



Producing **Green Ammonia** From Nitrogen Pollutants

October, 2025

Yash Mistry | ymistry@paniclean.com



Nitrate: An Invisible Choke

\$1.5B

Est. annual **healthcare impact** of nitrate-polluted drinking water

[Press release](#) > [Greenpeace](#)

'Only a matter of time' before a baby is harmed due to nitrate contamination, warns Greenpeace



Rhiannon Mackie

21 July 2025 • 0 Comments

Nitrates are hurting our waters and our fishing

Wild Side column: High levels are causing issues for many, including the fish that swim in our rivers and creeks

Orlan Love

Jul. 24, 2025 2:22 pm, Updated: Jul. 25, 2025 7:41 am

By now, we can all just stipulate that nitrate levels in Iowa rivers, streams and groundwater are unhealthy high, that most nitrate pollution drains or leaks from farm fields and that little will be done about it.

Nitrate-contaminated water linked to higher cancer rates

Monday, Jul 14 2025 | [Tom Walton](#) | [4 Comments](#) | [0 New!](#)

Tom Walton is an attorney in Dallas County.

In March 2024, Dr. Peter S. Thorne, Department of Occupational and Environmental Health at the University of Iowa, with his colleague Dr. Angelico Mendy, an epidemiologist at the University of Cincinnati College of Medicine, published [an important scientific paper](#) on the association between drinking water nitrate levels with the risk of death from cancer. Thorne is the former Chairman of the U.S. Environmental Protection Agency's Scientific Advisory Board.

Nitrate levels remain elevated in the Des Moines and Raccoon rivers, two of the drinking water sources for Central Iowa Water Works' 600,000 customers. The regional utility recently shared how it tests water and removes nitrates at one of its plants to meet federal drinking water standards.

In a lab at the Fleur Drive Treatment Plant, Des Moines Water Works chemist Lisa Morarend filtered samples of river water into vials. She then put them in an instrument

Inefficient Current Solutions:

Today's nitrate treatment methods are expensive. Conventional systems essentially relocate the pollutant instead of truly eliminating it.

Over 1,700 community water systems in the US are in violation of nitrate limits, yet upgrading them with current solutions is cost-prohibitive.

Gulf of America

\$2.4B

Est. annual impact to fisheries and marine habitat each year

WATER & DROUGHT

Uranium, nitrate pollute drinking water in homes near Tuolumne River. From what?

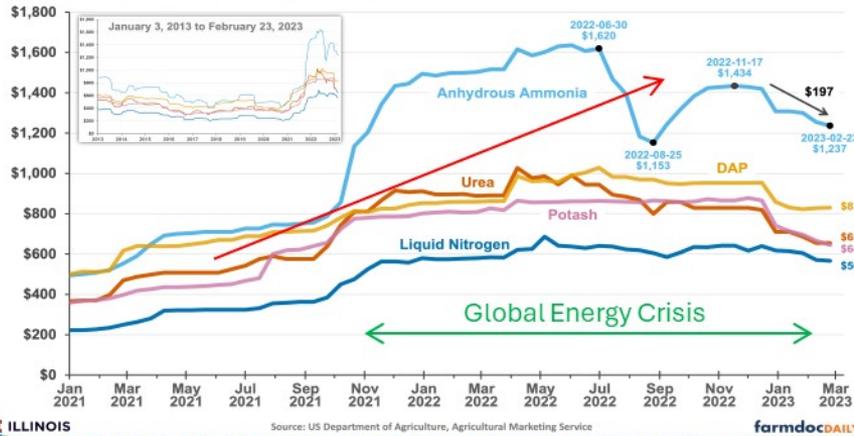
By [Kathleen Quinn](#)

Updated June 5, 2025 12:34 PM | [Gift Article](#)

Ammonia

A Highly Demanded and Geopolitically Influenced Commodity

Figure 1. Fertilizer Prices per Ton in Illinois



Anhydrous Ammonia Imports by Country in 2024 (\$M)



'Trying to Stick Around': U.S. Farmers Fight for Survival

The trade war is hitting American farms on multiple fronts.



By Olivier Knox | Sept. 15, 2023, at 4:30 p.m.

Farmers are not OK.

Already, farm bankruptcies as of July exceed those over the full year of 2024.

Trade wars aren't helping. Tariffs on other countries' exports to the U.S. make those products

Iowa farmers fear fertilizer shortage: 'It's simply not available'



Supply chain stresses sprout up for western Iowa farmers

Posted 6:28 PM, Mar 23, 2022

ATLANTIC, Iowa (KMTV) — Planting season is just around the corner for farmers, but there's already a lot of stress sprouting up. With Russia as a top fertilizer exporter, prices have shot to record highs in the past

U.S. Fertilizer Industry Faces Familiar Concerns Heading Into 2025



By Mark Milam | January 7, 2025



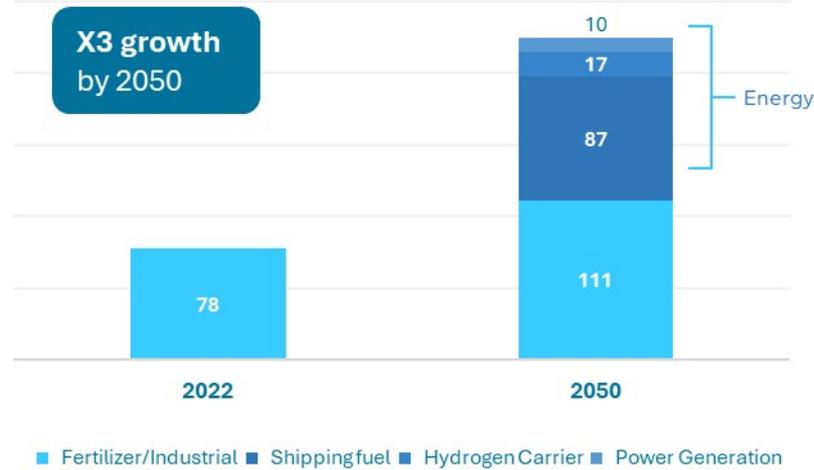
Ammonia

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Global Ammonia Market (\$Billion)

Source: BCC Research

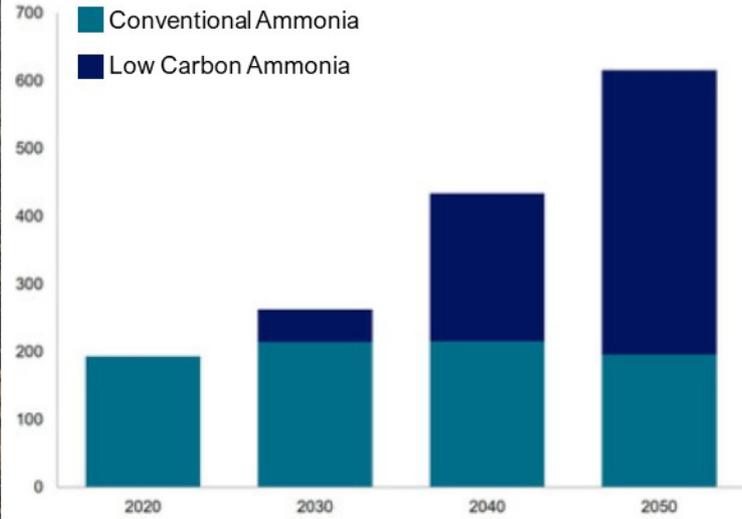
**X3 growth
by 2050**



Global ammonia demand (excluding urea)

