

FROM WASTEWATER TREATMENT PLANTS TO RESOURCE PLANTS

CAN TRADE AND TECHNOLOGY CONTRIBUTE?

WTO TESSD 20240617, Pär Larshans – Ragn-Sells

ENGAGEMENTS IN WATER RELATED ORGANISATIONS

WATER EUROPE

Interview with Pär Larshans, Ragn-Sells' Sustainability Director & Water Europe's Board Member - Water Europe



International Chamber of Commerce (Paris)

Ragn-Sells' Sustainability Director leads ICC's working group on Circular Economy (ragnsells.com)

<https://iccwbo.org/news-publications/policies-reports/key-enablers-for-a-circular-economy/> - presented at COP28 trade house

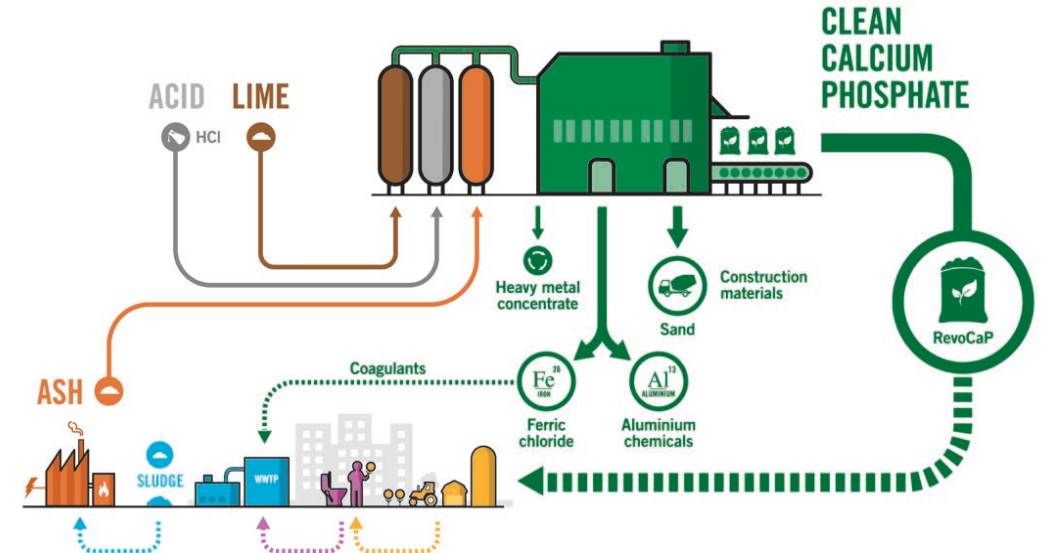
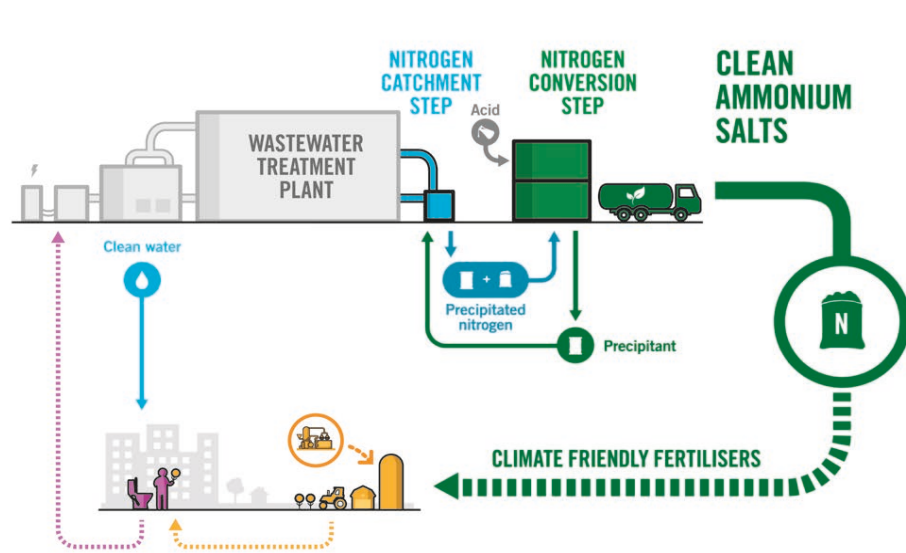
UNEP GPNM

Global Partnership on Nutrient Management

SIWI

World Water Week scientific program committee

RESOURCE PLANTS REPLACING WASTEWATER TREATMENT PLANTS AS THE LONG-TERM GOAL – WEFE NEXUS



1. Produce water for reuse in industrial applications and agriculture
2. Produce important macronutrients like phosphorus and nitrogen.
3. Produce much more renewable energy.
4. Avoid causing damage to our fragile ecosystem (rivers, lakes, coast)

WTO Geneva May 2022

"We need international agreements based on the quality, not origin"
(ragnsells.com) – WTO 18th of May 2022

WCO Brussels October 2022

"Not only rich people should be able to buy eggs in the future" (ragnsells.com)

UNEA-6 , 1 March 2024, Nairobi-UNEP HQ

Article from Water Europe Revolutionizing Water Resilience: From Wastewater to Resource Plants at UNEA6 - Water Europe

THE GLOBAL WATER CRISIS, A MATTER OF TOO MUCH, TOO LITTLE, AND TOO POLLUTED – GETTING WORSE! (UN CLIMATE ACTION)

- About two billion people worldwide don't have access to safe drinking water today (SDG Report 2022), and roughly half of the world's population is experiencing severe water scarcity for at least part of the year (IPCC). These numbers are expected to increase, exacerbated by climate change and population growth (WMO).
- Only 0.5 per cent of water on Earth is useable and available freshwater – and climate change is dangerously affecting that supply. Over the past twenty years, terrestrial water storage – including soil moisture, snow and ice – has dropped at a rate of 1 cm per year, with major ramifications for water security (WMO).
- Water supplies stored in glaciers and snow cover are projected to further decline over the course of the century, thus reducing water availability during warm and dry periods in regions supplied by melt water from major mountain ranges, where more than one-sixth of the world's population currently live (IPCC).
- Sea-level rise is projected to extend salinization of groundwater, decreasing freshwater availability for humans and ecosystems in coastal areas (IPCC).
- Limiting global warming to 1.5°C compared to 2°C would approximately halve the proportion of the world population expected to suffer water scarcity, although there is considerable variability between regions (IPCC).
- Water quality is also affected by climate change, as higher water temperatures and more frequent floods and droughts are projected to exacerbate many forms of water pollution – from sediments to pathogens and pesticides (IPCC).
- Climate change, population growth and increasing water scarcity will put pressure on food supply (IPCC) as most of the freshwater used, about 70 per cent on average, is used for agriculture (it takes between 2000 and 5000 liters of water to produce a person's daily food) (FAO).

