Industrial Water Challenges: New Technologies to Watch

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Lux Research | The Deciding Factor

How do we use less water?
(Draw less water from external sources)

How do we improve our wastewater management?


FOOD
ENERGY
MANUFACTURING
Water
=
Productivity

Water is an uptime issue for industry

INTERNATIONAL • TSMC

Taiwan's drought is exposing just how much water chipmakers like TSMC use (and reuse)

BY **EAMON BARRETT**

June 12, 2021 12:00 AM EDT

Bengaluru: Water crisis shakes India's Silicon Valley

6 days ago

Share

Heat and drought: A challenge for production and logistics at the Ludwigshafen site

BASF
We create chemistry

CLIMATE • EXTREME WEATHER

Mexico's Industrial Hub Suffers Weeks-Long Water Cutoff Amid Drought

Agenda

1 | **Industrial water-use challenges**

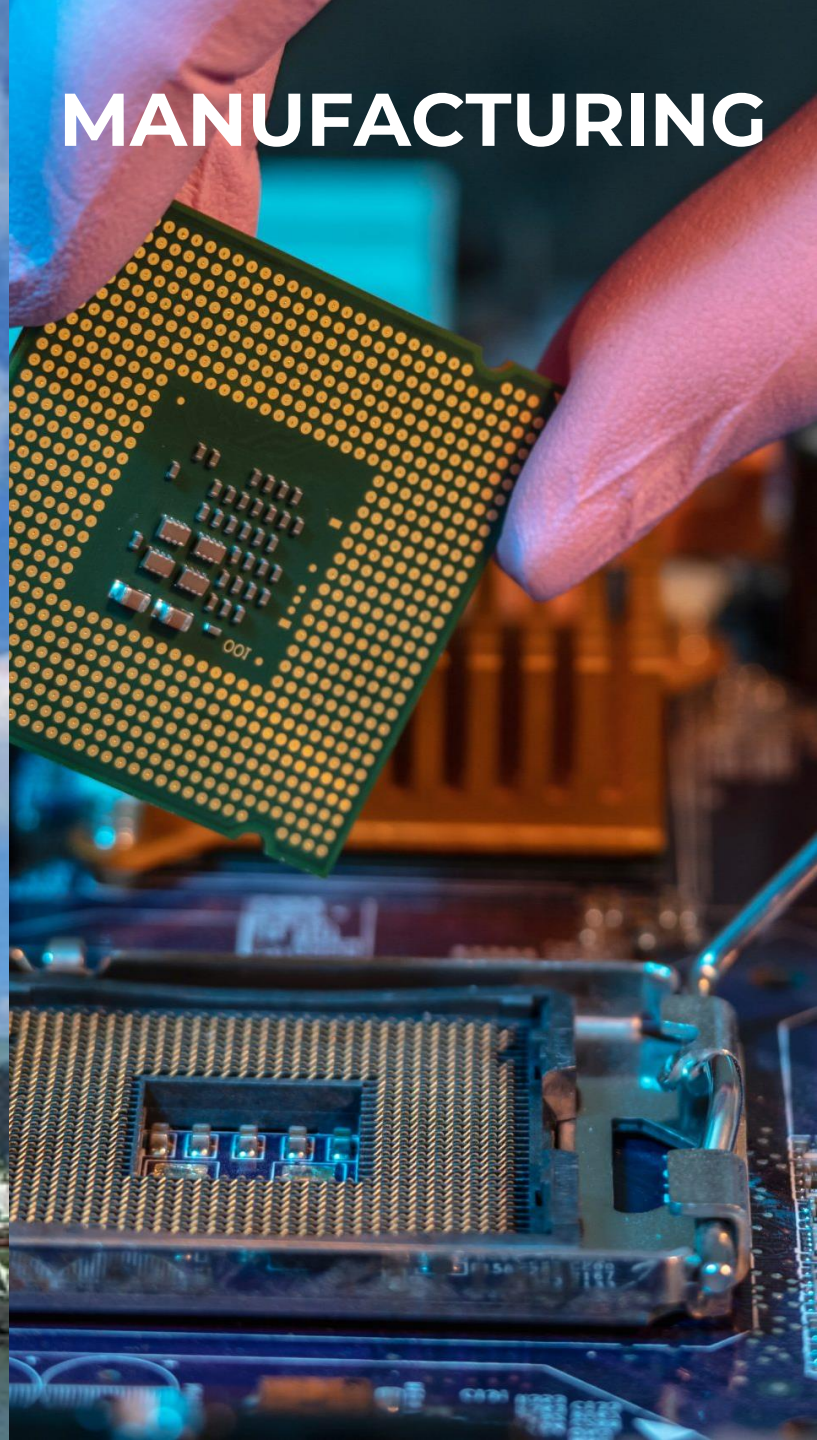
2 | Emerging technology trends

3 | Funding water innovation

4 | Outlook and recommendations

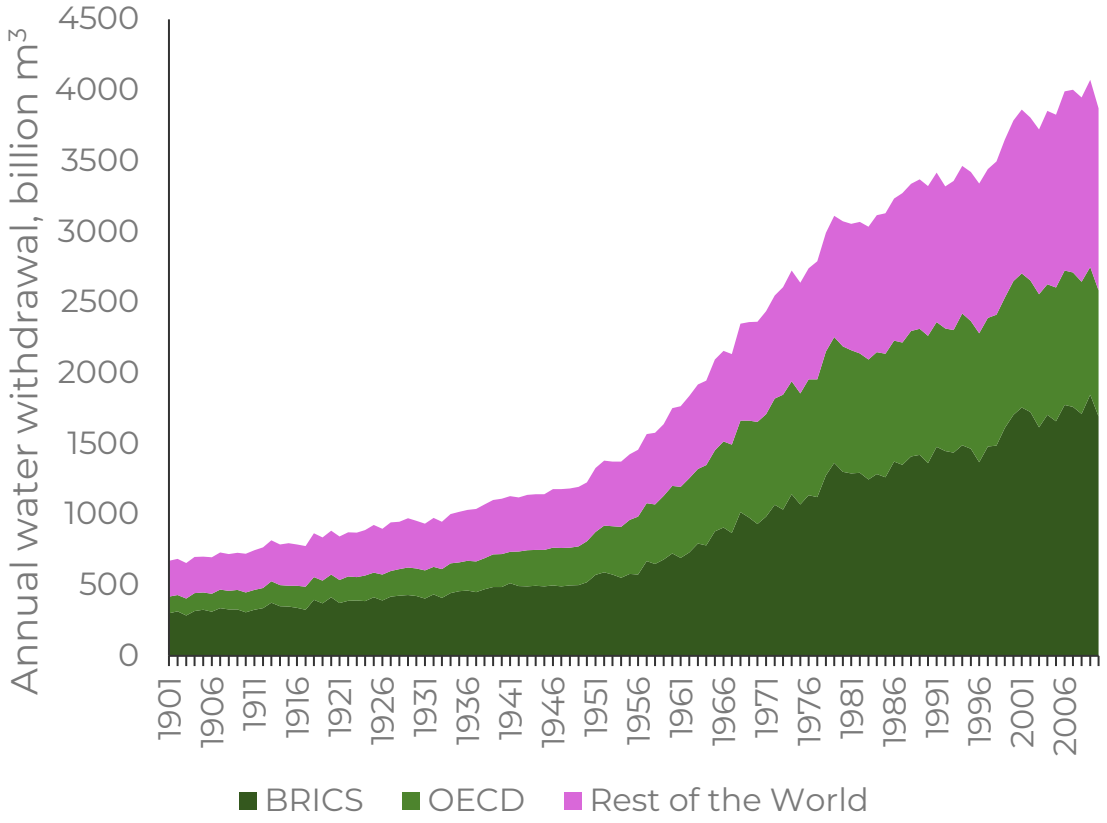

FOOD


ENERGY

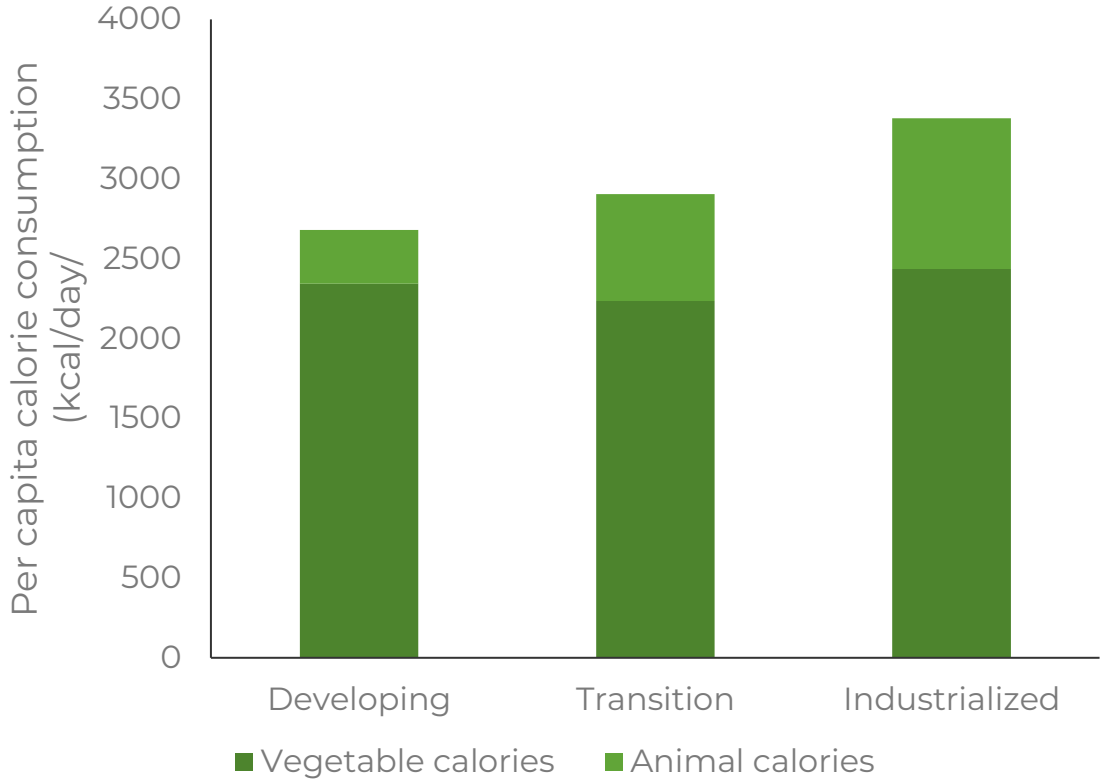

MANUFACTURING

Water-food nexus: Industrialization leads to increasing calorie consumption with higher water-, energy-, and land-use requirements