S&P Global

MMt

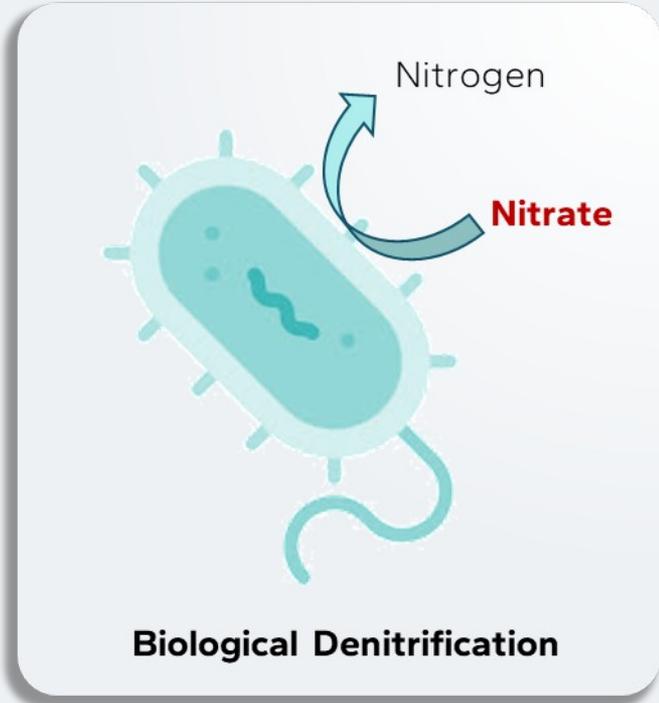


As of June 2023.
Source: S&P Global Commodity Insights

ONE PROCESS INSTEAD OF TWO



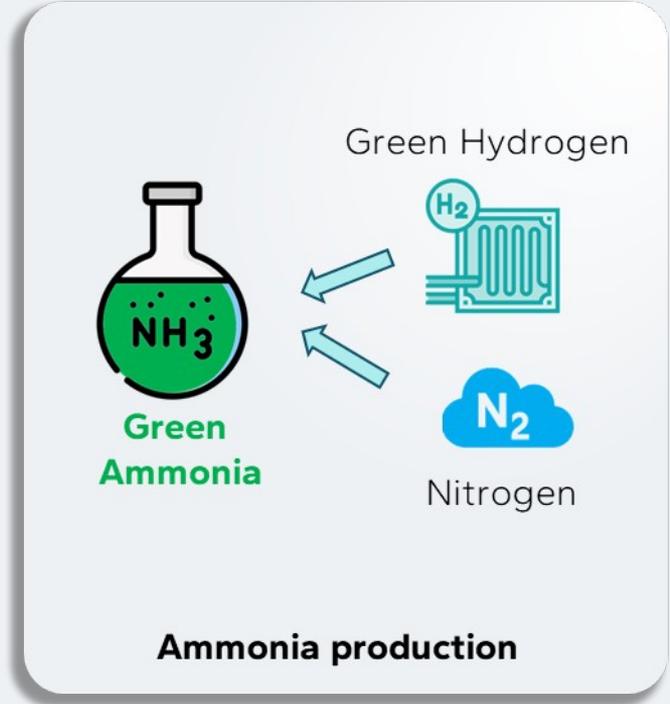
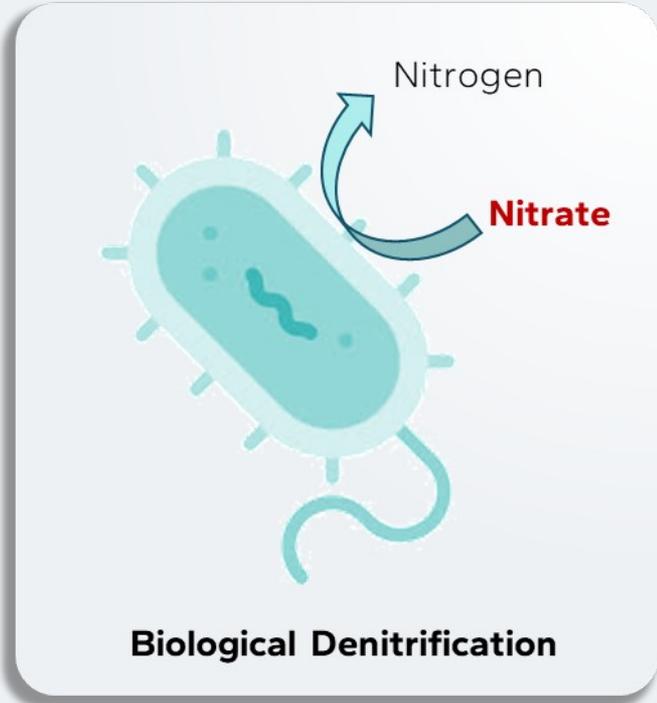
Turning two separate processes into one cost-saving, circular solution.



