

Glossary of Terms Used in the Water Sector

Companion document to *Increasing Energy Efficiency in Urban Water Systems: Summary Report*

There are many ways to express and describe the functions and efficiencies of electrical and hydrodynamic processes. While the electrical efficiency and water efficiency sectors may use the same words or terms when speaking of process and efficiency, these words and terms do not always mean the same thing. This glossary was developed to alleviate potential confusion between sectors.

For the convenience of the reader, this glossary includes terms used in the definitions of other terms and references used within the above-mentioned companion report.

acre-foot

A volume of water that covers one acre to a depth of one foot, or 43,560 cubic feet (1,233.5 cubic meters) or 325,851 gallons.

advanced metering infrastructure (AMI)

A system that measures, collects, and analyzes energy usage while interacting with advanced devices such as water meters through various communication media, either on demand or on predefined schedules. This infrastructure includes hardware, software, communications, consumer energy displays and controllers, customer-associated systems, meter data management software, and supplier and network distribution systems.

aeration

The process of adding air to water. Air can be added to water by either passing air through water or passing water through air through mechanical processes.

air blower

A device used to ventilate portions of a system such as manholes and lift stations.

air lift pump

A special type of pump consisting of a vertical riser pipe submerged in the wastewater or sludge to be pumped. Compressed air is injected into a tail piece at the bottom of the pipe. Fine air bubbles mix with the wastewater or sludge to form a mixture lighter than the surrounding water, which causes the mixture to rise in the discharge pipe to the outlet.

air padding

Pumping dry air (dew point -40°F (-40°C)) into a container to assist with the withdrawal of a liquid or to force a liquefied gas such as chlorine or sulfur dioxide out of a container.

alternating current (AC)

An electric current that reverses its direction (positive/negative values) at regular intervals.

altitude valve

A valve that automatically shuts off the flow into an elevated tank when the water level in the tank reaches a predetermined level. The valve automatically opens when the pressure in the distribution system drops below the pressure in the tank.

analyzer

A device that conducts a periodic or continuous measurement of turbidity or some factor such as chlorine or fluoride concentration. Analyzers operate by any of several methods, including photocells, conductivity, or complex instrumentation.

aquifer

A natural, underground layer of porous, water-bearing materials (e.g., sand, gravel), usually capable of yielding a large amount or supply of water.

asset management

The process of maintaining the functionality and value of a utility's assets through repair, rehabilitation, and replacement. Examples of utility assets include buildings, tools, equipment, pipes, and machinery used to operate a water or wastewater system. The primary goal of asset management is to provide safe, reliable, and cost-effective service to a community over the useful life of a utility's assets.

audit, water

A thorough examination of the accuracy of water agency records or accounts (volumes of water) and system control equipment. Water managers can use audits to determine their water distribution system efficiency. The overall goal is to identify and verify water and revenue losses in a water system.

average demand

The average demand for water during a period of time. For example, average daily demand is obtained by dividing the total demand for water during a specified period of time by the number of days in that time period.

back pressure

Pressure that can cause water to backflow into the water supply when a user's water system is at a higher pressure than the public water system.

backflow

A reverse flow condition, created by a difference in water pressures, that causes water to flow back into the distribution pipes of a potable water supply from any source or sources other than an intended source.

benchmarking

A process an agency uses to gather and compare information about the productivity and performance of other similar agencies with its own information. The purpose of benchmarking is to identify best practices, set improvement targets, and measure progress. The benchmark is a standard or point of reference used to judge or measure quality or value.

best available technology (BAT)

BAT is based on the very best (state-of-the-art) control and treatment measures that have been developed, or are capable of being developed, and that are economically achievable within the appropriate industrial category.

best practicable technology (BPT)

A level of technology represented by the average of the best existing performance levels within the industrial category.

capital improvement plan (CIP)

A detailed plan that identifies requirements for the repair, replacement, and rehabilitation of facility infrastructure over an extended period, often 20 years or more. A utility usually prepares or updates this plan annually. For water systems, the CIP is often a part of a master plan that combines water demand projections with supply alternatives and facility requirements. For wastewater systems, the CIP consists of programs and projects to upgrade and rehabilitate wastewater collection and treatment systems and increase their capacity to allow for future growth.

commissioning

The procedure used by a utility agency to inspect, test, train staff, start up, operate, and ultimately accept a new facility.

conduit

Any artificial or natural duct, either open or closed, for carrying fluids from one point to another. An electrical conduit, for example, carries electricity.

consumptive use

The part of withdrawn water that is evaporated, transpired by plants, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Also referred to as water consumed.

control system

An instrumentation system that senses and controls its own operation on a close, continuous basis in what is called proportional (or modulating) control.

controller

A device that controls the starting, stopping, or operation of a device or piece of equipment.

