

Attachment 2

Project Description

Regional Renewable Energy Facility at Paso Robles Landfill

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BACKGROUND AND NEED

Paso Robles is a city of 31,000 people in northern San Luis Obispo County, in the Central Coast Region of California. Paso Robles is surrounded by agricultural land, primarily wine grape vineyards.

Various organic waste streams are generated in the greater Paso Robles area. Some are processed locally, but most are currently transported out of San Luis Obispo County due to a lack of local facilities for processing and disposal. These organic waste streams include:

- Spoiled packaged food waste from grocery stores and food distributors
- Regional municipal biosolids (~20,000 to 30,000 wet tons per year)
- Green waste combined with food waste collected from populated areas by waste haulers (~10,000 tons per year from Paso Robles and nearby Atascadero)
- Winery waste, including pomace and lees
- Brewery waste, including spent grains and trub
- Liquid fats, oils, and grease, and
- Animal waste.

New Organic Waste Regulations. Per the State's new solid waste regulations commonly referred to as Senate Bill (SB) 1383, these organic waste streams may not be disposed in a landfill due to their potential to cause fugitive emissions of methane, a powerful greenhouse gas. SB 1383 requires local agencies to divert organic waste streams from landfills and procure organic waste products such as compost or renewable natural gas. There are several established composting facilities in the greater Paso Robles area that produce an abundance of compost. Composting organic waste is better for the environment than putting it in landfills, but there are some emerging issues with composting. Composting releases carbon dioxide and some methane to atmosphere. Hauling large volumes of compost also emits greenhouse gases. New research has found that most compost contains microplastics, which is an emerging concern for local farmers.

SB 1383 and related State grant programs are meant to incentivize establishment of new anaerobic digestion facilities throughout California. Anaerobic digesters reduce the volume of organic waste and convert it to valuable products such as renewable natural gas and electricity. Many local waste haulers, including Paso Robles Waste & Recycle,

use trucks fueled with natural gas to collect and haul waste. There is an opportunity to reduce usage of fossil fuels by supplying these truck fleets with renewable natural gas.

Biosolids and PFAS. All government agencies with responsibility to collect and treat wastewater generate biosolids and have a similar need to properly dispose of biosolids. Biosolids contain pollutants and are closely regulated by the State of California and U.S. Environmental Protection Agency. The County of San Luis Obispo has a moratorium on land application of biosolids. Biosolids may no longer be disposed in landfills.

Due to a lack of local disposal options, most government agencies in San Luis Obispo County haul their biosolids to facilities in Santa Maria or Kern County, where it is mixed with other organic waste streams, composted, then applied to land.

The State of California recently required most local government agencies to test their biosolids for polyfluorinated alkyl substances (PFAS), which are commonly referred to as “forever chemicals” due to their resistance to degradation in the environment. PFAS have been widely used in common household and personal care products for many years. In general, all local governmental agencies have low levels of various PFAS species in their biosolids.

Composting does not break down PFAS, because very high temperatures (typically greater than 1900° F) are required to break the strong carbon-fluorine bonds in PFAS. Consequently, compost derived from biosolids contains PFAS.

New technologies are available, such as high-temperature pyrolysis and super critical water oxidation, that are capable of eliminating PFAS in biosolids and converting the biosolids into valuable products such as biochar. These technologies are very expensive for any of the local agencies in San Luis Obispo County to install and operate individually but may be cost-effective if all wastewater agencies in the region pool their biosolids waste streams and process it all at one regional facility.

Regional Biosolids Cooperative. In 2022 and 2023, several local government agencies in the Central Coast area between Paso Robles and Santa Barbara convened a series of workshops to explore interest in a regional cooperative, for the purpose of advancing biosolids management. They learned:

- a. Most communities between northern San Luis Obispo County and northern Santa Barbara County already cooperate on a variety of common areas of interest, such as water and solid waste management;
- b. Pending regulatory changes at the State and Federal level could lead to a prohibition of land application of biosolids or compost derived from biosolids, so it would be prudent for wastewater agencies to plan for an alternative to land application;
- c. Cooperating would enable a facility to be large enough that it would be economical to install advanced processing equipment;
- d. A local facility would reduce out-of-county truck trips, thus help control long-term costs and reduce greenhouse gas emissions;