ONE PROCESS INSTEAD OF TWO



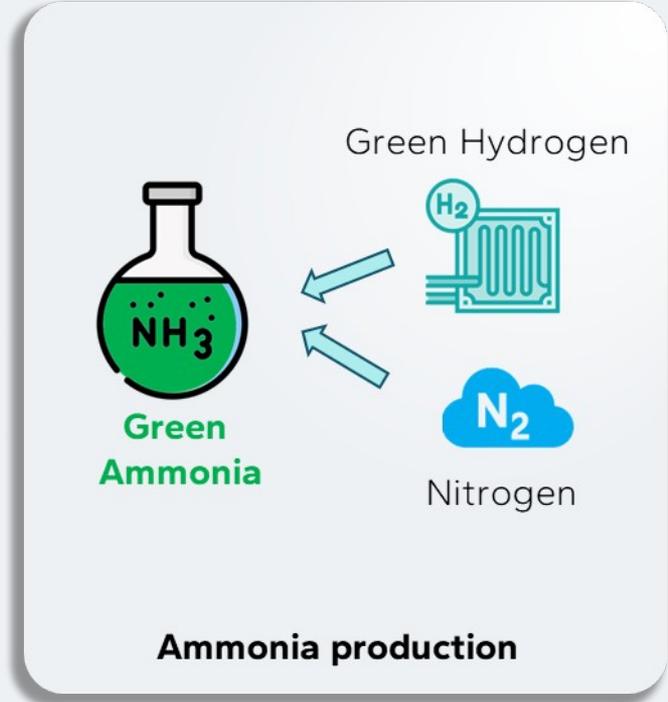
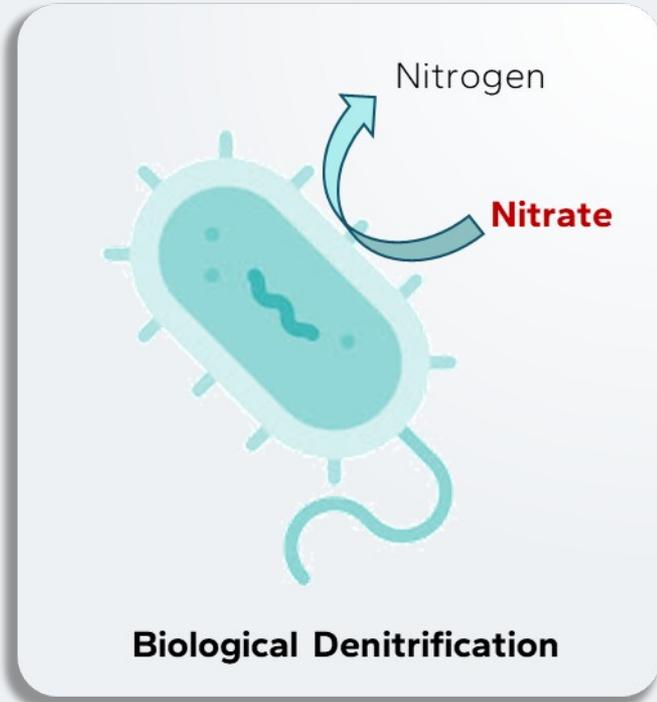
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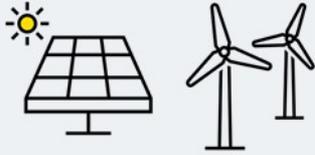
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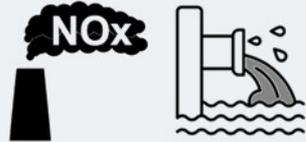


From Waste to Fuel: Recovering Nitrogen to Make **Green Ammonia**

Our solar-driven electrochemical technology upcycles nitrogen pollutants into green ammonia, reducing treatment costs and creating new revenue streams within a circular economy framework.



Renewable power

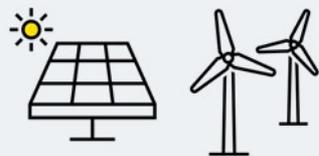


NOx emission Wastewater

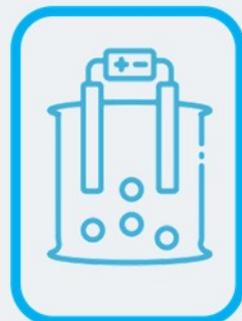


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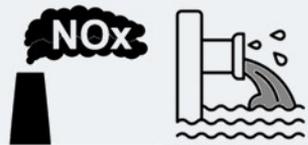
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Renewable power



