MEMO

Presentations
Item #: 6b

Meeting Date: April 19, 2024

To: Board of Directors
From: Director of Engineering & Compliance, Guy R. Petraborg
Approved by: Felipe Melchor, General Manager

Subject: Presentation of GHD's Summary Report of the Joint Feasibility Study

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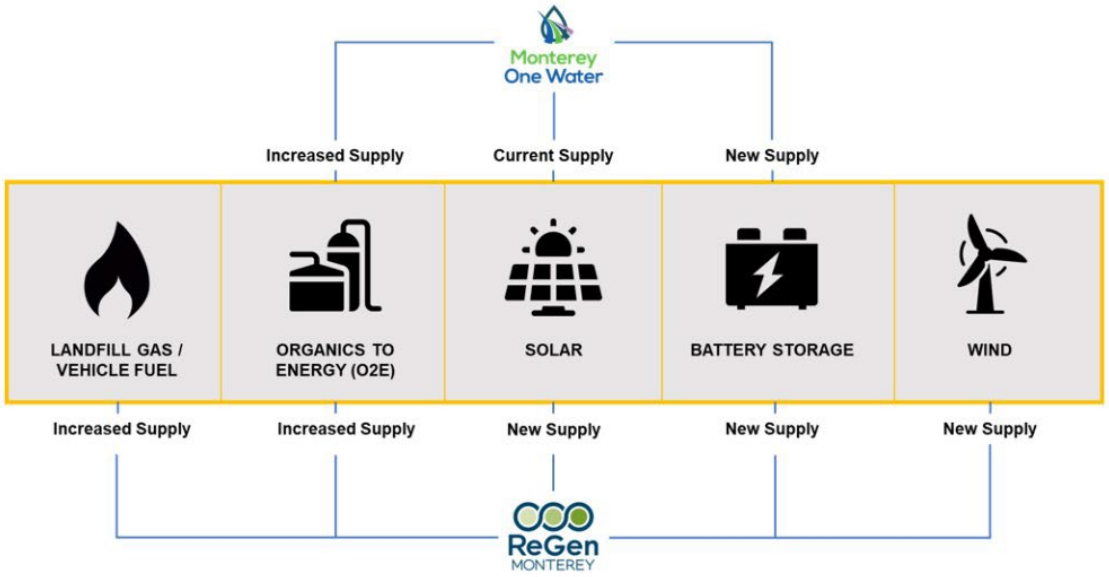
RECOMMENDATION: INFORMATION ONLY - Staff and Joint Agency (M1W/ReGen Monterey) representative Derek Wurst of Black & Veatch will provide a short presentation of the Feasibility Study Summary Report that was prepared under a professional service contract for the joint agencies (M1W/ReGen Monterey) by GHD. No Board Action proposed nor to be taken.

BACKGROUND

In late 2017, the ReGen Monterey ("ReGen") Board of Directors approved the vision of a joint study between ReGen and Monterey One Water (M1W) that would assess the 'highest and best use of wastes and waste by-products' of the two agencies in a collective and collaborative manner to define the feasibility of potential business opportunities for the agencies, jointly and/or separately, that would improve the reliability and/or sustainability of the critical 24/7 public works services and environmental protection roles that the agencies provide to the communities they serve. The Board directed ReGen staff to i) engage M1W on the feasibility study vision, ii) establish a joint Ad Hoc Committee to represent the two agency Boards during the feasibility study, iii) jointly prepare a Request for Proposals (RFP) to solicit consultants for the feasibility study, iv) recommend the selection of a consultant or consultant team to complete the feasibility study, v) receive approval of both agency Boards to award a professional services agreement to the selected consultant or consultant team, and vi) conduct the joint feasibility study and report back to the Board on findings of the study. The following is an approximate timeline of those tasks:

- Spring 2018, begin promotion of feasibility study vision to M1W
- Fall 2021, joint Ad Hoc Committee formed by the agencies
- Summer 2022, RFP for Feasibility Study issued
- Fall 2022, GHD selected and awarded a contract for the Feasibility Study
- 2023, GHD starts work of Feasibility Study tasks
- Spring 2024, presentation of GHD Summary Report findings for the Feasibility Study

The feasibility study vision is graphically represented below and generally describes organic wastes being received by the agencies, that waste being anaerobically digested in the landfill or a closed vessel (tank), biogas being created by the decomposition, use of the biogas to generate power and create heat for beneficial reuse, conditioning of biogas for pipeline injection and/or alternative vehicle fuel, and use of natural resources of solar and/or wind to generate power and allow for energy storage to gain reliability of an integrated electrical network connecting the two facilities.