conveyance loss

Water that is lost in transit from a pipe, canal, or ditch by leakage or evaporation. Generally, the water is not available for further use; however, leakage from an irrigation ditch, for example, may percolate to a groundwater source and be available for further use.

cubic feet per second (cfs)

A unit of measurement used to describe rate of flow, in streams and rivers, for example. It is equal to a volume of water one foot high and one foot wide flowing a distance of one foot in one second. One cfs is equal to 7.48 gallons of water flowing each second. For example, if your car's gas tank is two feet by one foot by one foot (two cubic feet), then gas flowing at a rate of one cfs would fill the tank in two seconds.

current

A movement or flow of electricity. Electric current is measured by the number of coulombs per second flowing past a certain point in a conductor. A coulomb is equal to about 6.25×10^{18} electrons. A flow of one coulomb per second is called one ampere, the unit of the rate of flow of current.

cycle

A complete alternation of voltage or current in an AC circuit.

debt service

The amount of money required annually to pay 1) interest on outstanding debts or 2) funds due on a maturing bonded debt or the redemption of bonds.

desalinization

The removal of dissolved salts (such as sodium chloride, NaCl) from water by natural means (leaching) or by specific water treatment processes.

direct current (DC)

Electric current flowing in one direction only and essentially free from pulsation.

distributed control system

A computer control system that has multiple microprocessors to distribute the functions performing process control, thereby distributing the risk from component failure. The distributed

components (input/output devices, control devices, and operator interface devices) are all connected by communications links and permit the transmission of control, measurement, and operating information to and from many locations.

domestic water use

Water used for household purposes, such as drinking, preparing food, bathing, flushing toilets, watering lawns and gardens, and washing clothes, dishes, and dogs. About 85 percent of domestic water is delivered to homes by a public-supply facility, such as a county water department. About 15 percent of the nation's residents supply their own water, mainly from wells.

drawdown

1. The drop in the water table or level of water in the ground when water is being pumped from a well.
2. The amount of water used from a tank or reservoir.
3. The drop in the water level of a tank or reservoir.

electric current

The flow of electric charges.

electricity

Physical conditions associated with the presence and flow of electric charges.

energy savings performance contracts (ESPCs)

A financing mechanism used by energy service companies (ESCOs) to make energy-efficiency upgrades to facilities on behalf of the owner, which are then paid for with money resulting from the energy savings.¹

enterprise fund reserves

Enterprise fund reserves typically serve two purposes: 1) funding unanticipated or emergency repairs to utility infrastructure (e.g., water main breaks, pump failures, etc.) and 2) making up for revenue shortfalls due to variations in utility usage (e.g., lower water usage during drought conditions) to provide a financial buffer, avoiding the need to continually adjust rates to account for usage variations. The minimum level of reserves relative to investments and operations costs is often defined in the debt covenants with the lender.

equity

The value of an investment in a facility.

¹ For more information, go to <http://energy.gov/eere/slsc/energy-savings-performance-contracting>.

evaporation

The process by which water or another liquid becomes a gas (such as water vapor or ammonia vapor).

feasible

Capable of being accomplished within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.²

feedback

The circulating action between a sensor measuring a process variable and the controller that controls or adjusts the process variable.

fixed costs

Costs (e.g., rent, insurance, interest) that a utility must cover or pay even if there is no demand for water or no water to sell to customers.

flow

The continuous movement of a liquid from one place to another.

fresh water

Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L of dissolved solids is undesirable for drinking and many industrial uses.

fuse

A protective device that has a strip or wire of fusible metal that, when placed in a circuit, will melt and break the electric circuit if heated too much. High temperatures will develop in the fuse when a current flows through the fuse in excess of that which the circuit will carry safely.

gauge

A device for checking or measuring a particular dimension of something, using specific standardized units. For example, a gauge might measure the elevation of a water surface, the velocity of flowing water, the pressure of water, the amount or intensity of precipitation, or the depth of snowfall. Gauges are also used to determine the location or position of equipment during installation and after operation.

gravity flow

Water or wastewater flowing from a higher elevation to a lower elevation due to the force of gravity. The water does not flow due to energy provided by a pump. Wherever possible, wastewater collection systems are designed to use the force of gravity to carry waste liquids and solids.

