

Clara NextGen: Improving Electro-chlorination Accuracy and Reliability

A collaboration between Eawag, CSEM, and CLARA Water AG aims to improve the chlorine dosing in untreated water. The technology developed will improve access to safe water. *Nicolas Seemann-Ricard¹, Donato Patrissi², Roger Limacher³, Jihyun Lee³, Noa Schmid³, Marisa Boller¹, Stefano Cattaneo³, Sara Marks¹*



Figure: Main work packages of the Clara NextGen project.



Photo: Operator refilling Clara V2 with brine solution.

Introduction

Achieving Sustainable Development Goal 6 – universal access to safe and affordable drinking water – requires scalable, reliable, and locally adaptable water treatment technologies. The Clara online electrochlorinator (Photo) is a promising solution. Unlike passive chlorinators that rely on chlorine tablet supply chains and have difficulty dealing with water quality and flow variations [1], Clara generates the chlorine solution *in situ* using table salt and solar energy. This solution is then dosed using pumps based on water flow in a distribution pipe.

Over 20 Clara systems have been installed across Ethiopia, Madagascar, and Kenya. These self-contained devices have been shown to significantly reduce *E. coli* contamination in distribution networks [2]. However, CLARA Water's experience in commercialising these devices revealed opportunities for improving user experience and the consistency of free residual chlorine levels at consumption points.

The Innosuisse-funded Clara NextGen project is a 2-year partnership between CLARA Water AG, CSEM, and Eawag to create the next-generation Clara device (Figure). This project focuses on developing: **1)** adaptive dosing based on real-time water quality sensing, **2)** a revamped hydraulic system to reduce manual operation and maintenance, and **3)** improved remote communication for retrieving quality data and key process parameters.

Research & Development activities

A custom inline water chlorination test bench at Eawag will be used to simulate chlorination dynamics for groundwater and surface water sources. An array of direct (free residual chlorine) and lower-cost proxy sensors (oxidation-reduction potential, pH, temperature, and conductivity) placed up- and downstream of the chlorination point will collect data on water quality, chlorine demand, and chlorine decay across various water compositions.

CSEM's artificial intelligence (AI) specialists will use these data to develop a model capable of estimating the optimal chlorine dose

based on the proxy-measurements enabling a target free residual chlorine level at the outlet of the Clara device and, consequently, at the end of the distribution system. In parallel, CSEM will also lead the redesign of the hydraulic and chlorine dosing system. The main objectives are to automate brine generation, reduce points of failure, and decrease the frequency of manual operator intervention from several times a day to once a week.

The second phase of the project (2026–27) will focus on combining the sensor array, AI modelling, and revamped system design to build a prototype. This system will be installed in Ethiopia to validate and fine-tune chlorine control. Here, the focus will also be on developing the back-end data management and graphic user interfaces.

Outlook

The Clara NextGen project represents an important step toward making water disinfection even more reliable, autonomous, and scalable. Ultimately, Clara NextGen's goal is to deliver a fully integrated, low-maintenance solution that can bring safe drinking water to more communities worldwide. •

References

- [1] Lindmark M. et al., 'Passive In-Line Chlorination for Drinking Water Disinfection: A Critical Review', *Environ. Sci. Technol.*, 56/13, (2022), 9164–9181.
- [2] Hänni J., 'Assessment of in-line chlorination and its effect on child health in rural Ethiopia' Master's Thesis, EPFL, (2024).

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