

CONTRIBUTION OF HOUSEHOLD WATER TREATMENT AND SAFE
STORAGE TO UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS



OVERVIEW

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs)¹.

Household water treatment and safe storage (HWTS) provides safe drinking water in the household to help improve the health of individuals, families, and communities. HWTS focuses on simple but effective technologies that can be used by families to improve water quality and reduce the risk of diarrheal disease. As such it makes a strong contribution to SDG 6 – Clean Water and Sanitation.

Although less obvious, HWTS also makes significant contributions to the advancement of other SDGs. Similarly, there is growing use of HWTS technologies in institutions such as schools and health centres as point-of-use (PoU) treatment providing further contributions to the goals. The following table and associated factsheets highlight the contribution of household water treatment and PoU to a range of sustainable development goals.

¹ United Nations, "Sustainable Development Goals: Sustainable Development Knowledge Platform," 2016, <https://sustainabledevelopment.un.org/?menu=1300>





Families living in poverty are disproportionately likely to be without access to safe water and feel its effects more intensely.

HWTS **reduces diarrheal disease, reduces spending** on safe water and medicine, **increases the time** families have to put to **productive use** and supports breaking the cycle of poverty.



Diarrheal disease is one of the leading causes of death and accounts for the loss of 45 million disability-adjusted life years (DALYs)* annually.

Sustained HWTS use has been demonstrated to **reduce diarrhea** among households by an average of 35-47% directly **improving the health and well-being** of users.



HWTS use in the home and PoU treatment at school results in reduced diarrheal disease among pupils. It reduces the time children spend caring for family members and can also **reduce the time children spend collecting and carrying water** – especially girls.

This increases the number of days **pupils can attend school** and their ability to **function while at school** and allows them to **fulfill their educational potential**.



Women and girls are especially impacted by limited access to safe water.

HWTS **reduces the time women and girls spend** with diarrheal disease and caring for sick family members. It can also reduce water collection and treatment time. This allows them to **use their time for education or other productive purposes**.

HWTS empowers women to **take control** of their water and hygiene situation and encourages them to make further positive changes in their households and communities.

HWTS initiatives also often **employ women** as community workers. Such employment opportunities provide women with **additional income** to invest as they see fit, and often **raises their status** among their families and communities.



HWTS solutions enable 24-hour **availability** of water for drinking, greatly improve microbiological **water quality**, and, in the case of fluoride and arsenic contamination, can greatly improve chemical water quality.

HWTS can also contribute to increasing the **accessibility** of water where HWTS treatment improves water quality from less safe sources closer to the home.



HWTS reduces the time individuals spend suffering from diarrheal disease and caring for sick family members. It can also reduce water collection and treatment time in certain circumstances. This **time saving** allows individuals - especially women and girls - to **improve their education** and **seek new economic opportunities**.

HWTS initiatives also provide **direct employment** opportunities within the local communities where they work, **improve skills** and support economic opportunities by supporting **new, long-term supply chains** for HWTS products and services.



Marginalized and minority populations, families living in poverty, vulnerable groups, and women and girls are disproportionately likely to be without access to safe water and feel its effects more intensely.

HWTS is particularly well placed to address inequalities. It can be **deployed more easily** than networked solutions such as piped water systems. HWTS can be made available and affordable to people living in poverty in areas which are **typically overlooked** for water-related investment. It can also be placed **directly in the homes** of individuals allowing more targeted interventions.

Further community action can also result from the personal and community achievement of obtaining HWTS, such as infrastructure improvements, education, or environmental protection.

* **Disability-adjusted life year (DALY)** - One DALY can be thought of as one lost year of "healthy" life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability.²

² "WHO | Metrics: Disability-Adjusted Life Year (DALY)," WHO (World Health Organization), accessed August 28, 2020, https://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/

1

NO POVERTY

GOAL AND RELEVANT TARGETS

SDG 1 – End poverty in all its forms everywhere



Target 1.1 Eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day

Indicator 1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)

Target 1.2 Reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions

Indicator 1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions

Target 1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including micro-finance

Indicator 1.4.1 Proportion of population living in households with access to basic services (including water)

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Families living in poverty are disproportionately likely to be without access to safe water⁴ and feel its effects more intensely. They get sick more regularly, have a reduced ability to generate income, and find their limited budgets under greater strain.

Families living in poverty collectively spend 200 million hours a day collecting, transporting, and treating water⁵. For almost a third of the population of sub-Saharan Africa, this means more than a one hour round trip, a burden that falls mainly on women and children. Without safe drinking water individuals regularly get sick from diarrheal disease and struggle to stay healthy. Other family members are required to spend significant amounts of their time caring for those who are sick⁶. Combined this severely impairs the ability of families to study, work,

³ UNHQ: Division for Sustainable Development Goals, "Home .. Sustainable Development Knowledge Platform," Sustainable Development Goals Knowledge Platform, March 9, 2020, <https://sustainabledevelopment.un.org/>

⁴ UNDP, *Beyond Scarcity*.

⁵ UNICEF: "Collecting Water Is Often a Colossal Waste of Time for Women and Girls," UNICEF, accessed August 28, 2020, https://www.unicef.org/media/media_92690.html

⁶ UNDP, *Beyond Scarcity*.

or engage in other productive activities. Repeated infections with water-related diseases in childhood are also associated with reduced height, cognitive impairment, and educational under-attainment⁷.

A case study showed families living in poverty in Nairobi can pay 10 to 25 times more for drinkable water than what the local utility would charge more affluent areas of the city⁸. When family members are affected by diarrheal disease due to poor water quality, they may spend their limited available money on medicine. These expenditures deplete resources and trap families in a cycle of poverty.

People living in poverty have the greatest to gain from the safe water that HWTS can provide. Sustained use of HWTS reduces diarrheal disease⁹, reduces direct household expenditures for safe drinking water and medicine, and provides families with additional time to spend productively. Such benefits help break the cycle of poverty and can provide a way to increased earning power.

Many HWTS initiatives employ local staff to promote HWTS among their communities, sell products, and provide advice and support to others adopting new HWTS solutions. Such employment opportunities provide these staff with additional income and put back resources into the local community.