WATER RELATED HAZARDS (UN CLIMATE ACTION)

- Climate change has made extreme weather events such as floods and droughts more likely and more severe (IPCC).
- Rising global temperatures increase the moisture the atmosphere can hold, resulting in more storms and heavy rains, but paradoxically also more intense dry spells as more water evaporates from the land and global weather patterns change. (World Bank)
- Drought and flood risks, and associated societal damages, are projected to further increase with every degree of global warming (IPCC).
- The frequency of heavy precipitation events will very likely increase over most areas during the 21st century, with more rain-generated floods. At the same time, the proportion of land in extreme drought at any one time is also projected to increase (IPCC).
- Water-related disasters have dominated the list of disasters over the past 50 years and account for 70 per cent of all deaths related to natural disasters (World Bank).
- Since 2000, flood-related disasters have risen by 134 per cent compared with the two previous decades. Most of the flood-related deaths and economic losses were recorded in Asia (WMO). The number and duration of droughts also increased by 29 per cent over this same period. Most drought-related deaths occurred in Africa (WMO).

RISKS?

- **GÉOPOLITICAL** – countries forest might be the neighbouring countries water supply
- **INSURANCE** – the cost to insure real-estate and industry will be very difficult
- **DEPRECIATION OF ECONOMIC VALUE** – will likely lead to slow down in economy
- **FOOD SUPPLY RISK** – decreased yields

AND A LOT MORE...

WHAT SHOULD BE DONE? (UN WATER)

- **Improving carbon storage.** Peatlands store at least twice as much carbon as all of Earth's forests. Mangrove soils can sequester up to three or four times more carbon than terrestrial soils. Protecting and expanding these types of environments can have a major impact on climate change.
- **Protecting natural buffers.** Coastal mangroves and wetlands are effective and inexpensive natural barriers to flooding, extreme weather events and erosion, as the vegetation helps regulate water flow and binds the soil in flood plains, riverbanks and coastlines.
- **Harvesting rainwater.** Rainwater capture is particularly useful in regions with uneven rainfall distribution to build resilience to shocks and ensure supplies for dry periods. Techniques include rooftop capture for small-scale use and surface dams to slow run-off to reduce soil erosion and increase aquifer recharge.
- **Adopting climate-smart agriculture.** Using conservation techniques to improve organic matter to increase soil moisture retention; drip irrigation; reducing post-harvest losses and food waste; and, transforming waste into a source of nutrients or biofuels/biogas.
- **Harnessing groundwater.** In many places, groundwater is over-used and polluted; in other places, it is an unknown quantity. Exploring, protecting and sustainably using groundwater is central to adapting to climate change and meeting the needs of a growing population.
- **Reusing wastewater.** Unconventional water resources, such as regulated treated wastewater, can be used for irrigation and industrial and municipal purposes. Safely managed wastewater is an affordable and sustainable source of water, energy, nutrients and other recoverable materials.



EIB Projects Directorate - SECTOR PAPERS

FACT SHEET



Wastewater and nutrient management for #ClimateAction

To solve the climate crisis we must take wastewater and nutrient management seriously – instead of contributing to pollution the recovered energy, water and nutrients can be used to help solve environmental and climate challenges.

See the video: [Wastewater and nutrient management for #ClimateAction](#)

Read the report: [Wastewater: from problem to solution](#)

Wastewater as a resource

May 2022

From Problem to Resource

Shifting paradigms for smarter wastewater interventions in Latin America and the Caribbean

Diego J. Rodriguez, Hector Alexander Serrano, Anna Delgado, Daniel Nolasco and Gustavo Saltiel



NEWS

Making Europe's sewage treatment plants more efficient and circular can help meet zero-pollution targets

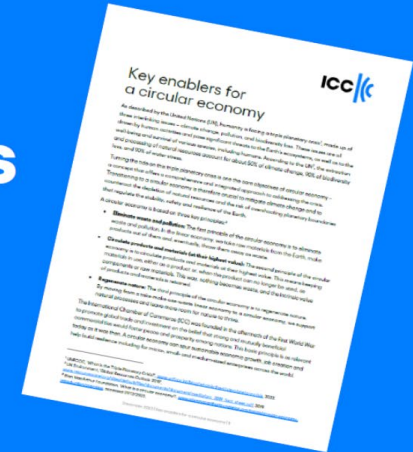


Circular Economy: The Key to a Net-Zero World

6 December 2023 | Trade House, COP28 | Dubai



ICC Key enablers for a circular economy



Background

Extraction and processing of natural resources account for about 1 :



50%

Climate change



90%

Biodiversity loss



90%

Water stress



“ Humanity is waging war on nature. This is senseless and suicidal. The consequences of our recklessness are already apparent in human suffering, towering economic losses and the accelerating erosion of life on Earth. ”

- António Guterres, United Nations Secretary-General

International Resource Panel, "2019: Natural Resources for the Future We Want," Global Resources Outlook (2022).