² California Water Code Section 8307

greywater

Wastewater from clothes-washing machines, showers, bathtubs, lavatories and sinks.

ground

An expression representing an electrical connection to earth or a large conductor that is at the earth's potential or neutral voltage.

groundwater

Subsurface water in the saturation zone from which wells and springs are fed. In a strict sense, the term applies only to water below the water table.

groundwater depth

The distance of the groundwater table below the surface at any selected location.

groundwater recharge

The natural or intentional infiltration of surface water into the zone (ground) of saturation.

groundwater table

The average depth or elevation of the groundwater over a selected area.

head

The vertical distance, height, or energy of water above a reference point. A head of water may be measured in either height (feet or meters) or pressure (pounds per square inch or kilograms per square centimeter).

head loss

The head, pressure, or energy (they are the same) lost by water flowing in a pipe or channel as a result of turbulence caused by the velocity of the flowing water and the roughness of the pipe, channel walls, or restrictions caused by fittings. Water flowing in a pipe loses head, pressure, or energy as a result of friction. Also called *friction loss*.

headworks

The facilities where wastewater enters a wastewater treatment plant. The headworks may consist of bar racks or bar screens, comminutors, a wet well, and pumps.

hectare

A metric unit equal to 2.471 acres or 10,000 square meters

hertz (Hz)

The number of complete electromagnetic cycles or waves in one second of an electric or electronic circuit. Also called *frequency of the current*.

hydraulic gradient

The slope of the hydraulic grade line. This is the slope of the water surface in an open channel, the slope of the water surface of the groundwater table, or the slope of the water pressure for pipes under pressure.

influent

Water or other liquid—raw (untreated) or partially treated—flowing into a reservoir, basin, treatment process, or treatment plant.

injection well

A well constructed for the purpose of injecting water (including treated wastewater) directly into the ground. Water is generally forced (pumped) into the well for dispersal or storage into a designated aquifer.

input horsepower

The total power used in operating a pump and motor.

$$\text{Input Horsepower, HP} = \frac{(\text{Brake Horsepower, HP})(100\%)}{\text{Motor Efficiency, \%}}$$

interceptor

A septic tank or other holding tank that serves as a temporary wastewater storage reservoir for a septic tank effluent pump (STEP) system.

irrigation

The controlled application of water for agricultural purposes through manmade systems to supply water requirements not satisfied by rainfall.

kinetic energy

Energy possessed by a moving body of matter, such as water, as a result of its motion.

life-cycle costing

An economic analysis procedure that considers the total costs associated with a sewer during its economic life, including development, construction, and operation and maintenance (includes chemical and energy costs). All costs are converted to a present worth or present cost in dollars.

lift station

In water systems, a series of pumps and valves that lifts water (or wastewater) to a higher elevation. Lift stations, also known as *pump stations*, may be equipped with air-operated ejectors or centrifugal pumps.

mechanical aeration

The use of machinery to mix air and water so that oxygen can be absorbed into the water. Some examples are paddle wheels, mixers, or rotating brushes to agitate the surface of an aeration tank; pumps to create fountains; and pumps to discharge water down a series of steps forming falls or cascades.

metered

Measured through a meter, as a quantity of water or flow might be measured.

million gallons

A unit of measurement used in wastewater treatment plant design and collection system capacities or performances. One million gallons of water is approximately equivalent to these units of measurement:

- 13,690 cubic feet
- 3.07 acre-feet
- 8,340,000 pounds
- 4,170 tons
- 3,785 cubic meters

motor efficiency

The ratio of energy delivered by a motor to the energy supplied to it during a fixed period or cycle. Motor efficiency ratings will vary depending on motor manufacturer and usually will be near 90 percent.

nameplate

A durable, metal plate found on equipment that lists critical installation and operating conditions for the equipment.

operating pressure differential

The operating pressure range for a hydropneumatic system. For example, when the pressure drops below 40 psi in a system designed to operate between 40 psi and 60 psi, the pump will turn on and stay on until the pressure builds up to 60 psi. When the pressure reaches 60 psi, the pump will shut off. The operating pressure differential in this example is 20 psi.

operation and maintenance

Efforts that must be expended to keep facilities in good working order and condition so they continue to perform as designed; poorly maintained facilities tend to be more vulnerable to failure.

outfall

1. The point, location, or structure where wastewater or drainage discharges from a sewer, drain, or other conduit.
2. The conduit leading to the final discharge point or area. Also see *outfall sewer*.

overall pump efficiency

The combined efficiency of a pump and motor together. Also called *wire-to-water efficiency*.

overdraft

The pumping of water from a groundwater basin or aquifer in excess of the supply flowing into the basin. This pumping results in a depletion or mining of the groundwater in the basin.

peak demand

The maximum momentary load placed on a water treatment plant, pumping station, or distribution system. This demand is usually the maximum average load in one hour or less but may be specified as the instantaneous load or the load during some other short time period.

potable water

Water of a quality suitable for drinking.

raw water

1. Water in its natural state, prior to any treatment.
2. Water entering the first treatment process of a water treatment plant.

reclaimed wastewater

Treated wastewater that can be used for beneficial purposes, such as irrigation and industrial processes that do not require potable water.

