Skid

Source: Rialto Energy Facility, LLC

Figure 14: Piping Installation at Biomethane Upgrader

Source: Rialto Energy Facility, LLC

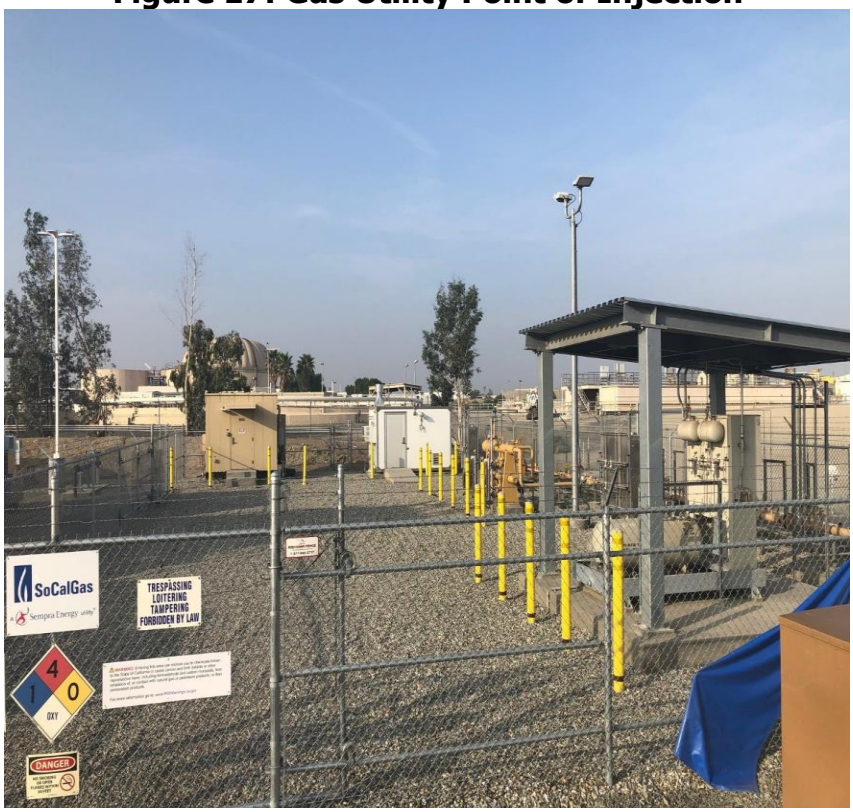
Figure 15: Underground Biomethane Piping Being Installed

Source: Rialto Energy Facility, LLC

Figure 16: Piping Connections to Gas Train Assemblies

Source: Rialto Energy Facility, LLC

Figure 17: Gas Utility Point of Injection



Source: Rialto Energy Facility, LLC

5.2 Project Timeline Summary

Table 4 provides a summary timeline of the key milestones and achievements of the project, and Table 5 summarizes grant deliverables.

Table 4: Project Milestone Summary

Milestone	Completion Date
Limited Notice to Proceed to Construct	06/26/2018
Grading Plan Completion	02/19/2019
Major Equipment Ordered	03/25/2020
Install Flares	06/07/2020
Biogas Piping	07/02/2020
Install Biogas Upgrader	08/11/2020
Install Control Panels	08/15/2020
Major Equipment Delivery	11/23/2020
Install Valves	12/01/2020
SoCal Interconnect	01/15/2021
Project Completion	02/15/2021