12



1

Change the way we view “waste” and enable the free trade of resources

2

Prioritise the quality of products over the nature of original production

3

Enable the use of strategic material banks and cross-border reverse logistics

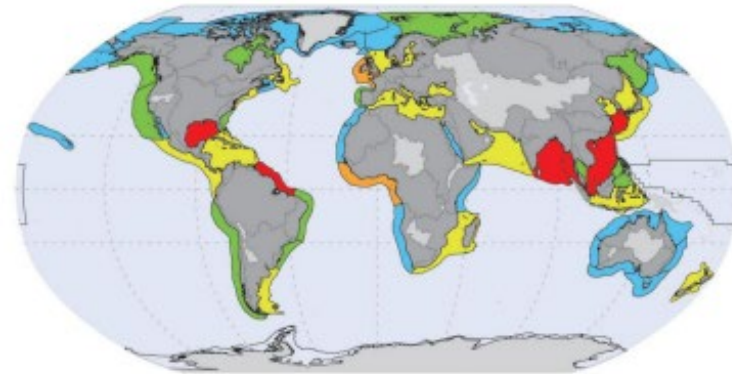
4

Adopt globally harmonised standards and definitions to achieve circularity at scale

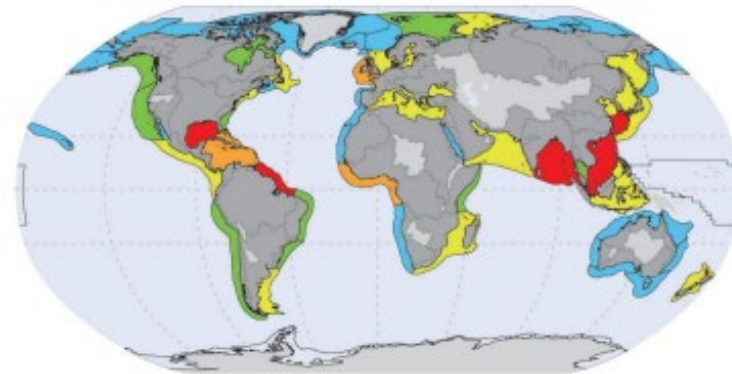
5

Recover raw materials from urban flows to boost food supply, prevent water scarcity and reduce the risk of eutrophication

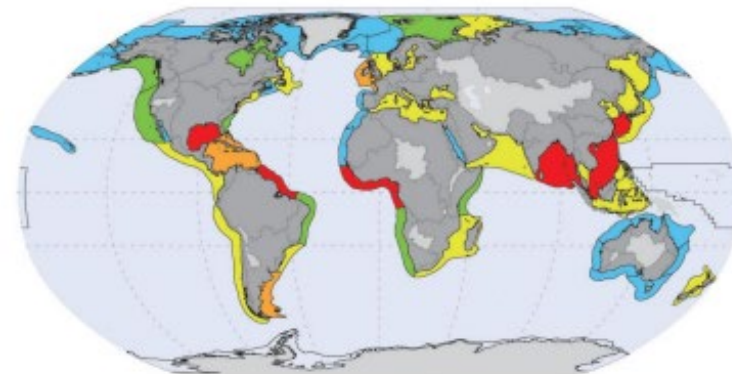
a) For 2000



b) For 2030

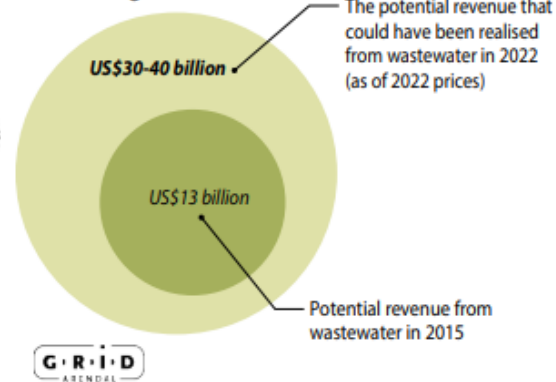


c) For 2050



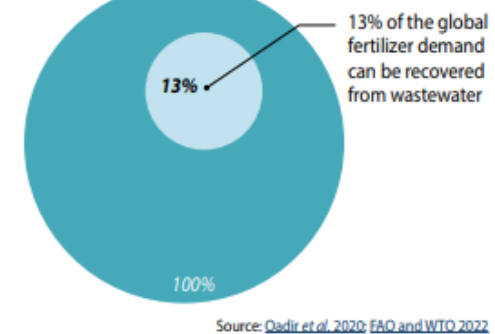
Global nutrient potential in wastewater

Revenue generation



Global fertilizer demand in agriculture

In %

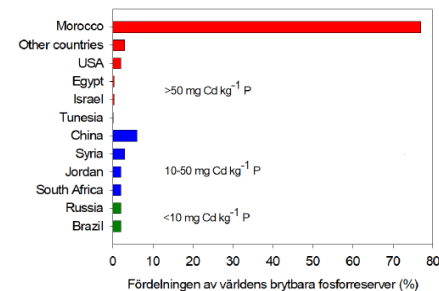


89%
of treated wastewater is being discharged without any resource recovery

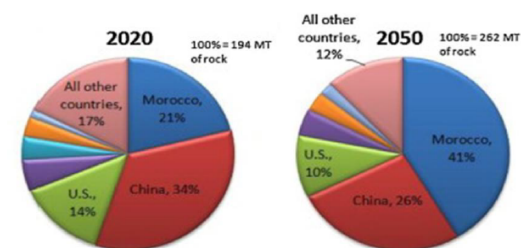
We are squandering the potential for recovering clean energy, water and nutrients that could contribute to climate change mitigation, adaptation and resilience.