Electrolysis



NOx emission Wastewater

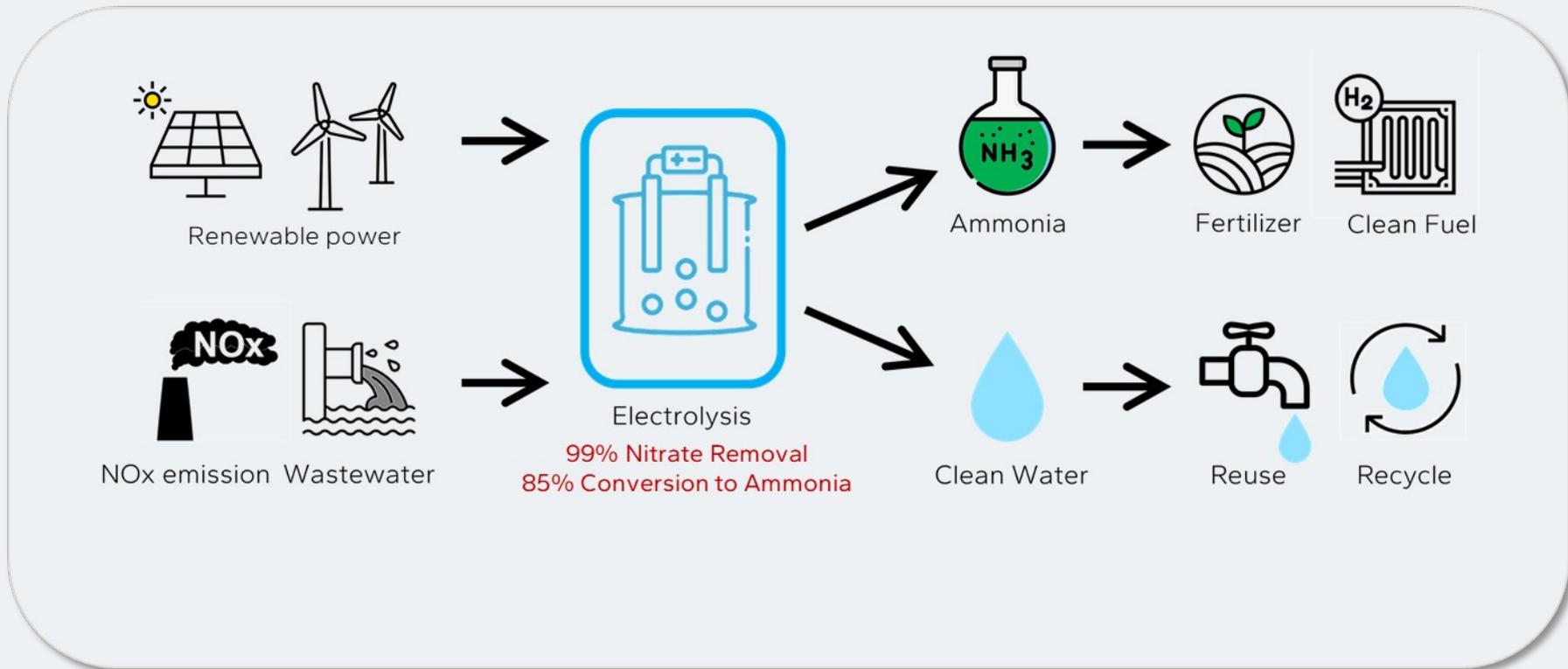


99% Nitrate Removal
85% Conversion to Ammonia



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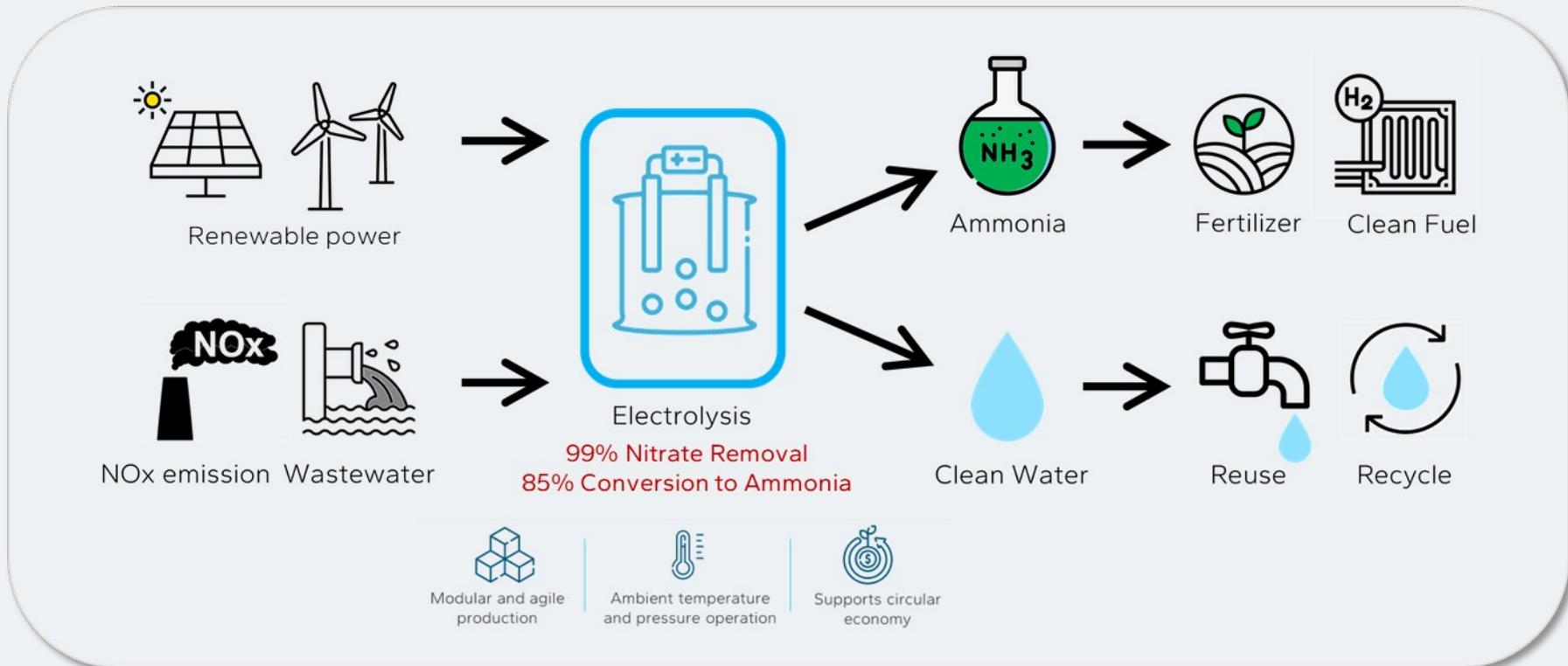
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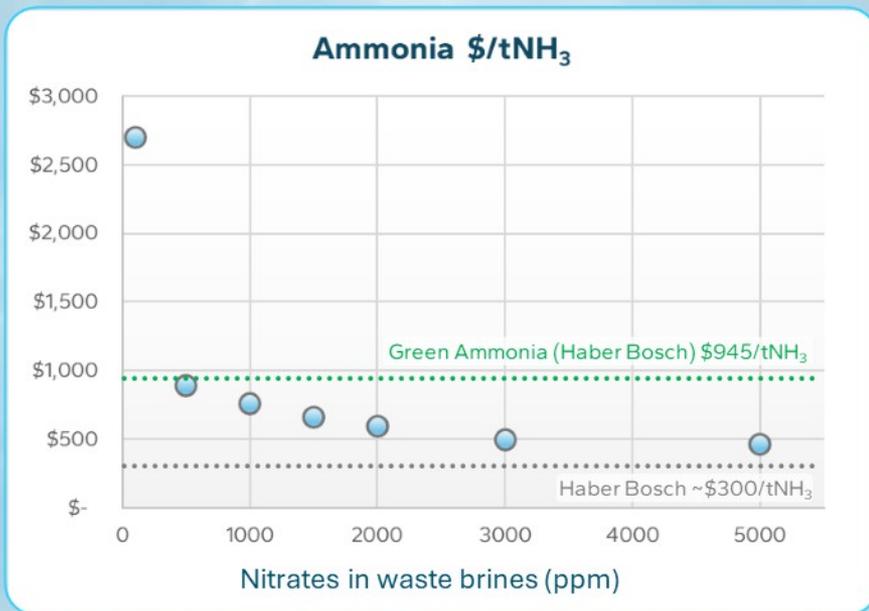


From Waste to Fuel: Recovering Nitrogen to Make **Green Ammonia**

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Levelized cost of Ammonia

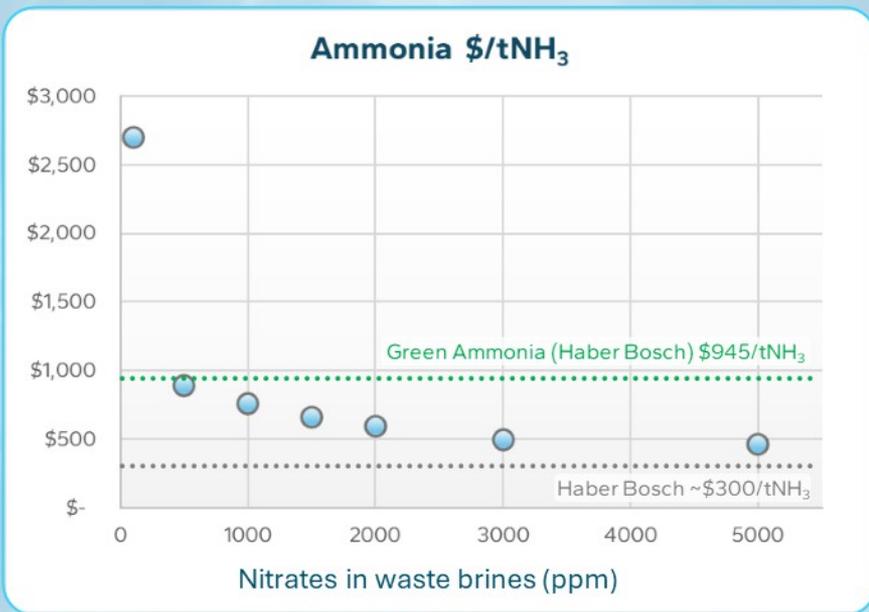


● Pani Clean's levelized cost of ammonia (LCOA) at various nitrate concentrations in the feedstock

$$LCOA = \frac{\sum(C + O + E + Other)}{\sum A}$$

Where:
C = Initial capital cost (CapEx)
O = Annual maintenance and operation cost
E = Electricity cost
Other = Other operational expenses
A = Annual ammonia production (ton/year)