- e. Advanced processing would greatly reduce the volume of biosolids and convert the material into valuable products such as biochar. These products may be sold to markets and the revenue used to offset the cost of an advanced processing facility;
- f. Cooperating increases the likelihood that private enterprises will participate in establishing a new facility, by ensuring the facility receives enough feedstock to justify a large expenditure for advanced equipment;
- g. Several regional biosolids cooperatives are presently forming throughout California;
- h. State grant funding is available for establishment of new organic waste processing facilities;
- i. There may be potential to further improve the economics of regional facility by making it large enough to receive and process all the organic waste streams described above.

In 2023, sixteen local government agencies in the area between San Miguel and Santa Barbara decided to form a regional cooperative with the purpose of establishing a local regional facility capable of advanced processing of biosolids. On November 28, 2023, these parties formalized their commitment by executing a Memorandum of Understanding (MOU). The MOU clarifies how the agencies will cooperate going forward and is meant to signal to private entities that Central Coast wastewater agencies are committed to supporting a regional facility.

Paso Robles Landfill. The City of Paso Robles owns and operates a municipal landfill at an 80-acre site located at 9000 East Highway 46, approximately nine miles east of U.S. 101. The Paso Robles Landfill is a relatively small operation, receiving an average of approximately 200 tons of waste per day.

The landfill has a system of extraction wells and piping for collecting methane gas generated by decomposing waste. This gas is transported to a flare, where it is burned (wasted). The landfill alone does not generate enough methane gas to justify installation of expensive equipment to use the gas beneficially, such as a cogeneration engine generator or a cleanup system capable of producing renewable natural gas suitable for export to the Southern California Gas pipeline network. In order for installation of such equipment to be economical, the landfill gas must be combined with other sources of methane.

The landfill has a modern liner system for collecting the liquid that leaches out of solid waste called leachate. Historically, the City has either spread leachate on the top of the landfill soil cover to control dust and support vegetation growth or recirculated it back into the top of the landfill. Testing required by the State of California recently revealed the leachate contains high concentrations of PFAS. All landfills in California face the same problem. The City would like to stop recirculating leachate and instead treat it to remove PFAS and other pollutants. Granular activated carbon (GAC) is commonly used to treat water for such pollutants. The City's landfill operator has pilot-tested GAC and found it to be effective at removing PFAS from the leachate.

Biochar. Biochar is a charcoal-like material produced by heating organic waste in the absence of oxygen. This process is called pyrolysis. See Figure 1 below for a close view of biochar. The material is essentially elemental carbon and has physical properties similar to GAC. The City would like to pioneer use of biochar to remove PFAS and other pollutants from landfill leachate.



Figure 1: Biochar derived from municipal biosolids, produced by a high-temperature pyrolysis process in Redwood City, California

Groundwater Issue. The greater Paso Robles area has a need to improve management of the Paso Robles Groundwater Basin. The State of California has identified the basin to be in critical overdraft and a high priority for new measures to improve groundwater management. Several local agencies have cooperated to prepare a Groundwater Sustainability Plan (GSP). There are over 40,000 acres of irrigated agriculture in the Paso Robles Groundwater Basin that are entirely dependent on groundwater. A new local source of biochar may be used to improve water retention in agricultural soils, reducing demand for groundwater, which would advance the goals of the GSP.

Available Land. The City of Paso Robles owns 132 acres of vacant land immediately south of the active landfill, fronting Highway 46 East, as shown in the figure below. The City purchased the land to create a buffer between the active landfill and any future

development in the vicinity. This land and all of the adjacent parcels are currently zoned agriculture, with a renewable energy overlay.