DISCUSSION

Monterey One Water (M1W) and ReGen Monterey (ReGen) are public agencies that manage wastewater and non-hazardous solid wastes, respectively. These two entities, together called "the Agencies," serve similar constituencies along the central coast of California and provide essential public services that need reliable and affordable power. As neighbors, they have established a visionary partnership for this Feasibility Study and its assessments for a Monterey Renewable Energy and Electrical Utility Reliability Study that would leverage infrastructure and resources and secure the energy resilience their critical public works operations require.

The first phase (this feasibility study) is an initial planning stage and has been focused on an electrical base-case scenario, in which M1W's and ReGen's power generation facilities can be interconnected so the Agencies' electrical networks can support each other's electrical loads and operate independently of the utility power grid in "island mode" when utility power is not available or is unreliable. For the purpose of the Feasibility Study, this electrical base case scenario assumes that a clean food waste slurry would be used for co-digestion in M1W's anaerobic digesters to produce additional biogas.

The Agencies identified the following guiding principles for use by GHD for this study:

- Provide a safe and secure power distribution system
- Achieve operational resilience
- Maintain and improve energy reliability
- Provide power from sustainable sources
- Achieve energy independence from the serving utility
- Make best and greatest use of biogas
- Reduce facility operational energy costs
- Support State and Federal initiatives to create a cleaner and safer environment
- Contribute to the health and safety of the community
- Reduce regional greenhouse gas (GHG) footprint
- Increase revenue from ReGen's onsite landfill gas fueled power generation system
- Preserve landfill capacity by redirecting organics to non-disposal processing facilities

PRESENTATION

The Summary Report prepared by GHD for the Joint Feasibility Study consists of six main chapters that are supported by technical detailed appendices:

#	Chapter	Supporting Appendices of GHD Summary Report
1	Introduction	
2	Base Case Electrical Network	• Appendix F: Electrical Network Base Case Study
3	Co-Digestion Processing of Organics	• Appendix A: Existing Conditions Assessment • Appendix B: Organic Waste Characterization • Appendix C: High-Solids Organic Waste Processing
4	Biogas Utilization	• Appendix E: Biogas Utilization Study
5	Biosolids Management	• Appendix D: Biosolids Management
6	Path to Implementation	• Appendix G: Permitting Considerations

The reporting structure has been modified since the initial scope to provide better organization of the technical content in a series of reports that work together to form the overall study.

The following sections provide a synopsis of the key results of GHD's assessments for the study.

Chapter 2: Base Case Electrical Network

In general alignment with the guiding principles, the Agencies have identified a base case study configuration that would allow their electrical networks to operate together or independently of each other, either while connected to the electrical utility or independently ("island mode") from the electrical utility.

The key characteristics of the selected base case electrical network study include:

- An initial 21kV connection between ReGen's power generation facility and M1W's AWPF operations (original design modifications and construction of this project is already in progress). M1W ultimately intends to connect the SVRP, the Regional Treatment Plant (RTP) and its cogeneration facilities to the initial 21kV ReGen and AWPF power connection. Integrates SVRP pond controls and PWM radio system into the SVRP power distribution system for power redundancy and consolidation of utility services.
- Transitions the existing PG&E service to the AWPF, SVRP facilities, SVRP pond controls, and PWM radio network from a primary service to more of a secondary service for power supply. The new 21 kV connections at the AWPF and SVRP facilities are connected to the existing PG&E service connections at the AWPF and SVRP main switchgear points of connection.
- In this option power is provided by ReGen to AWPF Facility, and M1W cogeneration facilities can be connected with ReGen's power generation system via the connection at the AWPF, functioning as "Nested Electrical Networks". Expands resilient operational concept to ReGen, AWPF, RTP, SVRP, SVRP pond controls, and PWM radio network when all are connected.
- Potentially reduces operating energy costs for the AWPF, SVRP, and potentially RTP facilities if ReGen sells power to M1W.
- Adds resiliency to ReGen and M1W (AWPF, SVRP, and RTP) facilities. Both facilities can provide limited support to each other's power needs in an emergency.