Levelized cost of Ammonia



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Where:
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 Other = Other operational expenses
 A = Annual ammonia production (ton/year)

GREEN AMMONIA by Haber-Bosch

\$945/tNH₃

Dependent on the cost of green hydrogen

GREEN AMMONIA by Pani Clean

\$912/tNH₃

(500ppm nitrates in feed)

\$490/tNH₃

(5000ppm nitrates in feed)

Dependent on the concentration of nitrogen species

Additional Considerations That May Further Lower the LCOA (Not Included Above):

Revenue or cost savings from nitrate brine disposal

Tax credits (US) from the Clean Fuel Production Credit for non-aviation fuel (\$0.20/gallon)

Potential revenue from Emission Reduction Credits (ERCs) (US) generated by reducing NOx emissions

Pani Clean's Pilot Unit



Pani Clean's Pilot Unit



>3,000 gallons/day unit

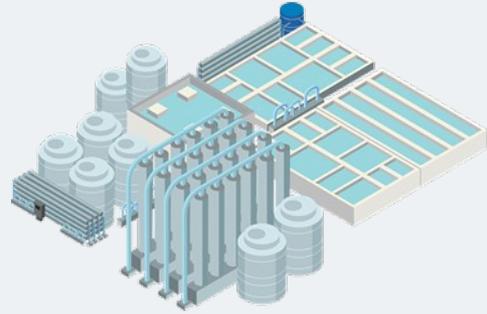
10ft

IWWERP Tech Park
Iowa City Wastewater Treatment Facility



APPLICATION EXAMPLE: Nitrate Brines to AMMONIA

Selectively remove nitrates from Ion Exchange brines

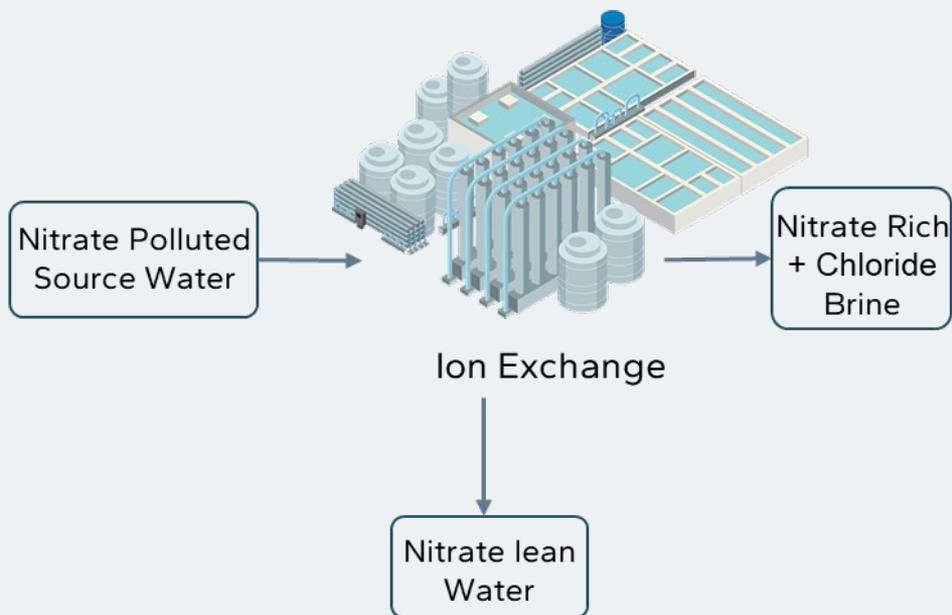


Ion Exchange



APPLICATION EXAMPLE: Nitrate Brines to AMMONIA

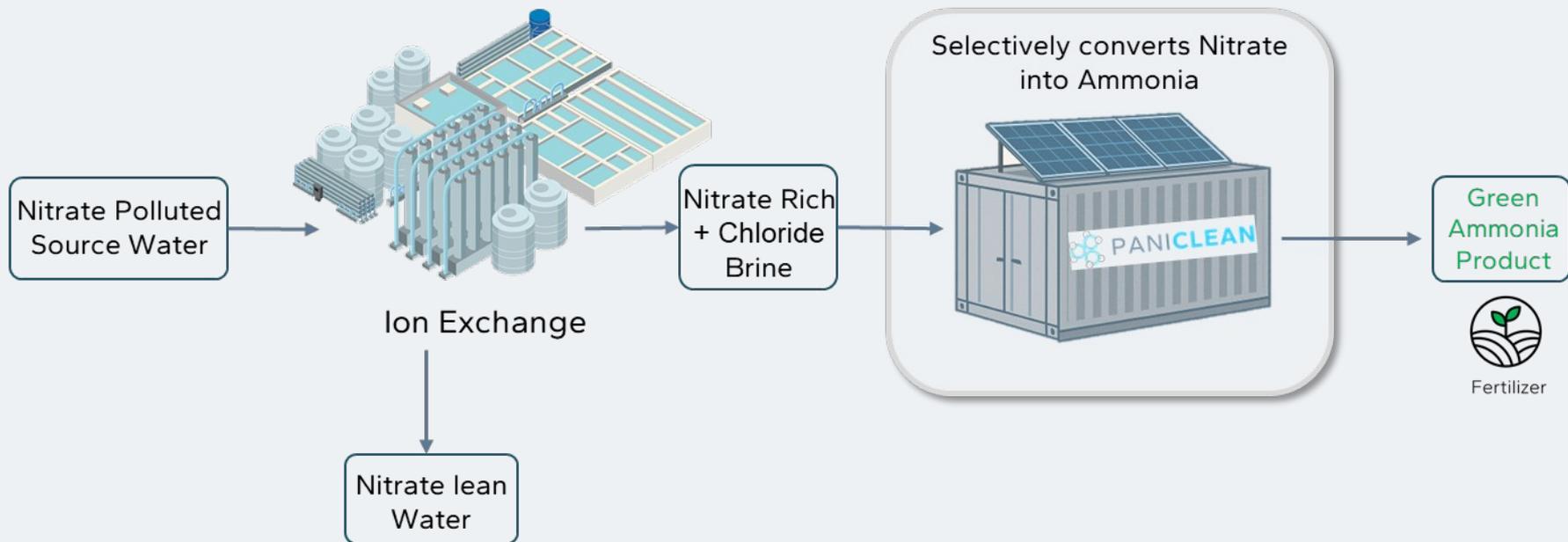
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APPLICATION EXAMPLE: Nitrate Brines to AMMONIA