⁷ Richard L. Guerrant et al., "Malnutrition as an Enteric Infectious Disease with Long-Term Effects on Child Development," *Nutrition Reviews* 66, no. 9 (September 1, 2008): 487–505, <https://doi.org/10.1111/j.1753-4887.2008.00082.x>

⁸ WWAP (UNESCO World Water Assessment Programme, **The United Nations World Water Development Report 2019: Leaving No One Behind** (Paris: UNESCO, 2019), <https://unesdoc.unesco.org/ark:/48223/pf0000367306/PDF/367306eng.pdf.multi>

⁹ Clasen, Roberts, et al., "Interventions to Improve Water Quality for Preventing Diarrhoea"; Lorna Fewtrell et al., "Water, Sanitation, and Hygiene Interventions to Reduce Diarrhoea in Less Developed Countries: A Systematic Review and Meta-Analysis," **The Lancet Infectious Diseases** 5, no. 1 (2005): 42–52; Hugh Waddington et al., "Water, Sanitation and Hygiene Interventions to Combat Childhood Diarrhoea in Developing Countries," **New Delhi: International Initiative for Impact Evaluation**, 2009, https://www.researchgate.net/profile/Howard_White2/publication/228378510_Water_sanitation_and_hygiene_interventions_to_combat_childhood_diarrhoea_in_developing_countries/links/004635214853d795f6000000.pdf

KEY FACTS

- People living in poverty are the largest part of the population without access to safe water and they feel its effects most intensely

HWTS' CONTRIBUTION

- HWTS reduces direct spending on safe water and medicine
- HWTS increases the time families have to put to productive use by reducing the time spent searching for safe water, suffering from diarrheal disease, and caring for sick family members
- HWTS reduces chronic diarrhea among children, lessening its effects on physical and cognitive impairment. Healthier children do better in school and have greater opportunities in the future
- HWTS helps break the cycle of poverty and can pave the way to better economic success

CASE STUDY: ECOFILTRO, GUATEMALA



Ecofiltro is an organization based in Guatemala that has been working since the 1990s to provide household ceramic water filters to Latin American families. While its ceramic pot filter remains the same across all its products, it sells a range of plastic, ceramic and enamelware receptacles that are aimed at different customers. Using the same filter technology, the company generates profits from more expensive models sold to wealthy customers in urban areas, while providing low-cost products aimed at poorer, rural families. Their profits enable them to donate filters to institutions such as schools that serve families living in poverty.

The methods Ecofiltro uses to promote its products to rural families highlight the financial savings that families can make by investing in a ceramic filter. For families purchasing bottled water, they highlight cost savings, for those drinking untreated water, they highlight the savings from not having to buy medicine to treat diarrhea. For those who are already boiling water, they highlight the time and cost savings compared to obtaining fuel such as firewood. Ecofiltro estimates the savings for a family in a single year is around 1,500 quetzales (around US\$190). The filter costs just 300 quetzales (around US\$40).

Ecofiltro provides financing options to families living in poverty, providing access to low payments that families can afford. The first payment is 100 quetzales (around US\$12) followed by 4 monthly payments of 50 quetzales (around US\$6).

Ecofiltro also provides broader economic support to rural communities by selecting, training, and supporting local vendors. Vendors generate an income selling new filters and the replacement parts families require over time.

3 GOOD HEALTH AND WELL-BEING



GOAL AND RELEVANT TARGETS

SDG 3: Ensure healthy lives and promote well-being for all at all ages

Target 3.2 End preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births

Indicator 3.2.1 Under-five mortality rate

Target 3.3 End the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, waterborne diseases and other communicable diseases

Target 3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all

Indicator 3.8.1 Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population)

Target 3.9 Substantially reduce the number of deaths and illnesses from hazardous chemicals, and air, water and soil pollution and contamination

Indicator 3.9.2 Reduced mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (reduced exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)

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For those living without access to safe water, repeated infections from waterborne diseases is a part of life. Living with regular bouts of waterborne disease deeply affects individuals' quality of life, affects the health of pregnant women, impairs the development of children and can lead to disability or death.

1.8 billion people drink contaminated water¹¹ that causes diarrheal diseases. Those diseases are estimated to account for the loss of 45 million DALYs annually and are among the top five causes of early death and disability¹².

For children aged 1 month to 5 years, diarrheal disease is the 2nd leading cause of death¹³ worldwide — almost 700,000 deaths a year. A lack of access to WASH impacts overall physical and cognitive development¹⁴. Fifty percent of global malnutrition is due to waterborne diseases, and a quarter of all cases of stunting have been attributed to five or more episodes of diarrhea before the age of two¹⁵. Repeated infections in children have been associated with reduced effectiveness of oral vaccines¹⁶ increasing their disease risk far beyond diarrheal disease.

Unsafe water has a significant impact on pregnant women and their unborn children. Approximately 10% of maternal deaths in developing countries may be due to Hepatitis E¹⁷ and persistent giardia can lead to malabsorption of nutrients in pregnant women¹⁸. Mothers infected with cholera have shown an average 30% death rate of fetuses¹⁹ and those infected with Hepatitis E have shown death rates of nearly a third of newborns²⁰.

¹¹ Robert Bain et al., "Global Assessment of Exposure to Faecal Contamination through Drinking Water Based on a Systematic Review," *Tropical Medicine & International Health* 19, no. 8 (August 2014): 917–27, <https://doi.org/10.1111/tmi.12334>

¹² Christopher Troeger et al., "Estimates of Global, Regional, and National Morbidity, Mortality, and Aetiologies of Diarrhoeal Diseases: A Systematic Analysis for the Global Burden of Disease Study 2015," *The Lancet Infectious Diseases* 17, no. 9 (September 1, 2017): 909–48, [https://doi.org/10.1016/S1473-3099\(17\)30276-1](https://doi.org/10.1016/S1473-3099(17)30276-1)

¹³ Claudio F. Lanata et al., "Global Causes of Diarrheal Disease Mortality in Children <5 Years of Age: A Systematic Review," *PLOS ONE* 8, no. 9 (September 4, 2013): e72788, <https://doi.org/10.1371/journal.pone.0072788>

