by Craig Tapscott and Geoffery Glanders

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Water Conservation Comes of Age—Computing Your Water Footprint

Stresses on water resources are a burgeoning problem at all levels in the United States and around the world. This problem not only affects access to fresh water for individuals and local municipalities, but for industrial and agricultural interests as well. The impact of increased water usage will be intensified as the effects of climate change and heightened demand manifest themselves in the near future.[1] Water footprinting is the first step in analyzing water usage and can provide a roadmap to begin conservation methods.

Water footprinting can be broadly defined as the total amount of water directly and indirectly consumed and the amount of discharged polluted water associated with the manufacture of a product. The term virtual water is often centrally associated with water footprinting and depicts the total quantity of water utilized (or more appropriately consumed) to generate a product.

Modern developments in water footprinting have adopted three areas of focus: green, blue, and grey water. These areas incorporate both direct and indirect consumption water uses, as well as the water necessary to dilute any pollutants added to discharge water to levels below recognized standards.

Green Water Footprinting

Green water footprinting refers to identifying and computing the consumption of rainwater stored in the soil as moisture. This moisture is called green water. In most instances, the consumption of green water is achieved in agriculture as plants remove water found in the soil and release it through transpiration.[1,2] Industries relying on agricultural interests to maintain production should realize indirect green water consumption by their suppliers is very large and, in most cases, will account for the majority of their water footprint. For these industries, the green water portion of the total water footprint can exceed 90%.[4]

Blue Water Footprinting

The water footprints of manufacturing and industrial concerns, particularly those with no production dependencies on agriculture, will focus more on the consumption of surface and groundwater resources. These reserves are commonly referred to as blue water resources. Blue water is typically consumed during the production or manufacture of a product and is returned to the water system at a different temporal and spatial position from which it was originally drawn.

Water used in the production of a product can incorporate many direct and indirect consumptive uses. All uses of water at a production facility must be considered in the blue water footprint.[3-5] Direct blue water uses can include process water utilization, facility domestic water use, water consumed in food preparation and facility cleaning, as well as water utilized in emergency protection systems. Indirect water usages are associated with these same consumptive practices, yet occur at facilities outside the focus of the investigation. These facilities often provide such materials as packaging, labeling, and storage material to the facilities under scrutiny.

Typically, blue water directly consumed at a facility is obtained through connections with local water utilities or gathered on-site from groundwater wells or reservoirs. Facilities that do not use large amounts of process water must focus on overall facility water use and the water utilized by their suppliers. Large industrial and many power-generating facilities utilize large amounts of blue water.

Grey Water Footprinting

The third area of modern water footprinting focuses not only on the amount of pollution generated through production of a product, but on the amount of freshwater needed to dilute pollutant concentrations to ambient water quality levels to ensure downstream water use is maintained. This overall focus is called grey water footprinting.

Unlike green and blue water footprints, which involve consumption, grey water footprints involve water discharge. Discharges can be analyzed on both agricultural and industrial levels. Pollutant discharges can include sedimentation and nitrogen loading in agricultural settings or inorganic and thermal pollutants in industrial settings.[3-5] For this reason, grey water footprints are significantly larger within industrial sectors that rely on agriculture and within the agricultural sector itself. Grey water discharges can be reduced or eliminated through treatment on-site or at municipal wastewater facilities.

Water Footprinting Data Needs

In order for a water footprint to be complete, it is of utmost importance that a facility utilize as much data as possible that is unique to the facility. It is tempting to use broad generalizations and estimates in the overall accounting of water footprinting; however, the use of these broad generalizations can affect the comparability of the water footprint to other areas and facilities. Generalizations may also reduce the ability of a source or facility to adequately analyze the areas of water use and promote necessary water conservation strategies.[3,5]

Actual water usage data may include potable municipal water used, well or reservoir pumping data, as well as specific water discharge data from facility outfalls or to the publically owned treatment works. In addition, facilities should attempt to measure how the internal process water is utilized, whether it is for domestic use at the facility, food service preparation, facility cleaning, and sanitation activities or for facility specific process requirements. Actual internal and external process data are necessary to develop accurate water footprints.

Climate data and any other external process water usage data should also be utilized. This type of external data may include localized rainfall, soil and temperature data, as well as facility stormwater management procedures. Facilities must also attempt to attain as much actual water usage data from their suppliers as possible.

Several large-scale commercial companies, including Coca-Cola,[5] have accurately measured all three sectors of the water footprint and provide an excellent example for companies to follow.

Comparison to Carbon Footprinting

Water footprinting is becoming an increasingly important metric for all types of entities to measure the environmental affect of a particular operation and the overall impact on natural resources used, especially on a local scale. Even though water footprinting can provide a very accurate picture of water use at a facility, the impact may be difficult to correlate between facilities. This difficulty arises from water availability, among other factors, and can be very specific to a particular geographic region.[1-3,5] Water demands are very specific to geographic regions and water usage in one geographic area may be substantially more impactful than water usage in another. To truly assess the environmental impacts from water footprinting results, the local aspects of water availability and water quality must be considered.

This is unlike comparison of impacts associated with carbon footprint results. Carbon emissions (including normalized emissions from other greenhouse gases) are essentially the same wherever they are emitted and have a global impact rather than local. This aspect also allows comparisons of carbon footprinting to be made across industries and across large geographic scales.

The ongoing lesson organizations are learning is when comparing water footprints, entities must set appropriate spatial and temporal boundaries to ensure comparisons are utilized appropriately. Only by thoughtfully considering these boundaries, can comparisons between facilities located in different geographic areas with differing water demands be made to allow sound policies on water use.

Summary

Water footprinting is an important tool facilities can use to track water usage and determine their effect on the water resources of a region and local area. For a comprehensive analysis, one must consider water usage utilized directly at the facility and indirectly by suppliers. The analysis must also consider water appropriated to remove or dilute pollutants found in discharge streams. Modern water footprints consist of three distinct areas: green, blue, and grey water footprints.

In order for the water footprint to be most useful, actual data, rather than engineering estimates, should be gathered to generate the water footprint. These data should include all internal and external process usage data. Localized climatic and environmental data must also be considered in the water footprinting exercise as well. Facilities should be wary of using water footprinting results to make broad generalizations about facility environmental impacts unless they first consider the local factors associated with water availability, quality, and consumption. **em**

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References

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