Source: Rialto Bioenergy Facility, LLC

Table 5: Grant Deliverables Summary

Task No.	***Task Description***	***Completion Date***		***% Complete***	***Status***
		Planned	***Actual***		
1.1	Updated Schedule of Products	ongoing			Ongoing
1.1	Updated List of Match Funds	6/15/20	7/7/20	100%	Complete
1.1	Updated List of Permits	6/15/20	6/12/20	100%	Complete
1.1	Kick-Off Meeting Agenda (CEC)	6/15/20	5/11/20	100%	Complete
1.2	1st CPR Report	TBD			
1.2	Written Determination (CEC)	TBD			
1.3	Written Documentation of Meeting Agreements	2/1/22			
1.3	Schedule for Completing Closeout Activities	2/28/22			
1.4	Monthly Progress Reports	Monthly	Monthly		Ongoing
1.5	Final Outline of the Final Report	1/15/22	1/12/22	100%	Complete
1.5	Draft Final Report	2/1/22			
1.5	Final Report	2/15/22			
1.6	Letter Regarding Match Status	6/29/20	7/7/20	100%	Complete
1.6	Copies of Match Fund Commitment Letter	6/29/20	6/12/20	100%	Complete
1.7	Letter Documenting the Permit Status	7/1/20	6/12/20	100%	Complete
1.8	Letter Describing Subcontracts Needed	6/24/20	7/7/20	100%	Complete
1.8	Draft Subcontracts	Per Contract	7/7/20	100%	Complete

1.8	Final Subcontracts	7/9/20	7/7/20	100%	Complete
2	Written Notification of Completion of Engineering Plans	8/15/20	8/11/20	100%	Complete
2	Construction and Equipment List	8/15/20	8/5/20	100%	Complete
3	Procurement Plan (Draft)	8/10/20	8/24/20	100%	Complete
3	Procurement Plan (Final)	8/31/20	9/2/20	100%	Complete
3	Procurement Report (Draft)	9/30/20	11/5/20	100%	Complete
3	Procurement Report (Final)	10/15/20	11/5/20	100%	Complete
3	Construction Plan (Draft)	8/10/20	8/11/20	100%	Complete
3	Construction Plan (Final)	8/31/20	9/2/20	100%	Complete
3	Written Notification of Site Preparation	8/21/20	7/27/20	100%	Complete
3	Major Project Change List	12/18/20	7/22/20	100%	Complete
3	Construction Report (Draft)	2/8/21	3/2/21	100%	Complete
3	Construction Report (Final)	2/29/21	3/2/21	100%	Complete
3	Written Notification of Completion of Installation	1/31/21	3/2/21	100%	Complete
3	Testing and Commissioning Plan (Draft)	10/19/20	11/19/20	100%	Complete
3	Testing and Commissioning Plan (Final)	12/30/20	12/2/20	100%	Complete
3	Testing and Commissioning Report (Draft)	5/9/21	6/15/21	100%	Complete
3	Testing and Commissioning Report (Final)	5/25/21	6/15/21	100%	Complete
3	Written Notification of Completion of Commissioning	4/26/21	6/25/21	100%	Complete
4	Outreach and Community Support Schedule	TBD			
5	Initiation of Operation (no deliverable required)	5/2/21		100%	Complete
6	Initial Project Fact Sheet	9/30/20	9/30/20	100%	Complete
6	Final Project Fact Sheet	2/15/22			
6	High Quality Digital Photos	Monthly	Monthly		Ongoing
	Data Collection (For Final Report)				

Source: Rialto Bioenergy Facility, LLC

5.3 Commissioning

Consistent with the Testing and Commissioning Plan, RBF Phase 3 conducted performance testing on the following equipment:

- Biogas Upgrader
- Flare
- Biomethane Upgrader Control Panel
- Biomethane Upgrader Spare Parts
- Instrumentation
- Piping and Valves for Biogas
- Natural Gas Pipeline Interconnection

In addition to performance tests, the equipment also underwent the following tests:

- **Factory Acceptance Testing** – Upon completion of vendor control panels prior to shipment, manufacturer's certificate of testing was provided.
- **Certification of Installation** – The Contractor and Vendor certified that all equipment was installed per manufacturers' recommended practices.
- **Commissioning** – Equipment was commissioned in accordance with manufacturers' written instructions.
- **Site Acceptance Testing (SAT)** – Upon completion of commissioning, a SAT was conducted on each piece of equipment or component of the system.
- **System Testing** – Upon completion of the individual SATs, a full system test was conducted.

