Green Global Innovation

Fresh water issues in Italy

Green opportunities

Issues & Solutions

Industry-Specific Contaminants and Corresponding Water Treatment Technologies

Industry	Contaminants of Concern	Suitable Technology for Treatment
Agriculture	Pesticides, Chemical Fertilizers, and Ammonia	• HiPEC™ for pesticides removal • AmmEL-LC-H_2™ for ammonia-nitrogen removal • ESD™ for TDS removal
Olive Oil Production	Acidic Wastewater (high acidity, organic compounds)	• AmmEL-LC-H_2™ for ammonia-nitrogen removal and NaOH production for pH control • ESD™ for TDS removal • HiPEC™ for organics removal
Beef, Chicken, Pork Industries	Antibiotics and Ammonia	• AmmEL-LC-H_2™ for ammonia-nitrogen removal • HiPEC™ for organics removal
Municipal Sewage	Organics and Ammonia	• AmmEL-LC-H_2™ for ammonia-nitrogen removal • HiPEC™ for organics removal
Leachate from Dumps	Organic Pollutants, Ammonia, and chlorides	• AmmEL-LC-H_2™ for ammonia-nitrogen removal • ESD™ for TDS and/or chloride removal • HiPEC™ for organics removal

Opportunities

Depending on the type of wastewater to be treated, **potential byproducts** that can be captured and sold are:

- **Hydrogen**
- **Chlorine-based disinfectant**
- **NaOH sodium hydroxide**
- **Carbon credits**
- **Purified water for use in boilers and nuclear powerplants**
- **Water for irrigation**
- **Potable water**

The net result is not only are we treating the wastewater for recovery purposes, which is your primary objective, we are also creating various revenue streams that will keep the cost of wastewater treatment well below alternative technologies.

Desalination + Oil & Gas

Desalination

Our partners are able to propose both short-term emergency solutions, such as nano-filtration, as well as long-term desalination plants that are cost-effective, at a fraction of older systems. The plants can be scaled to suit communities as small as 10,000 people and as large as required for major urban centers.

Oil & Gas Industry

This industry uses significant volumes of water for drilling, fracking, etc. The resulting wastewater is heavily contaminated. Our partners are able to extract totally dissolved solids to provide clean water and marketable byproducts. These newer technologies are able to achieve this at costs far below disposal costs for the industry, while providing water that can be reused on site or treated for alternative uses such as for irrigation or drinking water.

Technologies & partners

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Moving forward

The initial stage of engagement would involve in depth analysis of the various wastewaters to be treated:

- **Volume per annum**
- **Molecular data of wastewater by region, province or community**
- **Objective usage of the treated water, by type, for example pure water for industry, agricultural irrigation, potable, or return to ground water systems**

Our objectives will be:

1. ***To return with a variety of solutions, based on the most efficient and cost-effective alternatives, utilizing world leading Canadian technologies.***

2. ***Where possible, propose solutions that can be manufactured in Italy to service the European Community.***