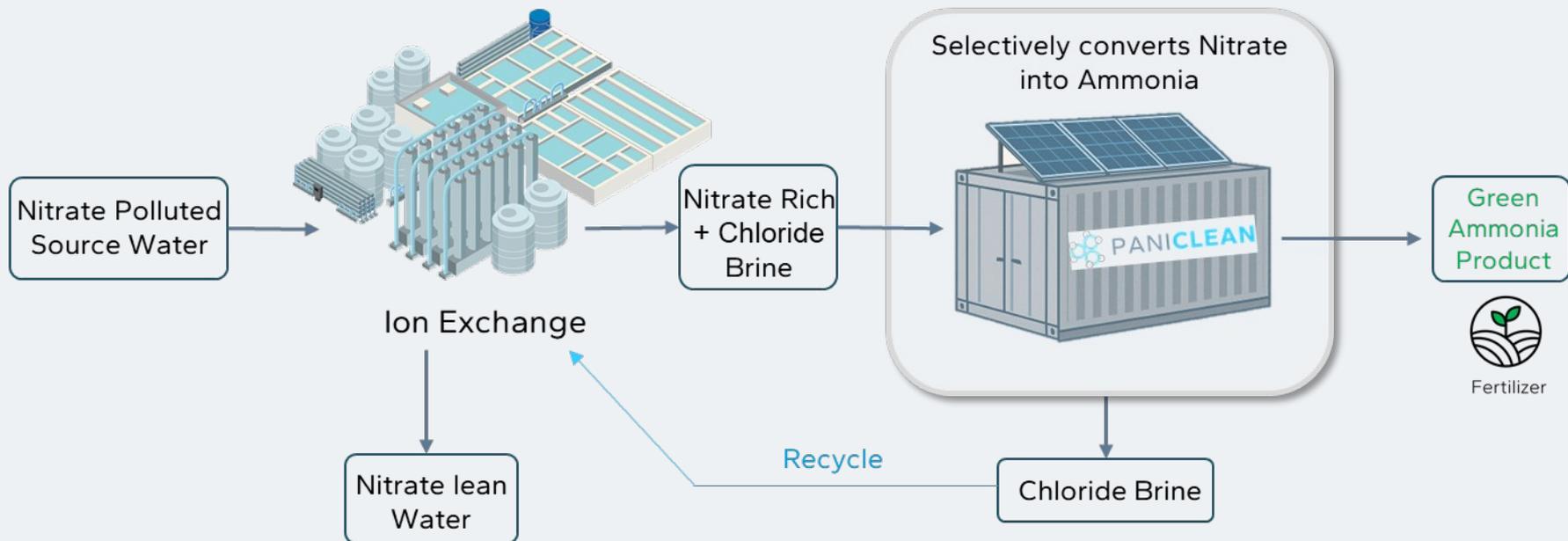
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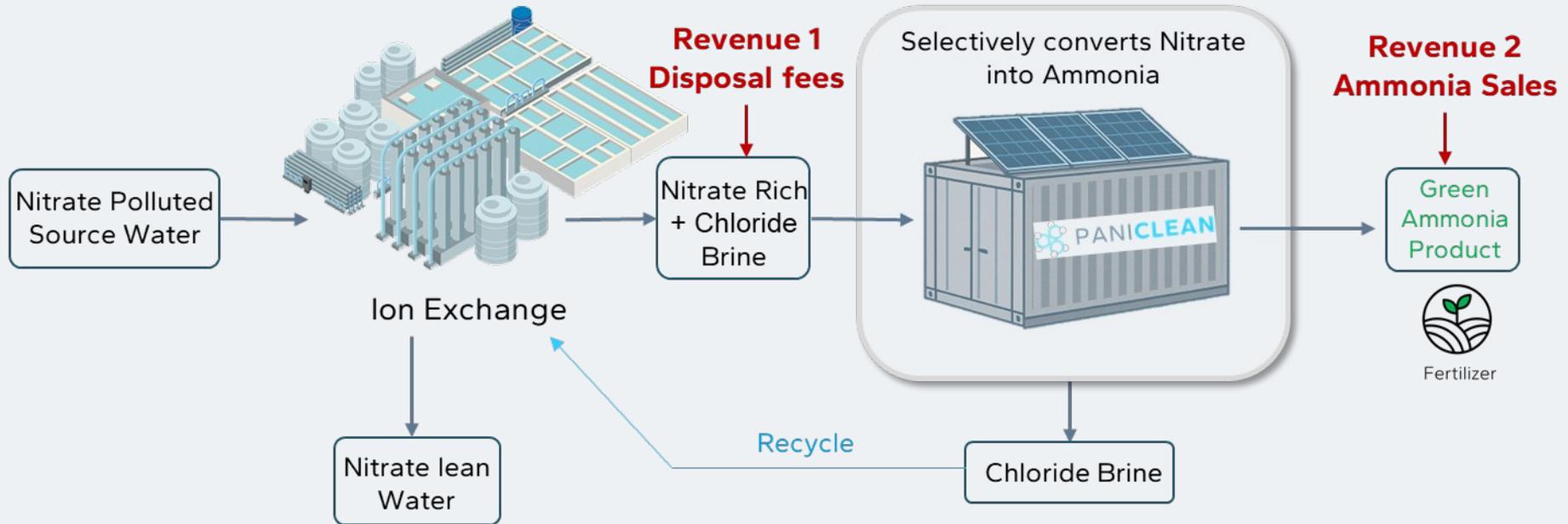


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Selectively remove nitrates from Ion Exchange brines



