WaterSense at Work

Commercial Kitchen Equipment

4.7 Dipper Wells

Best Management Practices for Commercial and Institutional Facilities

EPA WaterSense

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WaterSense® is a voluntary partnership program sponsored by the U.S. Environmental Protection Agency (EPA) that seeks to protect the nation's water supply by transforming the market for water-efficient products, services, and practices.

WaterSense at Work is a compilation of water efficiency best management practices intended to help commercial and institutional facility owners and managers from multiple sectors understand and better manage their water use. It provides guidance to help establish an effective facility water management program and identify projects and practices that can reduce facility water use.

An overview of the sections in *WaterSense at Work* is below. This document, covering water efficiency for dipper wells, is part of **Section 4: Commercial Kitchen Equipment**. The complete library of best management practices is available at www.epa.gov/watersense/best-management-practices. WaterSense has also developed worksheets to assist with water management planning and case studies that highlight successful water efficiency efforts of building owners and facility managers throughout the country, available at www.epa.gov/watersense/commercial-buildings.

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Overview

Dipper wells are used in some restaurants, coffee houses, and ice cream shops to rinse and temporarily store utensils between uses. There are a variety of technologies that can be used for this purpose, including continuous dipper wells, intermittent dipper wells, and heated dipper wells. Similarly, metering or self-closing faucets can be used for rinsing, although they do not provide temporary storage.

Traditional continuous dipper wells consist of two concentric tanks. A valve controls the flow of hot or cold water from a single spigot, which fills the inner tank. A perforation at the top of the inner tank allows water to overflow into the outer tank (or receiving well), which is connected to a drain. Shops often have dipper wells running constantly during service hours to provide a continuous exchange of the water in the well to reduce the potential for bacterial growth.[1] Many continuous dipper wells have unrestricted flow rate, although users typically manually control the flow rate to between 0.2 gallons per minute (gpm) (0.76 liters per minute [Lpm]) and 1.0 gpm (3.8 Lpm). This water may be hot or cold water.

In addition to continuous dipper wells, there are also non-continuous dipper wells, which do not rely on continuous flow of water and therefore offer greater water efficiency. These include intermittent dipper wells and heated dipper wells.

Intermittent dipper wells initiate and terminate water flow mechanically or automatically. Intermittent dipper wells include scoop showers, which require manual activation to rinse utensils, and ozone dipper wells, which initiate water flow automatically. Scoop showers consist of a basin with two sprayers, one that sprays water upwards into the inside of a scooper or other utensil, and one that sprays water downwards onto the outside of the scooper or utensil. The user must press down onto the upward sprayer to activate the water flow. As soon as the user releases pressure, the flow stops. Ozone dipper wells circulate the water in the receptacle through an ozone treatment unit. When the turbidity of the water reaches a certain point, the system automatically sends the turbid water down the drain and initiates flow to draw fresh water into the receptacle.

Intermittent dipper wells use significantly less water than continuous dipper wells because they only initiate water flow as needed, rather than running constantly. Additionally, compared to continuous dipper wells that run hot water, intermittent dipper wells save

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[1] Frontier Energy. November 2017. *Dipper Well Replacement Field Evaluation Report*. Prepared for the Metropolitan Water District of Southern California. www.bewaterwise.com/assets/2015icp-dipperwellfrontierenergy.pdf.

energy by lowering hot water demand and thereby reducing the amount of energy needed to heat the water.

Heated dipper wells maintain water within the storage reservoir at a temperature of at least 135°F (57°C) to inhibit bacterial growth. Users must regularly replace the water in the reservoir, typically every four hours. Like intermittent dipper wells, heated dipper wells use significantly less water than continuous dipper wells, because they do not require a constant flow of water. However, heated dipper wells require energy to maintain the water temperature. Because heated dipper wells require manual water replacement, they may not offer the same ability to remove food particles or allergens.

Some establishments might use metering or other self-closing faucets to rinse utensils between uses. Metering and self-closing faucets are activated by the user via a push button or sensor and initiate water flow for a specified period of time, or until the activation is released. However, because they do not incorporate a storage feature, they are not considered dipper wells.

When considering changes to facility operations that might involve installing, retrofitting, or replacing a dipper well, foodservice locations should ensure that the dipper well (or replacement device) meets the U.S. Food and Drug Administration (FDA) Food Code requirements.[2]

Operation, Maintenance, and User Education

For optimum dipper well efficiency, consider the following:

- Turn off water when service periods are slow, when the dipper well is not in use, and at the end of each day. Be sure to clean the dipper well prior to restarting the water to remove any bacterial buildup.
- Keep the flow rate of the dipper well valve at its minimum level required to flush food particles and allergens, which may vary depending on what type of setting in which the dipper well is being used. Some voluntary codes and standards recommend no more than 0.2 gpm (0.76 Lpm).[3]

Retrofit Options

To reduce the water use associated with existing dipper wells, consider retrofitting them by installing an in-line flow restrictor to reduce the flow rate.