Global Water Consumption Increases with Development

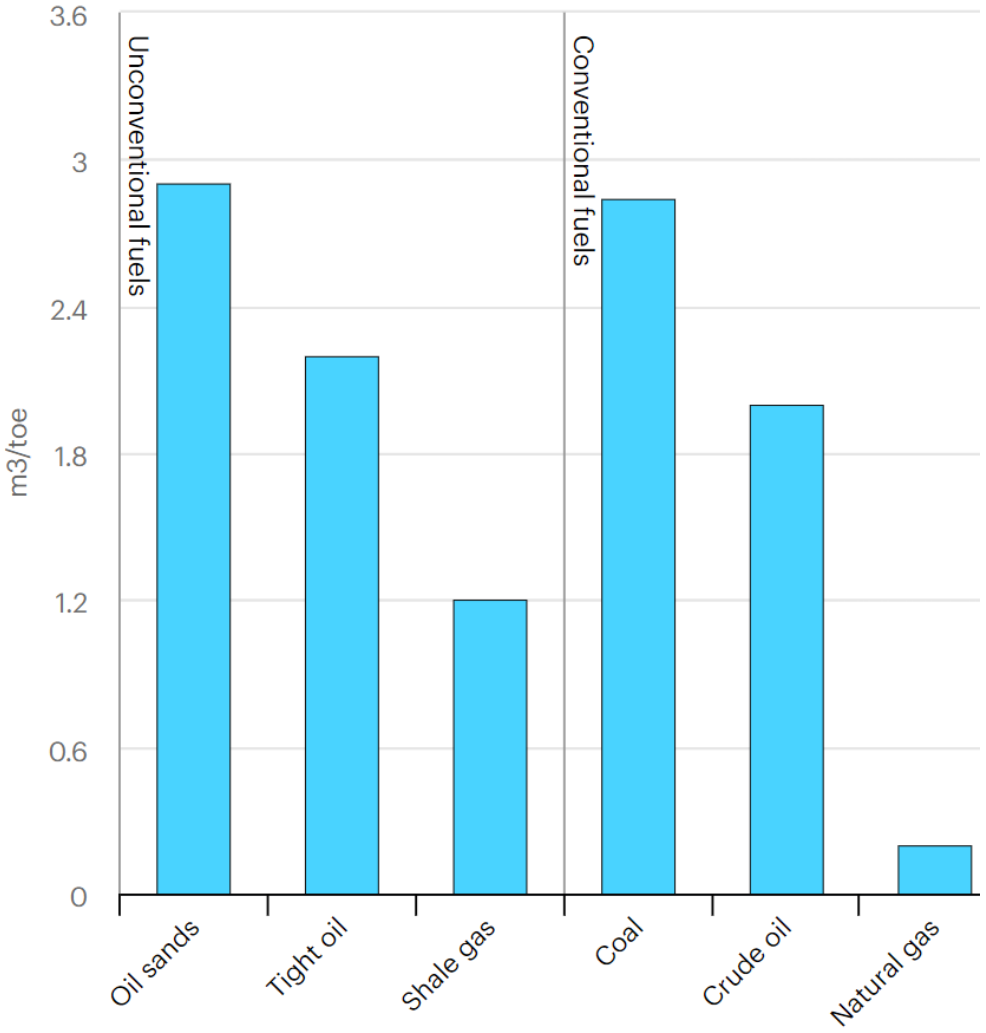


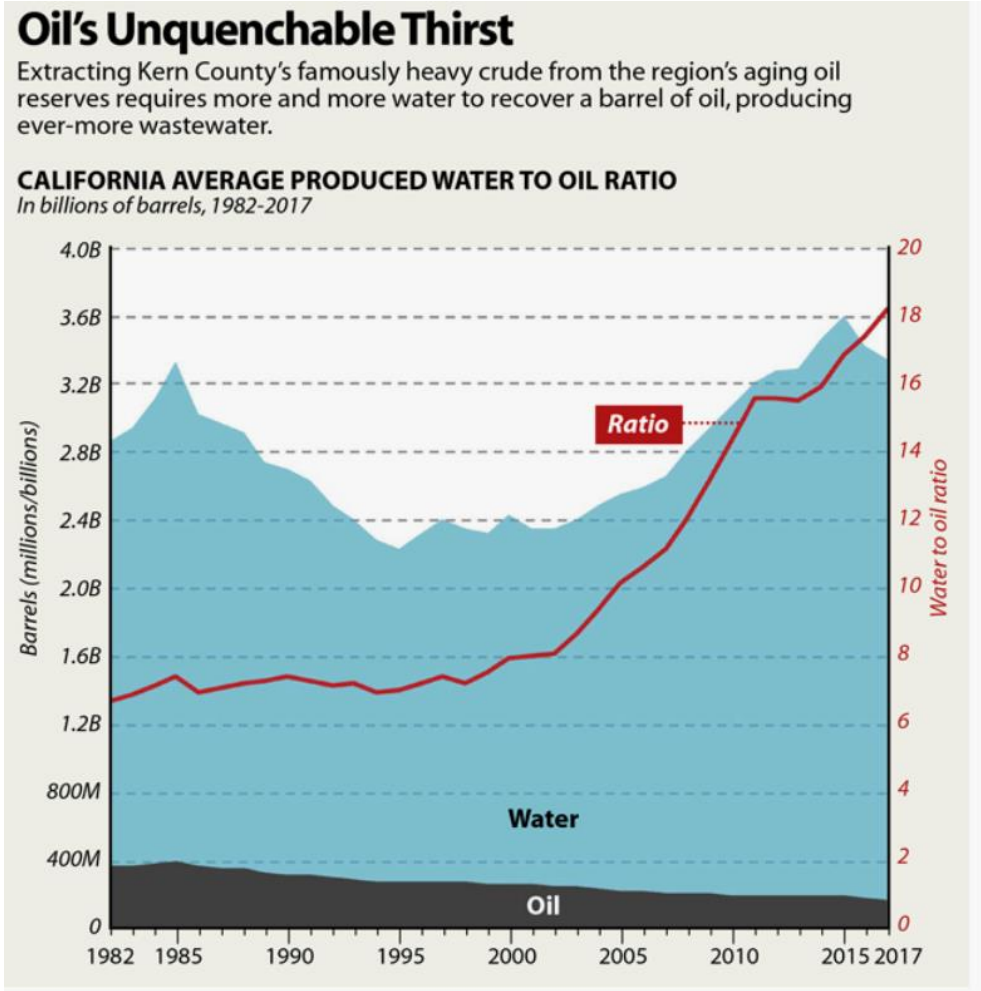
Industrialized Countries Consume 56% More Animal Calories Than Developing Countries



Source: Lux Research: Water-Food-Energy Nexus

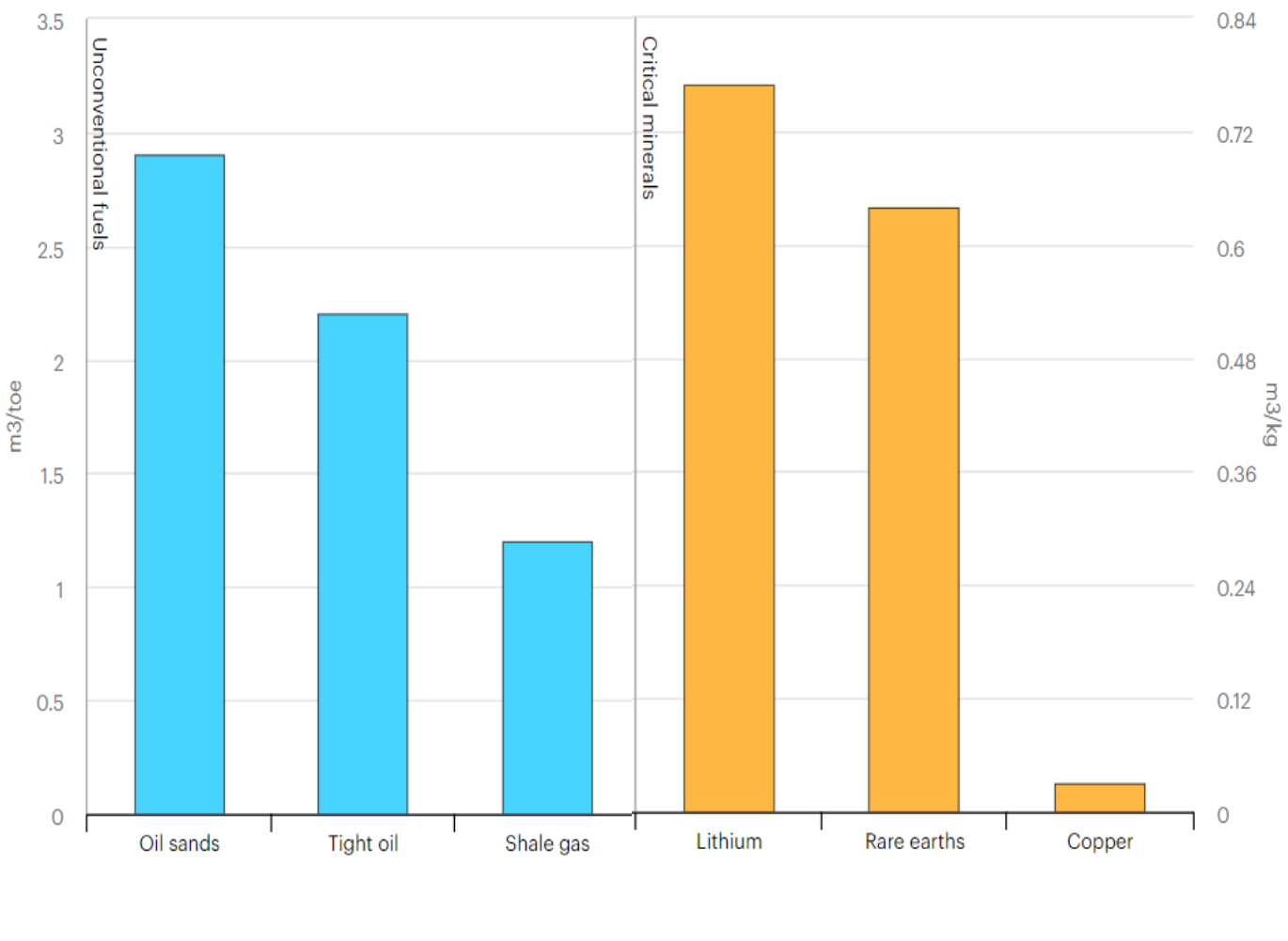
Water-energy nexus: Conventional power generation has always been a heavy water user



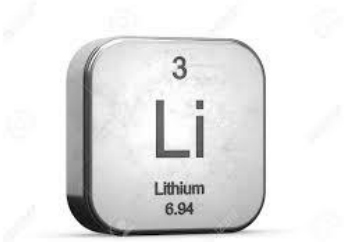


Sources: International Energy Agency (IEA), 2020, Our World in Data

Water-energy-material nexus: Critical minerals demand equal if not more water to power the energy transition