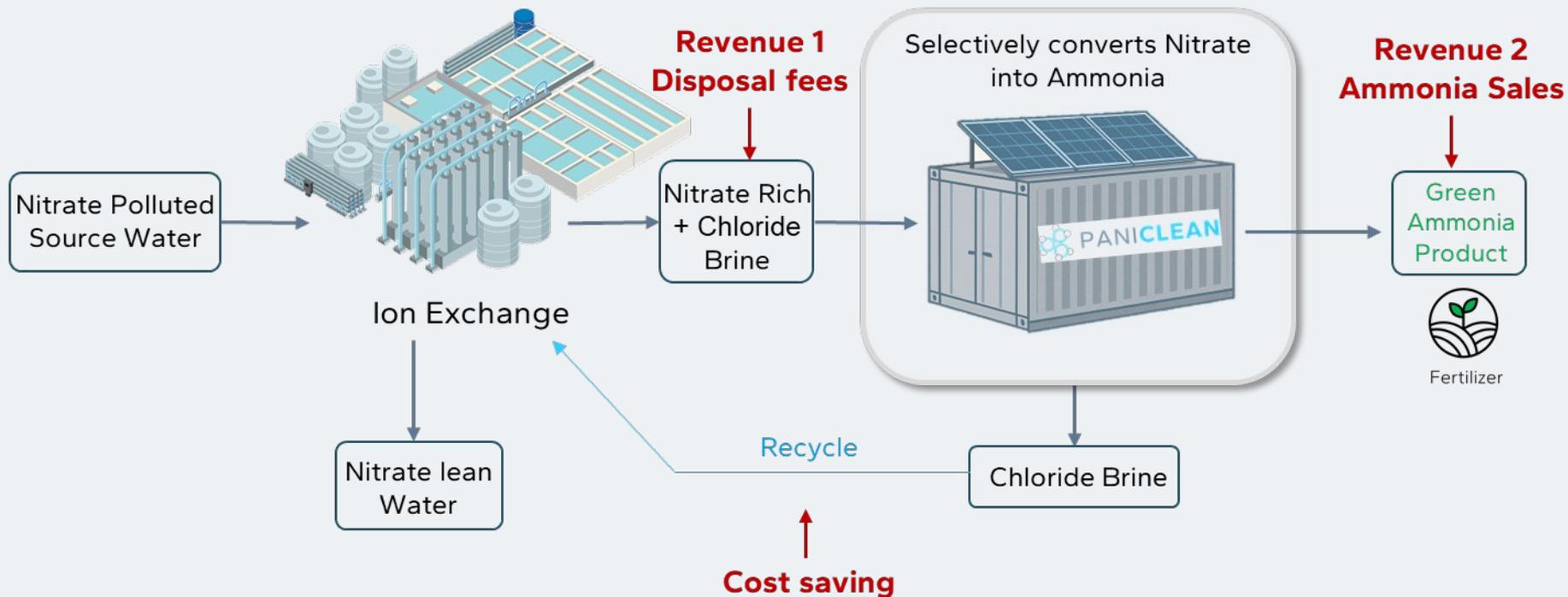
Pani Clean: Two Streams of Revenue





Pani Clean: Two Streams of Revenue

Customer: Cost savings · Sustainability · Environmental benefits · Circular economy



Funding To Date

Current Funding Sources (2019-2025)

| | |
|--------------------------------|-------------|
| USDA SBIR grant Phase I & II | \$1,574,999 |
| DOI USBR Pitch-to-Pilot award | \$480,000 |
| BioConnect Iowa In-state grant | \$75,000 |
| Iowa I-CORPS grant | \$2,500 |
| NSF I-CORPS grant | \$13,000 |
| Iowa Innovation award | \$10,000 |
| Iowa JPEC special grant | \$10,000 |
| Total | \$2,165,499 |



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Intellectual Properties:

- Hybrid electro dialysis and electrolysis systems and processes, WO/2021/252965A1 (US, EP, IN)
- System and Method for Ammonia Production from Nitrogen pollutants, WO/2025/106731
- Small-Footprint Unit for Direct Conversion of Nitrogen Pollutants to Ammonia, Provisional in preparation

Recognition: Featured in Global Water Intelligence (GWI) for the patent application and the pilot deployment

Collaborations: Received support and interest from a few municipalities (Hastings, Nebraska) and industries (Baker Hughes) pending successful pilot results.

Commercialization Timeline



2023

Prototype validated

1.2kW



2025

Pilot Demonstration

5-10kW

Technology

- Establish plan for pilot
- Tests for various industries
- Secure current & additional IP
- Improvements for automation & remote controllability

Business

- Secure funding for pilot demonstration
- Market Validation
- Finalize 3 industrial pilot agreements

M&O

- Enhance Technical team for pilot
- Enhance management & technical team
- Establish Sales & Marketing team

Commercialization Timeline



2023

Prototype validated

1.2kW



2025

Pilot Demonstration

5-10kW



2027

Scaling up

>250kW

Technology

- Establish plan for pilot
- Tests for various industries
- Secure current & additional IP
- Improvements for automation & remote controllability
- Refine the system with engineering partners
- Core parts manufacturing

Business

- Secure funding for pilot demonstration
- Market Validation
- Finalize 3 industrial pilot agreements
- Establish a manufacturing partner (**licensing revenue**)

M&O

- Enhance Technical team for pilot
- Enhance management & technical team
- Establish Sales & Marketing team
- Addition of field team

Commercialization Timeline



2023

Prototype validated

1.2kW



2025

Pilot Demonstration

5-10kW



2027

Scaling up

>250kW



2028+

Expansion

Technology

- | | | | |
|--|--|---|--|
| <ul style="list-style-type: none"> Establish plan for pilot <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> Tests for various industries Secure current & additional IP Improvements for automation & remote controllability | <ul style="list-style-type: none"> Refine the system with engineering partners Core parts manufacturing | <ul style="list-style-type: none"> Optimization in new environments Establish advanced IP strategies |
|--|--|---|--|

Business

- | | | | |
|--|---|--|---|
| <ul style="list-style-type: none"> Secure funding for pilot demonstration <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> Market Validation Finalize 3 industrial pilot agreements | <ul style="list-style-type: none"> Establish a manufacturing partner (licensing revenue) | <ul style="list-style-type: none"> Strategic JV (Profit-share, Royalty revenue) Partners in Asia and Europe Regulatory assessment |
|--|---|--|---|

M&O

- | | | | |
|--|---|--|---|
| <ul style="list-style-type: none"> Enhance Technical team for pilot <input checked="" type="checkbox"/> | <ul style="list-style-type: none"> Enhance management & technical team Establish Sales & Marketing team | <ul style="list-style-type: none"> Addition of field team | <ul style="list-style-type: none"> Enhance Sales & Marketing Establish international team |
|--|---|--|---|

Experts Making Cleaner Future



Joun Lee, PhD

CEO / Founder

20 years in Nano and Clean Tech

Expertise: Clean fuel,
Electrochemical conversion



Joe Zuback

Board Director

47 years of Water industry

Former CTO of Siemens Water
Technologies



Syed Mubeen, PhD

Co-Founder

Associate Professor of Chemical
Engineering University of Iowa
Expertise: Electrochemical processes



Sattar Alsaedi, PhD

CTO

10 years in Water Tech

Expertise: Water treatment and
pollutant conversion



Yash Mistry, PhD

Director of Process

7 years in engineering design and
product development.

Expertise: Manufacturing,
Engineering design and Prototyping



David Cwiertny, PhD

Scientific Advisor

Professor of Civil & Environmental
Engineering University of Iowa
Expertise: Public policy, water
treatment

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treatment



Raymond Richie

Business Advisor

Vice President, HF Sinclair
Former VP of Renewable Energy Group
Expertise: Business Strategy



Tim Young

Co-Founder

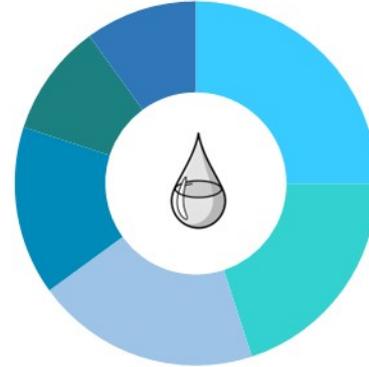
CEO, SunHydrogen, Inc.
Former President of Rovion
Former VP of America Online, Time
Warner

Investments

Raising \$2,000,000

- To strengthen **Business Management** and establish a **Sales & Marketing team**.
- To construct **First Commercial Size** (250kW) system and generate revenues.
- To manage both new and existing **Intellectual Property** assets.
- To cover **general and administrative (G&A)** costs to support overall business operations.