¹⁴ Christine P Stewart et al., "Effects of Water Quality, Sanitation, Handwashing, and Nutritional Interventions on Child Development in Rural Kenya (WASH Benefits Kenya): A Cluster-Randomised Controlled Trial," *The Lancet Child & Adolescent Health* 2, no. 4 (April 2018): 269–80, [https://doi.org/10.1016/S2352-4642\(18\)30025-7](https://doi.org/10.1016/S2352-4642(18)30025-7)

¹⁵ PMNCH, "PMNCH Knowledge Summary #30 Water, Sanitation and Hygiene - the Impact on RMNCH*," WHO, 2014, <http://www.who.int/pmnch/knowledge/publications/summaries/ks30/en/>

¹⁶ James A. Church et al., "The Impact of Improved Water, Sanitation, and Hygiene on Oral Rotavirus Vaccine Immunogenicity in Zimbabwean Infants: Substudy of a Cluster-Randomized Trial," *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America* 69, no. 12 (November 27, 2019): 2074–81, <https://doi.org/10.1093/cid/ciz140>

¹⁷ Alain B. Labrique et al., "Hepatitis E, a Vaccine-Preventable Cause of Maternal Deaths," *Emerging Infectious Diseases* 18, no. 9 (September 2012): 1401–4, <https://doi.org/10.3201/eid1809.120241>

¹⁸ SA Maternal & Neonatal Clinical Network, "Clinical Guideline: Giardiasis," Policy, South Australian Perinatal Practice Guidelines (Department of Health, Government of South Australia, December 19, 2014), http://www.sahealth.sa.gov.au/wps/wcm/connect/f3ac4d804ee47b91804b8dd150ce4f37/Giardiasis_May2014.pdf?MOD=AJPERES

¹⁹ Iza Ciglenecki et al., "Cholera in Pregnancy: Outcomes from a Specialized Cholera Treatment Unit for Pregnant Women in Léogâne, Haiti," *PLOS Neglected Tropical Diseases* 7, no. 8 (August 15, 2013): e2368, <https://doi.org/10.1371/journal.pntd.0002368>

²⁰ M. S. Khuroo, S. Kamili, and M. S. Khuroo, "Clinical Course and Duration of Viremia in Vertically Transmitted Hepatitis E Virus (HEV) Infection in Babies Born to HEV-Infected Mothers," *Journal of Viral Hepatitis* 16, no. 7 (July 2009): 519–23, <https://doi.org/10.1111/j.1365-2893.2009.01101.x>

Chemical contamination, including natural arsenic pollution of groundwater and surface water, affects more than 140 million people in at least 70 countries worldwide. Fluoride contamination of groundwater affects millions more in at least 25 countries²¹. In addition to the incidence of arsenicosis and fluorosis, these contaminants affect early life survival with newborns whose mothers have been exposed to arsenic in their pregnancies. These children experience an 80% greater risk of dying in their first 30 days²².

KEY FACTS

- Diarrheal diseases are the five leading causes of early death and disability among adults and the second leading cause among children under the age of five
- Contaminated water puts pregnant women, fetuses, and newborns at greater risk
- Waterborne diseases contribute significantly to malnutrition and reduced physical and cognitive development of children
- Repeated diarrhea in children can also reduce the effectiveness of oral vaccines leaving them more exposed to other diseases

HWTS' CONTRIBUTION

- Household water treatment and safe storage has been demonstrated to reduce diarrhea, reduce exposure to arsenic and fluoride and contribute to better health outcomes
- Interventions, such as HWTS, which improve water quality at the point of use are more effective at preventing diarrhea than water quality interventions at the source

Depending on the method, water treatment at the household level can remove, kill, or inactivate most microbial pathogens. Interventions to improve water quality at the household level are more effective than those at the source, in part because they minimize the risk of recontamination after collection²³. Many studies have shown that sustained household water treatment use reduces diarrhea among all ages, and children under the age of five²⁴. The average diarrheal reduction ranges from 35-47%²⁵. Continued use of HWTS to reduce chemical contaminants such as arsenic and fluoride for those affected provides further health benefits.

In 2016, 12% of health care facilities globally, serving 896 million people had no water service, meaning they either used water from an improved source more than 500 metres from the

²¹ J. K. Fawell and Kenneth Bailey, eds., **Fluoride in Drinking-Water**, WHO Drinking Water Quality Series (London ; Seattle: IWA Pub, 2006).

²² Abul Hasnat Milton et al., "Chronic Arsenic Exposure and Adverse Pregnancy Outcomes in Bangladesh," **Epidemiology (Cambridge, Mass.)** 16, no. 1 (January 2005): 82–86.

²³ Thomas F Clasen, Kelly T Alexander, et al., "Interventions to Improve Water Quality for Preventing Diarrhoea," in **Cochrane Database of Systematic Reviews** (John Wiley & Sons, Ltd, 2015), <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004794.pub3/abstract>.

²⁴ Clasen, Alexander, et al.

²⁵ Fewtrell (2005), Clasen (2006), Waddington (2010)

premises, or an unimproved source, or they had no water source at all²⁶. Many HWTS solutions are being deployed in health care facilities as point-of-use (PoU) treatment to ensure that staff, patients and visitors have access to safe drinking water, directly supporting the achievement of Sustainable Development Goal 3.8.

CASE STUDY: HEALTH IMPROVEMENTS FROM FILTERS IN BOLIVIA



Fundación contra el Hambre – Bolivia (Food for the Hungry) conducted a study in 2010²⁷ in collaboration with the School of Science, Engineering and Health, Messiah College in the USA. The randomized control trial, looked at eight economically depressed and ethnically marginalized (indigenous) peri-urban zones of the city of Cochabamba. Participants of the study primarily drank water provided by private water providers using tanker trucks, who in turn draw their water from artesian wells nearby.

In the intervention study, one group received a Sawyer PointONE Filter – a membrane filtration unit - and a 30-litre bucket with lid. They were also trained to use and maintain the filter. Six to fifteen households with children under the age of five were arranged into care groups, each with a care group volunteer (CGV) who was trained to educate household representatives and collect monthly data during intervention surveillance. A similar structure was used for control groups, but training was given on topics unrelated to water and sanitation.

