

WATER MANAGEMENT IN THE STEEL INDUSTRY worldsteel position paper



Water management in the steel industry

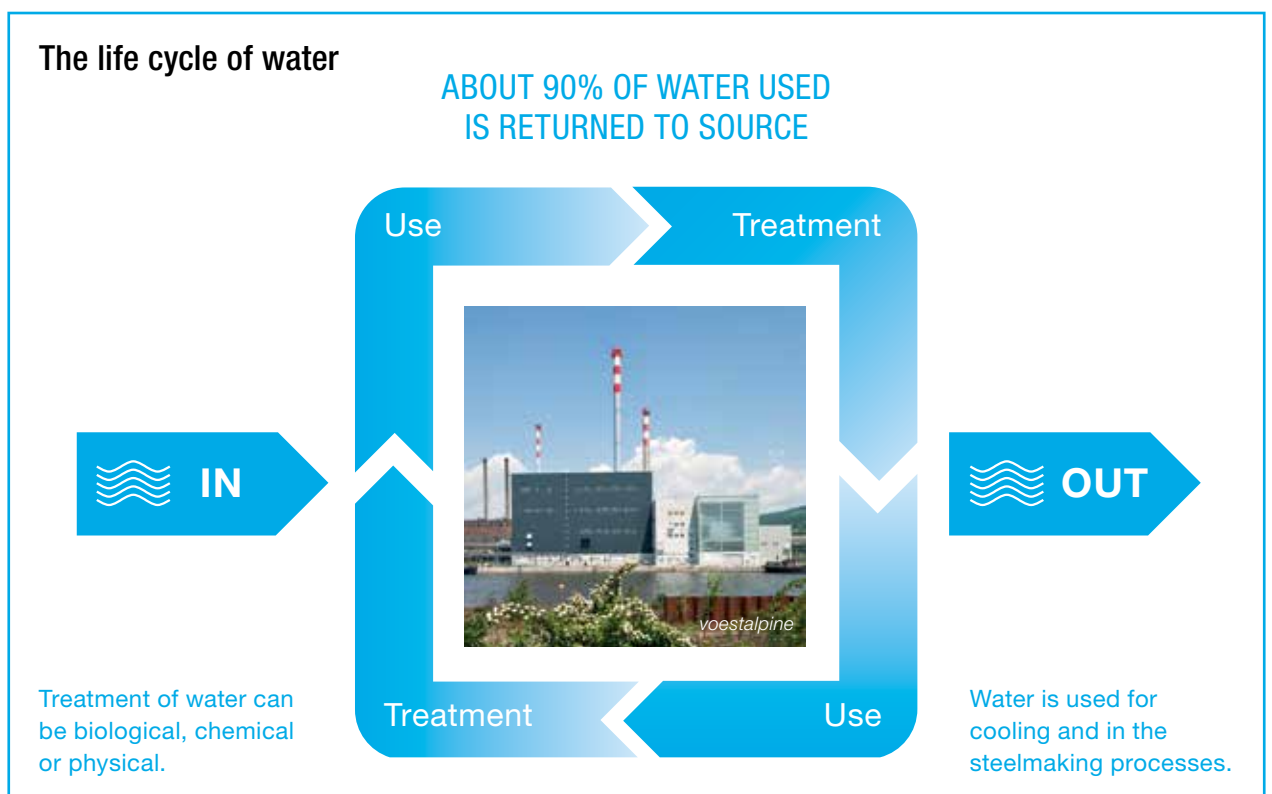
The steel industry recognises the important role that water plays in its manufacturing operations and also its value to society. Even though the steel industry uses large quantities of water, very little of that water is actually consumed as most is reused or returned to source. For example, sea water is almost exclusively used in cooling operations and the loss during these processes may account for less than 1% of the total due to evaporation. Although the intake is considerable, the water is returned to the sea without any change in quality. Water recycled back into rivers and other sources is often cleaner than when extracted.

In addition to being used in cooling operations, water is required throughout the steelmaking process for descaling, dust scrubbing and other processes.

The steel industry uses all types of water. Fresh water availability and quality is a major concern in large parts of the world and the management of water resources is considered to be the most important sustainability challenge after climate change. Fresh water resources are at risk due to demands from a growing global population and increased industrial activity, in particular in developing countries.

The steel industry takes its responsibilities for water management seriously and is constantly evaluating how best to use water, finding improvements both in conservation and reuse.

In the same way as steel, water can be reused and recycled, thus improving efficiency of use and reducing demand as well as cost. By increasing water recycling and cascading water use from higher to lower quality, steel producers have been able to reduce their water use and consumption considerably.



