Factor-X sprl

Water Footprint

1 What is a water footprint ?

Every day, we use water to drink, wash, cook and eliminate waste through water closets. But we also indirectly use large quantities of water when we eat, buy clothes, and even when we switch on the light or use a computer. Indeed, the production of food requires large volumes of water, to grow our greens and cereals, but also to grow grass that will feed livestock and to transform foodstuff. For example, the production of 1 kg of beef typically requires 11500 liters of water, of which the major part is used to water the bullock, while 3000 liters of water is needed to produce 1 kg of rice. Our cotton clothes require large quantities of water to irrigate cotton plants, up to 2700 liters for the production of one T-shirt. Similarly, the production of electricity requires huge volumes of water, used for cooling down the power plants, whether thermal (gas or fuel) or nuclear.

Every day, we directly or indirectly use a certain amount of water. Depending on whether the water is collected in an area where water resources are plenty or scarce, our water consumption will have different consequences. The **water footprint** is currently the most used indicator to evaluate the impact of our activities on the water resources. This indicator, jointly developed by UNESCO and the university of Twente in the Netherlands, is now supported and used by an independent organ, the Water Footprint Network (www.waterfootprint.org). The water footprint makes it possible to identify regions where the impact of our activities is the highest, and also to identify actions to take in order to reduce this environmental impact.

2 Why evaluate the water footprint ?

Evaluating the water footprint of a country, an enterprise or an individual means evaluating the total quantity of water needed to extract, transform and produce the goods and services that will be consumed by this entity during a certain period of time. The water footprint takes into account both direct consumption (drinks, hygiene, toilets, water used for an industrial process…) and indirect consumption (water needed for the production of electricity and heat, for the manufacture of working tools…). The water footprint evaluates the impact of those consumptions by comparison with the resources available in the various catchment areas where the water is collected and used.

3 Factor-X water footprint : a relevant but not yet widespread approach

Factor-X is its first client! In June 2011, Factor-X conducted a first estimate of its water footprint, in order to inform its clients and to raise awareness of the team toward possible improvements. Factor-X is a service company with very de-materialized activities, i.e. based on internet and modern communication tools. There are very few similar case studies, the water footprint having been up to now mainly applied to agricultural production.

The selected scope includes nearly all activities of Factor-X, i.e. the professional activities of its employees during the ca. 225 worked days on annual basis for the year 2011. This includes the use of computers and internet, fixed telephone and printer, but also office furniture. We have not included domestic and international travel, clothing and use of mobile phones, or the construction of the office, for which few reliable data are available. These aspects will be integrated in the water footprint of Factor-X when data will be available. For more information on the greenhouse gas impact of Factor-X, please refer to the company's Carbon Footprint .

We have chosen the methodology of the Water Footprint Network, recognized among others by UNESCO and has been applied by several large corporations. Those include The Coca-Cola Company, AmBev and C&A. It is important to note that we are considering consumed water in the strict sense, as defined by the Water Footprint Network, i.e. a volume of water integrated into a specific product, evaporated or liberated in another catchment area than the one where it was collected.

Results are expressed in number of directly or indirectly consumed liters, per worked day and per employee, i.e. results expressed in liter/person*day. This choice of unit makes it possible to estimate the water footprint of a service offered to a client or a conducted assignment.

4 A few definitions

“Green” water is rainwater, also present as soil humidity.

“Blue” water is water from rivers and unconfined groundwater also called phreatic water.

“Wastewater” is water contaminated by organic or chemical matter and released in the environment, either before or after treatment. Fecal water, water from showers and dishwashing belong to this category.

“Grey water” designates the volume of water that would be required to dilute wastewater produced by an activity until concentrations defined by local quality standards are attained. Volumes expressed under the grey water category are generally much larger that the volumes of wastewater effectively discharged.

“Virtual water” associated with a product (ex cotton T-shirt) or a service (ex electricity supply) is the quantity of water that was needed to produce, transport and use this product or service, and which was consumed during the production, transportation and transportation processes. This virtual water can be “green” water and/or “blue” water depending on its initial origin.