Diarrheal disease prevalence based on CGV reports was collected monthly. The result of the intervention was a reduction in diarrheal disease of 85% in comparison with control groups. The study was conducted just three months after filter distribution and the author noted several limitations of the study which may explain the high reduction in diarrhea reduction compared to other similar studies. The results remain nonetheless significant and demonstrate the impact HWTS can have on health.

²⁶ "WASH-in-Health-Care-Facilities-2019 .Pdf," accessed March 11, 2020, <https://www.unicef.org/media/51601/file/WASH-in-health-care-facilities-2019%20.pdf>

²⁷ Erik D. Lindquist et al., "A Cluster Randomized Controlled Trial to Reduce Childhood Diarrhea Using Hollow Fiber Water Filter and/or Hygiene–Sanitation Educational Interventions," *The American Journal of Tropical Medicine and Hygiene* 91, no. 1 (July 2, 2014): 190–97, <https://doi.org/10.4269/ajtmh.13-0568>

4

QUALITY EDUCATION



GOAL AND RELEVANT TARGETS

SDG 4 – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Target 4.1 Ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes

Indicator 4.1.1 Proportion of children and young people: (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex

Target 4.5 Eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations

Indicator 4.5.1 Parity indices (female/male, rural/urban, bottom/top wealth quintile and others such as disability status, indigenous peoples and conflict-affected, as data become available) for all education indicators on this list that can be disaggregated

Target 4.A Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all.

Indicator 4.A.1 Proportion of schools with access to: (e) basic drinking water (As per the SDG 6 definitions)

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Water-related diseases are among the leading causes of school absenteeism in middle and low-income countries²⁹ with an estimated 443 million school days lost each year from water-related illness³⁰. Even when sick children attend school, they perform less well: tests point to adverse effects on memory, problem-solving skills, and attention spans³¹. Poor water supply is associated with dehydration, which contributes to poor education outcomes³².

²⁸ UNHQ: Division for Sustainable Development Goals, "Home .. Sustainable Development Knowledge Platform."

²⁹ Ashish Joshi and Chioma Amadi, "Impact of Water, Sanitation, and Hygiene Interventions on Improving Health Outcomes among School Children," *Journal of Environmental and Public Health* 2013 (2013): 1–10, <https://doi.org/10.1155/2013/984626>

³⁰ UNDP, *Beyond Scarcity*.

³¹ UNDP.

³² Susan B. Sorenson, Christiaan Morssink, and Paola Abril Campos, "Safe Access to Safe Water in Low Income Countries: Water Fetching in Current Times," *Social Science & Medicine* 72, no. 9 (May 2011): 1522–26, <https://doi.org/10.1016/j.socscimed.2011.03.010>

Children – especially girls – can spend a significant amount of time collecting, transporting, and treating water³³. This time often provides a barrier to them attending school and contributes to the disparity in the educational level of girls versus boys, and poor versus wealthy.

In 2016, 570 million children lacked basic drinking water at school³⁴. Schools without safe water, decent sanitation and hygiene (WASH) facilities tend to have lower enrolment and increased absenteeism, limiting students' progress³⁵. Evidence suggests that settings outside the household, such as schools, are places important for reducing the overall burden of WASH-related diseases³⁶.

Household water treatment and safe storage helps prevent diarrheal disease³⁷ and can reduce the burden of collecting and carrying water by allowing collection closer to their homes and treating it more efficiently. This frees up time for children – especially girls – to attend school regularly and fulfill their educational potential. Many HWTS solutions are also being deployed in schools as point-of-use (POU) treatment to ensure that pupils have access to safe drinking water. This can further prevent diarrheal disease, improve students' hydration and help to bolster educational outcomes.

KEY FACTS

- An estimated 443 million school days are lost each year from water-related illness.
- Diarrheal disease has adverse effects on children's memory, attention span and problem solving skills
- Time spent collecting, transporting and treating water can prevent children – especially girls from attending school
- Schools without safe water facilities tend to have lower enrolment and increased absenteeism, limiting students' progress

HWTS' CONTRIBUTION

- HWTS at home and school helps ensure children can attend school regularly, fulfill their educational potential and can help address some of the current educational inequalities

³³ Jay P. Graham, Mitsuaki Hirai, and Seung-Sup Kim, "An Analysis of Water Collection Labor among Women and Children in 24 Sub-Saharan African Countries," *PLOS ONE* 11, no. 6 (June 1, 2016): e0155981, <https://doi.org/10.1371/journal.pone.0155981>

³⁴ UNICEF and WHO, "Drinking Water, Sanitation and Hygiene in Schools: Global Baseline Report 2018," 2018, https://www.who.int/water_sanitation_health/publications/jmp-wash-in-schools-en.pdf?ua=1

³⁵ "World Development Report 2018: Learning to Realize Education's Promise," Text/HTML, World Bank, accessed March 6, 2020, <https://www.worldbank.org/en/publication/wdr2018>

³⁶ Ryan Cronk, Tom Slaymaker, and Jamie Bartram, "Monitoring Drinking Water, Sanitation, and Hygiene in Non-Household Settings: Priorities for Policy and Practice," *International Journal of Hygiene and Environmental Health* 218, no. 8 (November 2015): 694–703, <https://doi.org/10.1016/j.ijheh.2015.03.003>

³⁷ Clasen, Alexander, et al., "Interventions to Improve Water Quality for Preventing Diarrhoea."



CASE STUDY: DISEASE REDUCTION IN KENYAN SCHOOL THROUGH POU CHLORINATION

In response to the lack of access to safe water and high diarrheal disease rates in rural Western Kenya, CARE Kenya collaborated with the U.S. Centers for Disease Control and Prevention (CDC) to initiate a Safe Water System (SWS) program in 2000³⁸. The SWS is an inexpensive household water quality intervention with three components:

- water treatment using 1.0% locally produced sodium hypochlorite solution;
- safe water storage in clay pots modified with a narrow mouth, lid, and spigot; and
- behaviour change techniques, including social marketing and community mobilization.

In 2003, CARE Kenya initiated a pilot project to use the SWS and handwashing promotion in a rural primary school, Rangwe Junior Academy. At the time of the project, there were 380 students in Grades 1 through 8, of whom 63 were AIDS orphans who lived in the school full time. The school water source was an unprotected shallow well, and there were two latrines each for girls and boys. School staff reported that diarrhea was a problem among the students because of a lack of safe drinking water and facilities for personal hygiene.