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[2] U.S. Food and Drug Administration (FDA). 2017. *FDA Food Code 2017: Chapter 3—Food*. Sections 3-304.11 and 3-304.12. www.fda.gov/food/fda-food-code/food-code-2017.

[3] IAPMO, July 2024. 2023 Water Efficiency and Sanitation Standard for the Built Environment. https://epubs.iapmo.org/2023/WESTAND/

Replacement Options

Before replacing or installing a new dipper well, consider whether the facility's operations actually require a dipper well or alternative between-use rinsing device. Check with your local health inspector about whether operations require utensils to be rinsed and/or stored in running or heated water between uses. If not needed, consider removing dipper wells from your facility.[4] Metering or self-closing faucets offer alternative options that may reduce water use. Similarly, if a facility chooses not to store utensils between uses and instead wash them after each use, a facility may consider installing an ENERGY STAR® certified dishwasher. Undercounter commercial dishwashers use less than 1.2 gallons per rack (4.5 liters per rack).[5] See *WaterSense at Work Section 4.10: Dishwashers* at www.epa.gov/watersense/best-management-practices for more information.

If between-use rinsing is required or preferred, consider installing alternative technologies rather than continuous dipper wells. Intermittent and heated dipper wells use significantly less water than continuous dipper wells. Alternatively, metered faucets can achieve similar rinsing functions while improving water efficiency. When looking to replace or install new utensil rinsing technology, consider these options:

- Install a heated dipper well for utensil storage, which maintains water at a temperature of at least 135°F (57°C) to inhibit bacterial growth.
- Install an intermittent dipper well, which only draws in fresh water for rinsing as needed.
- Install a push-button metering or self-closing faucet for utensil rinsing.

Savings Potential

Facilities can achieve water savings in two ways: they can retrofit existing continuous dipper wells to reduce the flow rate, or replace continuous dipper wells with heated dipper wells, intermittent dipper wells, or metering faucets.

Dipper Well Retrofit With In-Line Flow Restrictor

Retrofitting a dipper well with an in-line flow restrictor can be a simple way to save water. To estimate facility-specific water savings and payback, use the following information.

[4] Alliance for Water Efficiency. March 2017. *Commercial Kitchens Water Use Efficiency and Best Practice Guide*. Page 16.
[5] ENERGY STAR. Commercial Dishwashers Key Product Criteria. www.energystar.gov/products/commercial_food_service_equipment/commercial_dishwashers/key_product_criteria.

Current Water Use

To estimate the water use of an existing dipper well, identify the following information and use Equation 1:

- Flow rate of the existing dipper well. Most dipper wells have flow rates of about 0.35 gpm (1.3 Lpm) or more.
- Average daily use time. Dipper wells are often run continuously during facility operating hours.
- Days of facility operation per year.

Equation 1. Water Use of Dipper Well (gallons or liters per year)

= Dipper Well Flow Rate x Daily Use Time x Days of Facility Operation

Where:

- Dipper Well Flow Rate: Gallons (or liters) per minute
- Daily Use Time: Minutes per day
- Days of Facility Operation: Days of operation per year

Water Use After Retrofit

To estimate the water use after retrofitting an existing dipper well with an in-line flow restrictor, use Equation 1, substituting the flow rate of the existing dipper well with the flow rate of the retrofit in-line flow restrictor. Some voluntary codes and standards recommend no more than 0.2 gpm (0.76 Lpm).

Water Savings

To calculate the water savings that can be achieved by replacing an existing dipper well, identify the following information and use Equation 2 on the next page:

- Current water use as calculated using Equation 1.
- Water use after retrofit as calculated using Equation 1.

Equation 2. Water Savings From Dipper Well Retrofit or Replacement (gallons or liters per year)

= Current Dipper Well Water Use – Water Use After Dipper Well Retrofit or Replacement

Where:

- Current Dipper Well Water Use: Gallons (or liters) per year
- Water Use After Dipper Well Retrofit or Replacement: Gallons (or liters) per year

Energy Savings

For dipper wells that use hot water, a reduction in water use will also result in energy savings. The energy required to heat water depends on the fuel used for water heating (e.g., electricity, natural gas), the efficiency of the water heater, and water heater temperature set points. Since this information is not always readily available, the energy savings that can be achieved from retrofitting an existing dipper well that uses hot water can be estimated using the water savings calculated using Equation 2 and the assumptions presented in Equation 3:

Equation 3. Energy Savings From Dipper Well Retrofit or Replacement (kWh of electricity or Mcf of natural gas per year)

= Water Savings x Percent of Water That Is Hot x (Energy per Gallon or Liter Heated ÷ Water Heater Efficiency)

Where:

- Water Savings: Gallons (or liters) per year
- Percent of Dipper Well Water That Is Hot: Typically 100 percent
- Energy per Gallon or Liter Heated [assuming 75°F (42°C) water temperature increase]:
    - 0.183 kilowatt hours (kWh) of electricity per gallon (0.048 kWh per liter); or
    - 0.0006 Mcf (thousand cubic feet) of natural gas per gallon (0.00016 Mcf per liter)
- Water Heater Efficiency (unless otherwise known by the facility):
    - 1.0 for an electric hot water heater; or
    - 0.75 for a natural gas hot water heater

More detailed information to assist in calculating energy savings that result from saving water can be found on WaterSense's data and information web page at www.epa.gov/watersense/data-and-information-used-watersense.

Payback

To calculate the simple payback from the water savings associated with retrofitting an existing dipper well, consider the equipment and installation cost of the retrofit, the water and energy savings as calculated using Equation 2 and Equation 3, respectively, and the facility-specific cost of water, wastewater, and energy.

Continuous Dipper Well Replacement With Heated Dipper Well

When replacing an existing continuous dipper well or installing a new between-use rinsing device, facilities can consider heated dipper wells. Heated dipper wells maintain water at 135°F (57°C) or more to inhibit bacterial growth. Heated dipper wells typically require manual replacement of the water every four hours.

Current Water Use

To estimate the current water use of an existing continuous dipper well, use Equation 1.

Water Use After Replacement With Heated Dipper Well

To estimate the water use after replacing an existing continuous dipper well with a heated dipper well, identify the following information and use Equation 4 on the next page:

- Volume of water used to fill reservoir.
- Time water remains in reservoir before being replaced.
- Average daily use time. Dipper wells are often run continuously during facility operating hours.
- Days of facility operation per year.

Water Savings

To calculate water savings that can be achieved from retrofitting an existing dipper well, identify the following information and use Equation 2.

- Current water use as calculated using Equation 1.
- Water use after replacement as calculated using Equation 4 on the next page.

Equation 4. Water Use From Heated Dipper Well (gallons or liters per year)

= (Volume of Water in Reservoir Dipper ÷ Time Water Remains in Reservoir) x Daily Use Time x Days of Facility Operation per Year

Where:
- Volume of Water Used to Fill Reservoir: Gallons or liters per cycle
- Time Water Remains in Reservoir Before Being Replaced: Hours per cycle
- Average Daily Use Time: Hours per day
- Days of Facility Operation: Days per year

Equation 5. Energy Savings From Replacing A Continuous Dipper Well With A Heated Dipper Well (kWh of electricity or Mcf of natural gas per year)

= [Water Savings x Percent of Water That Is Hot x (Energy per Gallon or Liter Heated ÷ Water Heater Efficiency)] – (Average Electricity Input Rate of Heated Dipper Well x Daily Use Time x Days of Facility Operation]

Where:
- Water Savings: Gallons (or liters) per year
- Percent of Dipper Well Water That Is Hot: Typically 100 percent
- Energy per Gallon or Liter Heated [assuming 75°F (42°C) water temperature increase]:
    - 0.183 kWh of electricity per gallon (0.048 kWh per liter); or
    - 0.0006 Mcf of natural gas per gallon (0.00016 Mcf per liter)
- Water Heater Efficiency (unless otherwise known by the facility):
    - 1.0 for an electric hot water heater; or
    - 0.75 for a natural gas hot water heater
- Average Electricity Input Rate: Device-specific average daily operating power input of heated dipper well in kilowatts (kW)
- Daily Use Time: Hours of operation per day
- Days of Facility Operation: Days of operation per year

Energy Savings

If the continuous dipper well being replaced uses hot water, there will likely be energy savings associated with the replacement. Energy savings that can be achieved from replacing an existing dipper well with a heated dipper well can be estimated using the water savings calculated above and the assumptions presented in Equation 5 on the previous page.

Payback

To calculate the simple payback from the water savings associated with replacing an existing continuous dipper well with a heated dipper well, consider the equipment and installation cost of the heated dipper well, the water and energy savings as calculated in Equation 2 and Equation 5 respectively, and the facility-specific cost of water, wastewater, and energy.

Continuous Dipper Well Replacement With Intermittent Dipper Well or Metering Faucet

Alternatively, facilities can consider replacing a continuous dipper well with an intermittent dipper well, which can also result in significant savings. A push-button metering or self-closing faucet may also serve a similar purpose to achieve water savings.