Commissioning was completed by January 28, 2021. A summary of the testing and commissioning results was included in the Testing and Commissioning Report.

5.4 Project Operations

5.4.1 Throughput, Usage, and Operations Data

Due to the limited deliveries of feedstock as well as the challenges presented by the COVID-19 pandemic, the current throughput data does not represent the intended capacity of the Facility. The report will be updated at a later date with new data and will present a better representation of the Facility's capabilities. Please see Attachment A for preliminary data.

5.4.2 Normal Operating Hours, Uptime, and Downtime

The operating hours for the facility are 24/7. There is some downtime due to maintenance; however, this is difficult to predict. This downtime is kept to a minimum to maximize facility operations.

5.4.3 Feedstock Supply Summary

As mentioned in Section 5.4.1 above, due to the limited deliveries of feedstock, the data does not represent the intended capacity of the Facility and will be updated later. Please see Attachment A for preliminary data.

5.4.4 Maximum Fuel Production Capacity

Table 6: Fuel Production Design Capacity

Max Fuel Production at Facility Capacity	Amount (Phase 3)	Amount (Facility)	Unit
Max Avg Flow	994	2,030	SCFM
Max Daily Volume	1,431,771	2,923,200	SCF
Heat Value of Biomethane	1,010	1,010	BTU/SCF
Max Biomethane Injected Daily	1,446	2,952	MMBTU
Max Biomethane Injected Annually	527,823	1,077,638	MMBTU

Source: Rialto Bioenergy Facility, LLC

5.4.5 Class A Dried Biosolids Production

As mentioned in Section 5.4.1 above, due to the limited deliveries of feedstock, the data does not represent the intended capacity of the Facility and will be updated later. Please see Attachment A for preliminary data.

5.4.6 Waste from Production Processes

The Anaergia OPS™ rejects any plastics or other non-organic material that is not suitable for anaerobic digestion; these rejects are sent to a nearby landfill. Please refer to Attachment A for preliminary data.

Figure 18: OPS™ Rejects Collection

Source: Rialto Bioenergy Facility, LLC

5.5 RNG Production, Quality, and Standards

5.5.1 RNG Carbon Intensity

The Facility established an initial CI score of -58 gCO2e/MJ and with the increased capacity of RBF Phase 2 the CI score reached -65 gCO2e/MJ. The latest CI score following RBF Phase 3 has increased to -57 gCO2e/MJ. This increase is due to unscheduled downtime with the biogas upgrader which required some gas to be flared. These issues have been resolved and the CI score is expected to start dropping again. These CI scores are only estimates based on available data collection and will need to be confirmed by CARB and reviewed with the Facility's RNG broker Element Markets. The CI score is calculated via the GREET model from the CARB. The Facility uses the Siemens InfoServer to pull most of the data as well as scale tickets and monthly utility invoices.

5.5.2 RNG Fuel Price

RNG prices change daily due to the market, and it is difficult to predict future prices. Below is an average provided by EcoEngineers.

Figure 19: RNG Fuel Price

ecoengineers
people-driven solutions

Daily RIN, LCFS & CFP Update

8/9/21

D-Code	Average Price			Closing Value		
	2019	2020	2021	2019	2020	2021
D3	$3.170	$3.200	$3.180	$3.170	$3.200	$3.180
D4	$1.790	$1.820	$1.805	$1.790	$1.820	$1.800
D5	$1.780	$1.810	$1.790	$1.780	$1.810	$1.790
D6	$1.670	$1.680	$1.681	$1.670	$1.680	$1.675
	Average Price			Closing Value		
California LCFS Credit	$182.50			$182.50		
Oregon CFP Credit	$125.00			$125.00		