Students, teachers, and support staff were taught about the use of the SWS and proper handwashing practices. The school purchased five 40-litre clay pots modified for safe water storage with a narrow mouth, lid, and spigot as well as a supply of the locally available liquid chlorine solution, called WaterGuard. They also purchased two large (100- and 220-litre) plastic tanks, both fitted with taps for handwashing. Each day, students collected water from the well, filtered it into the clay pots and plastic tanks through a double folded cotton cloth, treated it with WaterGuard, covered the containers, and waited at least 30 minutes before consuming the water. The school was given a Hach Free and Total Chlorine Test Kit to test treated water and verify that free chlorine residuals in treated water exceeded 0.2 mg/L.

The project was monitored through biweekly visits. During all the visits, students were observed using the SWS and handwashing facilities, it was verified that the school had an adequate supply of WaterGuard and the treated water was tested to confirm free chlorine residuals greater than 0.2 mg/L.

During the pilot just one local physician provided care to the students; his daily log of student visits and diagnoses was reviewed, and diarrhea episodes were recorded for each three-month school term. During the quarter the intervention was introduced, 22 clinic visits for diarrhea were recorded compared to 62 the previous year. The following quarter recorded 18 compared to 37 the previous year. For pupils this meant they were able to participate more fully throughout the school year³⁹.

³⁸ Philip Makutsa et al., "Challenges in Implementing a Point-of-Use Water Quality Intervention in Rural Kenya," *American Journal of Public Health* 91, no. 10 (October 2001): 1571–73.

³⁹ John Migele et al., "Diarrhea Prevention in a Kenyan School through the Use of a Simple Safe Water and Hygiene Intervention," *The American Journal of Tropical Medicine and Hygiene* 76, no. 2 (February 2007): 351–53.

5 GENDER EQUALITY 	GOAL AND RELEVANT TARGETS SDG 5: Achieve gender equality and empower all women and girls
	Target 5.1 End all forms of discrimination against all women and girls everywhere
	Target 5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate Indicator 5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location
	Target 5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life Indicator 5.5.2 Proportion of women in managerial positions

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Women are most commonly responsible for collecting and treating water, drastically limiting their time spent on paid work and leisure and, in the case of girls, reducing the time available for educational opportunities⁴¹. In many cases, it makes women more vulnerable to harassment and violence⁴². Women and girls also spend the greatest amount of time caring for sick family members when they suffer from diarrheal diseases⁴³. Combined, this means they often have little time to attend school or take on paid employment.

Although HWTS cannot bring a water source closer to a household, it can enable users to collect water from less safe sources that are closer to the home and still produce water free from contamination. Providing HWTS in the home, therefore, can reduce the burden of water collection on women and girls, and lessen vulnerability to harassment and violence. As well as reducing the time spent fetching water, HWTS reduces the unpaid work of caring for sick relatives. This time can then be used for education or other productive purposes. HWTS empowers women to take control of their water and hygiene situation and their inclusion in the decision-making process regularly empowers them to make further positive changes in their households and communities.

⁴⁰ UNHQ: Division for Sustainable Development Goals, "Home ... Sustainable Development Knowledge Platform."

⁴¹ United Nations Department of Economic and Social Affairs and Statistics Division, **The World's Women 2015: Trends and Statistics** (New York, N.Y.: United Nations, 2015).

⁴² Marni Sommer et al., "Violence, Gender and WASH: Spurring Action on a Complex, under-Documented and Sensitive Topic," **Environment and Urbanization** 27, no. 1 (April 2015): 105–16, <https://doi.org/10.1177/0956247814564528>

⁴³ "Water and Sanitation Interlinkages across the 2030 Agenda for Sustainable Development," **UN-Water** (blog), accessed March 6, 2020, <https://www.unwater.org/publications/water-sanitation-interlinkages-across-2030-agenda-sustainable-development/>

Many HWTS initiatives also employ women to promote HWTS among their communities, sell products, and provide advice and support to others adopting new HWTS solutions. Such employment opportunities provide women with additional income to invest as they see fit, and often raises their status among their families and communities. Several women have obtained managerial positions within supporting organizations as a result of embracing these new opportunities. Anecdotal evidence suggests that men's attitudes to these women also change positively when they see the added value they provide to their families and community.

KEY FACTS

- The lives of women are particularly impacted by limited access to safe water as they spend more time preparing water and caring for sick family members

HWTS' CONTRIBUTION

- HWTS can reduce the water burden on women and girls allowing them to go to school or use their time for productive activities
- HWTS empowers women to make water and hygiene related improvements within their homes and communities
- Many HWTS initiatives employ women improving their economic opportunities and social status

CASE STUDY: BIOSAND FILTERS IN LA GUAJIRA, COLOMBIA

Fundación Hilo Sagrado is a Colombian organization started in 2013 focusing on empowering women and comprehensive rural development in La Guajira. They specifically work with indigenous Wayuu communities located in very arid areas of Colombia that been neglected for decades.

The organization's initial activities focused on improving incomes among local women by supporting them to develop high quality artisanal woven products, such as bags, to help them achieve higher profits from buyers. They quickly realized, however, that these women needed more than just a greater income and started supporting women and communities with other programs. These included financial education (traditionally a bartering system is used), food security and since 2019, access to safe drinking water.

Water in arid areas of La Guajira is scarce and a large proportion of groundwater is saline. While some communities also have juagueyes, traditional rainwater collection systems, they usually provide highly contaminated water and due to climate change, they are becoming less reliable in providing water. This means women and girls often have to walk up to two hours to get water, much of which is not safe to drink. Having to walk kilometres to get water is both inconvenient and risky. Young girls in particular face a high risk of assault. Since they spend so much time collecting water they also often miss out on school and have limited economic opportunities beyond traditional weaving.



Fundación Hilo Sagrado's biosand filter (BSF) project supported the training of local technicians and women leaders to allow them to construct, distribute, and monitor the use of filters. Women trained as part of the project have now become experts on the BSF and support their neighbours in solving any problems they encounter with their filters. Women and young girls can also now collect water from closer water sources dramatically reducing the time spent collecting, transporting, and treating water. They now have more time for generating income or going to school and have more money to invest in their well-being.