Use of funds (2026-2027)



| | |
|-----------------------------|-------|
| ● C-suite | 25.0% |
| ● Operations & Mfg. | 20.0% |
| ● Development & Engineering | 20.0% |
| ● Sales & Marketing | 12.5% |
| ● Intellectual Properties | 12.5% |
| ● General & Admin | 10.0% |



Joun Lee, Ph.D.
President / CEO
jlee@paniclean.com



Market Opportunities



Industry

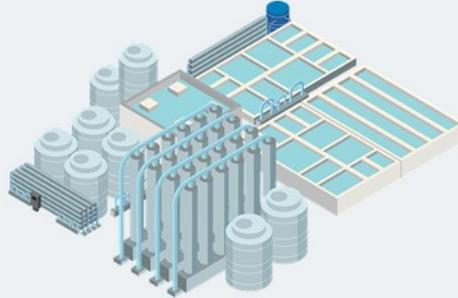


Chemical/Energy/Defense
Semiconductor/Food

High strength (>2000ppm)

- Chemical waste
- NOx wet scrubber wastewater

Municipal

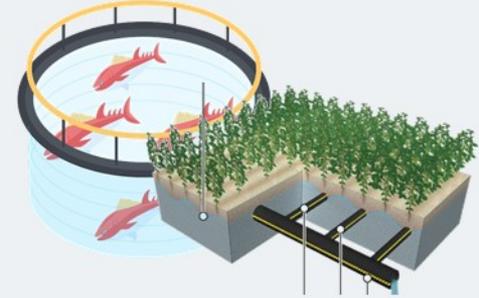


Water Treatment

Medium strength (200~2000ppm)

- Nitrate brines from RO reject
- Ion exchange regenerant waste

Farm



Agriculture/Aquaculture

Low strength (<200ppm)

- Agricultural runoffs
- Aquaculture



Established Industry Players

Generating Values from Wastewater



Feed Source

Wastewater, Brines

Wastewater

Wastewater, Brines

Wastewater

Wastewater

Industry Segment

Municipal,
Industrial

Municipal,
Industrial

Industrial

Municipal,
Industrial

Municipal,
Industrial

Process

Various

Various

Water Mining,
Stripping

Algae
Consumption

Anaerobic
Treatment

Values Recovered

Biogas, Rare
Metals, Lithium
etc.

Phosphorus,
biogas etc.

Lithium, Ammonia

Fertilizer

Biogas



Business Model

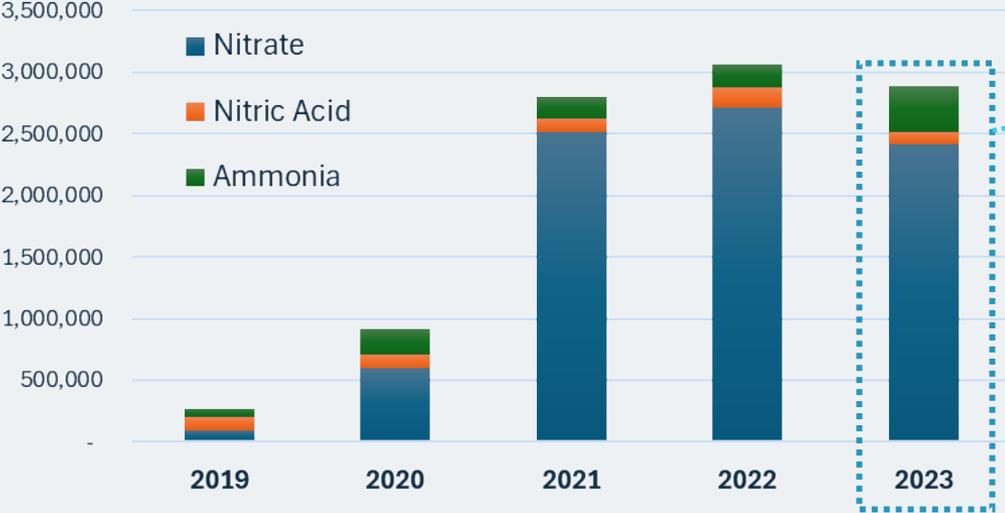
| Model Type | Description | Revenue Sources | Key Requirements | Capital Intensity | Salability |
|--|--|--|---|-------------------|------------|
|  IP Licensing | License proprietary technology to partners | Licensing fees, royalties, or profit sharing. | Strong IP portfolio, licensing agreements, partner network | Low | Very High |
|  Waste-to-Ammonia Operation | Operate facilities that convert waste brine into ammonia. | Disposal fees, ammonia sales | Treatment facilities, ammonia offtakers, operational capacity | High | Moderate |
|  Unit Sales & Service Subscription | Manufacture and sell system units; maintenance subscription. | Unit sales, subscription fees, replacement parts | Manufacturing partner, service network, upfront capital | High | Moderate |
|  Strategic Partnership | Produce key components and supply to partners | Profit sharing from partner operations | Parts Manufacturing, JV agreements, reliable partners | Moderate | High |



CASE STUDY (Immediate Target Customer)

Intel Corp. Router Acres Campus, Hillsboro, OR 97124
Industry: Semiconductor Products and Equipment
Products

Production-Related Waste Managed (lbs)



If Ammonify Technology was Integrated

| | |
|---------------------------------------|--------------------|
| Recoverable Ammonia | 168 tonne |
| Converted Ammonia (Efficiency 60%) | 1,017 tonne |
| Total Ammonia | 1,185 tonne |

Specification

| | |
|---------------------------|------------------------------------|
| # of Electrolyzers (10kW) | 10 |
| Footprint (container) | Standard (20x40x8ft ³) |



Intellectual Properties

| Title | Apparatus and method for three-dimensional photo-electrodialysis | Hybrid electrodialysis and electrolysis systems and processes | Electrodialysis and Electrolysis Conversion of Nitrate and Phosphorus to Struvite | System and Method for Ammonia Production from Nitrogen pollutants | Small-Footprint Unit for Direct Conversion of Nitrogen Pollutants to Ammonia |
|----------------------|--|---|---|---|--|
| Filing # | WO2018119280A1 | WO2021252965A1 | 63/547,649 | PCT/US24/56000 | In preparation |
| Priority date | 12/21/2017 | 06/11/2020 | 11/15/2023 | 11/30/2023 | - |
| Application | Water treatment | Water treatment / Ammonia production | Water / Fertilizer | Ammonia Production | Ammonia Production |
| Assignee | UIRF | Pani Clean | Pani Clean | Pani Clean | Pani Clean |
| Country | US, CN | US, EU, IN | - | TBD | - |
| Status | License terminated | Pending | Abandoned | Pending | - |