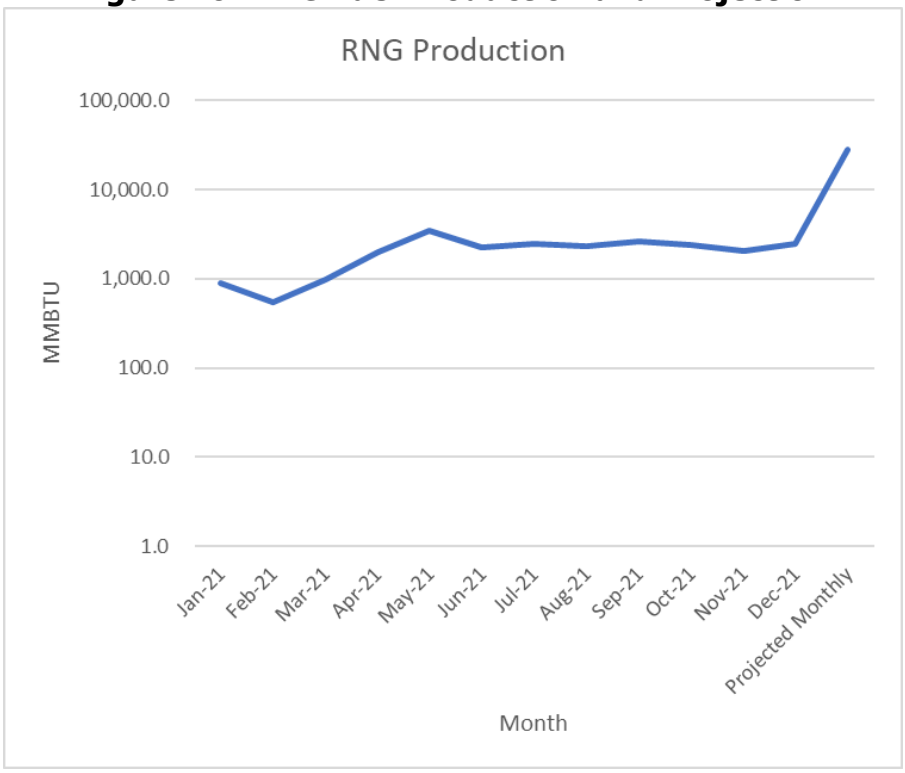
Data Provided in the EcoEngineers Daily RIN Price Update is intended for informational purposes only.

Source: EcoEngineers

5.5.3 RNG Production and Diesel Displacement

The data being presented for RNG production are limited by the feedstock being delivered. Please see Section 5.4.1 for the reasons causing this limitation. The data will be updated at a later date as the Facility is able to procure more feedstock and the anaerobic digesters have achieved the ideal microbial environment for biogas production.

Figure 20: RNG Fuel Production and Projection



Source: Rialto Bioenergy Facility, LLC

Table 7: Diesel Displacement

Month	RNG Delivered (MMBTU) (Phase 3)	RNG Delivered (Facility)	DGE Displacement (Phase 3)	DGE Displacement (Facility
January 2021	904.2	1,846	6,510.0	13,291
February 2021	544.2	1,111	3,918.0	7,999
March 2021	987.4	2,016	7,109.5	14,515
April 2021	1,976.8	4,036	14,233.1	29,059
May 2021	3,412.2	6,967	24,567.6	50,159
June 2021	2,263.8	4,622	16,299.3	33,278
July 2021	2,475.2	5,054	17,821.7	36,386
August 2021	2,349.6	4,797	16,916.8	34,538
September 2021	2,589.6	5,287	18,644.8	38,066
October 2021	2,366.7	4,832	17,040.2	34,790
November 2021	2,062.3	4,211	14,848.5	30,316
December 2021	2,457.9	5,018	17,697.2	36,132
Total	24,389.78	49,796	175,606.41	358,530

Source: Rialto Bioenergy Facility, LLC

5.5.4 Low Carbon Fuel Standard and Renewable Fuel Standard

The facility follows SoCalGas Rule 45, which can be found in Appendix 1.