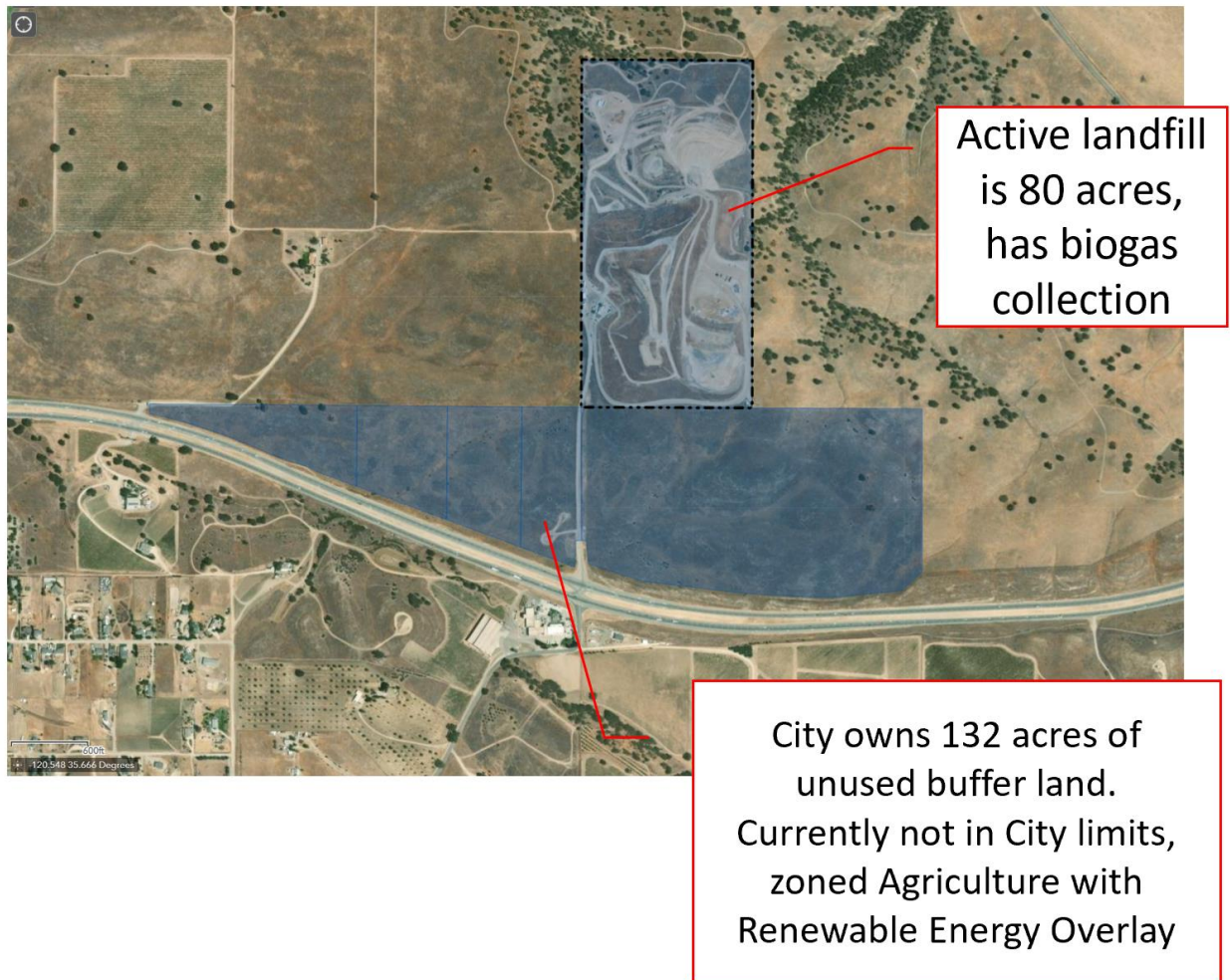


Figure 2: Vicinity of Paso Robles Landfill. Blue areas denote parcels owned by the City of Paso Robles.

Summary of City and Regional Needs. A local regional facility is needed in the greater Paso Robles area that will meet the following needs:

- Remove PFAS and other pollutants from municipal biosolids;
- Reduce trucking of biosolids out of San Luis Obispo County;
- Control biosolids disposal/management costs;
- Facility with large enough throughput to justify installation of expensive process equipment;
- Local disposal option for very high strength waste such as fats, oils, grease, winery lees, and brewery trub;
- Renewable natural gas (RNG) to fuel trash trucks and satisfy SB 1383 procurement requirement;
- Biochar to improve water retention and sequester carbon in agricultural soils;

- Biochar to treat landfill leachate and other PFAS-containing liquid; and
- Beneficial use for methane already collected from the Paso Robles Landfill.