CASE STUDY: BIOSAND FILTERS IN CUZCO, PERU

Started in 2008, DESEA is a Peruvian NGO working with remote rural communities in the Sacred Valley near Cuzco. They have a comprehensive implementation approach that brings together water, education, health, and community development.

These communities where they work are very poor and have few or no services. Households collect their drinking water from small mountainside creeks and drink it without treatment. DESEA wanted to help communities with a long term solution that didn't require spare parts as the communities are remote and access to vendors is complicated. To overcome the local challenges, they designed a PVC version of the biosand filter (BSF) and worked with local community members to distribute it.

They recognized early on the value of establishing a local community support network and worked with communities to select local women to act as their local distributors and community health promoters. The women were taught how to support new filter use and showed them how to solve common problems that might occur with the filters. DESEA taught them how to install and monitor the performance of the BSFs. The women were also trained in basic health care so they could help their neighbours when they are sick but are unable to access a doctor. All the training was completed using visual tools as the women are unable to read or write and only spoke their local language, Quechua.

Monitoring by the project showed that 90% of more than 400 filters installed are being used daily after five years, parents almost unanimously attest to less or much less diarrhea among their children. Ministry of Health nurses at local clinics report a very low incidence of diarrhea in project communities relative to nearby communities without water filters. In its final survey in 2018, DESEA recorded a single individual reporting diarrhea in the last three days among 393 respondents.

These women are now authentic leaders within their communities and are very well respected by everyone. DESEA used simple teaching techniques to transfer the knowledge to these women so they could all carry out their tasks regardless of their ability to read or write. The women receive a basic food basket for their families as compensation for their work every month, improving nutrition at home and helping aid the development of their children. Payment with food, as opposed to money, ensures the payment is managed by the women directly and not by their husbands, further empowering them as contributors to the family economy. It also avoids a common problem of family violence, as many men use any available income to use and abuse alcohol.



6

CLEAN WATER AND SANITATION



GOAL AND RELEVANT TARGETS

SDG 6: Ensure availability and sustainable management of water and sanitation for all

Target 6.1 Achieve universal and equitable access to safe and affordable drinking water for all

Indicator 6.1.1 Proportion of population using safely managed drinking water services

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The definition of safely managed drinking water is based on three criteria:

■ **Availability**

Is water always available when needed? The human right to safe drinking water specifies that water should be “available continuously and in a sufficient quantity to meet the requirements of drinking and personal hygiene, as well as of further personal and domestic uses, such as cooking and food preparation, dish and laundry washing and cleaning. Supply needs to be continuous enough to allow for the collection of sufficient amounts to satisfy all needs, without compromising the quality of water⁴⁵.”

■ **Accessibility**

Is the main drinking water source located in your dwelling or yard? Ideally water will be accessible within the home but the WHO/UNICEF Joint Monitoring Program for Water Supply, Sanitation and Hygiene (JMP) defines a basic water supply as one where collection from an improved water source takes less than 30 minutes, including queueing⁴⁶.

■ **Quality**

Is water free from contamination? For global monitoring purposes “free from contamination” requires that drinking water meet microbiological and priority chemical water quality standards. The microbiological standard applied is that no *E. coli* should be detected in a 100 mL sample. At the global level, the priority chemical contaminants are arsenic and fluoride⁴⁷.

⁴⁴ UNHQ: Division for Sustainable Development Goals, “Home ... Sustainable Development Knowledge Platform.”

⁴⁵ “Promotion and Protection of All Human Rights, Civil, Political, Economic, Social and Cultural Rights, Including the Right to Development” (Koninklijke Brill NV), accessed August 28, 2020, https://doi.org/10.1163/2210-7975_HRD-9970-2016149

⁴⁶ WHO, “JMP Methodology 2017 Update & SDG Baselines,” March 2018, <https://washdata.org/sites/default/files/documents/reports/2018-04/JMP-2017-update-methodology.pdf>

⁴⁷ WHO

HWTS solutions are used directly in people's homes and, when well-managed, enable 24-hour availability of water for drinking. The development of local supply chains can deliver a consistent supply of products and replacement parts. This contributes to HWTS products and services being a long-term, sustainable water management solution. HWTS can also be a vital component in providing clean drinking water when a household's regular drinking water supply is interrupted, such as a failure in a treatment plant or during a natural disaster.

Depending on the method, household water treatment can remove, kill, or inactivate most microbial pathogens. Many HWTS solutions offer a multi-barrier approach (for example, filtration, disinfection and safe storage) to ensure that water is free from contamination and all can be used in combination to form a multi-barrier approach, increasing their effectiveness. Interventions to improve water quality at the household level are more effective than those at the source⁴⁸ in part because they minimize recontamination. This microbial improvement in water quality through continued HWTS use has been demonstrated to reduce diarrhea among households by an average 35-47%⁴⁹. Specific HWTS technologies have also been developed to improve chemical water quality by removing priority chemicals of arsenic and fluoride, providing further health benefits.

Although HWTS cannot bring a water source closer to a household, water treatment can complement a variety of water distribution and treatment systems by providing a final step that guarantees the potability of water for human consumption. This enables users to collect water from less safe sources that are closer to home, and still produce drinking water free from contamination. It allows households to invest in lower quality in-home water supplies knowing they can adequately treat that water for consumption. Where household water supplies are predominantly used for non-potable activities such as cleaning, irrigation or animal watering, this can greatly decrease the complexity of water systems and reduce their overall costs. In such situations, household water treatment helps increase water accessibility.

KEY FACTS

- Safely managed drinking water is defined by availability, accessibility, and quality

HWTS' CONTRIBUTION

- HWTS directly improves availability and quality of drinking water
- HWTS can, under certain conditions, improve accessibility by allowing people to collect water from closer yet less safe sources, knowing HWTS will make it safe to drink

⁴⁸ Clasen, Alexander, et al., "Interventions to Improve Water Quality for Preventing Diarrhea."