The main infrastructure requirements for the base case electrical network study in which the Agencies can provide limited support to each other's electrical loads and operate independently of the grid in an "island mode" include:

- new gensets (1.6 MW, varies from 4 to 7 over time as facility connected is phased in), associated building expansion, electrical equipment and electrical network controls at ReGen
- new combined heat & power (CHP) units (4 x 1.5 MW), associated new building, electrical equipment and system controls at M1W (assumes 3 units online and 1 unit on "standby")
- 21kV AWPF interconnections to SVRP and RTP (ReGen to AWPF as the initial 21kV connection)
- potential future battery energy storage system (BESS)
- potential new solar photovoltaic (PV) (not including buyout of existing Tesla owned and operated PV system)

The total estimated capital investment for the base case electrical network is $131M, which can be phased over time. Some of these projects are optional and/or can be combined as part of a development strategy.

Chapter 3: Co-Digestion Processing of Organics

M1W has received a CalRecycle grant and procured some equipment (polishing system, buffer tank and new mixers in each of the fo ur digesters) that, in part, could enable co-digestion of up to 38,400 gallons per day (gpd) of an organic slurry containing 12.6% total solids (TS), with volatile solids (VS) being 88% of TS. Per Agencies' direction, this initial feasibility study assumed a clean food waste slurry would be available for co-digestion per the planned project under the grant and thus digester gas production would increase from about 370 standard cubic feet per minute (scfm) to 700 scfm on average (normalized at 50% methane content).

Based on capacity of the upgraded digesters, M1W could accept the anticipated additional organic waste for co-digestion when all four digesters are online. When only three digesters are in operation (for example during digester cleaning), there would not be sufficient digestion capacity during maximum municipal load month to maintain a solids retention time (SRT) greater than 15 days, and therefore would not meet the anaerobic digestion (AD) stabilization criteria required to achieve Class B biosolids for land application. However, Class B criteria might not be required if post-treatment such as drying or advanced thermal treatment is implemented. Potential mitigation measures also include implementing recuperative thickening to meet the 15-day SRT requirement or manage the digester cleanout during periods outside of maximum month loads. This could be achievable given that M1W cleans out their digesters approximately every 5 years and it reportedly takes 2 months or so to complete grit cleaning of a digester.

In addition to potential digester capacity limitations, co-digestion of organics at the M1W RTP triggers several other plant improvements, including improved digester mixing (already being procured as part of the co-digestion project), solids thickening, digester heating, biogas handling, storage & uses, improved dewatering and additional dewatering side-stream treatment.

The estimated capital investment required for steam piping replacement & a new boiler, biogas handling & storage, and ammonia side-stream treatment is $28M, with an additional $3M for solids thickening (optional).

Depending on how the Agencies decide to source the organics for co-digestion, a preprocessing system will be required to create a clean organic slurry. Preprocessing requirements vary greatly depending on the source of the organics (e.g., contamination level). **At this stage of the feasibility study assessment, the investment required for onsite preprocessing of organic solids such as food scraps to create an organic slurry suitable to a co-digestion treatment process is estimated at around $43M.**

Chapter 4: Biogas Utilization

The biogas utilization analysis only considers excess biogas available after the needs of the base case electrical network are met (e.g., biogas utilization for electricity generation by ReGen's and M1W's power generation facilities). It also assumes ReGen's landfill gas (LFG) collection system would be progressively expanded and maintained to maximize LFG collection, and M1W's digester gas would increase between 2024 and 2028 with the ongoing codigestion project.