5.5.5 Duty Cycle of Current Fleet and Future Vehicle Acquisitions

The Recipient has made extensive efforts to conduct outreach for low-NOX fleet conversion, including outreach to over 70+ fleet operators within the State of California over the course of the grant. Through this outreach, there was significant interest by companies to learn more about CNG/RNG and the availability of fuel. Several fleet operators expressed plans to convert their fleet and seek additional information about how to acquire RNG from the facility.

5.6 Project Economics

5.6.1 Project Jobs and Economic Development

The Facility has directly created a total of 24 new full-time, permanent jobs:

Chief operator (4 jobs)

Facility Administrator (1 job)

Facility Manager (1 job)

Instrumentation Technician (2 jobs)

Maintenance Manager (1 job)

Maintenance Mechanic Technician (3 jobs)

Maintenance Mechanic Trainee (1 Job)

Operations Manager (1 job)

Operations Technician (4 jobs)

Operations Technician Trainee (5 jobs)

Lab Technician (1 job)

All job titles listed are essential to the operation of the Facility. Recipient intends to continue employing these employees throughout the life of the project, which Recipient anticipates will be more than 20 years. During this time, it will be subject to upgrades and repairs to prolong its life cycle. All salaries will be sustained through the Facility's revenues.

5.6.2 Facility Financials Summary

Table 8: Grant Invoice Summary

Invoice Number	Invoice Date	Reimbursement Amount	Match Amount
1	7/15/2020	$1,271,709.33	$1,028,434.94
2	8/18/2020	$1,312,608.05	$2,287,339.84
3	10/09/2020	$105,363.23	$678,868.24
4	11/16/2020	$1,326,145.90	$136,553.98
5	1/22/2021	$570,500.00	$166,250.00
6	7/28/2021	$128,654.06	$69,530.88
7	11/24/2021	$228,200.00	$502,400.00
8	11/29/2021	$56,819.43	$100,180.57
9	12/14/2021	$0	$75,524.00
Total		$5,000,000.00	$5,045,082.45

Source: Rialto Bioenergy Facility, LLC

5.7 Environmental Impact

5.7.1 Greenhouse Gas Emissions

Please see Table 3 for GHG reductions.

Table 9: Air Emissions Summary

Particulates	Amount as of December 2021 (lbs) (Phase 3)	Amount as of December 2021 (lbs) (Facility)	Projected Amount (lbs) (Phase 3)	Projected Amount (lbs) (Facility)
ROG (Reactive Organic Gases)	1,432	2,924	7,993	16,319
NOx (Nitrous Oxide)	380	776	2,121	4,330
PM2.5	186	379	1,037	2,118
Diesel PM	20	41	113	230

Source: Rialto Bioenergy Facility

5.8 Facility Operations

5.8.1 Title 24 Standards

Please see Appendix 2 for Title 24 standards.

5.8.2 Potential Economic Development and Expansion

The project has injected $180 million directly into California's economy during Facility design and construction. This figure is based on the total Facility cost with a multiplier of 1.48 per dollar spent to account for indirect economic activity, such as raw materials, logistics, transportation, customer service, technical support, regulatory and safety specialists, distribution, professional services, and taxes. During operations, the Facility will contribute a minimum of approximately $7.5 million per year in additional statewide economic activity driven by RNG sales, tipping fees, coproduct sales, and new employment.

In addition, the Facility's innovative suite of technologies targeting MSW-derived food/organic waste, liquid commercial waste, and biosolids management aims to be replicable in up to 12 other major metropolitan areas in California alone and over 100 such areas nationally. Individual components demonstrated under the facility will also be viable for use in smaller applications focused on a single waste stream. Therefore, by supporting early market development of these technologies, the facility could ultimately support the deployment of 52 additional RNG production facilities of equal size to the Facility in the state within the next two decades.