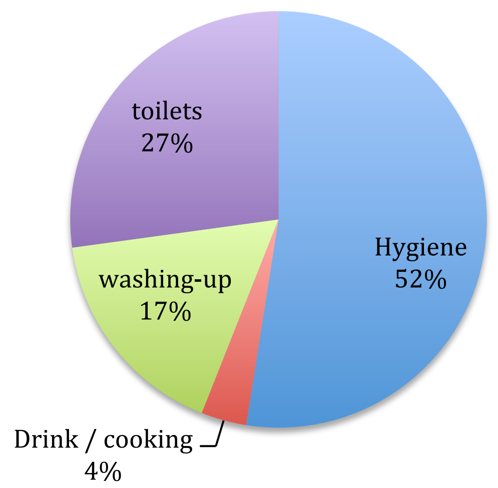
The **water consumed** by a process is the quantity of water lost by evaporation during the process, included in the product or liberated in another catchment area that the one where it was collected. The water consumed by a process is generally much smaller than the water used to conduct the process. For example, a nuclear power plant uses large quantities of water (up to 40 m3/s) to cool the reactors but only a small fraction (ca. 10%) is actually consumed in the form of steam liberated in the atmosphere, the rest being discharged in the river where it was collected.

5 Results of the Water Footprint of Factor-X

5.1 Potable water consumption per person*worked day

On average, each Factor-X employee consumes 119 liters of water per worked day. The various uses of these 119 liters are distributed as follow (see **Erreur ! Source du renvoi introuvable.**) :

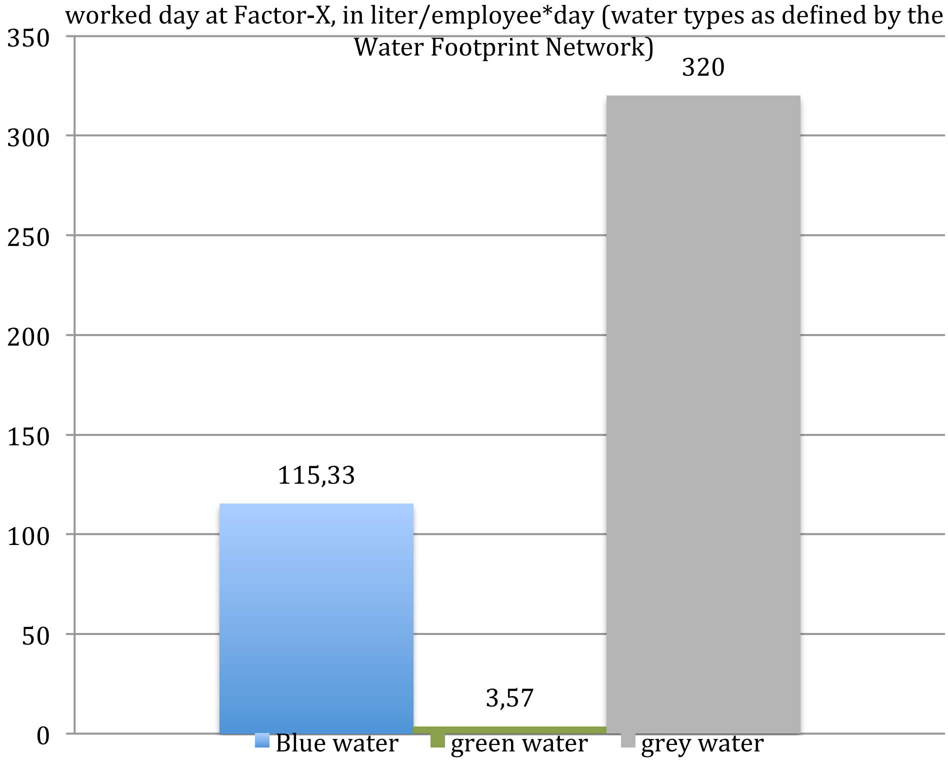
Figure 1 : potable water consumption per employee and per worked day at Factor-X, with split per use type



The potable water consumption of Factor-X employees is comparable to the daily domestic potable water consumption in Belgium, estimated in 2008 at 120 liters by the Brussels Institute for Environmental Management. It should be noted that a large portion of the total is allocated to toilet use. This is characterized by the use of potable water to evacuate waste. This ecological non-sense is one of the most convincing arguments in favour of the use of dry toilets or rainwater tanks to supply flush cisterns. Indeed, from the total quantity of potable water consumed daily, about 96% is eliminated in the sewage system, while the largest part of the wastewater (shower, washing and dishwashing water) has a low organic load and does not require advanced treatment. This is why Factor-X foresees the use of dry toilets and a vegetation filter for its future office, in order to reduce dramatically its water footprint. These solutions cannot be implemented immediately, Factor-X being a tenant of the current office, but the possibility of recovering rainwater from the roof and dishwashing water to supply the toilet is being studied.