PROPOSED PROJECT

The City of Paso Robles proposes to establish a waste-to-energy facility on approximately 20 of the 132 acres of unused City land immediately adjacent to the Paso Robles Landfill, at 9000 Highway 46 East. The waste-to-energy facility will include specialized equipment capable of processing a wide variety of organic waste streams, like shown in the figure below.

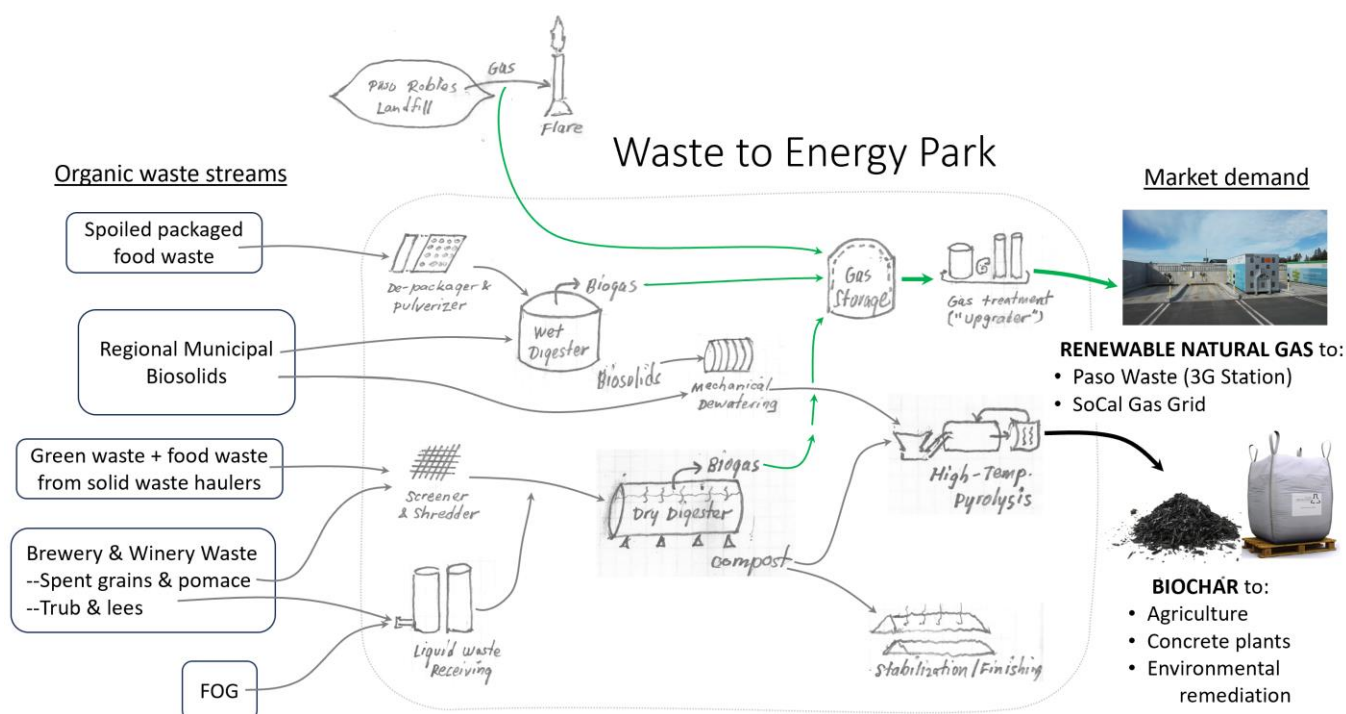


Figure 3: Conceptual Waste to Energy Park at Paso Robles Landfill.

Size. The facility will be sized to receive more than approximately 30,000 wet tons of organic waste per year. This is large enough to justify installation of expensive equipment such as screens and shredders, wet and dry digesters, high-temperature pyrolysis and/or super critical water oxidation, and a gas treatment system. The facility capacity will likely be limited to receive a maximum of approximately 200,000 wet tons per year, so that it serves only local regional needs and does not invite importation of organic waste streams from other regions of California. The City anticipates other regions of California will establish similar facilities for their regional needs. If the Paso Robles facility is one of the first to be established in California and can serve as a model for other regions, it will likely be more eligible for grant funding.

