waterenergy INNOVATIONS

# SCORING EXAMPLE 2

**Candidate Technology: Food & Beverage Water Recycling/Reuse**

**Technology Description:**
Several technologies are available today that enable cost-effective on-site recycle/reuse of Food and Beverage (F&B) process water. One very interesting technology uses proven physical-chemical processes to efficiently remove solids from F&B process water effluent. When combined with advanced filtration and disinfection, a high quality water resource is produced.

**Key Technology Attributes:**

## Strong fit with State policy goals

This technology helps to achieve the following state policy priorities:

1. Increases long-term drought resilience by:
   a. Increasing recycled water production and use;
   b. Reducing potable water demand by reducing water purchases, surface and/or groundwater withdrawals (by the adopter and/or by its municipal water and wastewater utilities).
2. Increases electric reliability through a combination of energy efficiency, demand reduction, and the potential to increase renewable distributed generation (bioelectricity).
3. Improves environmental quality and climate action by:
   a. Reducing GHG emissions; and
   b. Reducing adverse impacts of effluent discharges on species and ecosystems.
4. Increases biogas production, capture and use.

## Significant resource, economic and environmental benefits accrue to all key stakeholders

| STAKEHOLDER | RESOURCE | ECONOMIC | ENVIRONMENTAL |
|---|---|---|---|
| | | **ACTOR** | |
| **Adopter** | ▪ New water resource (recycled)<br>▪ Reduce water purchases<br>▪ Increase biogas production | ▪ Reduce water<br>▪ Reduce WW discharge costs | ▪ Reduce GHG emissions<br>▪ If discharges effluent to the environment: reduces quantity and improves quality |
| | | **IMPACTED STAKEHOLDERS** | |
| **Water Utility** | Reduced water demand | Reduced cost of water resources, demand on water infrastructure, electric use, and capital and operating costs | Reduced environmental impacts attributable to water pumping, treatment and delivery |
| **Wastewater Utility** | Reduced WW treatment load | Reduced demand on WW infrastructure, electric use, and capital and operating costs | Reduced environmental impacts attributable to wastewater collection, treatment and discharge |
| **Electric Utility** | Reduced electric demand (kWh and kW) attributable to water and WW; potential increase in renewable resource (bioelectricity) | Reduced demand for electric resources and on electric infrastructure, reduced capital and operating costs | Reduced environmental impacts attributable to electric generation and delivery |
| **Gas Utility** | Potential increase in renewable gas production | | |

The resource and economic benefits realized by each impacted utility (water, wastewater, electric, and gas) would flow to their respective ratepayers.

### Manageable costs and risks

One technology solution evaluated for this project produced substantial resource and economic benefits that resulted in estimated paybacks less than 3 years. There are few risks, and the primary operating risk – that the technology might fail, resulting in untreated effluent – can be managed by discharging any untreated effluent to the wastewater utility during the system outage.

**Technology Readiness:**
Physical/Chemical treatment is a proven technology. Although products in this category are undergoing continual improvement, the basic technology is not likely to become obsolete in the foreseeable future. Much more R&D is also being conducted on the water purification portion of these systems that uses a fair amount of electricity. Many market entrants are seeking new ways to perform ultrafiltration that is energy efficient and requires less frequent replacement of the filters.