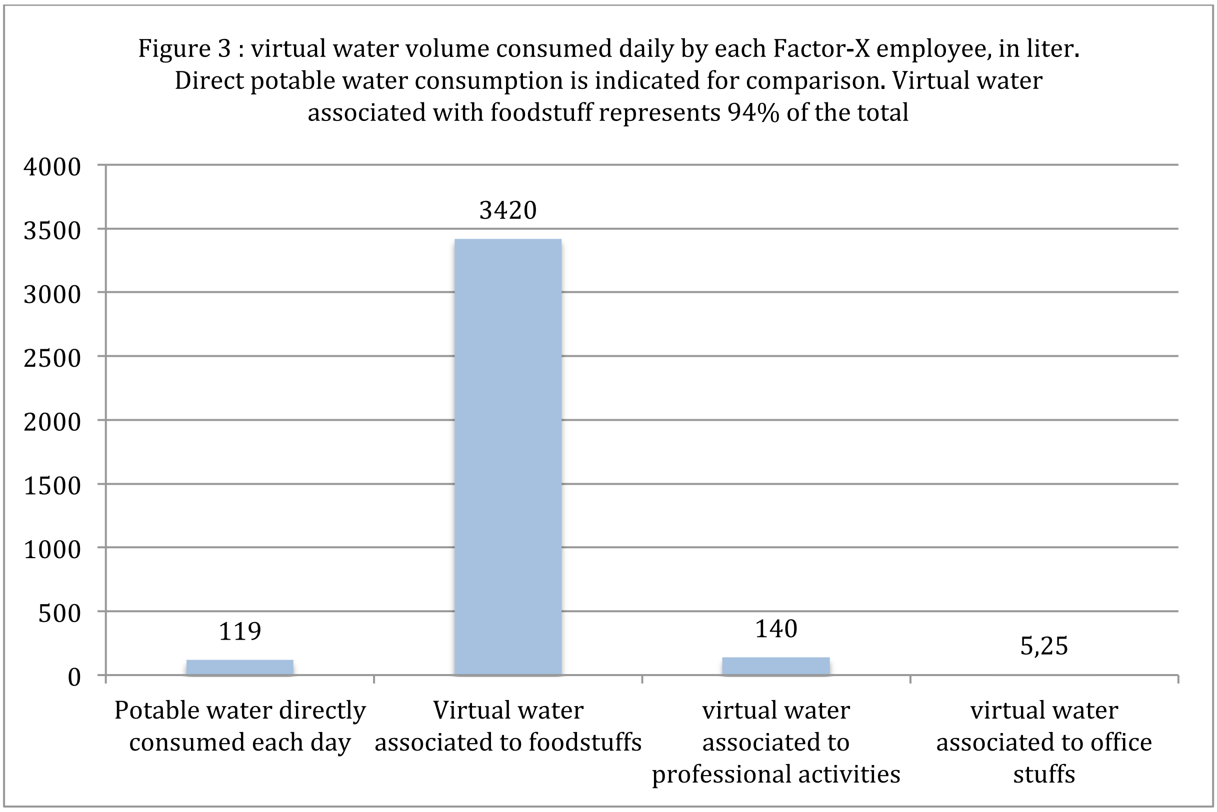
The main part of the potable consumption of Factor-X employees is classified as "blue" water (see **Erreur ! Source du renvoi introuvable.**) as it consists in water distributed by a public operator and ollected in infiltration galleries or in the Meuse river, for the distribution networks serving Braine-l'Alleud (office location) and Brussels (where most employees live). A water cistern collecting rainwater at the home of one employee provides a small volume of "green" water. When considering the volume of "grey" water produced, it should be noted that it is twice as high as the total potable water consumed, because of the high concentration in organic matter of fecal water. We have not included the concentration in non-fecal water in this calculation, because of their low concentration in organic matter. **Erreur ! Source du renvoi introuvable.** clearly shows the possible impact of wastewater on eceiving environments such as streams and ponds in absence of wastewater treatment systems. Indeed, in order to comply with the pollution standards in force in Belgium, the volume of wastewater should be diluted by clean water by a factor 10 at least. The nationwide availability of wastewater treatment systems is therefore an urgent necessity in order to preserve our ecosystems. It should be noted that this calculation should still be refined in order to take into account the existence of two wastewater treatment plants in Brussels, where the majority of the employees live. Strictly speaking, this calculation should take into account the fact that the volumes of "grey" water produced by employees when working from home are lower than those produced in the office. The detailed analysis of employees waste flows is out of scope in the frame of this study.