Renewable Natural Gas. There is plenty of market demand for new sources of renewable natural gas (RNG). The facility will be designed to produce and export RNG.

Landfill gas will be combined with RNG produced from organic waste. Southern California Gas Company has an existing natural gas pipeline at Geneseo Road, approximately 5,400 feet west of the project location. The City anticipates SoCalGas will extend its pipeline to the project location (separate project). If SoCalGas is unable or willing to extend its pipeline, the project may include a “virtual pipeline,” which consists of a small fleet of portable roll-off RNG tanks that are refilled at the facility and delivered directly to large RNG customers, such as Paso Waste & Recycle for fueling of their trash collection trucks. Waste haulers who enter long-term commitments to deliver their organic waste streams to the facility will be given preference for purchase of the RNG. Use of RNG may be used to satisfy the SB 1383 organic waste procurement requirement for the communities those waste haulers serve.

Many of the trucks that deliver organic waste to the facility will be fueled by natural gas. The facility may include an RNG fueling station to serve their needs. This fueling station may also serve other natural gas-fueled vehicles that pass through on Highway 46.

PFAS Destruction. The waste-to-energy facility will have a high-temperature pyrolysis process, or other technology capable of eliminating PFAS present in municipal biosolids. This equipment will greatly reduce the volume of material and produce valuable biochar. The biochar may be sold to market for a variety of uses, including as soil amendment to improve water retention and sequester carbon in soil; pigmentation; environmental remediation applications such as treatment of landfill leachate; and as a substitute for aggregate to produce carbon-negative concrete.

If biosolids throughput to the facility is sufficient to justify the relatively expensive equipment, super critical water oxidation (SCWO) may be used to destroy PFAS in biosolids. SCWO applies a combination of heat and pressure to oxidize all pollutants present in whatever media is put into the process. The waste media is completely reduced to water, carbon dioxide, and mineral ash. New companies such as 374Water are now producing SCWO systems for the water and waste sectors. If SCWO is picked to destroy PFAS in biosolids, the City would still like to have a pyrolysis process, to produce biochar from the other organic waste streams that do not contain PFAS.

Green Hydrogen. There is increasing market demand for new sources of “green hydrogen” in California, to provide a carbon-free alternative to electric vehicles. Green hydrogen is produced by routing RNG through a proprietary process containing an elemental carbon source such as biochar (carbon breaks the hydrogen atoms off the methane (CH₄) molecule). The proposed waste-to-energy facility will be master planned to include capacity for installation of a green hydrogen fueling station in the future, if and when market conditions become favorable and grant funding becomes available. The facility will be well-positioned to benefit from such grant funding, as it will have ample supplies of RNG and biochar.

Financial Considerations. Parties that send organic waste streams to the waste-to-energy facility will pay tipping fees. Revenues from tipping fees will be used to pay for construction, operation, and maintenance of the facility. The waste-to-energy facility will

be carefully designed to be economically sustainable. The City will endeavor to receive and process biosolids for a fee that is no greater than the average cost of what local agencies currently pay for biosolids hauling and disposal. The proposed facility exemplifies what the State intended with SB 1383 regulations, so will likely be eligible for State (e.g., CalRecycle) grant programs. The City will pursue grant opportunities and any grants awarded will be used to minimize tipping fees. Revenues from sale of RNG, biochar, and associated credits will help to minimize tipping fees.

Project Delivery Method. Waste-to-energy facilities are now common throughout the world, particularly in Europe. Consequently, many private entities are well-equipped to efficiently deliver a waste-to-energy facility. The City may solicit proposals from private entities to design, build, operate, and finance the waste-to-energy facility. This will be a competitive process, with selection of the private entity based on history of project delivery and performance measures such as anticipated tipping fees and capability to eliminate pollutants such as PFAS and microplastics.

