

# Water Reduction and Recovery in Freeze-dried and Spray-dried Coffee Manufacture



Through support from the U.S. Environmental Protection Agency Pollution Prevention Program, Rowan University has partnered with the Nestlé USA Freehold, NJ plant to conduct experimental and design studies to evaluate potential water recovery systems for the reuse of water in freeze-dried and spray-dried (FD/SD) coffee powder production.

## Current Process

Nestlé USA Freehold, NJ plant FD/SD coffee production involves complex processes that require large amounts of water. Most of which becomes wastewater (WW) since the finished coffee powder product as sold contains virtually no water.

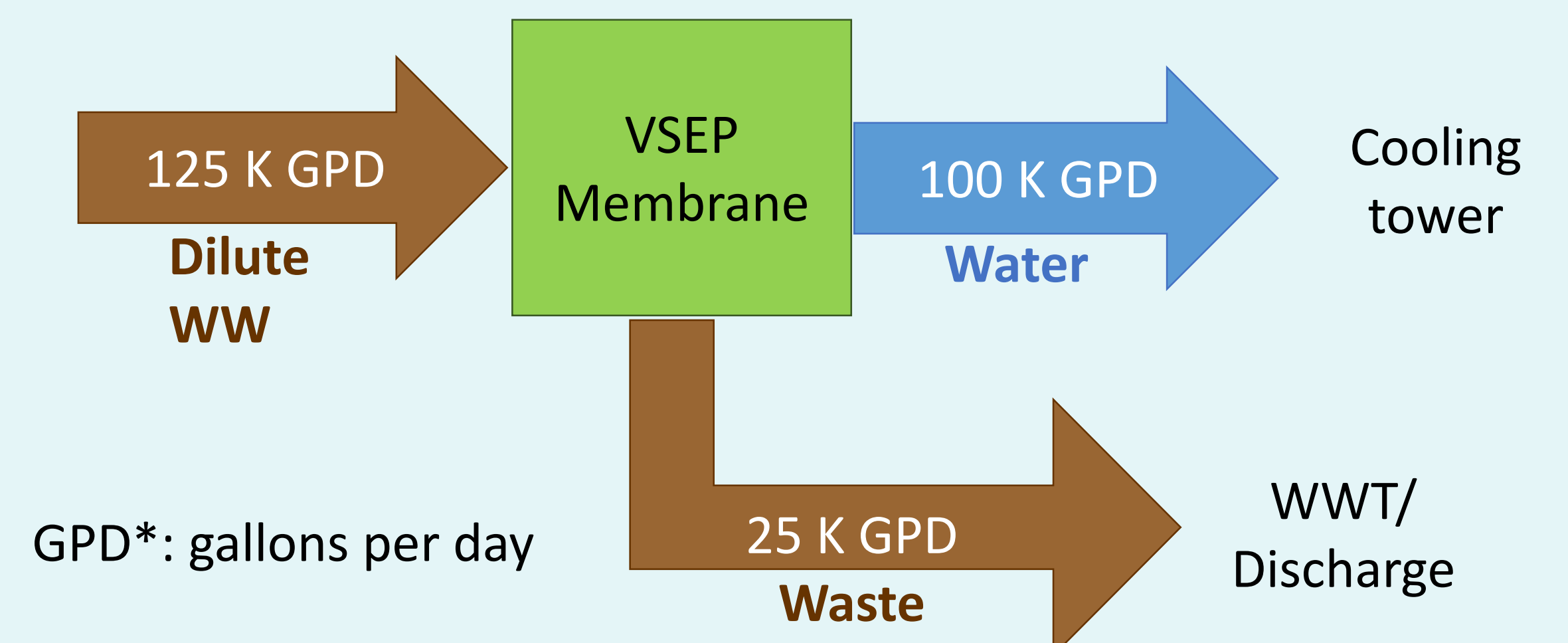
## Background

High water use and wastewater generation is characteristic of the food and beverage industry. Water can be used for a multitude of applications in product manufacturing, however, it frequently does not end up as an ingredient in the final product. To produce a single pound of FD/SD coffee from roasted beans, an estimated 7.3 lbs of water is required for a manufacturing plant. With global population and water scarcity on the rise, it has become imperative to seek opportunities to recover water in this industry and reduce demands on freshwater supply.