⁴⁹ Fewtrell (2005), Clasen (2006), Waddington (2010)



CASE STUDY: LIMA, PERU

In 2007 Equidad y Desarrollo (EDES) and others conducted a study to look at household water quality in the community of “27 de Junio” in peri-urban Lima. The community had no water service within their communities and were reliant on either collecting water from shallow wells or purchasing water from tanker trucks. The results showed that all households in the study were consuming contaminated water, in some cases with contamination levels above 1,000 colony forming units (cfu) per 100 millilitres (mL).

Following the study, EDES sought solutions for improving the quality of household drinking water. Their final solution was to work with the community to construct concrete biosand filters and provide the training and support necessary to ensure correct, consistent, and continued use. Once the project was complete, EDES returned to determine how well the filters were working. They found users were overjoyed with their “clearer water” that has “improved flavour”. They found an average 98.6% reduction in bacterial contamination and heard from mothers that their children had fewer cases of diarrhea.

8 DECENT WORK AND ECONOMIC GROWTH



GOAL AND RELEVANT TARGETS

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Target 8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services

Indicator 8.3.1 Proportion of informal employment in non-agriculture employment, by sex

Target 8.5 Achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value

Indicator 8.5.2 Unemployment rate, by sex, age and persons with disabilities

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People who live without safe water lose more than 45 million DALYs annually⁵¹ to diarrheal disease. Repeated infections of the disease can make it difficult to hold down a physically or mentally demanding job. Collecting and transporting safe water, as well as caring for sick family members is a burden that is primarily borne by women and young girls. It greatly reduces productive time and makes joining the workforce harder. Lack of safe water keeps people out of the workforce and in poverty. Spending money on medication to treat waterborne diseases reduces the amount of cash and other resources that might allow people to invest in new economic opportunities.

Many studies have shown sustained home water treatment systems reduces diarrhea among all ages from 35–47%⁵². HWTS can also reduce the time spent collecting and treating water, as well as the unpaid time spent caring for sick family members. Combined, these effects allow people greater opportunities to generate income and help alleviate poverty.

A large number of HWTS initiatives that target people living in poverty also bring training and employment opportunities. Workers are required at production and assembly facilities; local staff are needed to promote and sell HWTS solutions and often provide long-term monitoring and support to HWTS users. All these roles require new skills for which staff receive training and many of the new skills gained apply to other roles and other job sectors. The growth of the household water treatment and safe storage sector creates long-term supply chains for materials, consumables, and replacement parts. This means jobs will remain in local communities even after the initial demand for products has been satisfied.

⁵⁰ UNHQ: Division for Sustainable Development Goals, "Home ... Sustainable Development Knowledge Platform."

⁵¹ Troeger et al., "Estimates of Global, Regional, and National Morbidity, Mortality, and Aetiologies of Diarrhoeal Diseases."

⁵² Fewtrell (2005), Clasen (2006), Waddington (2010)

KEY FACTS

- Lack of safe water and associated diarrheal diseases adversely affect people's ability to be productive and participate in the workforce
- Caring for sick family members and spending time collecting safe water adversely affect people's ability to participate in the workforce
- Spending money on medicine reduces people's ability to invest resources in income generating activities

HWTS' CONTRIBUTION

- HWTS can allow people additional time and resources to take part in economic activities
- HWTS also provides a broad range of employment opportunities to areas where products are being actively produced, marketed, and distributed
- HWTS long-term supply chains ensure that employment opportunities last long after initial demand has been satisfied

CASE STUDY: AGUALOGIC, COLOMBIA



Agualogic is a Colombian company based in Bogota that started selling ceramic pot filters in 2018. Initially, they used a plastic container for the filter body. The plastic container was very practical for humanitarian projects where filters needed to be lightweight, robust and easily stackable for transport to remote areas. However, these containers were less acceptable to those throughout Colombia who wanted to purchase an effective filter for their home. They wanted a more aspirational design and could generally afford to pay more.

In response, Agualogic developed a set of new containers made of pewter and glass. As well as placing their products at different retail and hardware stores, they developed an extensive network of local distributors throughout the country. The new containers were produced by local artisans and the network of distributors provided new local work opportunities throughout Colombia.

After two years of operation, Agualogic employs more than a dozen staff and works with more than 20 local distributors. As they grow, Agualogic is planning to build a factory to gain control over the production process. The new factory will employ significant numbers of skilled production workers and support expansion of their local distribution network.

	GOAL AND RELEVANT TARGETS SDG 10: Reduce inequality within and among countries Target 10.1 Progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average Indicator 10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population Target 10.2 Empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status Indicator 10.2.1 Proportion of informal employment in non-agriculture employment, by sex
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Worldwide, 785 million people are lacking access to basic water services. Eight out of 10 of those people lived in rural areas and a majority were from the poorest 40% of the income distribution⁵⁴. In addition, rural communities, minorities, marginalized groups and vulnerable populations, such as people living with HIV/AIDS or pregnant women, are often overlooked for water-related investments despite having the most to gain. The lives of women and girls are especially impacted by limited access to safe water since they are typically the members of the family who spend the most time collecting, transporting, and treating water in the home⁵⁵. Women and girls also spend the greatest amount of time caring for sick family members when they suffer from diarrheal diseases⁵⁶. Lack of safe water, therefore, keeps people, especially women and girls, out of the workforce and in poverty. Spending money on medication to treat waterborne diseases also reduces the amount of cash and other resources that might allow people to invest in new economic opportunities.

HWTS can help relieve the water burden felt by marginalized populations, women and girls, allowing them more opportunities to generate income. HWTS is well placed to address this inequality as it can be deployed more easily than networked solutions, such as piped water systems, and can be made available and affordable to people living in poverty in areas that are typically overlooked for water-related investment. Household water treatment is deployed directly in people's homes allowing specific targeting of vulnerable groups.

⁵³ UNHQ: Division for Sustainable Development Goals, "Home ... Sustainable Development Knowledge Platform."

⁵⁴ United Nations Children's Fund (UNICEF) and World Health Organization (WHO), "Progress on Household Drinking Water, Sanitation, and Hygiene: 2000-2017 Special Focus on Inequalities," 2019.

⁵⁵ UNDP, *Beyond Scarcity*.

⁵⁶ "Water and Sanitation Interlinkages across the 2030 Agenda for Sustainable Development."

