CLIMATE ACTION COLLABORATIVE

Water Energy Nexus Report for Town of Minturn

I. Summary

Water and wastewater treatment and distribution processes rely on energy intensive systems, commonly powered by climate change-causing fossil fuels. While there has been a considerable amount of dialogue regarding climate change impacts on water supply and predictability, there have been fewer discussions around the energy intensity of water and wastewater treatment and distribution processes and their impact on our environment. Aerobic water treatment processes are used in all water treatment facilities across Eagle County and are particularly energy intensive compared to anaerobic processes[1]. Below we will detail connecting linkages between water and greenhouse gas emissions for the Town of Minturn and provide tailored recommendations for water provider operations and customer water conservation strategies.

II. Background

The Climate Action Collaborative for Eagle County Communities is tasked with implementing the Climate Action Plan for Eagle County Communities and subsequent goals and strategies. Our greenhouse gas reduction goals are: 50% by 2030 and 80% by 2050 from our 2014 baseline. This momentous task requires our communities and organizations to work in partnership on energy efficiency, electrification, and eradication of human-caused greenhouse gas emissions.

One such industry that has been less of a focal point for emissions reduction in our community is water and wastewater treatment and distribution centers. Community organizations and water providers have done a wonderful job advocating for water conservation, particularly for outdoor water use, however this messaging has not been contextualized with greenhouse gas emissions from treating and providing water to residents. Our aim is to incorporate accurate emissions data per gallons of water treated and distributed to paint a more precise picture of the climate impact of water consumption. This additional data and messaging will help our overall efforts to conserve water in the Eagle River Valley, and help our water utilities make informed decisions regarding increasing

[1] *Energy consumption in anaerobic and aerobic based wastewater treatment plants in Italy* by Ezio Ranieri, Silvia Giuliano, & Ada Cristina Ranieri

efficiencies in their operations. Due to the complex nature of treating and distributing water, energy intensity varies significantly[2] by landscape, source, and distributor. It is for this reason that we have created separate reports for participating water utilities/municipalities, rather than one report for the entire County.

Looking at national data in recent decades, more research has been published on the energy intensity of water treatment and distribution. Notably, River Network produced a report[3] in 2009 that estimated U.S. water-related energy use was at least 521 million MWh per year, equivalent to 13% of U.S. energy consumption at that time. This represented 5% of the nation's CO2 emissions, and was equivalent to the emissions from over 62 coal-fired power plants. Additionally, the U.S. Environmental Protection Agency (EPA) shares that water and waste-water facilities are commonly one of the largest energy consumers in a community, sometimes accounting for 35% of typical municipal energy budgets[4]. Even further, a peer reviewed national study[5] found that one four-person household's monthly drinking water and wastewater demand is equivalent to driving nearly 93 miles in a standard gasoline car each month. The same study found that the average energy demand of water utilities is equivalent to 9.3 million gasoline cars on the road each year.

Energy emissions from water and wastewater treatment plants are significant, and communicating this significance will be an important advancement for our greenhouse gas reduction efforts. We are fortunate to live in a community that is serviced by progressive electricity utilities, Holy Cross Energy and Xcel Energy. Holy Cross Energy's goal is to be 100% renewable energy by 2030, and Xcel Energy's goal is to be 80% renewable energy by 2030. However, it is important to stress that energy efficiency becomes even more important with an increasingly renewable energy grid system, due to the additional importance of reducing energy demand when relying on intermittent renewable energy sources like wind and solar. In other words, renewable energy on our grid should not be understood as a means to liberally use electricity.