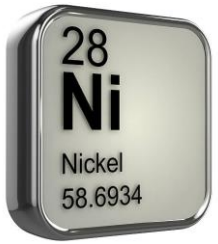


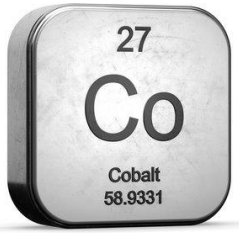
Annual demand for electric vehicle (EV) batteries will grow from 340 GWh to over 3,500 GWh by 2030



+50 mines

+60 mines



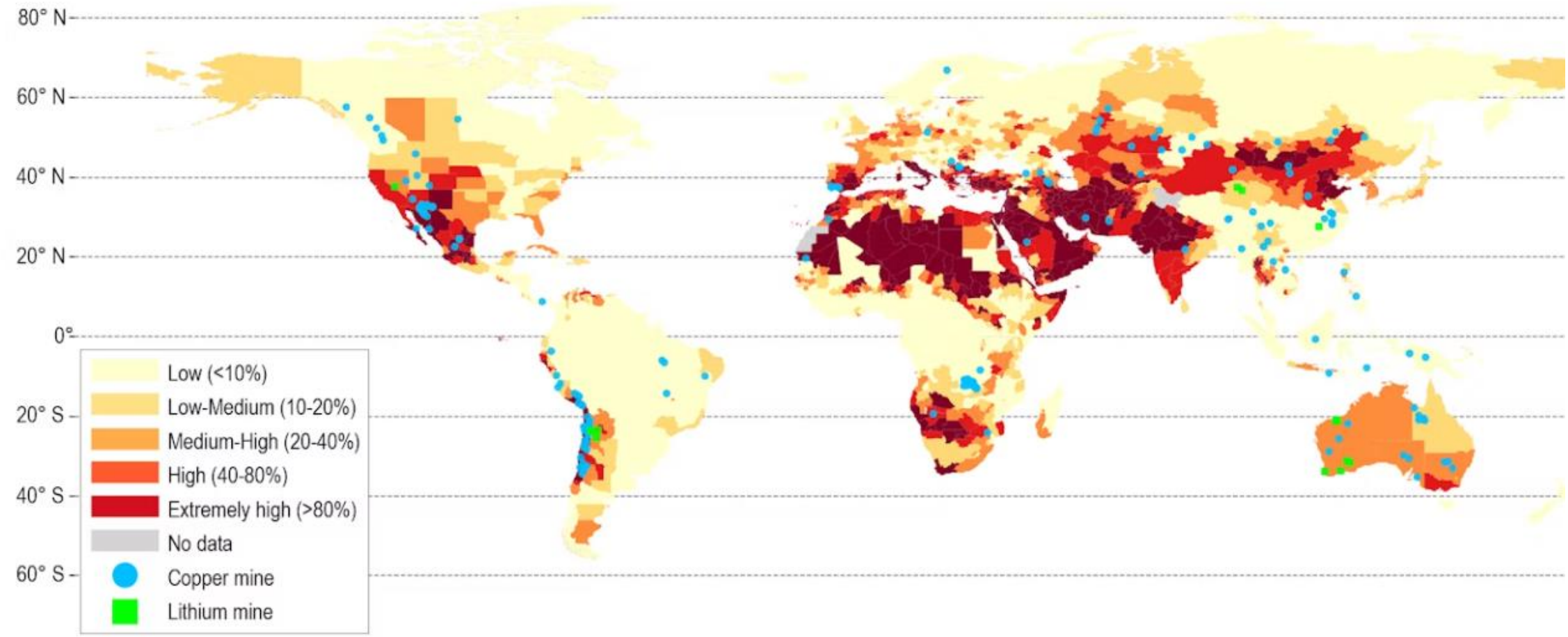


+17 mines

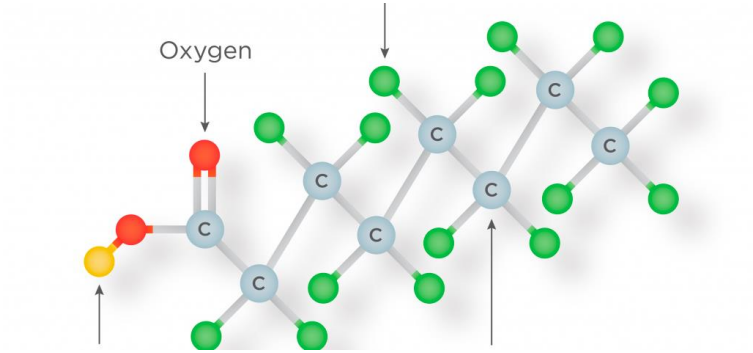
Sources: IEA, 2020, Water – Energy

Companies (and mines) are operating in water-stressed conditions

Location of copper and lithium mines and water stress levels, 2020

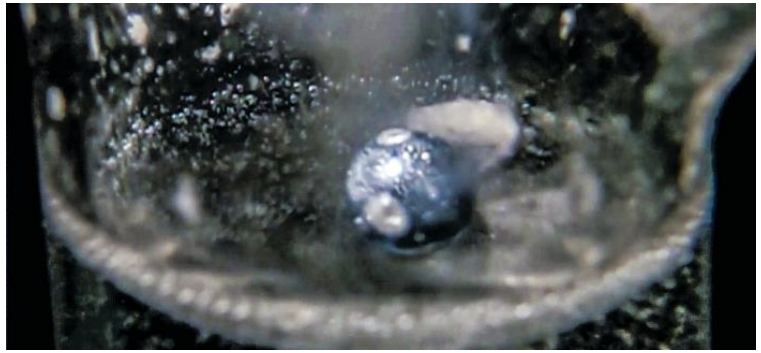


Emerging and tightening regulations lead to higher cost of operations



Contaminants of Emerging Concern

- Per- and polyfluoroalkyl substances (PFAS) in chemicals and electronics manufacturing
- Metals in mining, metals finishing, and automotive
- Micropollutants



Wastewater Disposal

- Rising costs of discharge permits
- Limitations on what factories can discharge
- Operating farther away from disposal options, increased trucking and tipping costs

Reuse/Recycling Mandate

- U.S., India, and China implementing sector-specific zero liquid discharge (ZLD)

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Lux groups innovations in industrial water management into 6 categories

1 MEMBRANES

From top to bottom: corporates, startups

DuPont | Toray | Nitto Hydranautics | LG Chem | Alfa Laval
gradiant | nx | Aquaporin | ZwitterCo | Saltworks

2 ELECTROCHEMICAL SEPARATION

From top to bottom: corporates, startups

Elentec | xylem + evoqua | Höganäs | Kurita | Veolia
Magna Imperio Systems | ElectraMet | mega | Membrion | Saltworks

3 OXIDATION

From top to bottom: corporates, startups

xylem + evoqua | Veolia | Trojan Technologies | Ecolab | Kurita
hpnow | Aclarity | H2nano | Indra | Inopsys Side Stream Solutions

4 ADSORPTION

From top to bottom: corporates, startups

Ion Exchange | 3M | Cabot | CalgonCarbon | Ecolab
Summit Nanotech | Puraffinity | arvia | CoreWater Technologies | Inopsys Side Stream Solutions