A large number of HWTS initiatives that target rural, marginalized, and vulnerable groups also bring with them many training and employment opportunities. Workers are required at production and assembly facilities. Local staff are needed to promote and sell HWTS solutions and local staff, often women, are required to provide long-term monitoring and support to HWTS users. All these roles require new skills for which staff receive training and many of the new skills gained apply to other roles and other job sectors. The growth of HWTS as a sector creates long-term supply chains for materials, consumables, and replacement parts. This means that jobs will remain in local communities even after the initial demand for products has been satisfied.

Waterborne diseases and the time required to collect safe water also make it difficult to organize for community development. When there is no safe water and sanitation, people are more vulnerable to powerful or wealthy individuals and groups that threaten their security and resources⁵⁷. When people are empowered to help themselves get access to safe water, this can lead to productive collaboration in other areas. The personal and community achievement of obtaining HWTS can lead to further community action to address other pressing community needs such as infrastructure improvements, education, or environmental protection.

KEY FACTS

- More than half the 785 million people lacking access to basic water services are in the poorest 40% of the income distribution
- Eight out of 10 of those lacking access to basic water services live in rural areas
- The lives of women are particularly impacted by limited access to safe water as they spend more time preparing water and caring for sick family members
- The effects of a lack of basic water services, such as disease and reduced time availability, make it difficult to organize for community development

HWTS' CONTRIBUTION

- HWTS can be made available and affordable to those that are regularly overlooked by traditional water-related investments
- HWTS can allow marginalized groups additional time and resources to take part in economic activities
- HWTS provides a broad range of employment opportunities to areas where products are being produced, marketed, and distributed
- HWTS long-term supply chains ensure that employment opportunities last long after initial demand has been satisfied
- HWTS can help stimulate community actions that can further generate new local development opportunities

⁵⁷ "Water and Poverty: How Access to Safe Water Reduces Poverty," Lifewater International, December 26, 2014, <https://lifewater.org/blog/water-poverty/>



CASE STUDY: BIOSAND FILTERS (BSF) TO RURAL POPULATIONS IN HONDURAS

Pure Water for the World began working with communities to provide access to biosand filters in Honduras in 2009. They prioritized vulnerable coffee-growing communities in the southern region of Trojes, close to the border with Nicaragua. These communities do not have road access and have therefore been repeatedly overlooked and marginalized by local authorities and other aid groups. Although it required a significant effort and increased operational costs to serve such communities it met with PWW's commitment to work with underserved people in Honduras. It required PWW to select a product that was easily transportable and required minimal repairs and replacement parts, such as a Hydrad plastic biosand filter.

In setting up operations in Trojes, PWW brought employment opportunities and built a strong team using local labour. PWW provided workers with opportunity to learn about WASH implementation, and to become providers of Hydrad biosand filters. PWW's staff is well known and respected in Trojes and their roots in the area have enabled them to create strong bonds with filter users. Users feel comfortable calling PWW when they have filter issues. According to the team, these relationships increase PWW's ability to reach more people as existing users feel comfortable calling staff to suggest new families or communities that might benefit from their program. These services have helped communities feel more valued. They have made clean water and advice available to people living in poverty in rural communities that do not usually have access to such services.

PWW has trained and continues to support a network of community agents. The agents are responsible for monitoring filter use and providing advice to families on other WASH-related practices. While PWW is currently unable to pay these volunteers, they receive a certificate of support and generate significant respect among their neighbours and peers. In some cases, this has helped empower them to return to studying and seek out new professional opportunities.

CASE STUDY: MEMBRANE FILTERS IN INFORMAL SLUMS, COLOMBIA



Fundación Entropika is a Colombian NGO based in Leticia, Amazonas, which aims to support the long-term conservation of tropical biodiversity. They realized quickly this aim was closely linked to the success of local, indigenous, and commonly marginalized communities. They started to focus on local community-led projects in the areas of education, waste management and the provision of safe drinking water to provide them with better long-term opportunities. As part of their commitment supporting these vulnerable communities, they linked up with a Swedish organization (Fundación Ancla) that was working with vulnerable populations, providing education in one of the biggest slums in the city of Medellín.

El Granizal is one of the most vulnerable areas of Medellín, with most of the inhabitants having fled ongoing violence in the Chocó region of the country. The slum is a dangerous place and

residents are living in the area illegally. There is a lack of land rights, limited infrastructure, limited services and limited economic opportunities. Local children have a particularly high risk of drug use and prostitution. They also lack access to safe water. Water is generally obtained from a network of illegal connections into the main water pipe which links the local dam to a treatment facility. The main connection is controlled by a local gang. The water it delivers is highly contaminated and during the rainy season is highly turbid. For drinking water, families typically either boil the water or travel 10 minutes by bus to buy 10-litre containers of drinking water.

Entropika provided household membrane filters, made by Sawyer, to families whose children were enrolled in Fundación Ancla's project. They installed filters at kindergartens, schools, community centres and a community canteen. At each home, two pipes are connected to existing household storage tanks outside families' homes. This allows the membrane filter to be installed on one pipe to provide drinking water and a tap is placed on the other pipe to provide water for other needs. Intensive education is provided on filter use and maintenance with particular attention paid to how to clean clogged filters, a common occurrence due to the high turbidity of the water. A team of four local women has been employed to provide follow up visits to households every three months.

For the 328 filters installed to date, Entropika has covered the full cost of the filters. Entropika hopes that users will pay the local water team for the maintenance of these filters and create a self-sustaining community water service. Entropika is exploring alternative financial models that might allow households to buy replacement filters when necessary. An affordable financing mechanism would help larger numbers of families in the community to purchase filters and allow Entropika to fully serve the demand this project has begun to generate.

Around 5,250 people are benefitting from clean drinking water as part of this initiative. The community has seen less illness, which is a crucial step in improving access to education, jobs and a decent quality of life. As well as improving the overall health of this community, the filters are enabling families to save money they would spend on gas for boiling contaminated water or purchasing potable water from stores. This extra money is then available for other basic necessities such as food, personal hygiene, and education. Although an interim measure, the filters are reducing social inequalities by bringing potable water to directly to the homes of those living in vulnerable neighbourhoods, similar to those in less vulnerable city neighbourhoods.

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