recycled water

Water that is used more than one time before it passes back into the natural hydrologic system.

representative sample

A subset (sample) of a population that reflects the entire population, such as portion of material, water, or wastestream that is as similar as possible in content and consistency to that in the larger body being sampled.

reservoir

A pond, lake, or basin, either natural or artificial, for the storage, regulation, and control of water.

reuse

The use of water or wastewater after it has been discharged and then withdrawn by another user. Also see *recycle*.

reverse osmosis (RO)

The application of pressure to a concentrated solution, which causes the passage of a liquid from the concentrated solution to a weaker solution across a semipermeable membrane. The membrane allows the passage of the water (solvent) but not the dissolved solids (solutes). In the reverse osmosis process, two liquids are produced: the reject (containing high concentrations of dissolved solids) and the permeate (containing low concentrations). The clean water (permeate) is not always considered to be demineralized. Also see *osmosis*.

supervisory control and data acquisition (SCADA)

A computer-monitored alarm, response, control, and data acquisition system used to monitor and adjust treatment processes and facilities.

sensor

A device that measures (senses) a physical condition or variable of interest. Floats and thermocouples are examples of sensors. Also called *primary element*.

surface water

Water that is on the earth's surface, such as in a stream, river, lake, or reservoir.

telemetry equipment

Equipment that translates physical measurements into electrical impulses that are transmitted to dials or recorders.

telemetry

The electrical link between a field transmitter and receiver. Telephone lines are commonly used as electrical lines.

temperature sensor

A device that opens and closes a switch in response to changes in the temperature. This device might be a metal contact or a thermocouple that generates a minute electric current proportional to the difference in heat or a variable resistor with a value that changes in response to changes in temperature. Also called *heat sensor*.

tertiary treatment

Any process of water renovation that upgrades treated wastewater to meet specific reuse requirements. May include general cleanup of water or removal of specific parts of wastes

insufficiently removed by conventional treatment processes. Typical processes include chemical treatment and pressure filtration. Also called *advanced waste treatment*.

ultraviolet (UV)

Pertaining to a band of electromagnetic radiation just beyond the visible light spectrum. UV radiation is used to disinfect water and wastewater. When UV radiation is absorbed by the cells of microorganisms, it damages the genetic material in such a way that the organisms are no longer able to grow or reproduce, thus it ultimately kills them.

upstream

The direction against the flow of water, or toward or in the higher part of a sewer or collection system.

urban area

A location characterized by high human population and human-built features; these areas can be cities or towns.

urban water supply system

A water system designed and operated to supply the domestic supply needs of a city or town. This water is withdrawn from a source, treated to appropriate standards and then provided for domestic, commercial, thermoelectric power, industrial, and public water users.

variable costs

Costs that a utility must cover or pay that are directly associated with the actual production and delivery of service. These costs fluctuate.

variable-frequency drive

A control system that allows the frequency of the current applied to a motor to be varied. The motor is connected to a low-frequency source while standing still; the frequency is then increased gradually until the motor and pump (or other driven machine) are operating at the desired speed.

vault

A small, box-like structure that contains valves used to regulate flows.

voltage

The electrical pressure available to cause a flow of current (amperage) when an electric circuit is closed. Also called *electromotive force (EMF)*.

wastewater

A community's used water and water-carried solids (including used water from industrial processes) that flow to a treatment plant. Stormwater, surface water, and groundwater infiltration

may also be included in the wastewater that enters a wastewater treatment plant. The term *sewage* usually refers to household wastes, but this word is being replaced by the term *wastewater*.

wastewater facilities

The pipes, conduits, structures, equipment, and processes required to collect, convey, and treat domestic and industrial wastes and discharge or reuse of the effluent and sludge.

water cycle

The process of the evaporation of water into the air and its return to earth by precipitation (rain or snow). This process also includes transpiration from plants, groundwater movement, and runoff into rivers, streams, and the ocean. Also called the hydrologic cycle.

water supplier

An agency, utility, or person that supplies water (usually potable) to a customer.

watt

A unit of power equal to one joule per second. The power of a current of one ampere flowing across a potential difference of one volt.

well

An artificial excavation put down by any method for the purpose of withdrawing water from underground aquifers. Specifically, a bored, drilled, or driven shaft or a dug hole with a depth greater than that of the largest surface dimension, the purpose of which is to reach underground water supplies or to store or bury fluids belowground.

wire-to-water efficiency

The combined efficiency of a pump and motor. Also called *overall efficiency*.

yield

The quantity of water (expressed as a rate of flow—GPM, GPH, GPD, cu m/day, ML/day, or total quantity per year) that can be collected for a given use from surface or groundwater sources. The yield may vary depending on the use proposed, the plan of development, and economic considerations. Also called *safe yield*.