5 BIOLOGICAL

From top to bottom: corporates, startups

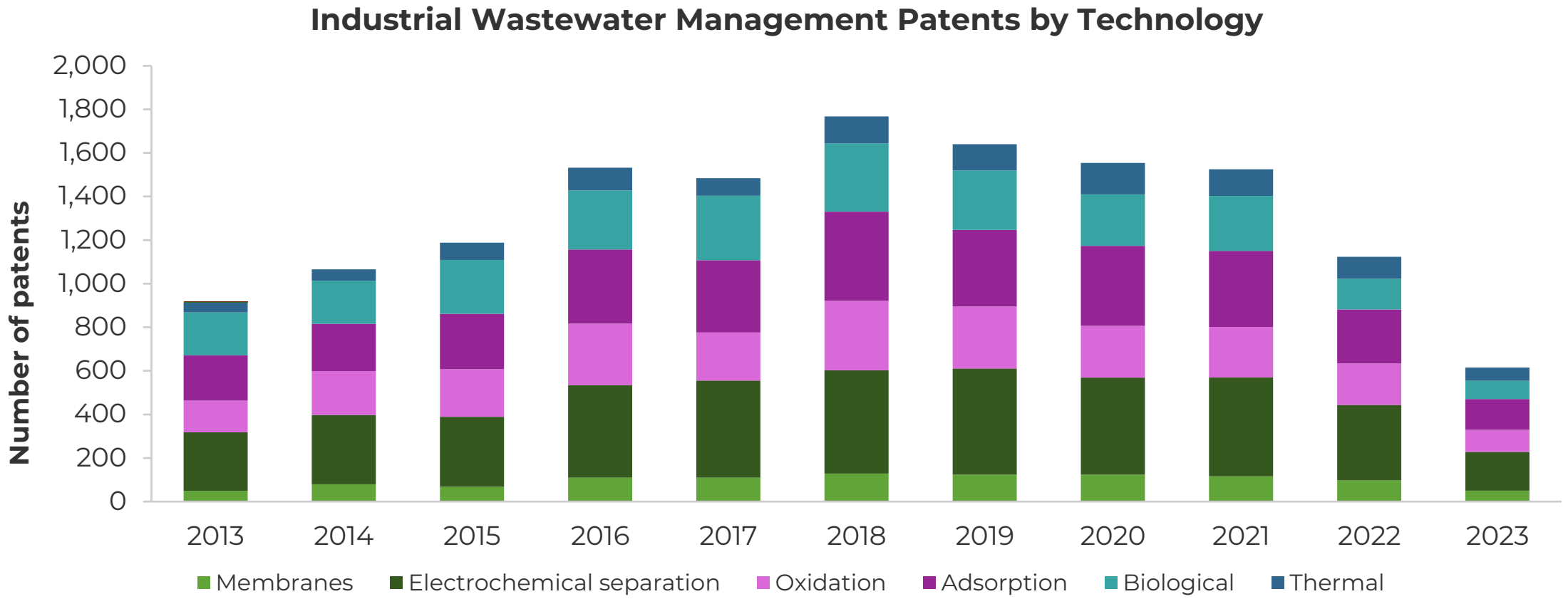
DuPont | Alfa Laval | fluence | Aquatech | Ovivo
Cambrian | Aquacycl | BioGill | GWT | Anaergia

6 THERMAL

From top to bottom: corporates, startups

Aquatech | Ovivo | Veolia | xylem + evoqua | Kurita
Memsift Innovations | Cleanteq Water | CoolSeparations | Aquagga | memsys

Patent activity suggests an increase in commercial activity; technology innovation bright spots emerge in key areas



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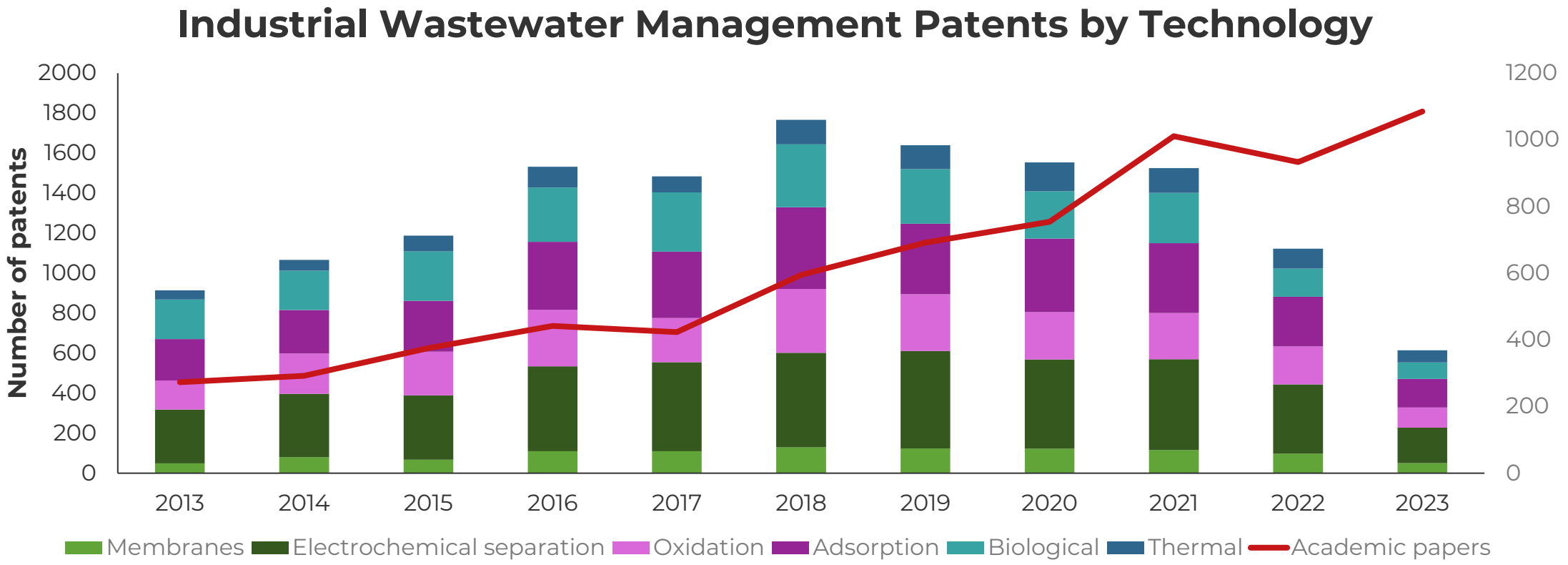
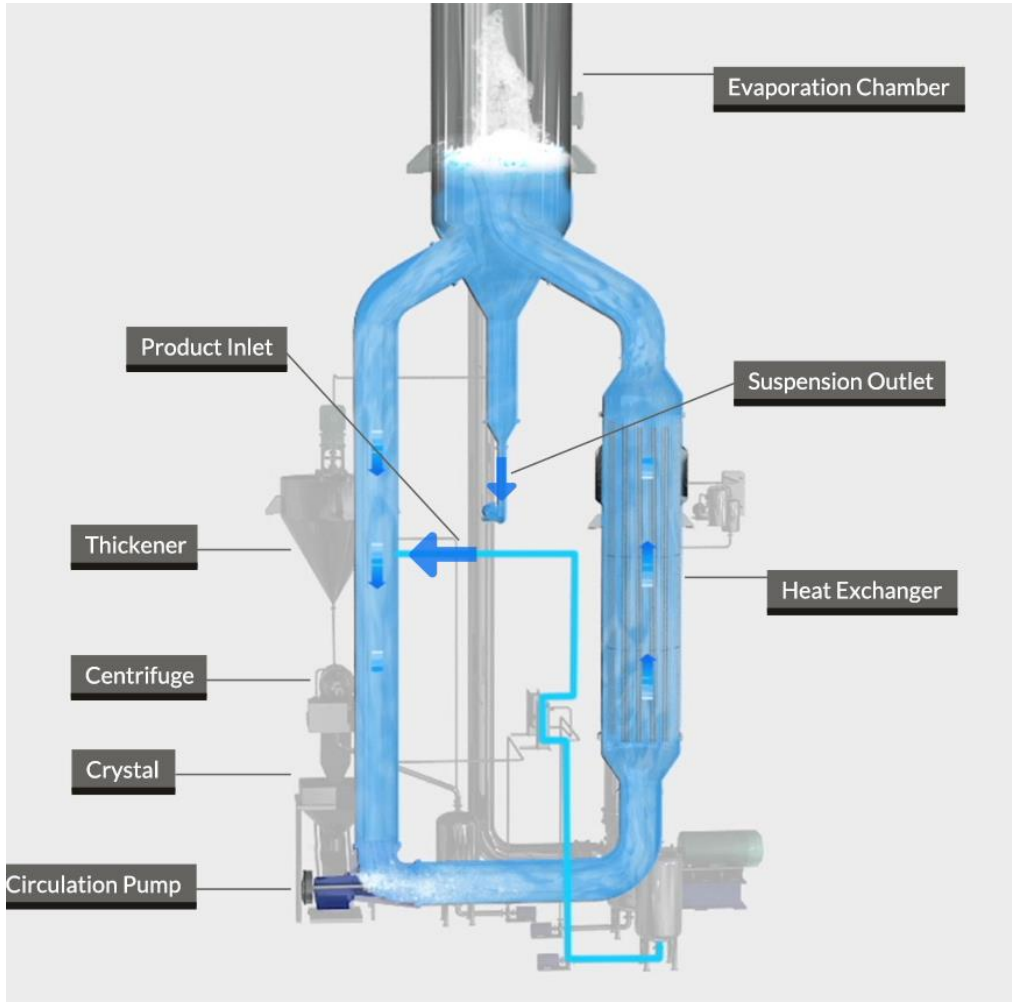