Chapter 6: Project Outreach

The Recipient developed a comprehensive outreach plan to actively engage community members and to support general community engagement. The plan was affected by COVID-19 restrictions but includes the following elements, which the Recipient will reestablish once the pandemic is over:

- Open house events designed to make DAC members and other stakeholders aware of the Facility, its operations, and the significant benefits of renewable energy. Pre-COVID-19 events included open house events, meetings, and site tours with a variety of attendees, including local tribe members, the Mayor of Rialto, Workforce Development agencies, other city officials, and local schools and colleges. These activities will continue throughout the working life of the Facility. Open house events have served as opportunities to educate local community members about upcoming job openings as well as upcoming job training opportunities and are held in coordination with the Workforce Development Department of San Bernardino County.

- A groundbreaking event was held on December 7, 2018, with stakeholders from around the state. A total of 27 organizations attended, including the California Energy Commission, CalRecycle, California Air Resources Board, and the U.S. Department of Energy.

- A follow-up Stakeholder meeting was held on September 4, 2019. The meeting was to introduce those new to the project to the technology involved and to initiate the process of engagement with local community leaders that supported the project.

- Site tours were also a critical part of engaging stakeholders with the project. For example, on August 29, 2019, the Los Angeles County Sanitation District was given a tour of the facility. Their feedback was positive because the Facility had similarities with their own visions and objectives.

- Hiring targeted specifically at DACs throughout the working life of the Facility.

- Allocation of $3,000 per year in annual scholarships for local high school seniors intending to follow environmentally related career paths. The first Rialto Bioenergy Facility Environmental Stewardship Awards were given to three students from Carter High School and Rialto High School in June 2021.

- Partnership with the San Bernardino Workforce Development through the Business Services Supervisor Curtis Compton. Mr. Compton is engaged as a community champion for the project and promotes the project at outreach events.

- Anticipated ribbon-cutting event for community and state stakeholders.

Chapter 7: Lessons Learned and Conclusions

7.1 Key Lessons

The Recipient has learned a great deal working through the various challenges presented by this project as well as navigating the delays caused by the COVID-19 pandemic. These lessons have been an invaluable learning experience that will serve to make all following projects even more successful. Some of these were already identified and recorded in the RBF Phase 1 and RBF Phase 2 reports and are restated as general project lessons learned in this RBF Phase 3 report. The following are important lessons learned by the Recipient.

- **Schedule**

Starting construction prior to finalizing 100% process design caused delays in the schedule and design review. The Recipient will ensure that 100% process design is completed prior to starting construction in future projects of this scale.

- **Integration Risks**

In RBF Phase 1 and RBF Phase 2, the Recipient purchased some equipment directly from vendors as Owner-Specified-Equipment. These purchases had to be integrated into the GMP contract with the EPC contractor WML which caused minor delay in construction and increased integration risks to both Recipient and WML. In RBF Phase 3, the Recipient procured equipment through its subsidiary and equipment provider Anaergia Technologies, LLC (AT), as AT was a subcontractor to WML. This allowed WML to manage the procurement and integration of the equipment in a cleaner and more efficient way, reducing integration risks to the Recipient and construction delays to the project.

- **Cost**

The gas interconnection costs were budgeted at around $4M and established prior to a detailed review of potential costs. The final costs totalled just over $7M, almost double the initial budget. The Recipient will allow for additional contigency to deal with unexpected construction issues that may arise. In addition, the Recipient will standardize or subsidize some of the costs for interconnection to facilitate future projects connecting to the grid, as the high cost of interconnection limits the minimum size for financial viability of RNG production at smaller scale.

- **Technical Aspects**

The gas testing and biogas monitoring equipment that was originally specificed and procured for the project was not sufficient for the LCFS program. Additional gas monitoring and analysis equipment was required to fully comply with the LCFS program requirements. The issue was identified during commissioning and operation as the Recipient was collecting the necessary information to establish a CI score with CARB. The Recipient will ensure that the design is reviewed by the operations team much earlier in the design to guarantee that all operations team requirements are incorporated into the plans as early as possible to more effectively and efficiently transition from construction to operations and meet all project requirements.