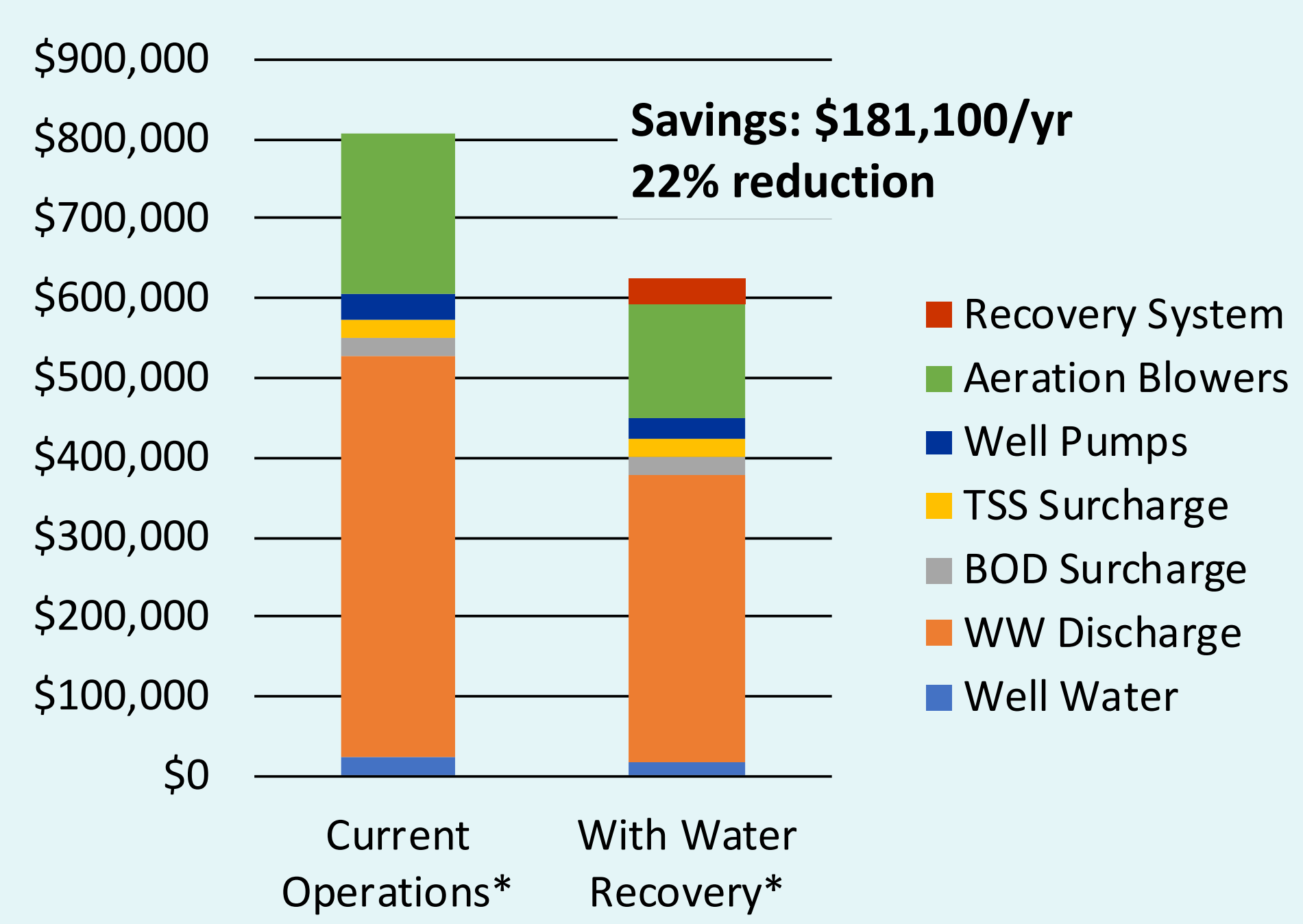
## Rowan Solution

Water recovery is a key area of sustainable design improvement for an instant coffee manufacturing plant. Current investigations have identified membrane separation technology as option for water recovery from factory process wastewaters†.