Figure 2 : « blue, « green » and « grey » water consumption per employee and per worked day at Factor-X, in liter/employee*day (water types as defined by the Water Footprint Network)



5.2 Virtual water consumption per person*worked day

When considering the virtual water quantity consumed per person*day (see **Erreur ! Source du renvoi introuvable.**), it is found that the largest fraction (94% of the total) consists in virtual water associated to the production of consumed food. The two other contributions (potable water directly consumed and professional activities) are almost negligible. The quantity of virtual water associated with professional activities (computer, internet, etc., see below) is of the same order of magnitude as the volume of potable water directly consumed on a daily basis.



This result questions our daily diet and the choices we make for each meal. For example, a vegetarian meal will be less consuming in virtual water than a meat meal, because it "saves" large water quantities required for livestock feeding and care. The choice of foodstuff is similarly important in the reduction of the water footprint of our meals. For example, cereals such as oats and rye are less irrigated than corn or wheat. It is currently difficult to conceive meals focusing on the reduction of its water footprint, but information is already available for some products, thanks to studies conducted by the Water Footprint Network among others (see § 7).

At Factor-X, the most common diet is strictly or predominantly vegetarian, this reduces the water footprint of approximately two third compared to a meat diet, predominant in many other service companies.

Erreur ! Source du renvoi introuvable. shows that the water consumption for the production of energy (necessary to conduct professional activities) represents a very minor contribution to the water footprint of a tertiary sector company, especially when compared to the indirect water consumption for foodstuff. This, of course, depends of the energetic mix of each country. Belgium, being strongly dependent on nuclear power, has a relatively low water footprint for electricity production.

It should be noted that, contrarily to the direct consumption of potable water (which consists entirely of "blue" water), the indirect water consumption from foodstuff is split between "blue" water for irrigated cultivation (approx. 50%) and "green" water for non-irrigated cultivation (50%). Choosing foodstuff from agricultural sectors not based on intensive irrigation is therefore a good means of reducing the water footprint associated with food consumption. In our study, we did not include the production of "grey" water associated to food consumption, due to insufficient available data on the origin of foodstuff consumed by Factor-X employees.

It is interesting to examine in detail the various contributions associated to professional activities (see), as the purpose of this study is to consider the operation of a consulting company such as Factor-X.

Figure 4 : split of usage types for the virtual water consumption associated with Factor-X activities. The daily total is estimated at 91 l. per employee