Sea water versus fresh water

Sea water is mainly used for once-through cooling without pre- or post-treatment. It does not come into contact with the material or equipment. Fresh water is mainly used for processes and cooling. It comes into contact with the material and equipment and is treated before reuse or discharge.

Water use and water consumption



- Water use = water intake
- Water consumption = water intake - water discharge

Water issues and how they are managed at specific steel plants vary greatly due to local conditions such as water availability, water quality, plant configuration and legislation.

Regulatory framework

A local approach is necessary

Though almost all activities and areas of the world are facing or will face water challenges, the nature of the challenges varies significantly. They include fresh water scarcity, salinisation, flooding and pollution.

Due to this variability, regulatory frameworks need to be tailor-made, taking local conditions such as water availability and discharge options into account. Water management is therefore most effectively regulated by local and/or regional authorities. Typically, regional authorities are best suited to dealing with quantitative issues as these issues concern the entire water basin, whereas local authorities are best suited to dealing with quality issues related to waste water discharge for example. Generic global or continental measures, in particular if expressed as a reduction in water usage per tonne of product, do not take these local circumstances into account, and might even be counterproductive. They should therefore not be applied at all.

→ Water usage objectives should always be linked to water scarcity.

→ Local and/or regional authorities are the most competent regulatory bodies for water management issues since they are best placed to assess the local/regional circumstances.

Water reuse

Energy consumption must be considered

The most effective way to reduce water intake is by reusing it. This usually involves cleaning and cooling water flows between each use. Some of these treatments, such as cooling, require large amounts of energy and can lead to increased rates of water consumption due to greater evaporation. The additional processes required are nearly always in conflict with objectives to reduce energy consumption or CO₂ emissions. It is therefore necessary to assess the effectiveness of water reuse in an integrated manner, taking all environmental aspects into consideration.

→ It is imperative to consider the potential increase in energy use before implementing any water reuse management system.

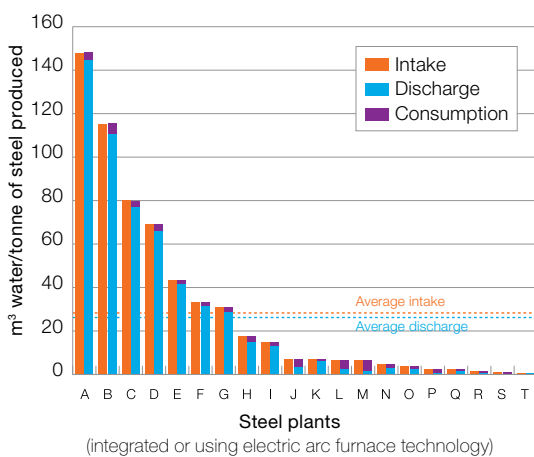
→ As the reuse of water in a high-temperature industry can increase water consumption, it is crucial to have a holistic view of the overall impact on water resources.

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Water intake and discharge

A worldsteel member survey published in 2011 showed that the average water intake for an integrated plant was 28.6 m³ per tonne of steel produced, with an average water discharge of 25.3 m³. For the electric arc furnace route, the average intake was 28.1 m³ per tonne of steel, with an average discharge of 26.5 m³. This demonstrates that overall water consumption per tonne of steel produced is low, ranging from 3.3 m³ to 1.6 m³. Most of the water is lost due to evaporation.

Water intake and discharge at 20 steel plants surveyed*, including sea water for once-through cooling



*Sample of results from 'Water management in the steel industry' report, worldsteel, 2011

Zero effluent discharge

Need to examine cross-media environmental effects

In areas with fresh water shortage, it is becoming more common to introduce 'zero discharge' policies for industrial plants. The purpose is to reduce usage by encouraging recirculation. In order for the water to be reused, it needs to be cooled and desalinated since an increased concentration of salt in water circulation systems (due to evaporation) can affect vital equipment, for example, in the the rolling mills. A significant amount of energy is required to crystallise solid salt out of the brines which are a by-product of the desalination process. Furthermore, the salt that is created in the process is normally of poor quality and can rarely be used. Processing the salt to acceptable purity levels is usually too expensive. These salts are therefore highly problematic. Typically, they need to be landfilled at very high cost. Additionally, they are difficult to manage on a waste disposal site as they have a significant influence on the quality of leachate.

Increased recycling can also cause a higher consumption of water due to increased evaporation.

→ Due to the additional energy required, increased consumption, and the need to treat/dispose of generated by-products, it is crucial to have a holistic approach taking all environmental aspects into account when considering the introduction of zero effluent discharge policies.



Plant configuration considerations

Brownfield versus greenfield sites

Steel plants have a long service life. Their configurations change over the years in order to adapt to new circumstances. The possibility to alter these sites further is often limited due to space restrictions and/or existing water interdependencies between processes. These limitations should be considered when assessing the water management of a site. Older plants should not be compared to greenfield sites where water consumption considerations were taken into account during the design phase as new plants will be designed for optimal use of resources.