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[2] *The estimated impact of California's urban water conservation mandate on electricity consumption and greenhouse gas emissions* by Edward Spang, Andrew Holguin, and Frank Loge
[3] *The Carbon Footprint of Water* by Bevan Griffiths-Sattenspiel and Wendy Wilson
[4] *Energy Efficiency in Water and Wastewater Facilities* by U.S. EPA
[5] *Operational Carbon Footprint of the U.S. Water and Wastewater Sector's Energy Consumption* by Zib III et al. 2021

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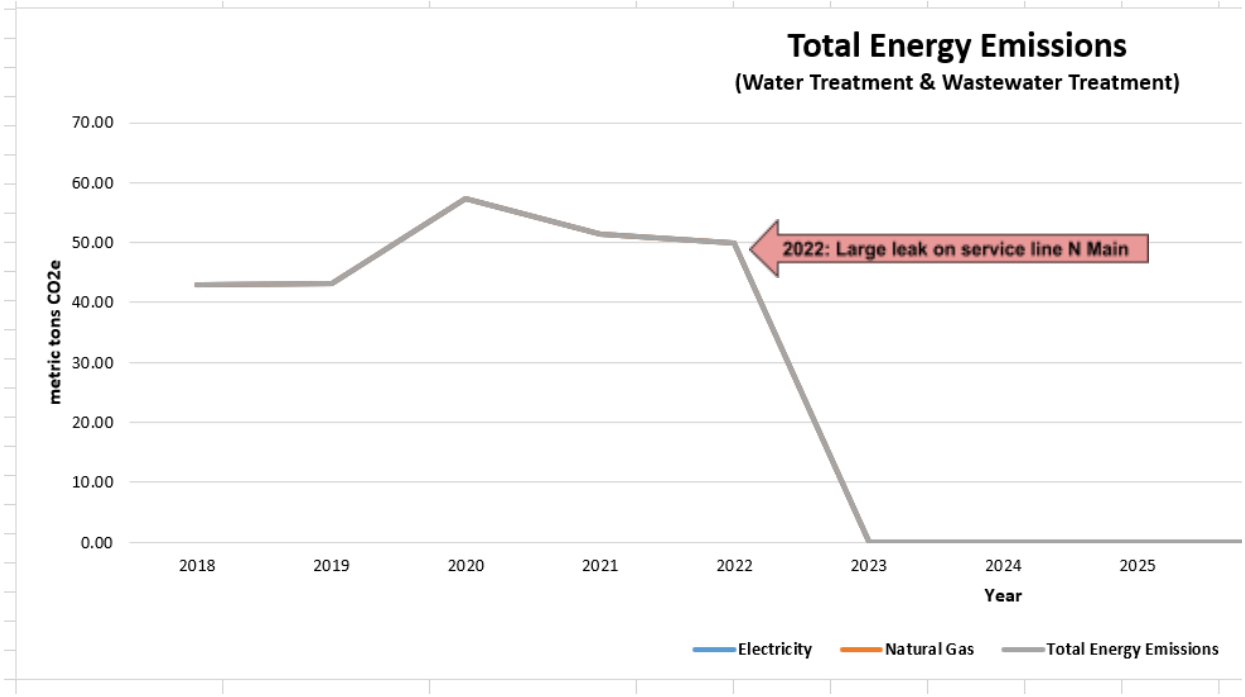
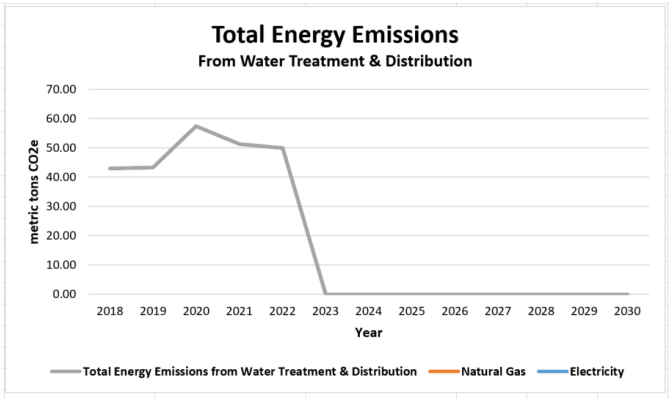
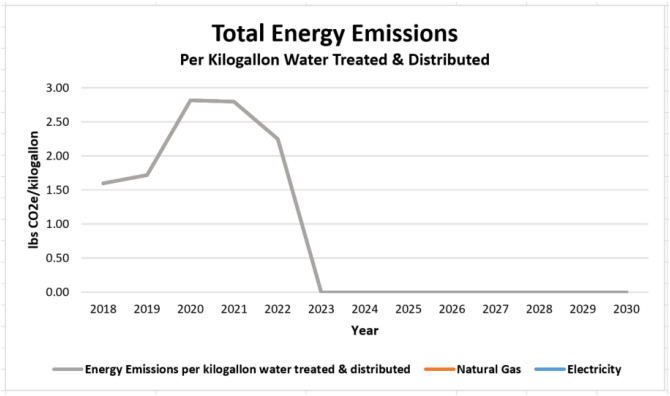
III. Data and Analysis for the Town of Minturn:

Annual Data														
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Energy Emissions														
(metric tons CO2e)	*Electricity*	*42.90*	*43.22*	*57.37*	*51.34*	*49.91*								
	Natural Gas	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*								
Total Energy Emissions from Water Treatment & Distribution														
(metric tons CO2e)	*Electricity*	*42.90*	*43.22*	*57.37*	*51.34*	*49.91*								
	Natural Gas	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*								
Total Energy Emissions from Wastewater Treatment														
(metric tons CO2e)	*Electricity*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*								
	Natural Gas	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*								
Energy Emissions per kilogallon water treated & distributed														
(lbs CO2e/kilogallon)	*Electricity*	*1.60*	*1.72*	*2.82*	*2.80*	*2.25*								
	Natural Gas	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*								
Energy Emissions per kilogallon wastewater treated														
(lbs CO2e/kilogallon)	*Electricity*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*								
	Natural Gas	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*								







Greenhouse gas emissions per gallon from the Town of Minturn's water treatment and distribution process are aligned with similar calculations of emissions from water treatment and distribution. Spang et al. (2018) found that in California, greenhouse gas emissions per kilogallon of water treated ranges between .617 and 2.5 lbs CO_2e, depending on location throughout the State[6]. In 2018 through 2022, emissions per kilogallon in Minturn ranged between 1.6 and 2.25 lbs CO_2e. Most likely, this is due to Minturn's relatively low-energy intensive slow-sand filter system, a process that uses little energy to treat water. If Minturn were to replace the slow-sand filter system with a process packaged water treatment plant or a membrane filtration water treatment plant, as has been proposed[7], it is likely that energy consumption, and therefore emissions, will increase.

Interestingly, the data shows that while the amount of water treated in 2020 decreased by nearly 11,000 kilogallons as compared to 2019, monthly electricity consumption between February and May 2020 was nearly double that of previous years. The Town of Minturn may want to investigate this further to understand the reasoning.

IV. Site-Specific Information for the Town of Minturn

Town of Minturn's wastewater is treated by Eagle River Water and Sanitation District. The numbers within this report do not include Eagle River Water and Sanitation District's impact.

V. Recommendations for the Town of Minturn

A. Customer-Facing

1. **Update Rate Structure**
    a) Change the water rate structure to incentivize water conservation. Consider introducing a tiered system where customers are charged more based on the amount of water consumed as it relates to the property's square foot equivalent (SFE). In addition, fixed costs can be tied to the

[6] *The estimated impact of California's urban water conservation mandate on electricity consumption and greenhouse gas emissions* by Edward Spang, Andrew Holguin, and Frank Loge
[7] *Can Minturn find a water solution that no longer requires a treatment plant?* by John LeConte

home's number of SFEs: the higher the square footage, the higher the fixed costs.