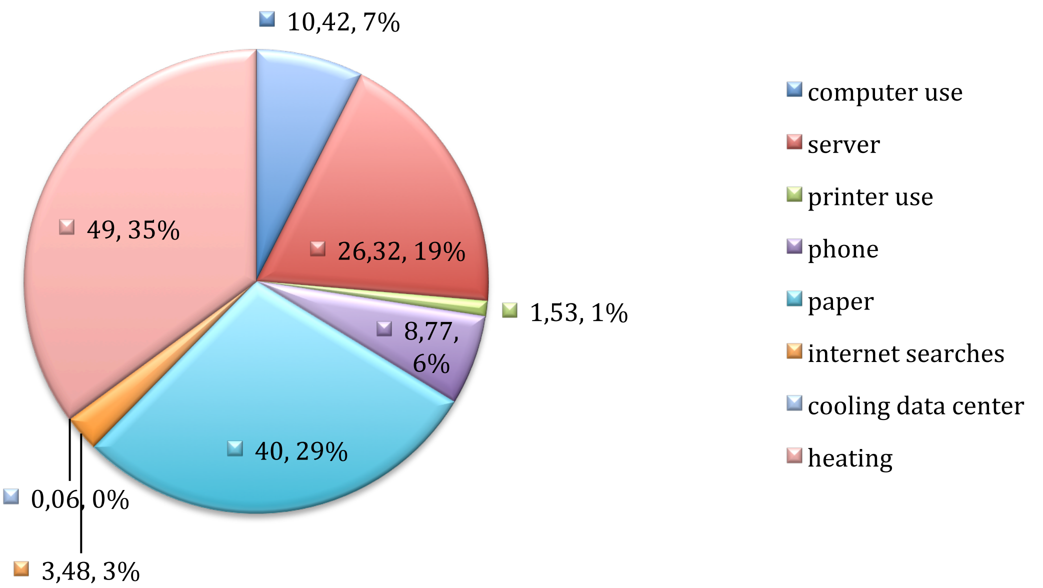
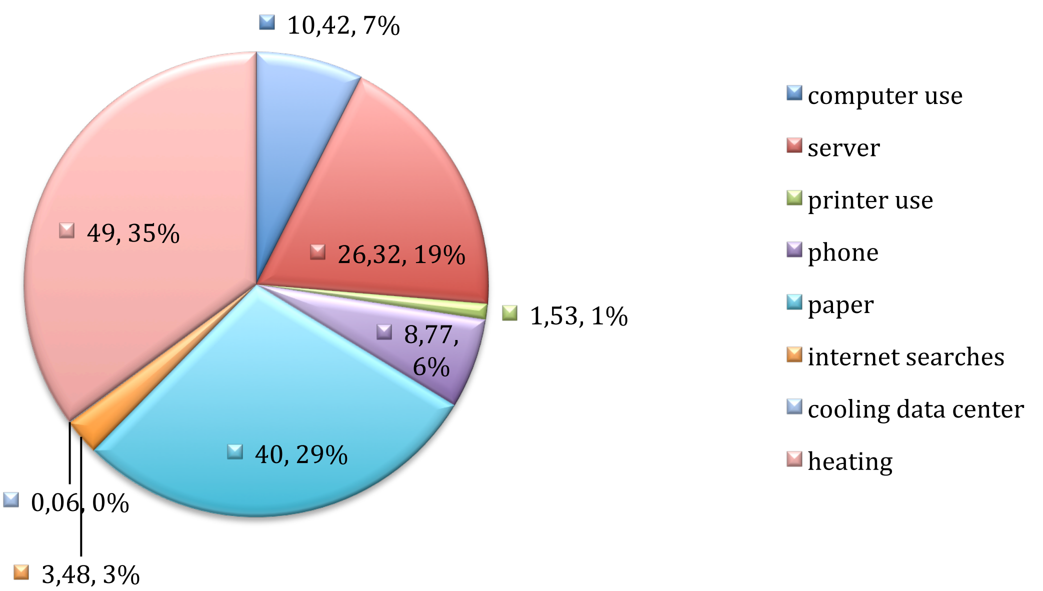


Figure 4 : split of usage types for the virtual water consumption associated with Factor-X activities. The daily total is estimated at 91 l. per employee