→ **Brownfield limitations should be taken into consideration when assessing water management improvement possibilities.**

Power plants

It is generally acknowledged that power generation uses a considerable amount of water, primarily for cooling. When comparing water use at different steel manufacturing sites, it makes a significant difference whether or not the power generation facility is on-site or off-site. All comparisons should be on a like-for-like basis.

→ **The location of the power plant should be taken into account when comparing water use between sites. Whether the power plant is on-site or off-site will have an impact on the site's overall water use.**



Cooling towers - NLMK

Water footprint

Due to the recognised importance of water issues globally, there is a desire to find a method to evaluate the impact caused by products, services and organisations related to water. In many cases, these efforts focus only on water usage rather than on consumption because this is the easiest information to collect. Unfortunately, local aspects, such as availability and quality, are often left out which could lead to a misinterpretation of the true water related impacts.

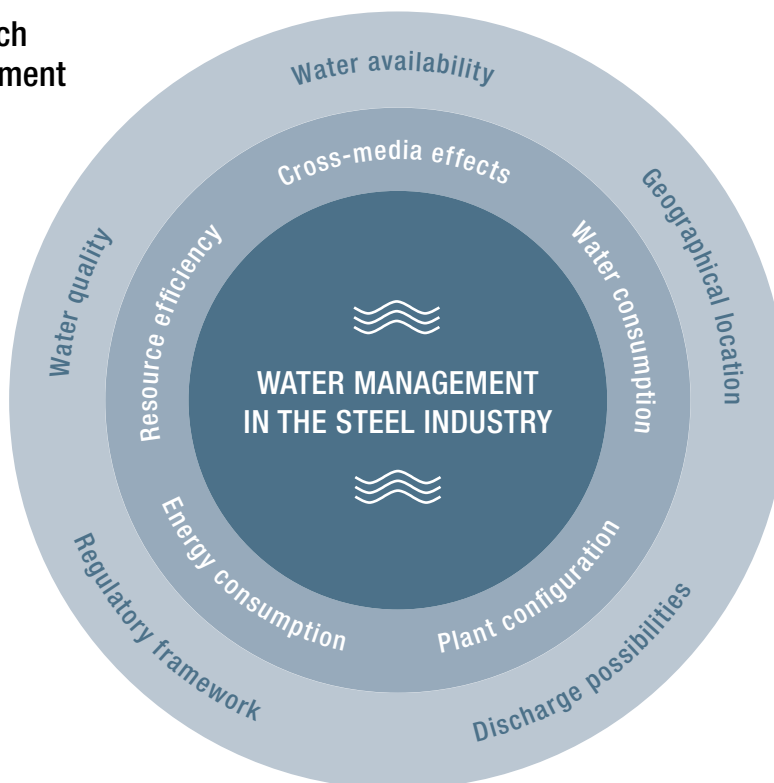
In order to address all these issues and harmonise the methods, The International Organisation for Standardisation has developed a framework standard for calculating a water footprint

(ISO 14046:2014), published in July 2014. The standard is based on the ISO 14040-series for Life Cycle Assessment and defines what requirements are needed to complete a water footprint assessment, including local aspects related to both scarcity and quality. It also covers the full life cycle, including upstream processes. This standard is supported by the global steel industry.

→ **The steel industry supports the ISO 14046:2014 standard for water footprints. It is currently the only methodology that contains all the factors necessary to assess a product, service or organisation's water footprint.**

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A holistic approach to water management



Resource efficiency

Policies must look beyond water use

Discussions on resource efficiency typically take water use into account. Large quantities of water in the steel industry are used for cooling and process purposes. The overall water usage of an average steel production site, however, shows that little water is actually consumed. Most of the water is evaporated or leaves the site as part of the waste and by-products (such as sludge). Overall, around 90% (on average, 88% in an integrated plant and 94% in an electric arc furnace)¹ of the water is, after cleaning and/or cooling, returned to source. Continuous work to reduce water consumption includes, among other things, the reduction of evaporation and prevention of leaks.

High water usage, providing that there is no increase in energy consumption or loss in quality, is not inherently negative provided that there is ample water available for all potential users. For steel producers in arid regions where water is scarce, recycling and reuse is a priority. It is therefore essential that a holistic and balanced approach be taken to avoid unintended consequences leading to additional use of resources or shifting the burden to other areas which may have a greater impact on the environment.

→ **Resource efficiency should consider actual consumption i.e. difference in intake and discharge (of the same or better quality), as well as availability aspects and influences on other resource categories such as energy.**

¹ 'Water management in the steel industry' report, worldsteel, 2011