## SAMPLE BENEFITS SCORE SHEET:
## FOOD & BEVERAGE WATER RECYCLING/REUSE

| Weighted Score | Score | Factor | Basis for Score |
|---|---|---|---|
| | | **DROUGHT RESILIENCE** | |
| @ 35% = 1.75 | 5 | ↑ Water Supplies | Enables Recycle/Reuse of Substantial Quantities of Water (80-90+% of F&B process water has been documented). |
| | 5 | ↑ Water Quality | Water purification (ultrafiltration and disinfection) creates a high quality recycled water resource. Depending on the level of treatment, effluent can be treated to levels comparable to that of potable water. |
| | 5 | ↑ Water Use Efficiency | By substantially increasing on-site recycle/reuse, demand for potable or "fresh" water is reduced by the amount of water recycled/reused. |
| | 5 | ↑ Water Recycling/Reuse | This technology helps to meet California's recycled water policy goals. |
| | **5** | **Avg Score** | ***Drought resilience can be significantly enhanced by substantially increasing both the quantity and the quality of recycled water production and use.*** |
| | | **ELECTRIC RELIABILITY** | |
| @ 25% = 0.6875 | 2 | ↓ Electric Consumption (kWh) | Direct: Reduces the amount of electricity needed to treat comparable wastewater (WW) quantities and quality vs. conventional centralized biological wastewater treatment.<br>Indirect (Embedded): Avoids electric consumption that would otherwise have been needed to produce the water that is now being saved by using recycled water instead (e.g., electricity saved from avoided surface or groundwater pumping, treatment, and distribution). |
| | 3 | ↓ Electric Demand (kW) | Direct: Reduces electric demand associated with avoided use of blowers and other high electric intensity equipment and processes that would have been needed for conventional WW treatment.<br>Indirect: Reduces the amount of electric demand not needed to produce, treat and distribute the water that is now being saved. |
| | 4 | ↑ Clean/Renewable Distributed Energy Production (kWh/kW) | Separating/collecting biosolids at the beginning of WW treatment (vs. at the end, as is typical during conventional WW treatment) preserves the energy value of the biosolids and increases biogas production. The incremental biogas can be used to produce renewable distributed bioelectricity and/or other valuable energy products. Biogas increases of 300+% have been documented.) |
| | 2 | ↑ Demand Response (kW) | Depending on the volume of WW to be treated, treatment can sometimes be deferred during periods of high electric demand. |
| | **2.75** | **Avg Score** | ***Electric benefits are significant when measured on a holistic basis: i.e., the quantity of electric energy and demand that can be saved by replacing conventional WW treatment plus "embedded" kWh and kW saved by substantially reducing potable water demand.*** |
| | | **ENVIRONMENTAL RESPONSIBILITY** | |
| @15% = 0.4125 | 5 | ↓ GHG Emissions | Direct: Increases capture and opportunity for beneficial use of biogas, thereby reducing GHGs emitted throughout the WW treatment cycle).<br>Indirect: Reduces electricity related GHGs attributable to avoided electric consumption for both water production, treatment and distribution, and for wastewater treatment. |
| | 0 | ↑ Carbon Sequestration | Does not increase carbon sequestration. |
| | 4 | ↑ Biogas Production, Capture & Use | Increases biogas production, capture & use. |
| | 2 | ↓ Adverse Impacts on Ecosystems | May have beneficial impacts on ecosystems:<br>▪ If the quality of any treated effluent discharged to the environment is improved, and/or<br>▪ If the volume of treated effluent discharged to the environment is reduced. |

| Weighted Score | Score | Factor | Basis for Score |
|---|---|---|---|
| | | | Note: *Depending on the unique circumstances of the affected ecosystems, impacts may or not be deemed beneficial.* |
| | **2.75** | **Avg Score** | ***The primary anticipated benefits are reductions in GHG emissions and increased biogas production; some benefits may also accrue to ecosystems but it depends on the ecosystem's unique circumstances.*** |
| **SOCIO-ECONOMIC IMPACTS** | | | |
| | 3 | ↑ Jobs (Local & Statewide) | Could increase jobs if markets are created for these products and at least some of the manufacturing, assembly, installation, and/or maintenance is performed in California. |
| | 4 | ↓ Water &/or Energy Costs | Technology Adopter: Reduces purchased water costs.<br>Electric Utility: May realize cost reductions due to net reduction of electric demand (kWh and kW), and potential increases in renewable distributed generation (e.g., bioelectricity) that enable deferring or reducing investments in new electric resources and/or infrastructure.<br>Water/WW Utilities: Customer-side investments that reduce water demand and either defer or reduce need for municipal water and WW capital improvements can reduce both capital and operating costs.<br>Ratepayer Benefits: Reduced electric, water and WW utilities' costs are passed onto the respective ratepayers. |
| @ 15% = 0.375 | 2 | ↑ Quality of Life for Local Residents | Increasing recycle/reuse could increase the quality of life for local residents by substantially relieving pressure on existing surface and groundwater resources, making more water available for residential users. |
| | 1 | ↓ Reduces Risks to Public Health & Safety | On-site recycle/reuse of industrial process water may reduce risks to public health and safety (e.g., where discharges may have been made to natural waterways that were not in compliance with regulatory discharge permit requirements). A modest score of "1" was used to indicate that there could be a benefit, but it need not necessarily be so in all cases. |
| | **2.5** | **Avg Score** | ***The primary anticipated socio-economic benefits of these technologies are increased jobs and decreased costs of water, energy, and WW treatment.*** |
| **OTHER RESOURCE AND ENVIRONMENTAL BENEFITS** | | | |
| | 0 | ↑ Natural Gas Efficiency | Does not increase natural gas efficiency. |
| | 2 | ↑ Renewable Natural Gas | Increases biogas production that can be used to produce renewable natural gas, one of the state's resource goals. However, the biogas can be used for other purposes, including heating and production of bio-electricity – increased production of biogas does not necessarily mean that production of renewable natural gas will increase. Consequently, a conservative score of "2" was ascribed to this benefit. |
| @10% = 0.233 | 3 | ↓ Disadvantaged Communities | May benefit residents of Disadvantaged Communities (DACs) whose wells have gone dry by (a) increasing production of recycled water which could be used for non-potable purposes by residents of DACs, and/or (b) reducing competition for limited surface and groundwater supplies. |
| | **2.33** | **Avg Score** | ***The primary additional benefits of these technologies are (a) potential drought resiliency benefits to DACs, and (b) the potential to increase production of renewable natural gas.*** |
| **3.455** | **Wtd. Average Score: BENEFITS** | | |