- **Financial/Budget**

The Recipient underestimated the operations startup budget prior to commercial operations to fully commission and hand over the facility. The Recipient will increase the budget for this transition from construction to commercial operations for future projects. Most of the contingency budget was spent for the interconnection costs and Recipient still exceeded the cost estimates, see COST section for additional details.

- **Scope**

The biogas upgrading system vendor provided control system for only a portion of the biogas upgrading unit, however it was not a full turnkey motor and control system. Commissioning issues delayed startup of the system and required some programming changes in the field. For future projects Recipient will fully integrate the motor and control design and procurement for an RNG plant with one vendor instead of splitting the scope between multiple vendors.

- **Feedstock Shipments**

Due to the COVID-19 pandemic and the limited enforcement of SB 1383, feedstock has not been delivered at the desired rate. The Facility has the capacity to receive a higher volume of processed organics and expects the feedstock deliveries to continue ramping up in the next few months until capacity is reached.

- **CI Score**

As part of the grant application, the Recipient included a CI projected score of -187 gCO2e/MJ as calculated by Lawrence Berkeley National Laboratory (LBNL). This report[6] was based on the correct feedstock inputs and energy outputs. The majority of the CI calculation values were based on credits estimated from the avoided landfilling of food wastes (700 tons/day) and the application of biochar (27 tons/day). Emissions credits from the avoided landfilling of food waste were calculated using EPA's 2017 WARM model (-0.72 kg of CO2e per kg of wet food waste intake). The biochar credit is not readily identifiable in the summary findings.

The forecast -57 gCO2e/MJ provided in the Recipient's final report uses CARB's 2020 Tier 1 Organic Waste calculator (attached is a blank template). CARB's model currently offers -0.377 kg of CO2e per kg of wet food waste intake) and does not allow for any credits associated with biochar production.

This discrepancy in the emissions credits is the primary reason for the difference between the projected -187 gCO2e/MJ in the biochar application and today's findings.

7.2 Conclusions

This Facility continues to be the largest anaerobic digestion facility in North America. This is a flagship project that establishes California as the epicenter of food waste RNG production. This Facility, since its inception with support from RBF Phase 1, has served as a showcase for agencies nationwide evaluating AD opportunities as well as addressing the scalability of such projects. The additional capacity provided by the funding from RBF Phase 3 resulted in a more cost-effective project and established a viable and replicable system. The costs related to the gas

[6] Rialto Bioenergy LLC & Lawrence Berkeley National Lab. (2017). DE-FOA-0001232: Rialto Biosolids/Biodigester Waste Recovery and Advanced Thermal Conditioning Project. Department of Energy.

interconnection and biogas upgrading skids proved to be financially rewarding thanks to the additional capacity provided by RBF Phase 3.

The CEC funding of this project was critical to its success. The investment by the state into the project at the beginning and intermediary phases of a larger multistage project demonstrated the potential of converting organic waste from MSW into RNG. As the Facility ramps up, the GHG reductions, CI score reduction, and RNG production will only increase. Due to the ramp-up nature of anaerobic digesters, it will be several years until full production is realized. The projected RNG production is shown in Figure 24 Currently, RNG production is approximately 10% of the expected projection of a monthly production of 27,000 MMBTU per month. RBF Phase 1 established an initial CI score of -58 gCO2e/MJ and with the increased capacity of RBF Phase 2 the CI score reached -65 gCO2e/MJ. The latest CI score following RBF Phase 3 has increased to -57 gCO2e/MJ. This increase is due to unscheduled downtime with the biogas upgrader which required some gas to be flared. These issues have been resolved and the CI score is expected to start dropping again. These CI scores are only estimates based on available data collection and will need to be confirmed by CARB and reviewed with the Facility's RNG broker Element Markets. These are examples of how the benefits are increasing over time with additional equipment to increase the Facility's capacity.