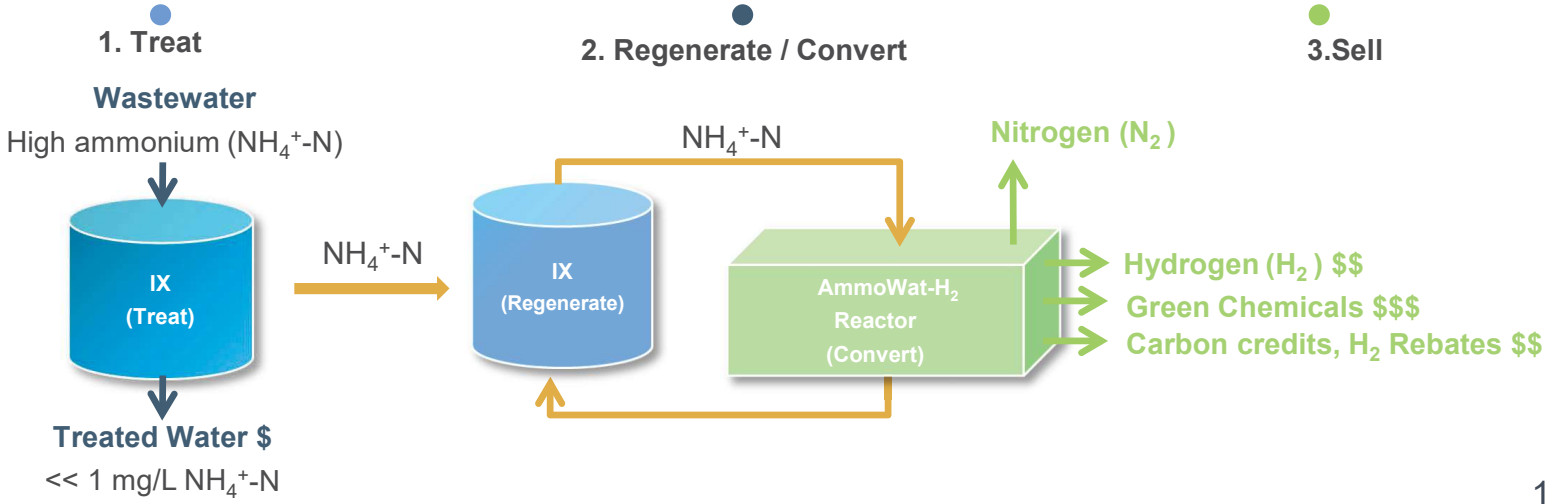
AmmoWat-LC-H_2 Technology Abstract

The innovative electrochemical AmmoWat-LC-H_2 system represents the most environmentally friendly ammonia treatment approach available. Unlike conventional biological ammonia treatment, the AmmoWat-LC-H_2 technology effectively treats municipal and industrial wastewater containing toxic ammonia, a valuable energy vector, in a
manner that results in the production of environmentally friendly N_2 gas (no nitrous oxide emissions), a high-purity stream of H_2 gas (valued at $15/kg), and other valuable byproducts such as sodium hydroxide (NaOH) and chlorine-based disinfectant that can be used onsite or commercialized to generate significant revenues. To cater to diverse client
requirements, the AmmoWat-LC-H_2 technology also comes in another design, the standard AmmoWat-LC design, which is designed to convert ammonia in wastewater to nitrogen gas without generating the byproducts mentioned earlier.
Additionally, the efficacy of the AmmoWat-LC-H_2 system is not affected negatively by low temperature enabling
responsible management of ammonia in northern regions of the globe year-round. This robust technology is capable of handling a wide range of ammonia-nitrogen concentrations (<1 to >5,000 ppm) across various wastewater types and under variable operating conditions while achieving very low concentrations of ammonium in the treated water (< 1 ppm).
The AmmoWat-LC-H_2 technology is a proven system for treating ammonia in wastewater associated with municipal and numerous industrial sectors (mining, oil & gas, agricultural, etc.) and is revolutionary in its ability to convert wastewater treatment facilities, which currently are liabilities, into potentially perpetual profit-generating assets while combating climate change, delivering circular economy outcomes, and producing green energy.

AmmoWat-LC-H_2 Process

The AmmoWat-LC-H_2 system is a multistage **continuous** process for on-site installations or mobile containerized systems.

- Stage 1: Loading ion exchange (IX) column(s) → producing **effluent** containing ≤ 1 ppm NH_4^+-N
- Stage 2: IX column(s) regeneration with **NaCl electrolyte**
- Stage 3: The reactor converts total ammonia (valuable energy vector) directly to environmentally friendly N_2 gas and a high-purity stream of H_2 gas and other valuable chemicals (NaOH and disinfectant).



Technology Strengths

- Commercially proven, patented/patented-pending
- Fully automated, remotely monitored, zero chemical consumables, scalable, modular, and low maintenance
- **Zero** harmful emissions: AmmoWat eliminates the production of nitrous oxide greenhouse gas, the most significant ozone-depleting substance (a byproduct of conventional biological ammonia treatment)
- Cashflow positive wastewater treatment facilities: AmmoWat byproduct sales offer potential for **multimillion-dollar revenues** from global wastewater treatment operations
- Treating ammonia & producing hydrogen independently of water/ambient temperature (unlike high-temperature ammonia cracking)
- Address ammonia challenges in different kinds of wastewaters
    - Municipal (anaerobic digestion digestate & tertiary effluent)
    - Industrial (military basis wastewaters, mining leachate, oil & gas produced water, contaminated stormwater, etc.)
    - Agricultural (animal anaerobic digestion digestate & raw manure)

Pictures from Select Case Histories