## SAMPLE ADOPTION CHALLENGES SCORE SHEET: FOOD & BEVERAGE WATER RECYCLING/REUSE

| Weighted Score | Score | Factor | Basis for Score |
|---|---|---|---|
| | | COSTS | |
| @ 25% = 0.9375 | 3 | % of Annual Budget | In general, the technologies described herein require substantial capital investments (>$100,000) that will require senior management approval. Therefore, although the relative magnitude of the financial investment decision depends on the adopter's unique financial circumstance, a median score of "3" was provided to indicate that procurement of these systems will likely need to be planned for and scheduled. Financing may also be needed. |
| | 5 | Est. Payback (# years) | The systems that were considered when scoring these technologies indicated paybacks < 3 years, which is viewed as financially feasible by most organizations. |
| | 4 | Funding Availability | The ability to obtain funding depends on the financial strength of the adopter. In general, especially with an anticipated payback < 3 years and fairly modest annual operating costs, we believe that most financially viable organizations are likely able to obtain funding. |
| | 3 | Timeline to Secure Funding | The timeline to obtain funding depends on many factors specific to the adopter's financial circumstance, business, cash flows, assets, etc. A modest score of "3" was used or this illustration. |
| | **3.75** | **Avg Score** | ***In general, although these technologies appear to have a fairly quick payback, the magnitude of the initial investment will likely require scheduling the investment and obtaining funding.*** |
| | | REGULATORY AND ENVIRONMENTAL RISKS | |
| @ 25% = 0 | 0 | ↑ Permit Violations | No increases in permit violations are expected. In fact, it is more likely that discharge permit violations would decrease as a result of treating process water effluent to higher standards before discharging to the environment. |
| | 0 | ↑ Threats to Species & Ecosystems | Similarly, these technologies are not expected to adversely impact species and ecosystems. They may in fact have a beneficial impact by improving the quality of effluent discharges and reducing the volume of industrial effluent discharged to the environment. |
| | **0** | **Avg Score** | ***These technologies are not expected to adversely impact regulatory compliance or the environment.*** |
| | | OPERATING RISKS | |
| @20% = 0.20 | 1 | ↑ Operating complexity | The technologies described herein are deemed fairly simple to operate. |
| | 1 | ↑ Risk of outages | The frequency of outages is deemed minimal. Further, in the event that one or both portions of the systems (the wastewater treatment portion or the advanced filtration/disinfection portion) were to fail, the effluent could be discharged to the local municipal WW treatment plant. |
| | 1 | Requires changes to other systems | Changes to other systems are minimal, and the footprint of the combined systems is relatively small. |
| | 1 | Requires specialized staff or training | Relatively little training is required to operate these systems, and no specialized staff are expected to be required. |
| | **1.0** | **Avg Score** | ***Operating risks for these technologies are relatively low.*** |
| | | ECONOMIC RISKS | |
| @ 20% = 0.134 | 0 | ↓ Revenues | These systems are not expected to adversely impact the adopter's revenues. If the targeted benefits are achieved, these technologies may actually reduce the adopter's costs, increasing their competitive position in their market(s) and potentially increasing revenues. In addition, if the adopter also creates valuable products from increased biogas production, new revenue streams may be developed. |

| Weighted Score | Score | Factor | Basis for Score |
|---|---|---|---|
| | 1 | ↑ Operating Costs | The adopter's operating costs for the new system(s) are expected to be more than fully offset by substantial reduced costs for discharges to municipal WW treatment systems and avoided water purchases. |
| | 1 | ↑ R&R Frequency and Costs | R&R frequency and costs for these system(s) are expected to be modest. |
| | **0.67** | **Avg Score** | ***Economic risks of these systems are expected to be modest.*** |
| **TECHNOLOGY RISKS** | | | |
| @10% = 0.1 | **1** | Technology Obsolescence | ***Physical/Chemical treatment is a proven technology. Although products in this category are undergoing continual improvement, the basic technology is not likely to become obsolete in the foreseeable future. Much more R&D is being conducted on the water purification portion of these systems that uses a fair amount of electricity. Many market entrants are seeking new ways to perform ultrafiltration that is energy efficient and requires less frequent replacement of the filters that are fairly costly. Consequently, it seems likely that more economic and efficient units will be available prior to the end of a system's useful life. However, with such a short payback period, technology risks are fairly low.*** |
| **1.3715** | **Wtd. Average Score: ADOPTION CHALLENGES** | | |