MACRO FACTORS THAT AFFECTS THE LONG TERM SUPPLY OF PHOSPHORUS

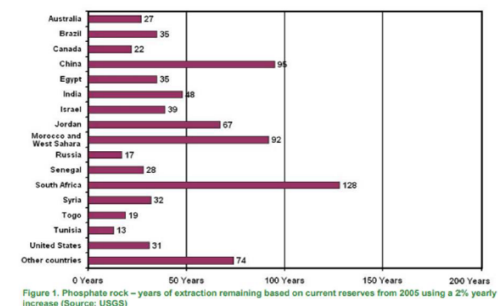
Much of the world's P reserves are located in Morocco



China, USA, and Morocco are the three big players supplying 70% of the world's needs



Many countries P rock reserves and supply are diminishing rapidly



THE POTENTIAL TO TURN WASTEWATER TREATMENT PLANTS INTO RESOURCE PLANTS, SUPPORTING BOTH ADAPTATION AND MITIGATION AND INCREASES RESILIENCE

CIRCULAR MATERIAL FLOWS ARE KEY TO REDUCE RISK

Phosphorus

This irreplaceable natural resource is being used up increasingly fast. Without phosphorus, there would be no life.

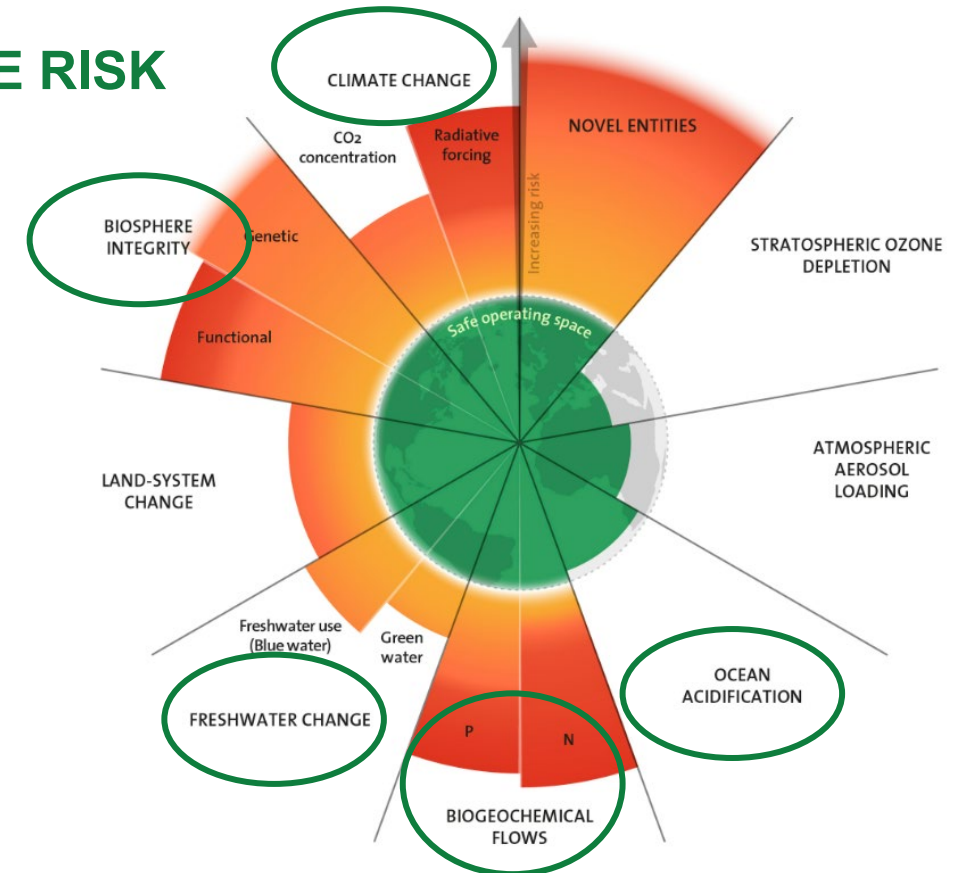
The demand for phosphorus is growing and virtually all phosphorus rock is mined in countries outside of Europe.

Globally, phosphorus is not being treated sustainably. It disappears from the food chain as animal manure, human excreta and organic waste.

Nitrogen

In the last six decades, the consumption of reactive nitrogen (N_r) in the form of fertiliser has been growing rapidly, whilst the nitrogen use efficiency (NUE) of cropping systems has been decreasing.

These trends have led to increasing environmental losses of N_r , threatening the quality of air, soils, and fresh waters, and thereby endangering climate-stability, ecosystems and human-health.



Both phosphorus and nitrogen ends up in our lakes, rivers, and oceans causing eutrophication – resource treatment plants where the process can be reversed has a huge potential