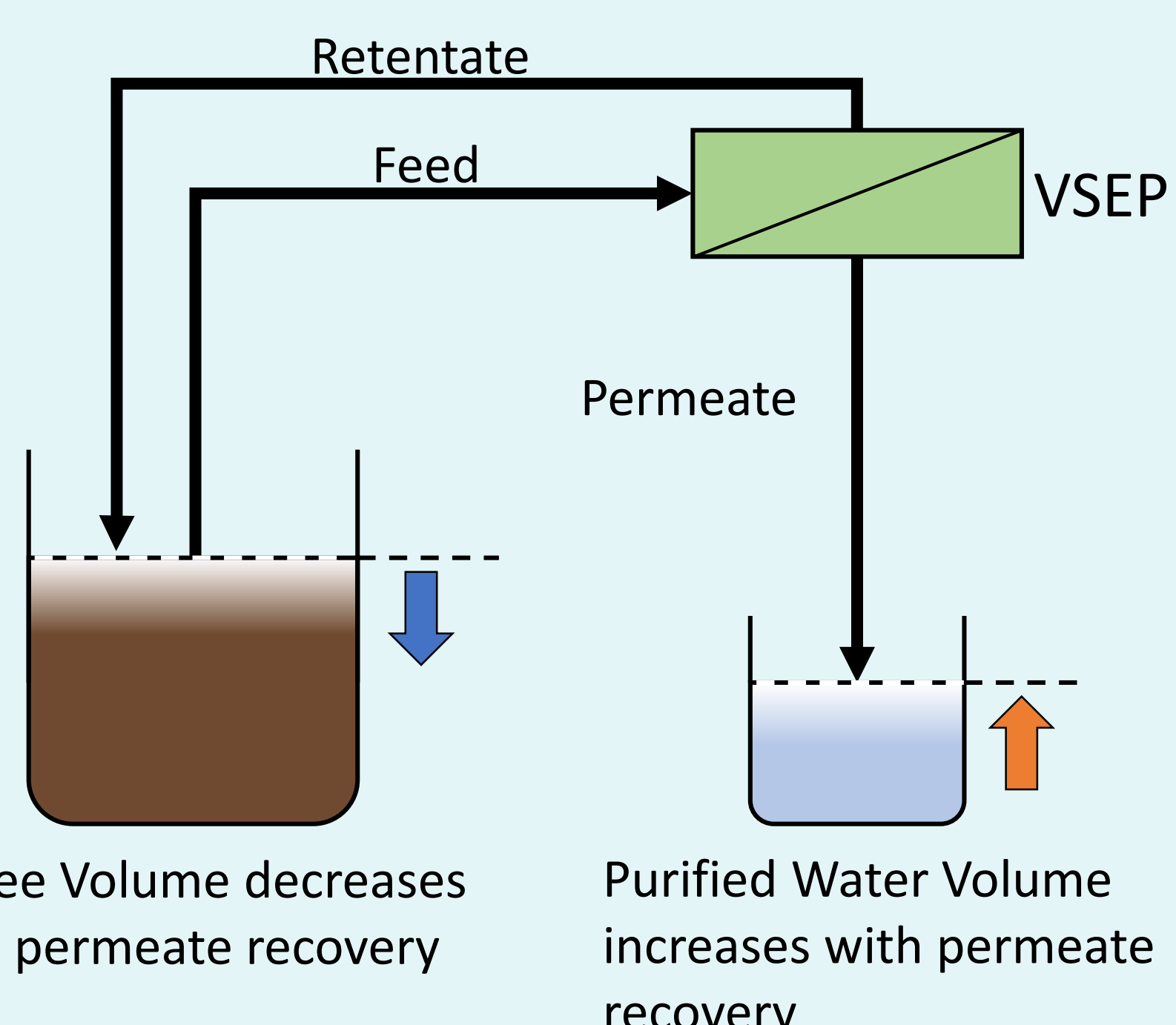
- A Vibratory Shear-Enhanced Processing (VSEP) was deemed optimal†
- VSEP imparts high shear rates at the membrane surface
- VSEP operation reduces surface and internal fouling
- Experimental results show increase in flux by up to **four** times
- Concentrate WW by recovering permeate in separate collection tank to simulate high-recovery for scale-up design