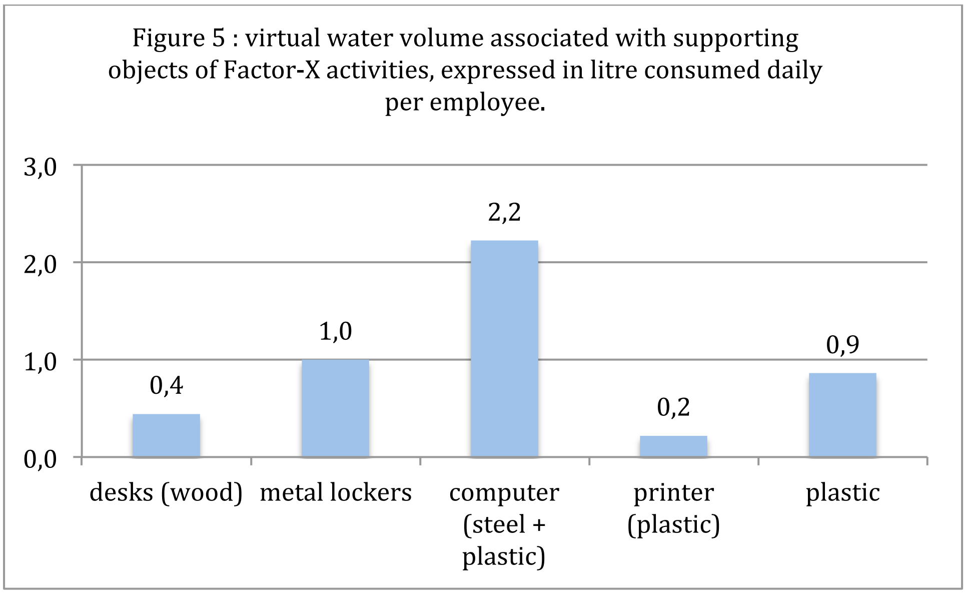
The first WF is for heating of our offices, with a virtual water consumption of 49 liters per person*day. The bad isolation of our offices and the organisation of those offices as duplex explain our heavy needs in heating. The quality of isolation of the roof will be one of the main concern for the future offices of Factor-X.

Printing of paper documents represents about one-third the virtual water consumption per employee*day. This consumption is related to clients' requests to print out reports, but also to printing of documents that cannot be easily consulted on a computer screen. In this respect, widespread use of electronic books on a format compatible with office reading (A4 format) and where the screen is not back-lighted would make it possible to reduce the paper consumption and the associated virtual water consumption. It should be noted that Factor-X already applies a strict printing reduction policy, by favouring electronic documents sharing internally and with its clients, and by widespread usage of on-line libraries.

The use of the server and computers represents the next application in terms of importance. Its water consumption is directly associated with the energy mix for electricity production. We based our calculation on the Belgian energy mix, characterized by a large portion of nuclear energy (54% of the national production vs. 6% at world level). Knowing the quantities of water evaporated for various power plant types, we can calculate the quantity of water lost by evaporation to produce 1 megawatt*hour and, therefore, deduce the virtual water quantity associated with the usage of electronic equipment of known power.

5.3 Virtual water associated with the manufacture of office furniture

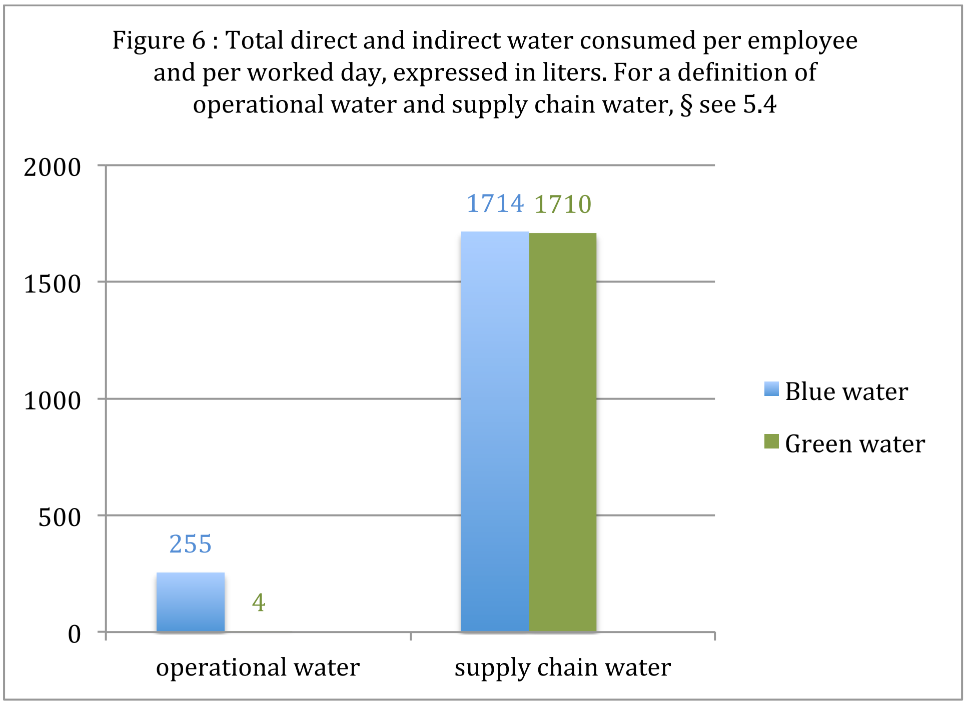
We estimated the volume of virtual water associated with the manufacture of the main objects supporting our activity (desks, cupboards, chairs…), i.e. the quantity of water consumed by the manufacturing process of these objects (water evaporated or not returned to the catchment area where is was taken). Figures considered for the calculation take into account average lifetime and typical compositions.