Centre for
Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL



THE UNIVERSITY
of EDINBURGH



OUR PHOSPHORUS FUTURE



Dr Will Brownlie



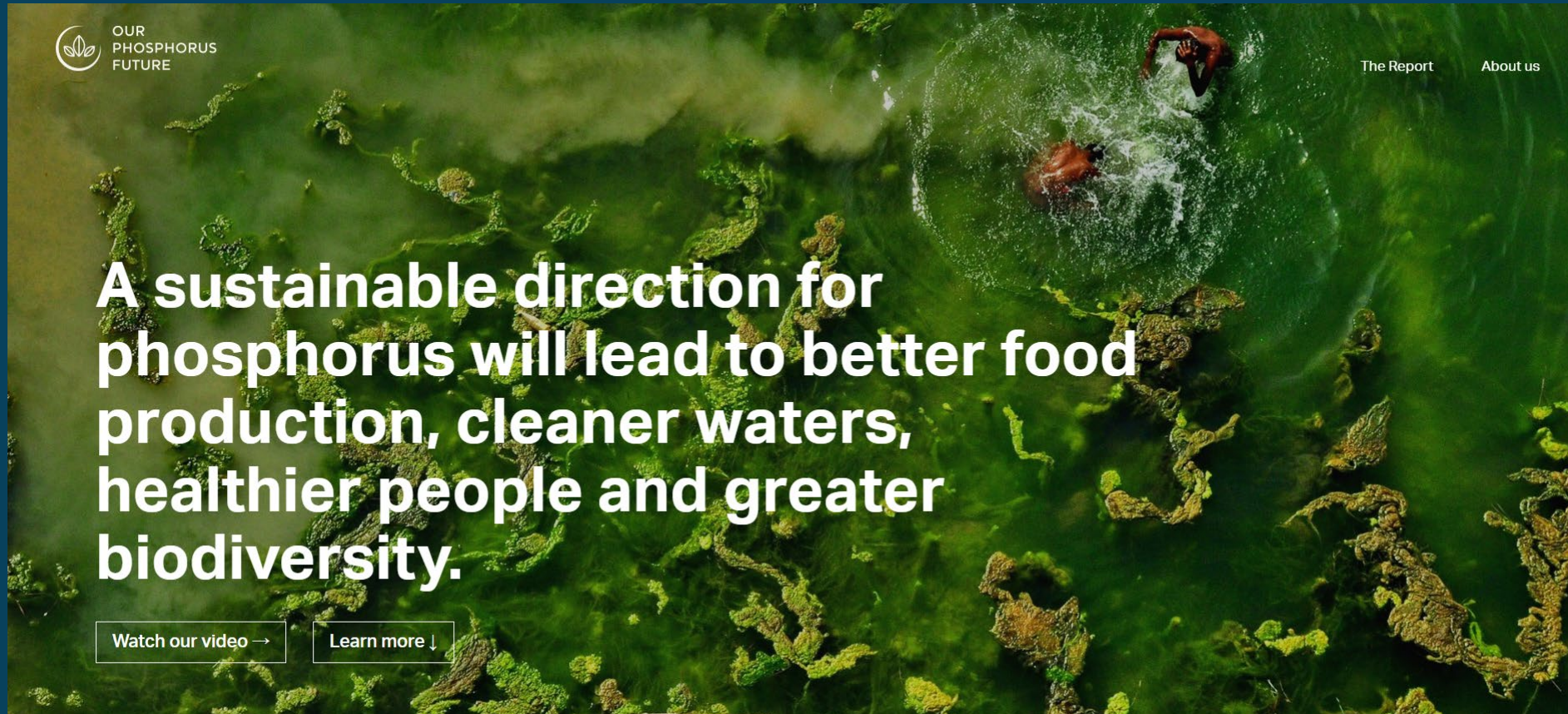
Phosphorus is
essential for food
security



Phosphorus is a threat to water quality

Photo: Chinese army called into to deal with an algal bloom at the Beijing Olympics in 2008, as a result of phosphorus-rich wastewater pollution

www.opfglobal.com



OUR
PHOSPHORUS
FUTURE

[The Report](#)

[About us](#)

A sustainable direction for phosphorus will lead to better food production, cleaner waters, healthier people and greater biodiversity.

[Watch our video →](#)

[Learn more ↓](#)

Solutions to increase phosphorus, circularity are well known

- Treat waste streams as valuable nutrient resources
- Optimise the spatial integration of arable and livestock agricultural systems
- Develop policies, regulations, and financial instruments that support phosphorus recycling.
- A goal for fertiliser products to contain a minimum of 20% recycled phosphorus by 2030, could set a benchmark that demonstrates green commitment across the fertiliser industry

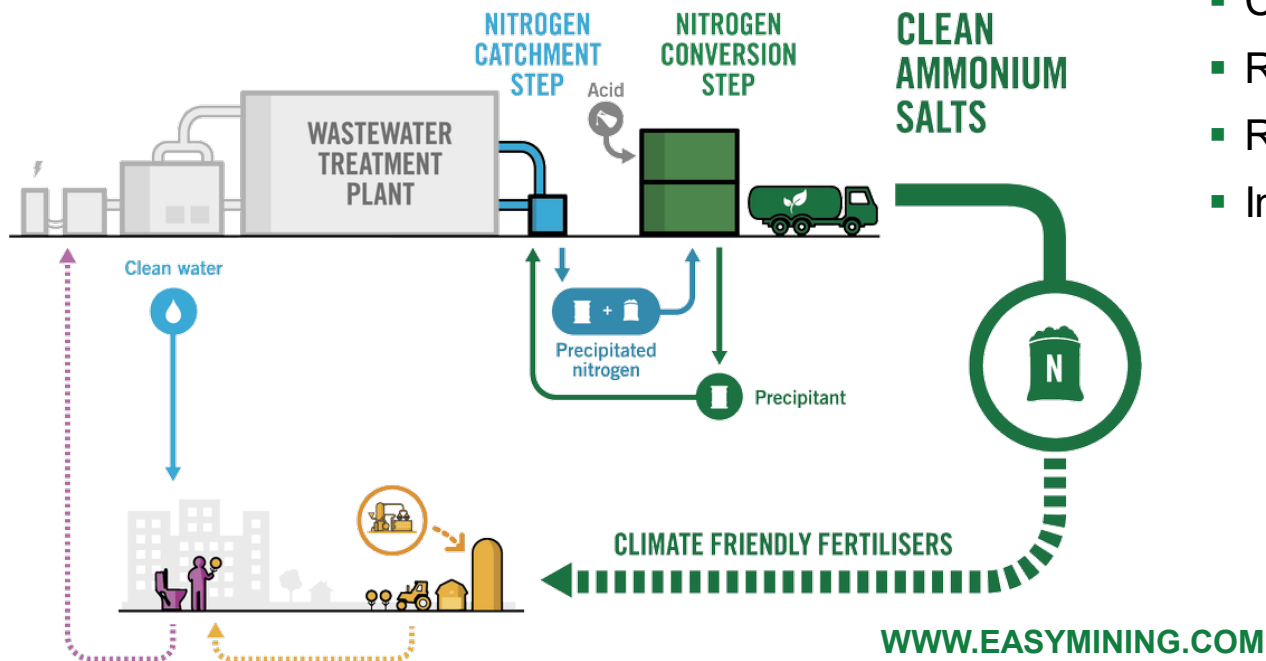
Picture: Struvite recovered from a sewage works in Switzerland



AQUA2™N – REMOVING AND RECOVERING NITROGEN FROM LIQUID WASTE STREAMS

- Removes >95% of the nitrogen from liquid waste streams with a high concentration of ammonium nitrogen, such as sludge liquor in wastewater treatment plants
- Converts the removed nitrogen to ammonium sulphate

- Reduces the nitrogen load in the WWTP, making it possible
 - Connecting more P.E. to exciting infrastructure
 - Reduction of cost for nitrogen removal in mainstream
- Can eliminate nitrous oxide emissions (N₂O)
- Revenue from produced ammonium sulphate
- Reduced CAPEX need
- Increased biogas production



Liquid and solid ammonium sulphate, produced in the demonstration plant for Aqua2™N

ADVANTAGES OF ASH2[®]PHOS

Ash2Phos produces large market volumes of safe domestic phosphorus from sewage sludge ash. It also avoids spreading toxic cadmium via fertiliser produced from mined phosphorus.