The state's investment into the Facility was critical to attracting more traditional private funding, which drove the ability to expand to make a larger environmental impact. In addition to the improved environmental benefits, projects like the Facility can offer significant economic potential through local job creations. As stated in Section 5.8.3., this project has the potential to be implemented in 12 metropolitan areas in California and over 100 such areas in the nation. In addition to aligning with the current goals of SB 1383, this project is an example that producing RNG from feedstocks such as MSW is an impactful and viable solution that will only help California in the current climate crisis.

Attachment A: Incoming and Outgoing Throughput Data

	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Se
Feedstock Deliveries												
Food Waste Tankers (tons)	198.67	684.83	514.63	867.33	561.99	563.77	544.30	461.78	702.45	724.94	732.50	1,0
Food Waste End Dump (tons)	26.15	214.58	199.35	305.47	235.56	412.52	457.01	434.04	342.04	429.69	448.29	3
Total (tons)	224.82	899.41	713.98	1,172.80	797.55	976.29	1,001.31	895.83	1,044.49	1,154.63	1,180.79	1,3
Biosolids (tons)	-	205.71	-	84.44	172.07	147.82	-	57.99	70.87	282.86	812.18	4
Outgoing Trailers												
Digestate for Land Application (tons)	-	-	7.41	12.20	78.07	142.63	183.97	277.96	145.32	145.57	104.82	1
Class A Dried Biosolids (tons)	-	-	-	-	-	-	-	-	-	17.73	103.05	7
Total (tons)	-	-	7.41	12.20	78.07	142.63	183.97	277.96	145.32	163.30	207.87	2
Rejects/Plastic (tons)	-	-	8.82	9.16	66.91	34.87	57.99	52.51	35.80	50.06	69.89	5
RNG (DGE)				6,510	3,918	7,109	14,233	24,567	16,299	17,821	16,916	1

GLOSSARY

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The Energy Commission's five major areas of responsibilities are:

1. Forecasting future statewide energy needs
2. Licensing power plants sufficient to meet those needs
3. Promoting energy conservation and efficiency measures
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels
5. Planning for and directing state response to energy emergencies.

COMPRESSED NATURAL GAS (CNG)—Natural gas that has been compressed under high pressure, typically between 2,000 and 3,600 pounds per square inch, held in a container. The gas expands when released for use as a fuel.

RENEWABLE NATURAL GAS (RNG) is a pipeline-quality gas that is fully interchangeable with conventional natural gas and thus can be used in natural gas vehicles. RNG is essentially biogas (the gaseous product of the decomposition of organic matter) that has been processed to purity standards.

CALIFORNIA AIR RESOURCES BOARD (CARB)—CARB is charged with protecting the public from the harmful effects of air pollution and developing programs and actions to fight climate change. From requirements for clean cars and fuels to adopting innovative solutions to reduce greenhouse gas emissions, California has pioneered a range of effective approaches that have set the standard for effective air and climate programs for the nation and the world.

LOW CARBON FUEL STANDARD (LCFS)—Under the AB 32 Scoping Plan, the Board identified the Low Carbon Fuel Standard as one of the nine discrete early-action measures to reduce California's greenhouse gas emissions that cause climate change. The LCFS is a key part of a comprehensive set of programs in California to cut GHG emissions and other smog-forming and toxic air pollutants by improving vehicle technology, reducing fuel consumption, and increasing transportation mobility options. The LCFS is designed to decrease the average carbon intensity of California’s transportation fuel and provide an increasing range of low-carbon and renewable alternatives, which reduce petroleum dependency and achieve air quality benefits.

DIESEL GALLON EQUIVALENT (DGE)—The amount of special fuel, or special fuel that is liquefied natural gas or compressed natural gas, that is equivalent in terms of energy content to 1 gallon of diesel fuel, as provided in this subsection. The equivalent amount is the amount of fuel that by volume possesses an energy content of 129,500 British thermal units.