Promoting the use of reclaimed water from waste water treatment effluents

In a nutshell

SUMMARY

It is best practice to promote the use of reclaimed water from waste water treatment effluents. This can be used for, e.g.:

- irrigation, including non-agricultural irrigation, e.g. parks;
- non-potable urban uses, such as street cleaning, snowmaking for adjacent ski resorts, toilet flushing in public buildings, public fountains;
- industrial uses, e.g. cooling;
- groundwater recharging.

Local public administrations can ensure the possibility to use the reclaimed water in some specific applications by fitting waste water treatment plants with the appropriate tertiary and disinfection treatment systems as needed. In the process, local public administrations need to engage with relevant stakeholders (e.g. local farmers, agricultural cooperatives) that may be interested in making use of the reclaimed water.

Target group

Public administrations responsible for waste water management and urban drainage.

Applicability

This best practice is applicable to all public administrations in charge of waste water treatment. However, water reuse is particularly relevant in water-scarce areas, where it can reduce the impact on water resources and where the extra investments and operational costs are economically feasible.

Environmental performance indicators

- Amount of reclaimed water produced from waste water treatment in a given time period (m^3/year, m^3/hour)
- Percentage of reclaimed water out of the total waste water treated (%)

Benchmarks of excellence

N/A

Description

Local public administrations have a considerable influence on waste water treatment operations therefore they can promote the use of reclaimed water for a number of applications, reducing eventually the demand of fresh water. Water

stressed areas, especially where agricultural irrigation requires considerable amounts of fresh water, may benefit from the use of reclaimed water.

It is considered best practice for local public administration to promote the use of reclaimed water (from waste water treatment plants) for several uses, such as:

a. Irrigation, including also the non-agricultural irrigation operations e.g. parks etc.;
b. Non potable urban uses, such as streets cleaning, ice-making for adjacent ski stations, toilet flushing in public buildings, fountains etc.;
c. Industrial uses, e.g. cooling etc.;
d. Groundwater recharge.

Stringent checks on the quality of the reclaimed water obtained from wastewater treatment must ensure that the parameters are met for the purpose the reclaimed water is used for. In the case of reclaimed water used for agricultural irrigation, the levels of components like salinity, sodium, chloride, calcium etc. should be carefully evaluated whereas the solid particles (either organic or inorganic) should be removed through proper filtering system, in order to avoid clogging into the irrigation delivery equipment. Additionally the pathogen removal in waste water treatment can be checked thanks to a pathogen indicator bacterium, the E. coli. The Word Health Organisation (WHO) published in 2006 a report recommending which are the levels of E. coli allowed in reclaimed water agricultural irrigation. Table 1 presents some of these values for unrestricted irrigation (use of reclaimed water to grow crops that are normally eaten raw) and restricted irrigation (use of reclaimed water to grow crops that are not eaten raw by humans) (WHO, 2006).

Table 1: WHO quality criteria recommendations for E. coli in reclaimed water used for agricultural irrigation

Type of irrigation	**E. coli/100 mL**
Unrestricted	?1,000 for root crops ?10,000 for leaf crops ?100,000 for drip irrigation of high-growing crops ?1,000 for drip irrigation of low-growing crops
Restricted	?10,000 for labour intensive agriculture ?100,000 for highly mechanised agriculture

Local public administrations, in order to promote and improve the use of reclaimed water in different applications, can firstly fit waste water treatment plants with tertiary and disinfection treatment systems, which are able to improve the quality of the treated water, ensuring the possibility to use the reclaimed water in some specific applications. Technologies which allow treating waste water to a sufficient level for the uses listed above include UV treatment, chemicals (e.g. peracetic acid), reverse osmosis, reversible electrodialysis and sand filtration.

Secondly, local public administrations can involve stakeholders (e.g. local farmers, agricultural cooperatives) in the establishment and operation of systems for the use of the reclaimed water generated in the waste water treatment plants. In fact, the treated water needs to be stored and transported to the final-use destination and this infrastructure may already exist (e.g. irrigation canals) or would need to be built. Public administration can also decide to use the reclaimed water for their operations, such as watering of green public spaces, in such case the infrastructure for the transport and use has to be managed and operated directly by the public administration or the company in charge of the maintenance of green public areas.

Finally, local public administrations can introduce economic incentives (i.e. reduced tariffs for the use of reclaimed water instead of fresh water), which can support the use of the reclaimed water by potential stakeholders. Additionally, awareness raising campaigns about water use and the measures implemented to employ reclaimed water in a number of applications can be a useful tool for improving the knowledge of citizens and businesses on the use of fresh and reclaimed water.

Environmental benefits

The main environmental benefit achieved thanks to the use of reclaimed water for a number of applications is the reduced demand of fresh water. Additionally, since waste water is treated to a higher standard, in order to be able to use the reclaimed water for a number of different applications, less pollutants are discharged to the environment and they are properly treated.

Side effects

The most relevant cross media effect is the use of energy and materials/resources (e.g. chemicals, infrastructure, land) for further treating waste water in order to reach a higher level of quality of the reclaimed water. However, these environmental cross-media effects are marginal compared to the benefit of using reclaimed water instead of fresh water, especially in water-stressed areas.

Applicability

The use of reclaimed water from waste water treatment plants can be applied everywhere, provided that there is demand of fresh water which can be substituted by reclaimed water. In areas where water resources are abundant and less water stressed, the installation and operation of systems for the production of reclaimed water is usually not attractive for the extra investments and operation costs (e.g. waste water treatment, transport of reclaimed water).

Economics

In the case of the Tel-Aviv airport, capital expense for the construction of the waste water treatment plant able to produce reclaimed water to be reused was 0.58$/$m^3$ water treated (0.52€/m^3) while operational costs are 0.43$/$m^3$ of water treated (0.38€/m^3) (El Gohary et al., 2013).

In the case of Milan, the cost of the Nosedo treatment facility was 150 M€ while for the San Rocco plant 136 M€. The operation and maintenance costs for 2011 were 0.115 €/m^3 for San Rocco and 0.139 €/m^3 for Nosedo (Mazzini et al., 2013).

The construction of the El Prat de Llobregat plant in Barcelona was of 100 M€. Its operational costs are 0.07€/m^3 for the generation of reclaimed water suitable for agricultural irrigation while higher operational cost, due to the higher quality required, are incurred for the production of reclaimed water injected in wells and used as barrier against sea water intrusion (0.3€/m^3) (Cazurra, 2008).

Costs for the storage and distribution network vary a lot depending on size, location, distance etc. and should be evaluated on a case by case basis.

Driving forces for implementation

The need to limit the use of fresh water in water stressed areas is the main driving force to employ reclaimed water in a number of applications. Nowadays, increased and prolonged period of droughts requires a careful management of water natural resource also in regions where in the past this was not a major concern.

Reference organisations

Further to reference organisations presented in the operational data section, below a short list of companies or other areas where reclaimed water from waste water treatment has been used is presented:

- Intermunicipal Water Company of the Furnes Region (Belgium): project for the use of reclaimed water in Flemish Dunes;
- Limagne Noire (France): Use of reclaimed water in agricultural irrigation.

Literature

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Mazzini R., Pedrazzi L., Lazarova V. Production of high quality recycled water for agricultural irrigation in Milan. Milestones in Water Reuse: The Best Success Stories, Chapter 15, ISBN-13: 978-1780400075.

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