Reduces import dependency for an essential and critical element. Greater food security for society.



Over 90 % recovery of phosphorus plus other valuable commercial-grade chemicals.



Utilises more than 95 % of the ash.



Output product quality (P, Fe, Al) is independent of input ash quality. High flexibility for incinerator operators.



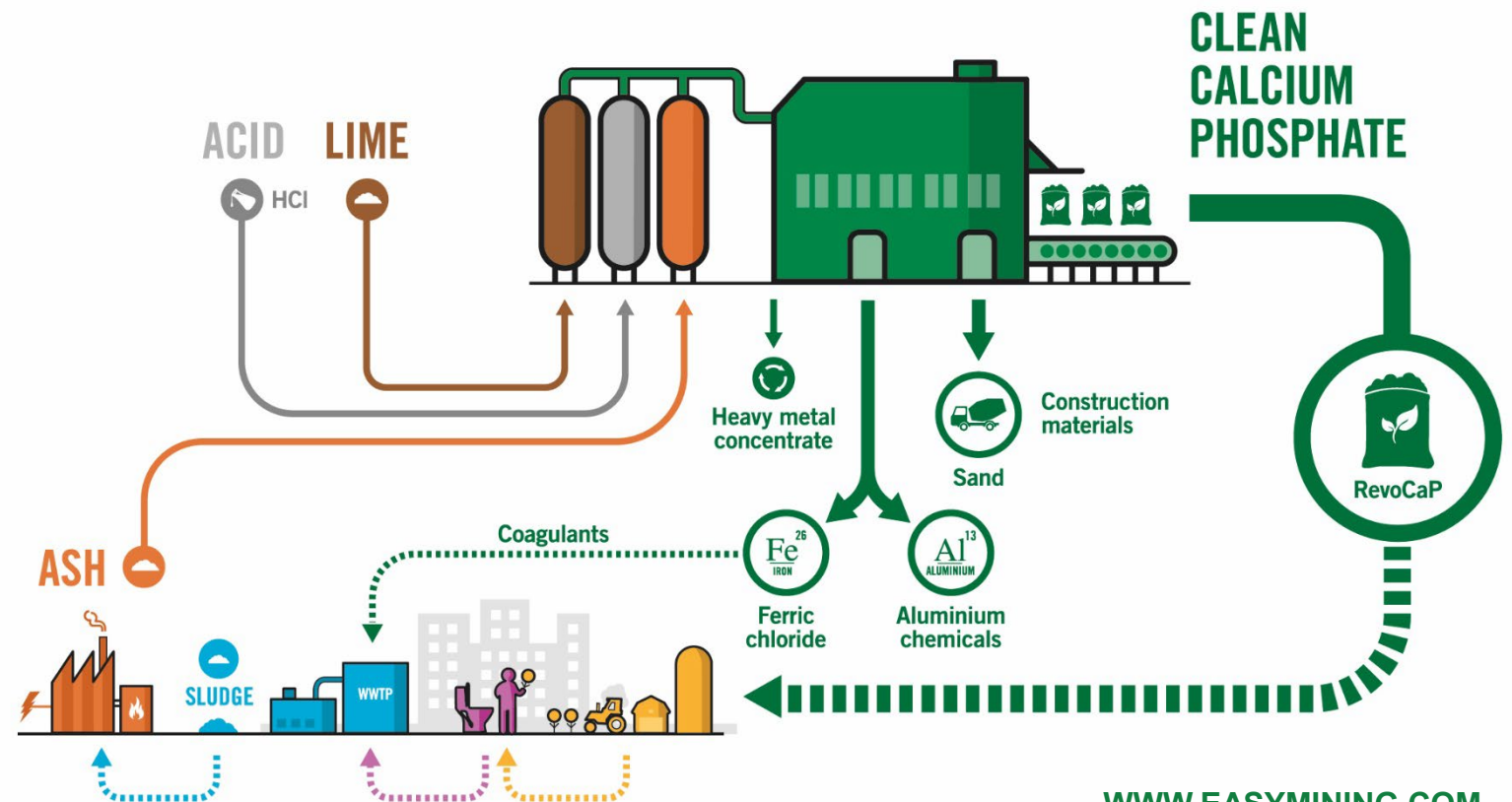
Efficient heavy metal separation detoxifies the nutrient cycle.



Process aligns with EU strategic goals and future legislation for phosphorus recovery and supply.