Electrified separation uproots energy-guzzling thermal technologies for brine concentration and ZLD



CASE STUDY

ZLD and resource recovery using membrane distillation

Memsift Innovations reduces energy by 65% in comparison to evaporator crystallizers. Lowered disposal volumes and hence costs by 90%. Valorizes waste by recovery of nickel sulfate (~10.2 tonne/y of nickel).

Carbon footprint nickel for concentrate (11.5 kg CO_2/kg nickel) is lower than for mined nickel; decreases CO_2 emissions by about 71 tonne/y of CO_2.

LUX TAKE

Membrane distillation (MD) has had a history of false starts due to poor membrane performance. In Memsift, we're seeing a revival of MD as a contender for small- to medium-scale ZLD.

MEMSIFT INNOVATIONS

Linxens

Bioreactor innovations go mainstream to decentralize wastewater

CASE STUDY

Bioelectrochemical wastewater treatment for food & beverage manufacturers

Aquacycl's microbial fuel cell technology is a self-powered, on-site bioelectrochemical wastewater treatment solution.

The company specializes in hard-to-treat organic waste streams that typically represent less than 3% of all the flows at a manufacturing facility but 60% to 80% of the sewer discharge fee.

LUX TAKE

The value proposition for Aquacycl's customers is discharge permit compliance and reduced costs from waste hauling, disposal, and energy use (to treat such highly concentrated organic wastes). It saves customers around 20% to 60% in net sewer discharge costs

AQUACYCL

PEPSICO

Emerging tech to address contaminants of concern, especially PFASs

CASE STUDY

HALT PFAS destruction gains traction

Aquagga's hydrothermal alkaline treatment (HALT) technology eliminates PFASs at lower temperatures with benign byproducts

Process to function at lower pressures and temperatures than alternatives like supercritical water oxidation and incineration.

LUX TAKE

PFAS disposal through incineration can cost between USD 1,000/tonne and USD 2,000/tonne and emit toxic gases like hydrogen fluoride. Aquagga offers a lower-cost solution for on-site PFAS destruction.

Aquagga

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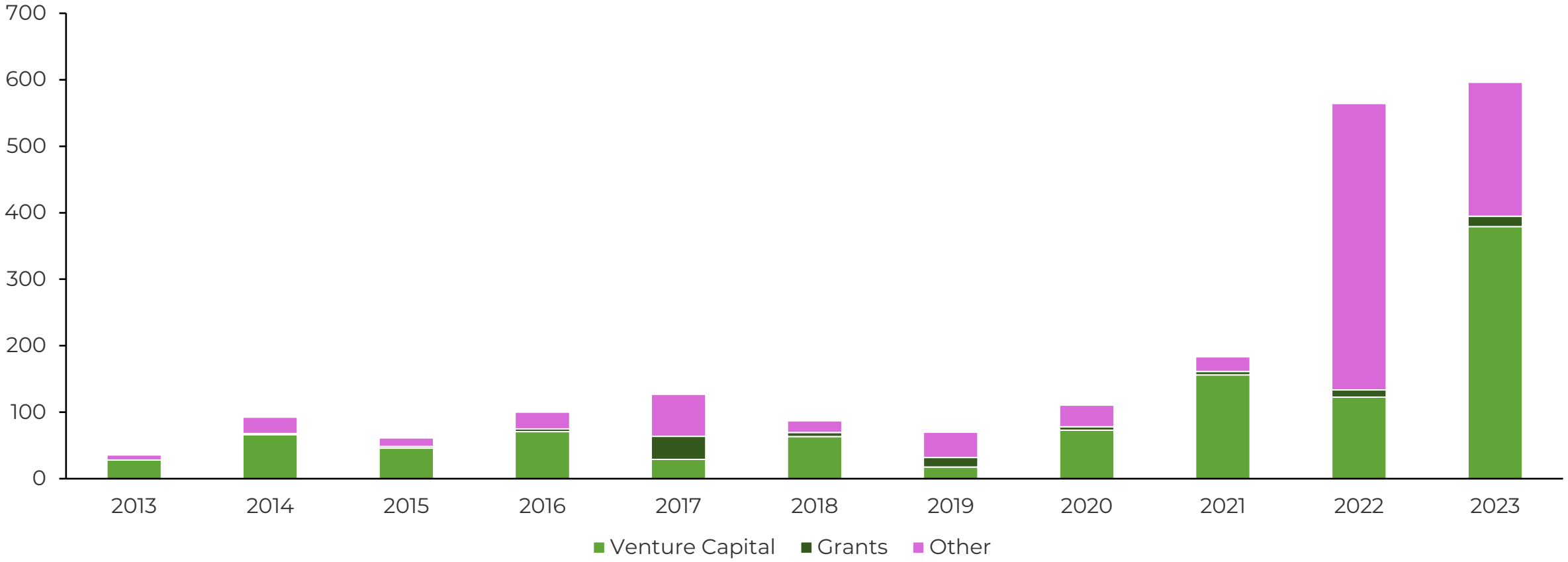
FUNDING WATER