(1) **Local context:** The Town of Minturn has updated its outdoor water rate structure to mirror Eagle River Water and Sanitation District's tiered rates for sprinkler and outdoor irrigation use. We recommend that the town also update the residential account rate structure to incorporate a fixed charge per single family equivalent (SFE), and a tiered use rate per kilogallons of water, as Eagle River Water and Sanitation District has.

(2) Case: ERWSD 2023 Tiered Rate Structure

2. **Implement Smart Metering:**
   a) Smart meter technology is an advanced metering infrastructure that measures and records water usage accurately and in real-time. Unlike traditional water meters, which require manual reading and are prone to human error, smart meters provide automated readings that are transmitted to utility companies for billing and analysis.
      (1) Local context: The Town of Minturn is almost complete with updating all water meters to smart meters. The Town should utilize the available data to identify anomalies and high water users towards the goal of reducing water consumption.
      (2) Case Study: What if saving water became a game? (*Suez Smart Solutions*)
3. **Offer Rebate and Incentive Programs for Water Efficiency**
   a) Consider funding match rebates that build off the rebates the Beyond Lawn program provides. Water efficiency rebates are available to landowners across Eagle County and are provided by the Beyond Lawn Program in areas not served by Eagle River Water and Sanitation District. The Beyond Lawn program is collecting benchmarked information about the landscapes they work with. This information will be accessible to each town.
      (1) Local context: Town of Minturn staff are in communication with Beyond Lawn program representatives. We recommend providing match

rebates for landscape assessments, irrigation controllers, turf removal, and more.
(2) Beyond Lawn Program turf replacement rebates
(3) Beyond Lawn Program irrigation system rebates

4. **Host Consumer Education Events**
    a) The more water conservation knowledge consumers have, the more likely they are to implement water-saving measures in their homes and businesses. Engaging educational events are a great way to develop customer's knowledge and build relationships in the community.
        (1) Local context: Beyond Lawn program representatives, including Colorado State University Extension, should be invited to table and provide educational opportunities at the Minturn Market. Minturn could also host a waterwise demonstration or rain barrel event with partners.
        (2) Article: Communication and Education (*Alliance for Water Efficiency*)
5. **Distribute Outdoor Water-Efficient Quick Fixes**
    a) Water-efficient quick fixes are inexpensive tools to encourage customers to reduce their outdoor water consumption. Typically given out for free or during an irrigation assessment, quick fixes include watering gauges, high efficiency hose nozzles, and soil moisture meters.
        (1) Local context: Free outdoor water irrigation quick fixes should be purchased and distributed at Town events or at the Minturn Market. Quick fixes are inexpensive to purchase and an easy way to get people to make small changes in their behavior.
        (2) List of water-efficient quick fixes (*The Water Scrooge*)
6. **Promote Irrigation Assessments**
    a) Irrigation assessments are an effective and low-cost tool for customers to understand their outdoor water consumption and strategies for reduction. The Beyond Lawn program offers discounted irrigation assessments and irrigation upgrade rebates for customers outside Eagle River Water and Sanitation District's territory. After receiving an irrigation assessment, it is recommended to have the findings inform

potential upgrades to an irrigation system. Consider incentivizing homeowners to work with Qualified Water Efficient Landscaper (QWEL) certified contractors.

(1) Local context: The Town of Minturn should promote Beyond Lawn irrigation assessments for residents on its website and at the Minturn Market in coordination with Beyond Lawn representatives. The Town should also do an irrigation assessment of town properties, and direct public outreach about irrigation assessments to properties with large irrigated landscapes and high outdoor water consumption.

(2) Beyond Lawn Irrigation Assessment Rebates (Minturn, Red Cliff, Eagle, Gypsum)

(3) Hire a QWEL Pro

B. Operational

1. **Require Outdoor Water Consumption Submeter**
    a) Require all new construction to install a separate irrigation account submeter or create a separate account for outdoor water consumption. Alternatively, you can compare summer versus winter water consumption to estimate the additional water used for outdoor irrigation across all meters. Eagle River Water and Sanitation District requires all new commercial construction to have a separate outdoor water account.