RECYCLED P

Ash2[™]Phos



WWW.EASYMINING.COM

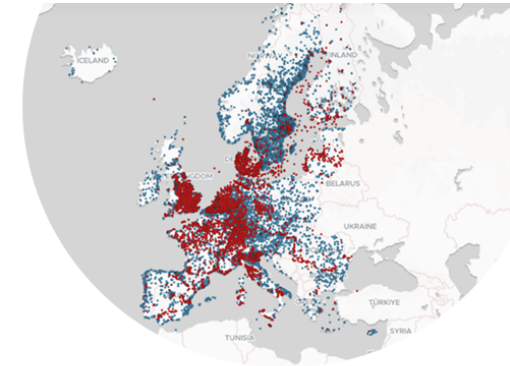
DETOXIFICATION IMPORTANT

PFAS solutions installed in Flanders to avoid it ending up in wastewater plants

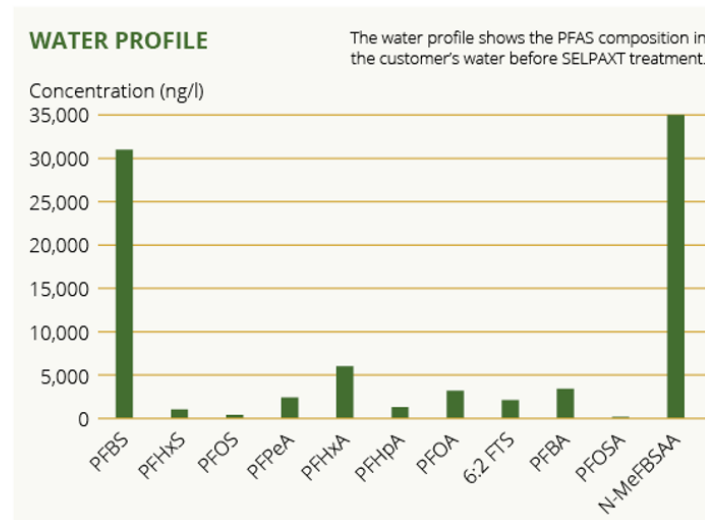
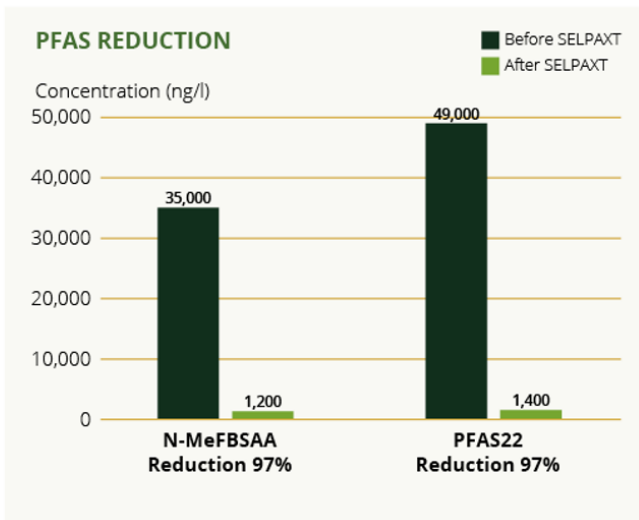
CHROMAFORA – PFAS SOLUTION FIRST INSTALLED IN FLANDERS

SELPAXT FOR PFAS REMOVAL IN BELGIUM

- Installed SELPAXT for landfill leachate with very high share of short PFAS. 2-step treatment resulting in 97% reduction in collaboration with local partner.
- Several lab tests from Belgian companies with great results.
- Huge interest for our technology with several on-going dialogues.



PFAS reduction results from the 2-step SELPAXT installation:



REDUCTION %

The symbol > indicates that the reduction result after SELPAXT treatment is below the detection limit (LOQ).

N-MeFBSAA	97%
PFAS22	97%
PFAS4	>99%
PFAS11	98%



ANNEX

WHAT ARE WE CURRENTLY WORKING WITH?

N

Aqua2N – boost energy production
Remove the risk of N₂O emissions



Copenhagen: Process demonstrated in 2022
 Capacity: 4 m³/h process water (landfill or WWTP)
 • **Ammonium sulphate**

P

Ash2Phos – high quality for feed
or organic farming



Schkopau: Joint-Venture with Gelsenwasser AG
 2026/7 intended start operation, capacity: 30,000 t ssa/year,
 • **15,000 t Calcium phosphate/year**

Helsingborg: Cooperation Ragn-Sells Treatment & Detox
 2027/8 intended start operation, capacity: 30,000 t ssa/year, y
 • **15,000 t Calcium phosphate/year**