Climate tech funding decreased 30% to USD 32 billion in 2023

Water was less than 1%

Water investments are booming, breaking a decade-long drought in funding

Industrial Water Technology Funding by Type
USD million



The rare water tech unicorn: Gradiant lands USD 225 million Series D

End-to-end solutions for water reuse in industrial and manufacturing sectors

Suite of solutions

Range of advanced membrane, thermal, oxidation processes, and smart chemical-dosing technologies

Digital capabilities through AI acquisition

Synauta: Machine learning data and mathematical models can optimize the performance of desalination and reuse plants, delivering up to 20% operational cost (opex) savings

Expanding into new markets

- Semiconductors
- Pharmaceuticals
- Mining – Lithium

Synauta
ACQUIRED

Water deals: Greater frequency of big-money rounds indicates a maturing sector

CAMBRIAN

USD 200M

USD 201M

Adionics™ Advanced ionic solutions

USD 27M

ZWITTERCO

USD 33M

120Water™

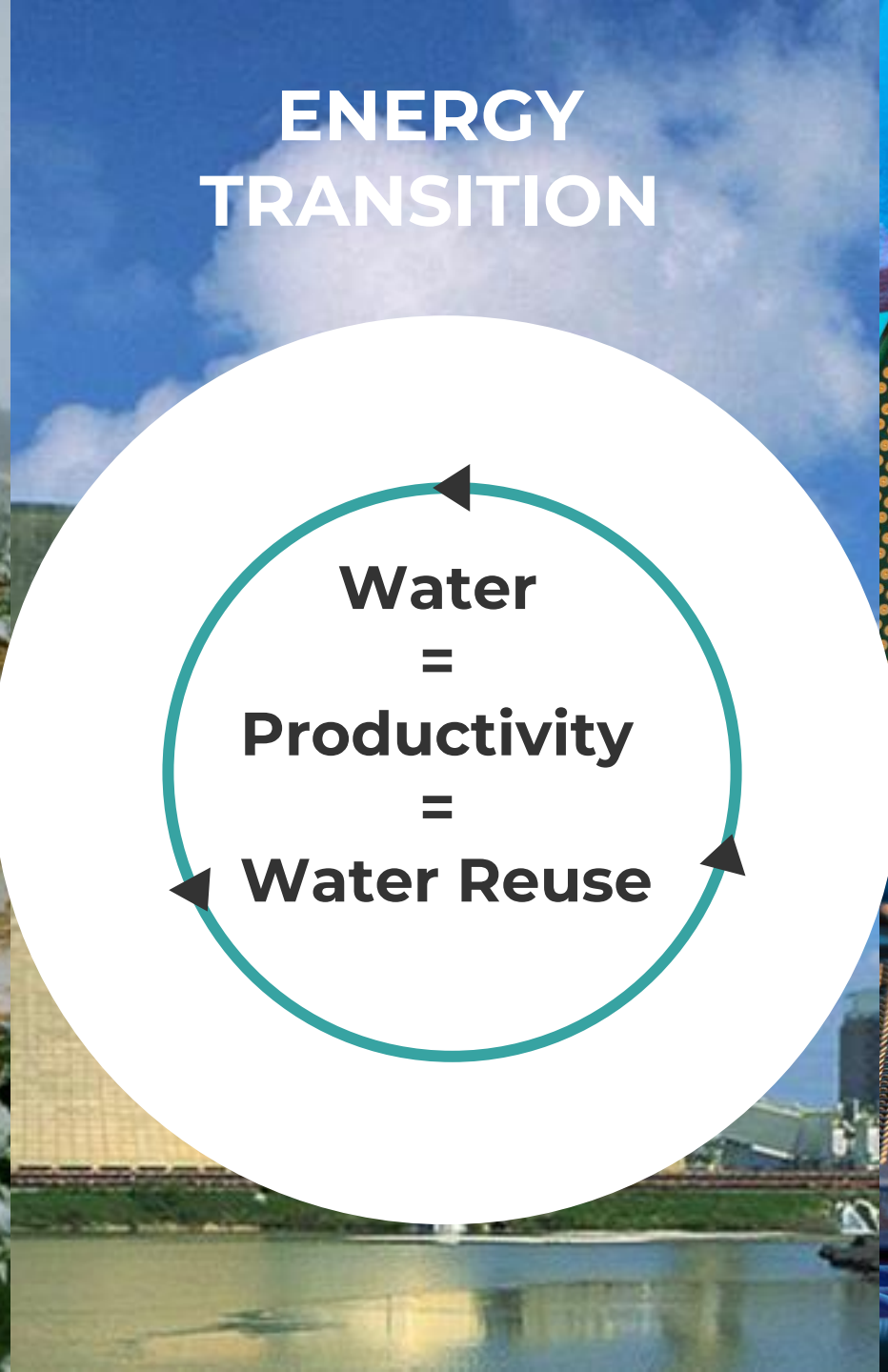
USD 43M

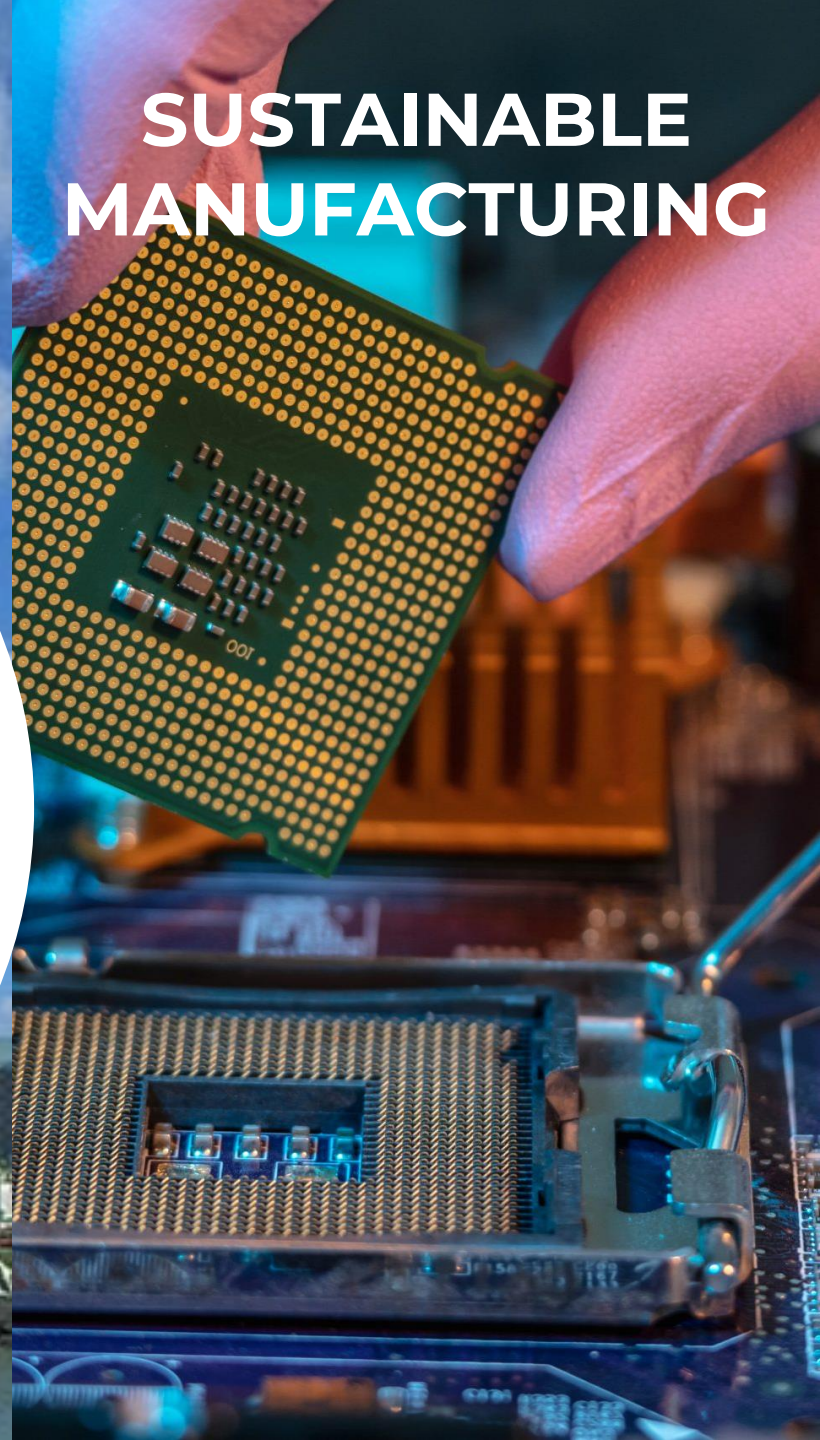
hpnow purification made simple

USD 15M

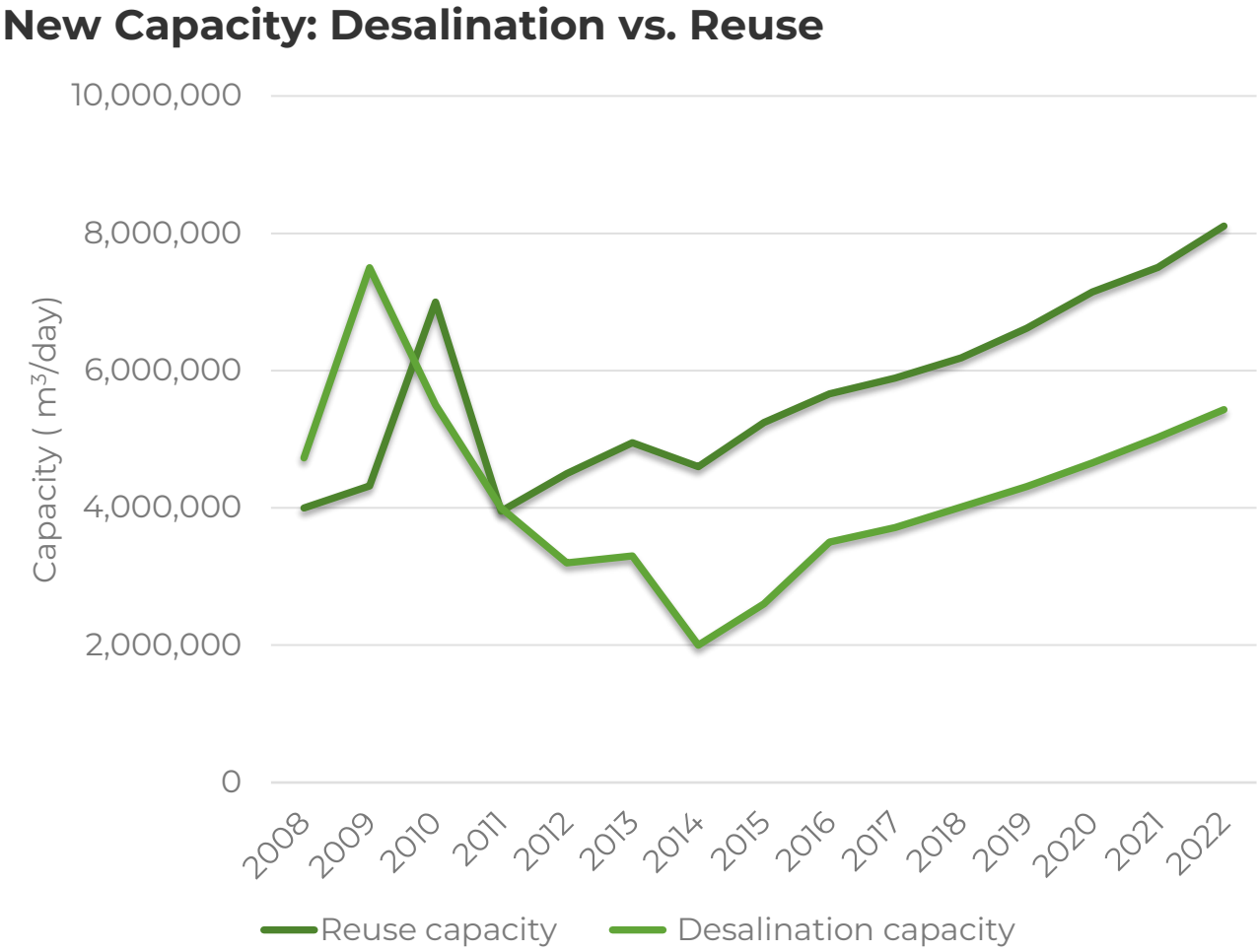

FOOD
ENERGY
MANUFACTURING
Water
=
Productivity


CLIMATE-
PROOF FOOD


ENERGY
TRANSITION
Water
=
Productivity
=
Water Reuse


SUSTAINABLE
MANUFACTURING

Increasing water consumption drives innovations in reuse



Source: Lux Research,


CLIMATE-PROOF FOOD
BOTANICAL WATER TECHNOLOGIES
ZWITTERCO
hpnow
purification made simple
ENERGY TRANSITION
gradiant
Adionics™
Advanced ionic solutions
nx
SUSTAINABLE MANUFACTURING
MEMSIFT INNOVATIONS
gradiant
AQUACYCL
Aquagga

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Key Takeaways

1 **Water is a climate challenge for industry. Stop ignoring the problem**

Water availability is a growing operational and supply chain risk, and solutions in industrial settings can help alleviate this problem.

2 **Innovation momentum has grown. Investments are catching up**

Many novel technologies are approaching commercialization. Investors are more bullish about the prospects for water tech startups.

3 **Water use = water reuse**

Solutions that enable water recycling within an industrial facility solve the two grand challenges of reducing consumption and managing wastewater.

Thank you

A link of the webinar recording will be emailed within 24–48 hours.

UPCOMING WEBINARS

APRIL 11

Taking Flight: The Future of Sustainable Aviation Fuels

APRIL 18

The Future of Agile Research: Using AI-Enabled Tools for Consumer-Centric Innovation

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