W-1. Use Reclaimed Non-Potable Water

GHG Mitigation Potential

Small

Potentially small reduction in GHG emissions from outdoor water use

Co-Benefits (icon key on pg. 34)

Climate Resilience

Using reclaimed non-potable water conserves water resources, which will become more strained under climate change, and provides a backup water source should extreme events disrupt current sources. This could also reduce costs associated with obtaining fresh potable water from distant sources.

Health and Equity Considerations

The project will provide appropriate education on non-potable water for project residents/employee.

Measure Description

This measure requires use of reclaimed water for outdoor uses. Reclaimed water is water reused for non-potable uses (e.g., landscape irrigation) after wastewater treatment instead of returning the water to the environment (i.e., discharging into rivers and other bodies of water). Using water after it has been treated requires substantially less energy to deliver it to users than fresh water from distant sources and, therefore, reduces GHG emissions. The use of reclaimed water is typically designated for non-potable uses, such as landscaping and other outdoor uses.

Although wastewater treatment processes have improved, there has been limited implementation of reclaimed water projects for household or potable uses. Furthermore, the treatment of wastewater to produce potable water (often through reverse osmosis) is usually energy-intensive and thus may not result in reduction in energy consumption and associated GHG emissions.

Scale of Application

Project/Site

Implementation Requirements

See measure description.

Cost Considerations

Initial costs of altering a system, whether it is irrigation, plumbing, or cleaning, to use reclaimed non-potable water will vary with the source of the water and the use; however, all applications will have costs associated with installing water collection and distribution infrastructure.

Expanded Mitigation Options

This measure does not include treatment of wastewater for potable uses, although the approach to assessing the potential change in GHG emissions would be the same.

GHG Reduction Formula

$A1 = \mathbf{C1} \times (D - E)$ (Energy savings)

$B1 = A1 \times F \times G \times H$ (Emissions reduction)

$B2 = \mathbf{C2} \times \frac{D-E}{D}$ (Percent emissions reduction)

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A1	Energy savings from using reclaimed water	[ ]	kWh	calculated
B1	GHG reduction from using reclaimed water	[ ]	MT CO_2e	calculated
B2	% GHG reduction from outdoor water use	[ ]	%	calculated
User Inputs				
C1	Amount of water to be used from reclaimed sources	[ ]	acre-feet (AF)	user input
C2	Percentage of water from reclaimed water (relative to total outdoor water demand)	[ ]	%	user input
Constants, Assumptions, and Available Defaults				
D	Electricity for municipally provided water	Table W-1.1	kWh per AF	CPUC 2016
E	Fraction of electricity for reclaimed water	Table W-1.1	kWh per AF	CPUC 2016
F	Conversion from kWh to MWh	0.001	MWh per kWh	conversion
G	Carbon intensity of electricity provider	Tables E-4.3 and E-4.4	lb CO_2e per MWh	CA Utilities 2021
H	Conversion from pounds (lb) to MT	0.000454	MT per lb	conversion

Further explanation of key variables:

- (C1) – The amount of water to be used from reclaimed water must be provided by the user.
- (D, E) – The water energy-intensity factors are derived from the most recent version of the California Public Utilities Commission (CPUC) Water Energy Calculator and are provided in Table W-1.1 in Appendix C, *Emission Factors and Data Tables* (CPUC 2016). The energy intensity factors rely on region-wide average values for the California Department of Water Resources' (DWR) 10 hydrologic regions. Following wastewater treatment, reclaimed water would be pre-treated (to meet standards) and distributed back to an end use (e.g., city park). Accordingly, the fraction of energy required to provide reclaimed water can be determined by consulting Table W-1.1 and identifying the columns for pre-treatment and water distribution (omit the column for extraction and conveyance).

- (G) – GHG intensity factors for major utilities in California are provided in Tables E-4.3 and E-4.4 in Appendix C. If the project study area is not serviced by the listed electricity provider, or the user is able to provide a project-specific value (i.e., for the future year in which the reclaimed water system would be established), the user should replace these defaults in the electricity consumption GHG calculation formula.

GHG Calculation Caps or Maximums

None.

Example GHG Reduction Quantification

The user reduces GHG emissions from water-related electricity by using reclaimed water for non-potable uses in place of fresh water. In this example, the project is in the San Joaquin River hydrologic region and includes the use of 31 AF per year of reclaimed water (C1), which represents 80 percent of the project's total outdoor water demand (C2). The electricity provider for the project area is Turlock Irrigation District and the analysis year is 2027. The carbon intensity of electricity is therefore 296 lb CO_2e per MWh (G).

$$A1 = \mathbf{31\ AF} \times \left(252\,\frac{\text{kWh}}{\text{AF}} - 163\,\frac{\text{kWh}}{\text{AF}}\right) = 2{,}759\ \text{kWh}$$

$$B1 = 2{,}759\ \text{kWh} \times 0.001\,\frac{\text{MWh}}{\text{kWh}} \times 296\,\frac{\text{lb CO}_2\text{e}}{\text{MWh}} \times 0.000454\,\frac{\text{MT}}{\text{lb}} = 0.4\ \text{MT CO}_2\text{e}$$

$$B2 = \mathbf{80\%} \times \frac{\left(252\,\frac{\text{kWh}}{\text{AF}} - 163\,\frac{\text{kWh}}{\text{AF}}\right)}{252\,\frac{\text{kWh}}{\text{AF}}} = 28\%$$

Quantified Co-Benefits

Energy and Fuel Savings

Energy savings (A1) are derived in the steps above that are necessary to quantify GHG reductions.

Water Conservation

This measure would not necessarily change water consumption, but it would result in conservation of fresh water sources by using reclaimed water. This quantity of freshwater savings is equal to the amount of reclaimed water (C1).

Sources

- California Public Utilities Commission (CPUC). 2016. Water-Energy Calculator–Draft Version 1.05. Available: https://www.cpuc.ca.gov/nexus_calculator/. Accessed: January 2021.
- California Utilities. 2021. Excel database of GHG emission factors for delivered electricity, provided to the Sacramento Metropolitan Air Quality Management District and ICF. January through March 2021.