Total biogas (M1W digester gas + ReGen LFG) collected is expected to increase from about 2,600 scfm currently to 3,800 scfm by 2040.

For the base case electrical network, 700 scfm digester gas from M1W would be converted into electricity and heat through CHP engines (3 units online and 1 unit on "standby") to supply some of M1W's energy needs and 1,100 scfm LFG would be converted into electricity through 4 to 7 new gensets (increases over time) to supply ReGen's electrical needs and M1W's remaining electrical needs.

After the biogas quantity for base case electrical network requirements are met, there is approximately 1,000 scfm excess LFG initially (2026), increasing to over 1,900 scfm in 2040.

Based on a high-level technology review and discussion with the Agencies, three scenarios were evaluated for utilizing excess biogas:

- **Scenario 1: Electricity Generation** – Additional gensets to generate more renewable electricity for continued distribution to the grid and sale into the California Independent Service Operator (CAISO) network (3 to 4 x 1.6 MW). Assumed average selling price of $0.1045/kWh based on 2022 data.
- **Scenario 2: Renewable Natural Gas (RNG) Production** – Upgrading of excess LFG to RNG pipeline quality for injection into PG&E gas grid (about 450 initially in 2026 to over 800 scfm RNG in 2040). PG&E's preliminary screening study (December 2023) confirmed that the natural gas distribution pipeline crossing ReGen property can accommodate more than the full RNG potential that is expressed here for this scenario.
- **Scenario 3: RNG and Renewable Compressed Natural Gas (R-CNG) Production** – Upgrading of excess LFG to RNG pipeline quality for injection into PG&E grid + LFG to R-CNG with a new vehicle fueling station assumed equivalent in size to the existing CNG station at ReGen (120 scfm of LFG, i.e., 60 scfm R-CNG) and location to be determined in the future. Alternatively, ReGen can explore supplying the gas to Trillium's existing onsite CNG fueling station

When distributing RNG via PG&E pipeline, there are three main options for securing RNG revenue:

- Selling the RNG as vehicle fuel (R-CNG) to fueling stations (D3 RINs and LCFS credits = $9,460 per year per scfm LFG, or $39 per MMBTU)
- Participating in the utilities (e.g., PG&E, SoCalGas) biomethane procurement program (PG&E Biomethane Tier Program = $4,250 to $6,520 per year per scfm, or $18 to $26 per MMBTU)
- Selling the RNG to one or several large gas users looking to lower their carbon footprint (LFG with carbon intensity around 50 kgCO2e/MMBTU = $4,800 to $8,400 per year per scfm LFG, or $20 to $35 per MMBTU)
- There are evolving state and federal regulations and programs that may support or hinder RNG developments. However, the RNG market in California is still expected to be strong at least in the next ~15 years.

Based on the estimated capital investment required, operational costs and potential revenues, as well as other evaluation criteria, such as reliability, complexity, modularity, and greenhouse gases emissions reduction, **Scenario 2: RNG Production ranked the highest. The estimated investment required for biogas upgrading to RNG is $67M**. Total operations costs between 2026 and 2040 are estimated at $60M and total potential revenues are estimated at $224M (including revenues generated through the sale of RINs and LCFS credits). If the Agencies want to reduce market risk, a contract with the utilities (e.g., PG&E) or another long-term off-taker should be considered – revenues would be reduced but reliable for a set contract term.

Chapter 5: Biosolids Management

M1W's wastewater treatment solids are currently managed via anaerobic digestion (3 digesters in service) followed by dewatering with screw presses. The screw presses are approaching end of useful life and are underperforming; they only produce a 16% TS cake (instead of typical 25% TS). The dewatered biosolids are then placed in sludge drying beds followed by landfill disposal at ReGen. Current biosolids quantities produced by M1W are about 7,200 dry tons per year on average. With the added organic waste for co-digestion, biosolids quantities would increase to about 9,200 dry tons per year (28% increase) under the same dewatering performance metrics (16% TS cake, and 90% solids capture in concentrate).