(1) Local context: The Town of Minturn could amend building code to require a separate, outdoor water account for new commercial and multifamily construction. This would enable the Town to gather better data on outdoor water consumption of large properties.

(2) ERWSD requires a landscape sprinkler account for new commercial construction (ERWSD Rules & Regulations p.49)

2. **Efficiency, Electrification, & Renewable Energy Enrollment**
    a) Make your facility more energy efficient by installing efficient technologies such as LED light bulbs, weatherizing the facility, and purchasing energy efficient all-electric

equipment. These upgrades, especially switching your operations to all-electric, will reduce emissions and save money. Then, enroll in renewable energy programs offered by your utility that will power your water treatment with emission-free energy for a small increase in cost.

(1) Local context: The Town of Minturn is exploring upgrading its water treatment plant soon. For that reason, we do not recommend any investments in the current system. However, when the Town upgrades to a new system, the infrastructure should be built all electric and highly energy efficient.

(2) Public Building Electrification Grant from the CEO

(3) Holy Cross Energy's PuRE Program (Vail, Avon, Eagle, Gypsum)

(4) Xcel Energy's Renewable*Connect (Minturn, Red Cliff)

3. **Onsite offsets**
   a) Investing in onsite renewable power generation at your water and wastewater treatment operation can offset some of the power used and save you money over time. Onsite solar arrays are one such example of an onsite offset, and there are significant federal funding opportunities available right now. Pairing an onsite system with battery storage will increase your operation's resiliency, allowing you to deploy that battery storage in times of need or utilize it during peak hours to reduce utility costs.

(1) Local context: The Town of Minturn is investigating a solar array at the current Consolidated Tailings Pile site. This is a fantastic use of land that is otherwise undevelopable. The Town of Minturn should consider utilizing energy generation from the future solar array to offset the energy consumption of water treatment operations.

(2) Local example: Eagle to undertake two major energy-saving projects as it pursues goal of net-zero carbon emissions by 2030

4. **Water benchmarking key accounts**

a) Water benchmarking allows users to track their water usage across a property and compare water usage over time and against other properties. Requiring key accounts to benchmark their water usage can help reduce water consumption and waste and improve water efficiency. Reduced water consumption saves the user money and translates into reduced greenhouse gas emissions, as detailed in this report. Energy Star Portfolio Manager is a free benchmarking tool which can be utilized, or many for-purchase benchmarking tools exist with additional sophistication.
    (1) Local context: The Town of Minturn is already water benchmarking its own buildings. Additionally, while billing is handled by Eagle River Water and Sanitation District, the Town has access to resident's water data, making benchmarking a much easier process. The Town should require structures above a certain square footage to submit their water data and make reductions to their water consumption. There are different administrative approaches to water benchmarking that the Town would have to consider, and CAC staff would be happy to provide detailed information if desired.
    (2) Case: Austin, Texas Water Benchmarking

VI. Limitations

This report provides an initial snapshot of the greenhouse gas emissions associated with treating and distributing water and wastewater at the Town of Minturn. However, this report only focuses on scope 2 emissions, or those that are indirectly emitted through energy consumption of the operation. There are other emissions from operations, such as from fleet or methane from the wastewater treatment process, that have not been captured. This is important to understand as we communicate these numbers, and we recommend that the Town of Minturn works to understand the emissions impact from these other sources.

Additionally, our analysis is not able to isolate emissions from general building operations, such as lighting or heating and cooling systems, versus the process emissions for treatment and distribution of water. Therefore, even if the marginal emissions become zero, there will still be fixed emissions due to general building operations.

Furthermore, we acknowledge that due to regulatory compliance, not all recommendations that we've offered will be feasible to implement. Our recommendations take environmental sustainability into account.