K

Ash2Salt – desalination and
metal recovery



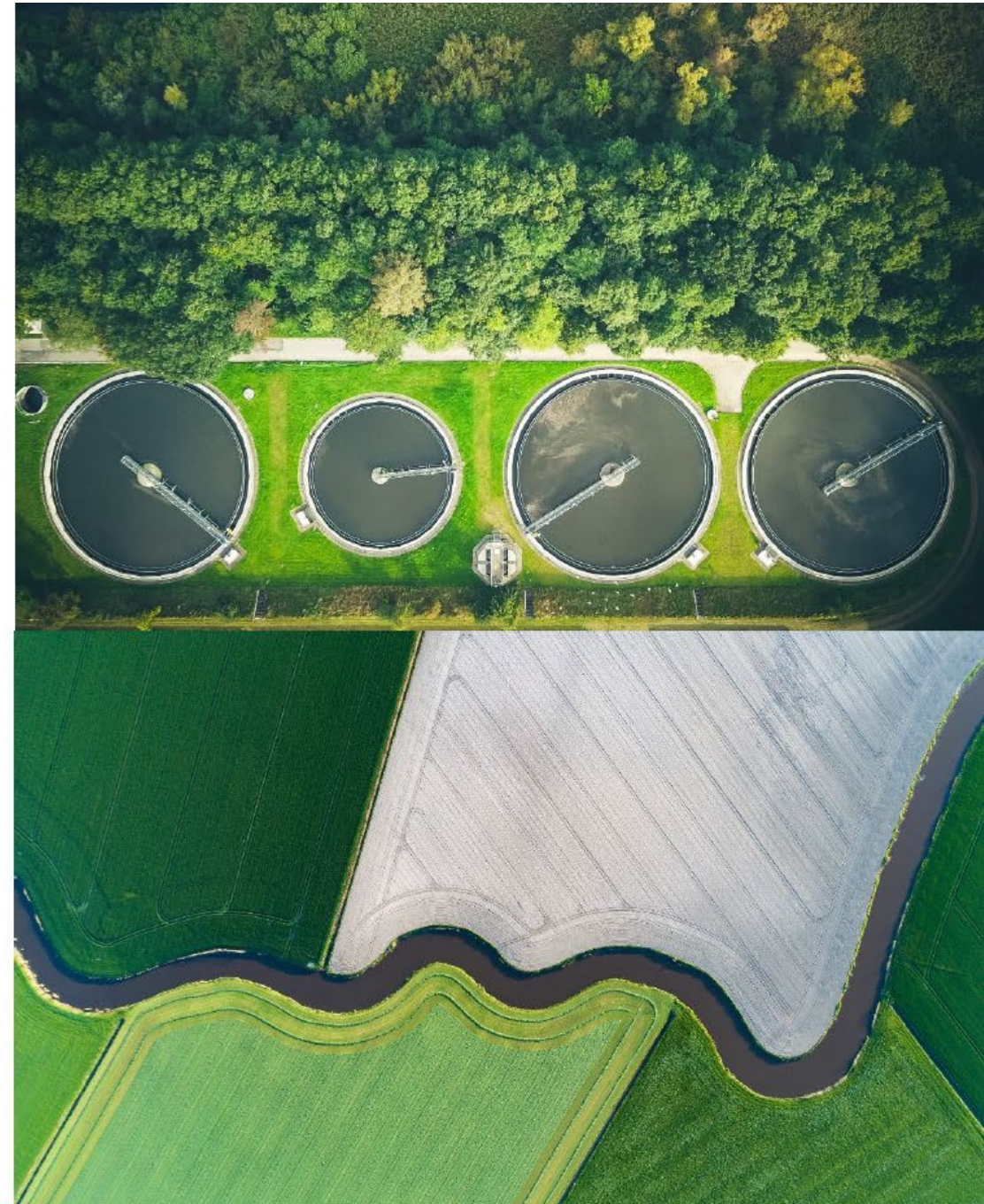
Stockholm: Inaugurated in April 2023
 Capacity: 130,000 t fly ash/a
 • **3,500 t /year Potassium chloride**
 • **7,000 t/year Sodium chloride**
 • **32,000 t/year Calcium chloride (36%)**

CANADA ARE PUSHING FOR TRADE WITH RECYCLED PHOSPHORUS



COMMON GOALS

- For the Waste-Water Treatment Plants to become resource plants
- For Canada to become more self-sufficient and resilient, to have a stable production of fertilisers and feed to strengthen the feed and food value chain
- Produce sustainable, non-toxic fertilisers and feed with low CO₂ emission and ecological footprint
- Decrease Cadmium levels in the feed and food value chain*
- Make innovations that can close nutrient cycles in an efficient way
- Push for circular legislations that will close nutrient cycles



*Cost estimated in Sweden and France for injuries and health issues linked to Cadmium: 420 million / y and 2 billion / year (ref Daniel Edgar Livsmedelverket 22-10-24)

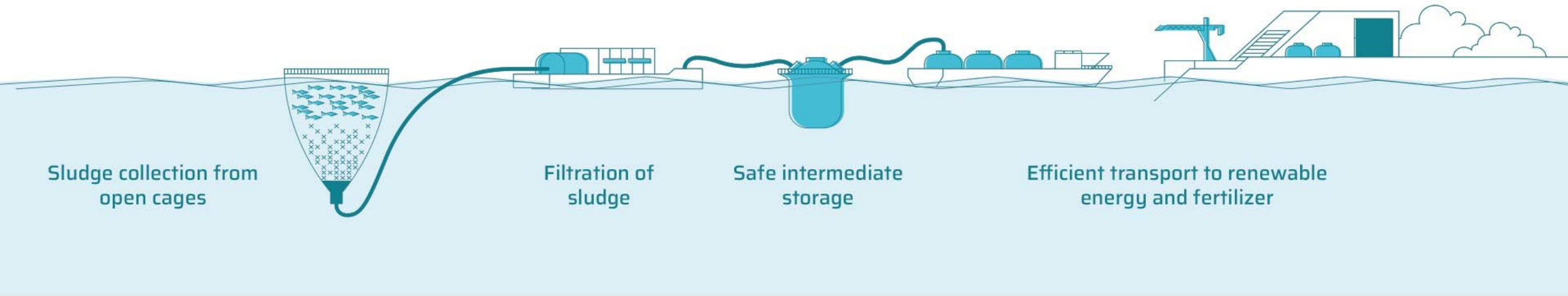
FISH POOP/FISH SLUDGE – A FORGOTTEN PHOSPHORUS SOURCE

- Today we just push it out in our rivers/fjords/oceans

What do the scientist say?

- Transforming sustainable aquaculture by applying circularity principles - Stockholm Resilience Centre

TECHNOLOGY EXIST



POTENTIAL

Sludge from
aquaculture



2022: 334,000

2030: 459,000

2050: 1,018,000

Sludge becomes
BIOGAS

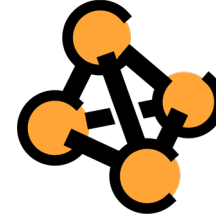


2022: 112 - 309 mill m³ CH₄

2030: 158 - 429 mill m³ CH₄

2050: 350 - 950 mill m³ CH₄

PHOSPHORUS
for food



2022: 11,000

2030: 15,100

2050: 33,500

NITROGEN
to fertilisers



2022: 18,700

2030: 25,700

2050: 57,000

Norwegian fish poo can power 600,000 households and supply entire countries with phosphorus

Norwegian fish poo can power 600,000 households and supply entire countries with phosphorus



Energy for up to 600,000 households and enough phosphorus fertiliser to cover the agricultural needs of many small nations. These resources can be extracted from sludge washed into the sea from Norwegian salmon farms every year, according to a new report from international consultants PwC commissioned by environmental company Ragn-Sells and partners. New technology enables fish farms all over the world to collect the sludge and put it to use.

– Circular solutions for fish-farm waste mean lower climate impact, less pressure on the marine environment in the fjords and give the ability to double or triple the fish production, while making