Depending on the dewatering and advanced thermal treatment technology used, the following quantities of material could be produced:

- Improved dewatering only: About 40,000 wet tons/year of dewatered cake at 25% TS, or
- With added thermal drying step after dewatering: About 10,000 tons/year of pellets at 95% TS, or
- With added pyrolysis after drying: About 7,000 tons/year of biochar.

M1W's biosolids samples have shown higher concentrations of certain PFAS compounds than "high" values seen in the industry. This issue might be exacerbated in the future with organics co-digestion as food waste packaging are often a source of PFAS or PFAS-precursors and may not be completely removed in the pre-processing operations to produce an organic slurry.

PFAS are generally untreated during widely used stabilization technologies such as anaerobic digestion, drying and composting. Advanced thermal treatment (e.g., pyrolysis) has shown promise in managing PFAS in biosolids. **As M1W wants to address PFAS, it is recommended to focus on dewatering improvements as an initial step as it would be required for any future drying and advanced thermal treatment technologies.** Dewatering would also reduce hauling costs in the near future for any offsite solutions.

Based on the study's assessment, there is regional land available to support land application for the foreseeable future, whether the product is applied in liquid or cake form. However, costs for land application are increasing and market development efforts in collaboration with the agricultural sector will be required.

Based on the above analysis, the following biosolids management approach is proposed:

- Phase 0 (immediate term) – Agreement with third party in order to find an alternative to landfilling biosolids by January 1, 2025 as driven by current organic waste landfill diversion regulations (any onsite solution will typically take longer than two years).

- Phase 1 – Dewatering improvements (e.g., centrifuges) to achieve 25% TS cake dryness and increase the flexibility of options available for further thermal treatment after dewatering. **The estimated capital investment for dewatering improvements is $28M**.
- Phase 2 – Potential drying step to allow potential advanced thermal treatment in the future, reduce operating costs (no haulage costs) and generate pellets which currently have market demand and somewhat address PFAS as less quantities are needed to land apply for the same nutrient value thus lowering potential PFAS release to the environment. **Capital investment for drying is estimated at $46M**.
- Phase 3 – Potential advanced thermal treatment (e.g., pyrolysis) if PFAS become an immediate concern such as through legislative changes. **Capital investment for advanced thermal treatment is estimated at $19M**.

Some of the phases are optional and/or can be combined as part of a development strategy.

Chapter 6: Path to Implementation

The table below summarizes the preliminarily estimated capital investment required for the proposed infrastructure under each of the major project components. As shown in the table ("key triggers for implementation" column), there may be opportunities to phase in the investment.

Study Component	• Brief Description	Estimated Capex Plus*	Key Triggers for Implementation
• Base Case Electrical Network		$131M	
ReGen system improvements	• 7 x 1.6 MW new gensets (6 operating + 1 standby), • new emergency genset to allow black start, • associated genset building expansion to house 3 x 1.6 MW gensets and the emergency genset (4 x 1.6 MW generators could be installed on the existing pads in the genset building), • associated electrical equipment and electrical network control systems	$33M	• Installation of the 21kV electrical intertie to the planned ReGen CASP Composting Facility and the M1W AWPF
M1W system improvements	• 4 x 1.5 MW new digester gas fueled CHPs (3 operating + 1 standby) – these would replace the current CHPs that are past their useful life, • associated new CHP building, • associated electrical equipment and electrical network control systems	$49M	• Downward trend of CHP unit reliability