The virtual water consumption per day of usage of a computer (excluded electrical consumption considered in § 5.2) represents the largest fraction, i.e. 47% of the total. This can be explained by the very high water quantity needed to manufacture the electronic components of a computer, in particular electronic chips, printed circuits and screens. It should be noted that the virtual water consumption for plastics is almost as high as for metal parts. These two industrial segments are high water consumers, in the first case for oil extraction, and in the latter for steel cooling processes.

5.4 Water footprint of a Factor-X employee

In total, the water consumption of one Factor-X employee amounts to 3635 liters per worked day (**Erreur ! Source du renvoi introuvable.**), of which 210 liters are consumed for professional activities (119 directly and 91 for electricity production) and is called the operational consumption, and 3424 liters consumed through our supply chain, i.e. foodstuff (3420 liters) and water associated with supporting objects and furniture (less than 5 liters)



6 Conclusions and perspectives

The water footprint of Factor-X is a first tentative exercise in the services sector, and there are no published results available for comparison. In view of the employees' habits (specifically related to the predominantly vegetarian diet), this footprint could prove smaller than that of other European or North American offices. Possible improvement measures in the team's customs are related to: a more careful selection of the origin of foodstuff and an even lower meat consumption, re-use of dishwater for toilet flushing, a choice of internet search engines integrating a clear policy respectful of local water resources needed for its operation (cooling of data centers), use of a server that would shut-down during off-hours, availability of electronic books for document reading, use of computers with a lower electricity consumption.

From a methodological viewpoint, the water footprint of Factor-X could be improved, in particular by including the clothing of employees, work-home transportation, local and international business trips, use of mobile phones… This will be considered when data will be made available in the respective sectors. However, food will still probably represent the major part of the virtual water consumption associated with Factor-X activities.

The water footprint is a geographically explicit indicator, as it considers the relationship between water consumption and available resource on a geographical basis. In our case, we do not have the necessary data to establish this relationship with accuracy, as it is difficult to identify the origin of our foodstuff and office furniture, and to a lesser extend, the energy consumed when searching the Internet. It is however possible to compare the water consumed by Factor-X with the availability of water resources in Belgium.

The yearly quantity of renewable water per inhabitant in Belgium is evaluated by the FAO at 1728 m3 in 2011. Knowing that one Factor-X employee uses 3635 liters of water per worked day, this corresponds to a yearly consumption of 818 m3 for the professional activities (approx. 225 worked days in year 2011). Extrapolated to the full year, the water consumption of a Factor-X employee would amount to 1327 m3, i.e. 77% of the renewable water resources available per person and per year. At first sight, this situation appears not to be sustainable. In reality, the pressure put on the national water resources is much lower that suggested by these figures, because the major part of our water consumption consists in virtual water associated with feeding activities. As we do not produce all feedstuff on the Belgian territory, we import water from other countries in the form of virtual water associated to feedstuff entering our borders. We therefore indirectly consume water that is not collected in Belgium, and this allows us to have a higher water footprint that what our resources would sustain without attaining a situation of hydric stress. The Water Footprint Network estimates that the yearly water footprint of Belgium per inhabitant represents 1802 m3 on average, i.e. more that the available renewable resources. This is because 80% of the water footprint of Belgium is actually applied outside of its borders. The water footprint is therefore an interesting tool to underline interdependencies and unbalances caused by our current production and consumption modes on the world's water resources.

7 Main references

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