

Challenge Brief

Challenge title:	Harmful Algal Blooms in Reservoirs
-------------------------	------------------------------------

1. Brief description of the business process context of the challenge to be addressed

The reservoir associated with this challenge, located in Chile's Central-Southern Region, was built to ensure agricultural irrigation, generate electricity, and, for the past decade, serve as a balneario for relaxation and recreation in the area. In recent years, an increase in the frequency and intensity of algal blooms has been observed in the area, raising concerns among visitors and local communities.

No toxicity has been identified; however, it is important for the company to:

1. Identify the causes of the algal blooms.
2. Characterize and monitor the components of the blooms.
3. Find a solution that reduces or eliminates them.

2. Description of the technological challenge associated with the business need outlined above

Although the recreational balneario located at the reservoir is not directly related to the power generation business, its proper management is important to the company, given that its creation was an initiative sponsored by it and is linked to its commitment to regional development, the community, and the safe and sustainable use of the reservoir.

Algal blooms are typically caused by rising water temperatures and/or eutrophication (enrichment with phosphorus and nitrogen) of the environment. When algal blooms contain phycotoxins and/or cyanotoxins, they are referred to as Harmful Algal Blooms (HABs) and are associated with increased water toxicity for both wildlife and humans, with significant consequences for public health and the lake ecosystem.

The company currently does not have a defined protocol for sampling and characterizing HABs, nor a methodology for their reduction or elimination. In this context, the challenge involves two complementary components: first, to develop a protocol for characterization, monitoring, and early warning that enables an understanding of the blooms and identifies the conditions that favor their occurrence; and, second, based on this information, to evaluate and implement prevention, control, or mitigation measures that are environmentally safe, economically viable, and easy to operate.

Solutions such as monitoring buoys, ultrasound systems, and bubble injection systems—which improve water circulation and reduce the eutrophication that causes algal blooms—have been explored. The company is seeking alternatives that are easier and more cost-effective to implement.

3. Minimum and ideal requirements for a solution to be considered

Minimum Requirements

- The solution reduces the occurrence of toxic algal blooms
- The solution has minimal impact on the aesthetic appeal of the balneario
- The solution does not affect the rest of the reservoir's ecosystem (flora and fauna) and complies with the company's regulatory standards
- The solution is easy to implement over the next few years

Ideal Requirements

- The solution can be implemented by December 2026
- The solution is not visible from the balneario
- The solution includes real-time monitoring of the type of algae and the potential toxins they produce
- The solution completely eliminates toxic algal blooms

4. Additional comments on the expected solution

- The most promising solution today is monitored buoys, which are capable of monitoring and controlling water quality but come at a high cost to the company.
- The company's guiding principle is to "seek nature-based solutions" and comply with the WHO's international standard (maximum 24 µg/L of microcystins).
- The company is interested in working both with companies and startups offering ready-to-deploy products or services and with universities or research centers capable of co-developing new solutions.