Aesthetics. Much of the waste-to-energy facility will be enclosed within buildings to control odors and minimize aesthetic concerns. See an example of similar facility from Sweden in the photo below. The processing equipment will be sealed and will not emit air pollutants. Methane generated by the anaerobic digestion equipment will be collected, stored, and used beneficially off-site. Building spaces containing odorous materials will have negative pressure systems to contain foul air and route it to filters.



Figure 4: Example of a waste to energy facility in Jonkoping, Sweden. Image courtesy of Hitachi Zosen Inova.

Traffic. All municipal biosolids generated by the Cities of Paso Robles and Morro Bay are currently trucked to the Paso Robles Landfill for composting. Diverting these streams to the proposed waste-to-energy facility will cause no change in traffic flow. Much of the other organic waste that will be delivered to the waste-to-energy facility is presently trucked to composting facilities in Kern County, via Highway 46 East. Diverting this organic waste to the proposed facility will greatly reduce truck traffic on Highway 46 east of the landfill. There will be increased left turn movements by east-bound traffic into the landfill entrance road, but these left turn movements will start from the existing dedicated left turn lane, with excellent sight distance. Nearly all trucks will be returning west, so most return trips will be right-turn movements onto Highway 46 East. If increased left turn movements are a problem, this can be mitigated by directing incoming truck traffic to the right turn and underpass at Whitley Gardens, two miles east of the landfill.

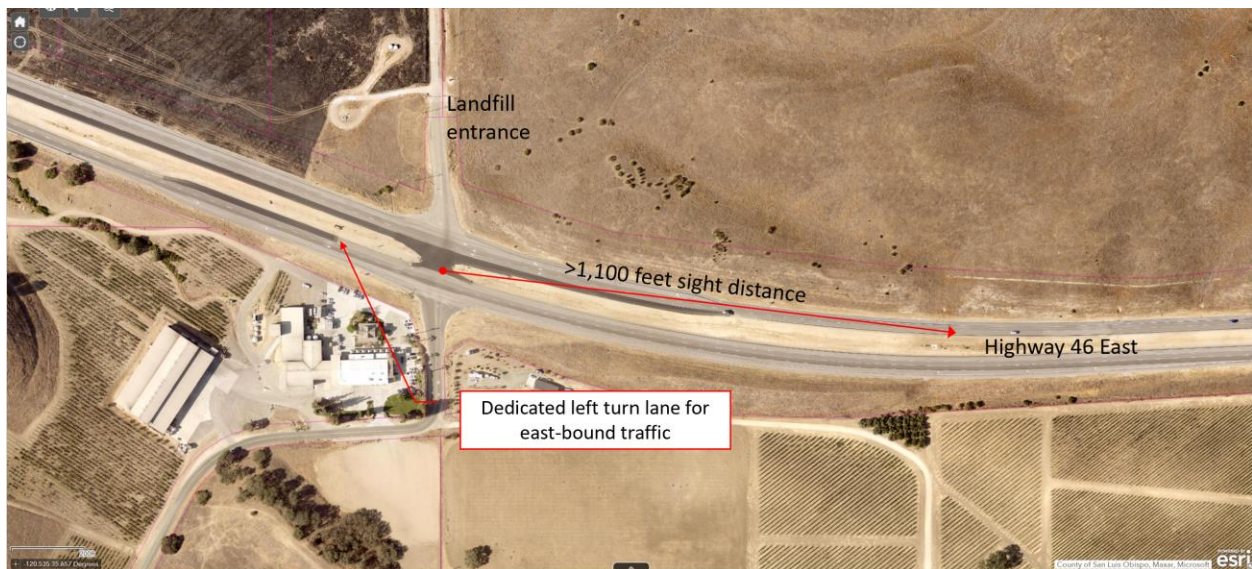


Figure 5: Entrance to Paso Robles Landfill, Highway 46 East

Timing. The City intends to solicit proposals in 2024 from private entities to design, build, operate, and finance the waste-to-energy facility. The private entity will likely be responsible for preparation of environmental documents needed to satisfy the California Environmental Quality Act and for obtaining all necessary environmental permits. The City would like to select the private entity so they may begin construction in 2025, with the goal of commissioning the facility by late 2026.

END