Water and energy are connected in the brewery: energy is almost entirely used to heat, cool or evaporate water of aqueous systems, and the high specific heat of water assures that much energy is required for this. Both commodities have become increasingly expensive over the years, and in most recent times energy especially so. Conservation of energy and water and control of pollution have become watchwords of modern brewing. Most breweries use 4 to 6 hectoliters of water per hectoliter of beer produced, but some use much more, especially small breweries.

Water first affects brewers as soil moisture in the barley-growing districts. It arises as snowmelt water or as winter rains. Sufficient, but not excessive, soil moisture permits the soil to warm up quickly in Spring and be ready to be planted with seed. Spring rain, or in some areas irrigation, assures the barley plant grows to maturity and forms an adequate head in which the seeds fill properly; absence of appropriate rain during ripening and harvest contribute to a satisfactory barley crop. Barley for brewing use, among other qualities (see Chapter 8), must be of low moisture content suitable for prolonged (up to 15 months) storage. Moisture content and temperature are the variables that determine how long a lot of barley can be stored. Barley harvested at high moisture must be dried for storage.

After preparation for malting barley enters the steep, in which the grain is buried in water. Water for steeping must be cool (about 12°C), potable
and free of excessive iron, sulfur or other noxious elements. A cool steep assures that water uptake is properly paced so that each kernel is evenly wetted; the process takes about 2 days. Warmer water accelerates the process but also promotes unevenness of water uptake. The husk rapidly takes up water and is regarded as a reservoir from which the grain can absorb water during, e.g., steeping air rests or in germination, and the water is siphoned to the micropyle through the ventral crease. Water enters the grain itself through the micropyle region close to the embryo where the testa is thin or absent. The embryo therefore also hydrates quite quickly. However, water penetration into the endosperm takes much more time, and it is here that “mealy” (rather than “steely”) kernels are preferred. In a mealy endosperm water penetrates more rapidly and evenly from the embryo (proximal) end toward the distal end of the kernel, and more rapidly on the dorsal side than the ventral. Sufficient and even moisture uptake by the endosperm is required if sufficient and even modification of the endosperm is to follow during the germination phase of malting.

Maltsters wish to limit water use because water is expensive to acquire and to dispose of, especially in the heavily polluted form (steep water) in which it leaves the malt house. Steep water performs two main functions: (1) it washes the grain including removal of microbes and (2) provides the water for grain hydration. It is now quite common to separate these two functions and first put the grain through a barley washer in which it is aggressively and efficiently cleaned before it enters the steep proper. There is no reason why different conditions cannot be used in barley washing and barley steeping, e.g., agitation, aeration, lime cleaner and temperature. This saves water. In steeping, barley takes up water and begins to respire and the microbes associated with the grain also take up oxygen and produce CO₂. It is therefore necessary to assure a sufficient supply of air (oxygen) to prevent the grain from suffocating. The barley swells to nearly 1.5× original volume as it takes up water.

The objective of steeping is to assure that grain reaches the overall moisture content required for the malt being made; this is almost always in the range 42% (e.g., for regular pale malt of average modification made from a vigorous variety of barley) to say 48% (for dark malt or well-modified malt, especially one made from a less vigorous variety). The “steep-out” moisture of barley therefore is a major determinant of future malt quality and an harbinger of malting losses that might accrue; generally higher malting losses result from higher steep-out moistures. The end of steeping is signaled by the appearance of the “chit” or coleorhiza. Further exposure to water after chitting would drown the grain.

Water is occasionally added to grain during germination if the grain is falling behind in its development. This water almost certainly affects only the embryo. Water addition also counteracts the tendency of the grain bed to dry out under the influence of airflow in the germination vessel. The airflow