21 kV SVRP and AWPF interconnections	• 21 kV power interconnections for RTP, SVRP and AWPF sites.	$8M	• Completed construction of RTP 21kV switchgear replacement
Potential future battery energy system storage (BESS)	• New BESS to support operation in an islanded configuration. The BESS can be installed at two separate locations (e.g., 3 MW/15MWh BESS east of the biosolids drying beds and 1.7 MW/8.5 MWh near the existing SVRP PV solar array) but would be able to operate as a single unit.	$25M	• Replacement of CHP units
Potential future solar PV	• New and optional solar PV to supplement grid power and used as an energy source to charge the BESS. In addition to current Tesla solar PV facility.	$17M	• Additional solar can be developed in the future, for example when grant funding is available
• **Co-Digestion Infrastructure**		**$74M**	
Organic waste pre-processing	• Preprocessing system to create a clean organic slurry for co-digestion with sludge in M1W digesters	$43M	• Depending on how the Agencies source the organic waste for co-digestion
RTP plant improvements – Phase 1	• Steam piping replacement & new boiler, • Biogas handling & storage, • Ammonia side-stream treatment	$28M	• Triggered by the ongoing co-digestion project
RTP plant improvements – Phase 2	• Recuperative thickening to maintain 15-day solids retention time (SRT) when one digester is offline (e.g., during digester cleaning). 15-day SRT is only needed to achieve Class B biosolids for land application	$3M	• May not be needed depending on biosolids management option selected or if M1W can undertake digester cleaning outside of the maximum month period. If 15-day SRT is needed, then recuperative thickening needs

			to be implemented before the first digester cleanup.
• **Excess Gas Utilization**		**$67M**	
Landfill gas to pipeline (ReGen)	• Landfill gas upgrading equipment to meet pipeline quality requirements. Able to accommodate 2,000 scfm capacity. Operating at 1,000 scfm initially and ramping up to 1,900 scfm by 2040 as biogas production increases.	$67M	• Main revenue potential to help support the overall required investments.
• **Biosolids Management**		**$93M**	
Dewatering improvements	• New equipment (sludge pumping, centrifuge, polymer preparation & feed) to improve dewatering performance to at least 25% and increase the flexibility of options available for further thermal treatment after dewatering.	$28M	• Highly recommended to enable alternative pathway to biosolids landfilling
Potential future drying	• Potential thermal drying step (rotary drum dryer or similar creating uniform pellets)	$46M	• Allows potential advanced thermal treatment in the future, reduce operating costs (no haulage costs) and generate pellets which currently have market demand and somewhat address PFAS as less quantities are needed to land apply for the same nutrient value thus lowering potential PFAS release to the environment
Potential future advanced thermal treatment	• Potential advanced thermal treatment (e.g., pyrolysis or gasification)	$19M	• If PFAS concern caused by legislative changes, or if

			market or grant opportunities
• **TOTAL – Preliminary Budget Characterization**		**$365M**	ReGen ($100M) M1W ($265M)

** Capex Plus includes Design Contingency (10%), Sales tax on materials (7.75%), General conditions (8%), Bonds and insurance (2%), Overhead and Profit (15%), and Accuracy for Class V estimate (30%)*

FINANCIAL IMPACT

None. This presentation is for "Information Only". No Board Action is proposed and none is to be taken for this agenda item. The work included in the presentation was accomplished under an existing professional services contract that was approved by the respective joint agency Boards of Directors. No changes, new commitments, or other financial impacts are proposed nor inferred by making this presentation.

CONCLUSION

None. This presentation is for "Information Only". No Board Action is proposed and none is to be taken for this agenda item.

ABBREVIATIONS

AD	Anaerobic Digestion
AWPF	Advanced Water Purification Facility
BESS	Battery Energy Storage System
CAPEX	Capital Expenditures
CHP	Combined Heat and Power
CPRG	Climate Pollution Reduction Grants
kV	kilovolt
kW	kilowatt
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
LCFS	(California) Low Carbon Fuels Standard
M1W	Monterey One Water
MW	Megawatt
PFAS	Per- and Polyfluoralkyl Substances
PG&E	Pacific Gas & Electric (gas and electric utilities)
PV	Solar Photovoltaics
PWM	Pure Water Monterey
R-CNG	Renewable Compressed Natural Gas
Regen	ReGen Monterey
RIN	Renewable Identification Number
RNG	Renewable Natural Gas
RTP	Regional Treatment Plant
SB1383	California Senate Bill 1383 Lara, Chapter 395,
scfm	Standard Cubic Feet per Minute
SVRP	Salinas Valley Reclamation Project
tpy	tons per year
TS	Total Solids