TO: Mayor Robert Simison
Members of the City Council

FROM: Laurelei McVey, PW Director

DATE: September 12, 2023

SUBJECT: **Analysis of Potential Public Works ARPA Funded Projects (Biosolids Dryer and Biogas Utilization)**

Background

Two Public Works related projects were identified in early discussions regarding potential utilization of ARPA funding. Key project criteria, at that early stage, included funding eligibility under ARPA, ability to be constructed in the identified timeframe (by Dec 2026), and a positive return on investment (ROI). Two projects that were identified to move forward for further analysis included a biosolids dryer and a project that would convert excess biogas produced by the WRRF's digestion process into power.

Biosolids Dryer ($5M ARPA Placeholder)

At the landfill, the City is charged to dispose of biosolids by the ton (weight based). A drying facility would reduce the weight and volume of the biosolids by removing most of the moisture. The current technology at the WRRF treats the biosolids to a level that meets all landfill regulations but is currently not treated to a level that allows for easy disposal in another manner (example: land application, compost). A drying facility would produce biosolids that could be disposed of in other manners, if desired.

As part of this analysis, two types of dryers were analyzed- a thermally enhanced solar greenhouse dryer (solar dryer) and a low-temperature thermal belt dryer. These dryers were evaluated based on the following criteria:

- Ability to meet dryness requirements year round
- Initial capital equipment costs
- Building/piping/utility costs
- Siting constraints
- Ongoing O&M (including staffing requirements)
- Expandability

A thermally enhanced solar biosolids dryer is a newer, innovative process for enhancing greenhouse drying. It uses stainless steel floor plates for heat transfer and external sources of heat can be added which accelerate the drying process. This modification reduces the footprint and cost of the greenhouse, and using external heat sources allows for more consistent operation overnight and seasonally. Digester gas that is currently flared would be used as the primary external heat source in times when solar energy is lower. An evaluation of Meridian's year-round climate and solar patterns were also evaluated to ensure this type of dryer could be used effectively. Some additional benefits of these systems are that they are simple to operate, do not require an additional building, and require minimal staffing/operational costs.

Thermal drying systems typically employ conductive and/or convective heat transfer processes. Belt type dryers rely on convection using hot air to evaporate water. This type of dyer would require an additional boiler to provide a heat source (digester gas would be used to heat this boiler) and would require the construction of a building to house the engine and boiler equipment. Because this system is mechanically more complex, it does require a higher level of staffing and maintenance than a solar dying application.

While both technologies are capable of achieving the desired dryness and both would fit on-site, the significant difference in initial capital costs and staffing requirements led to the recommendation of the solar dryer for further return on investment (ROI) analysis.

Alternative 1: solar greenhouse dryer	Alternative 2: thermal belt dryer
Estimate: $3.8M Range (-30% to +50%): $2.7M to $5.8M	Estimate: $10.7M Range (-30% to +50%): $7.5M to $16.0M

The costs presented above are high level estimates of capital project costs. They do not include engineering costs (~20% of project cost). The solar dryer with engineering costs added would likely fall in line with the City's $5M ARPA project budget.

	Alternative 1: Solar Greenhouse Dryer
Estimated Construction Cost	$3.8M (range $2.7-$5.8M)
Estimated Engineering Costs (~20%)	$0.8M (range $0.6-$1.2M)
Total Project Estimated Costs	**$4.6M (range $3.3-$7.0M)**

It is anticipated that the ARPA schedule constraints could also be met. Design and construction of the solar dyer is estimated to be completed by early 2026 if design is started in the fall of 2023.

ROI

It is anticipated that the solar dryer will reduce the mass of the solids by 4:1, reducing the hauling trips and disposal costs at the landfill. The City currently spends approximately $315K on biosolids disposal alone (not including hauling costs). For the ROI, all hauling costs were evaluated with the City self-hauling its biosolids which is projected to start in February 2024. In FY22 the City Council approved a budget amendment for the Department to pursue self-hauling

to save costs. The truck and trailer, as anticipated, had a very long lead time. The Department is anticipating final delivery of this equipment in January 2024.

In FY23 the Ada County Landfill raised its rates from $29/ton to $32/ton. Additional increases have been proposed in the near future (potentially to $36/ton in FY25).

At $36/ton, it is anticipated that the City would save approximately $237,000 annually on disposal costs and $55,000 annually on self-hauling costs. Additionally, by treating the biosolids to Class A, the City would have the opportunity to investigate other disposal options such as land application and composting, that have previously been more challenging. These alternative disposal option may become even more important as future regulations and capacity concerns continue to exist at the county landfill.

Table 7. Benefits, Simple Payback, and ROI

Category	Item	Base Scenario
Summary Benefits	Annual net benefit	$243,154
	20-year benefits	$4,863,079
	Capital cost	$3,800,000
	Simple payback	15.63
	20-year ROI	28%

Biogas Utilization ($1.5M ARPA Placeholder)

This proposed project evaluated the design and installation of a facility that would convert the excess biogas produced at the facility into electrical power that would offset some of the facility's power costs. Biogas is a natural biproduct of the anaerobic digestion process that the WRRF uses to treat the solids at the WRRF. Currently approximately 40% of the gas produced is used to heat the facility's digesters and approximately 60% of the facility's biogas is flared to the atmosphere.

Unfortunately, the cost of the capital equipment needed to condition and utilize the biogas in an engine generator is higher than originally anticipated. Because biogas is a rather dirty fuel source (high in H_2S, moisture, and siloxanes), additional equipment is needed to condition the gas prior to use. A building must also be constructed to house the engine equipment and boiler.

Cost Component	Alt 0 Status Quo	Alt 01 500kW Engine (Siemens)	Alt 02 408kW Engine (CAT)	Alt 03 335kW Engine (Jenbacher)	Alt 04 633kW Engine (Jenbacher)
Gas Conditioning	-	$0.9 M	$0.9 M	$0.9 M	$0.9 M
Engine	-	$0.9 M	$1.5 M	$0.7 M	$0.8 M
Installation Cost	-	$ 2.7 M	$ 3.5 M	$ 2.3 M	$ 2.5 M
Total Construction Cost	-	$ 4.5 M	$ 5.9 M	$ 3.9 M	$ 4.2 M
Soft Cost	-	$ 1.1 M	$ 1.5 M	$ 1.0 M	$ 1.0 M
TOTAL Project Cost [a]	-	$ 5.6 M [b]	$ 7.4 M [c]	$ 4.9 M [d]	$ 5.2 M [e]

a. *Soft cost assumed to be 25 percent of total construction cost, which includes design and contingency cost.*
b. *-50/+100 cost rounded, $3M/$11M*
c. *-50/+100 cost rounded, $4M/$15M*
d. *-50/+100 cost rounded, $2M/$10M*
e. *-50/+100 cost rounded, $3M/$10M*

Because the equipment for biogas conversion is complex, a full time FTE would also likely be needed.

The biogas system could produce approximately $142K-$232K in annual power savings.

The results of the biogas-fueled cogeneration evaluation indicate that continuing to use biogas in boilers for process and facility heating is more economical than purchasing and operating a new engine generator-based cogeneration system. The anticipated energy savings do not outweigh the high capital cost. Electrical costs continue to remain low in Idaho ($0.065/kWh). As electrical costs change in the future (above $0.20/kWh), this type of system should be reevaluated.

Recommendations

It is recommended that the City commit to the utilization of $5M to the Biosolids Dryer project and begin design efforts as soon as possible. This project would be anticipated to be constructed by January 2026.

It is recommended that the City discontinue efforts on the biogas project and reallocate the $1.5M ARPA placeholder funding to another project.