Current Water Use

To estimate the current water use of an existing continuous dipper well, use Equation 1.

Water Use After Replacement With Intermittent Dipper Well or Metering Faucet

To estimate the water use after replacing an existing continuous dipper well with an intermittent dipper well or metering faucet, identify the following information and use Equation 6:

- Flow rate of the intermittent dipper well or metering faucet (in gallons or liters per cycle).
- Average cycles used per hour.
- Average daily use time.
- Days of facility operation per year.

Equation 6. Water Use of Intermittent Dipper Well or Metering Faucet (gallons or liters per year)

= Flow Rate of Intermittent Dipper Well or Metering Faucet x Uses per Hour x Daily Use Time x Days of Facility Operation

Where:

- Flow Rate of Intermittent Dipper Well or Metering Faucet: Gallons or liters per cycle
- Uses per Hour: Cycles per hour
- Daily Use Time: Hours per day
- Days of Facility Operation: Days per year

Water Savings

To calculate water savings that can be achieved from replacing an existing continuous dipper well with an intermittent dipper well or metering faucet, identify the following information and use Equation 2.

- Current water use as calculated using Equation 1.
- Water use after replacement as calculated using Equation 6.

Energy Savings

Facilities may save energy from reduced hot water use after replacing existing continuous dipper wells with intermittent dipper wells or metering faucets. To calculate energy savings that can be achieved from replacing an existing continuous dipper well with an intermittent dipper well, identify the water savings using Equation 2 and use Equation 3.

Payback

To calculate the simple payback from the water savings associated with replacing an existing continuous dipper well with an intermittent dipper well or metering faucet, consider the equipment and installation cost; the water and energy savings as calculated in Equation 2 and Equation 3 respectively; and the facility-specific cost of water, wastewater, and energy.

Continuous Dipper Well Replacement With Dishwasher

Although installing a dipper well retrofit is likely the most cost-effective choice for a facility, significant water savings can also be achieved by replacing the need for a dipper well and instead using an ENERGY STAR certified commercial undercounter dishwasher to wash utensils.

Current Water Use

To estimate the current water use of an existing continuous dipper well, use Equation 1.

Water Use After Replacement With ENERGY STAR Certified Dishwasher

To estimate the water use of an ENERGY STAR certified commercial undercounter dishwasher, identify the following information and use Equation 7:

- Water use per rack washed. A high-temperature, ENERGY STAR certified commercial undercounter dishwasher uses 0.86 gallons (3.26 liters) per rack or less. A low-temperature model uses 1.19 gallons (4.5 liters) per rack or less.[6]
- Average estimate of racks washed per day.
- Days of operation per year.

Equation 7. Water Use of ENERGY STAR Certified Undercounter Dishwasher (gallons or liters per year)

= Water Use per Rack x Racks Washed per Day x Days of Operation

Where:

- Water Use per Rack: Gallons or liters per rack
- Racks Washer per Day: Racks per day
- Days of Operation: Days per year

Water Savings

To calculate water savings that can be achieved from replacing an existing dipper well with an ENERGY STAR certified commercial undercounter dishwasher, identify the following information and use Equation 2:

- Current water use as calculated using Equation 1.
- Water use after replacement as calculated using Equation 7.

[6] ENERGY STAR. Commercial Dishwashers Key Product Criteria. www.energystar.gov/products/commercial_food_service_equipment/commercial_dishwashers/key_product_criteria.

Payback

To calculate the simple payback from the water savings associated with replacing an existing dipper well with an ENERGY STAR certified commercial undercounter dishwasher, consider the equipment and installation cost of the new dishwasher, the water savings as calculated in Equation 2, and the facility-specific cost of water and wastewater.

The facility should also consider the energy impact of replacing the dipper well with an ENERGY STAR certified dishwasher. A dishwasher might use less hot water than a dipper well, but it also uses energy to run cleaning cycles.

See *WaterSense at Work Section 4.10: Dishwashers* at www.epa.gov/watersense/best-management-practices for more information about dishwasher water and energy use.

Additional Resources

Alliance for Water Efficiency (AWE). March 2017. *Commercial Kitchens Water Use Efficiency and Best Practices Guide*. www.allianceforwaterefficiency.org/impact/our-work/commercial-kitchens-guide.

Frontier Energy. November 2017. *Dipper Well Replacement Field Evaluation Report*. Prepared for the Metropolitan Water District of Southern California. www.bewaterwise.com/assets/2015icp-dipperwellfrontierenergy.pdf

New York City (NYC) Environmental Protection. *Restaurant Managers Guide to Water Efficiency*. www.nyc.gov/assets/dep/downloads/pdf/water/drinking-water/restaurant-managers-guide-to-water-efficiency.pdf.

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