## Estimated Annual Operating Costs\*

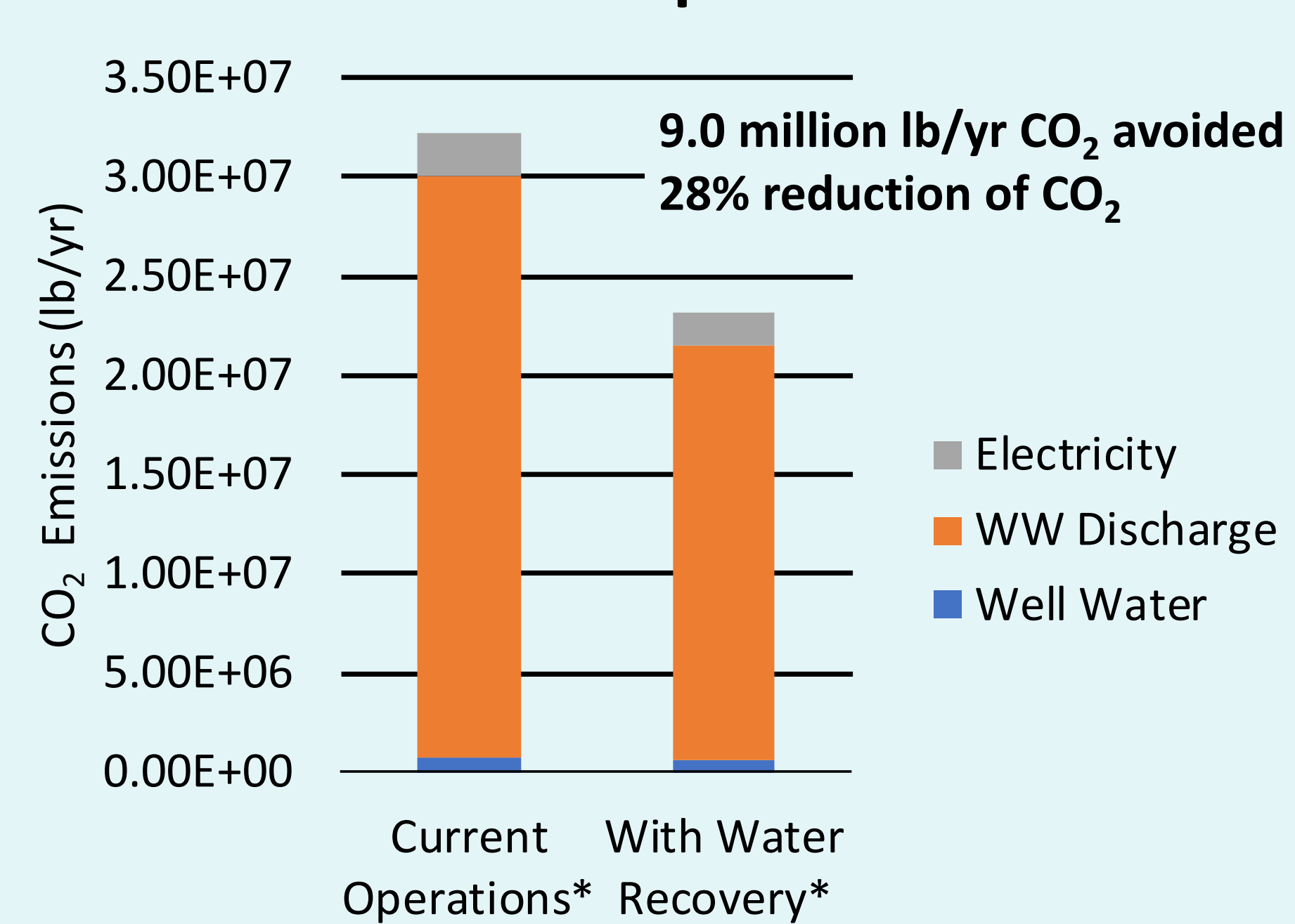


Design proposal using membrane system shows 100,000 gal/day freshwater can be saved in a projected overall operation



Coffee Volume decreases with permeate recovery  
Purified Water Volume increases with permeate recovery

## Environmental Impact Reduction\*



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†Wisniewski, Slater, Savelski, *Clean Tech. Environ. Policy*, 20, 1791–1803, 2018. <https://doi.org/10.1007/s10098-018-1569-4>

\*Based on a projected overall operation