Microbial Hydroponics (Mi-Hy): A Prosthetic Rhizosphere for Sustainable Agriculture
Pathway to an EIC Pathfinder Challenge – Carbon & Nitrogen Portfolio

Rachel Armstrong

Coordinator Mi-Hy, ZAP professor of Design-Driven Construction for Regenerative Architecture, Department of Architecture, KU Leuven, Belgium, EIC Ambassador

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Pathfinder: The Big Picture

EIC Pathfinder Global challenges: GHG reduction/mitigation, Nitrogen pollution, unsustainable agriculture, circular bioeconomy.

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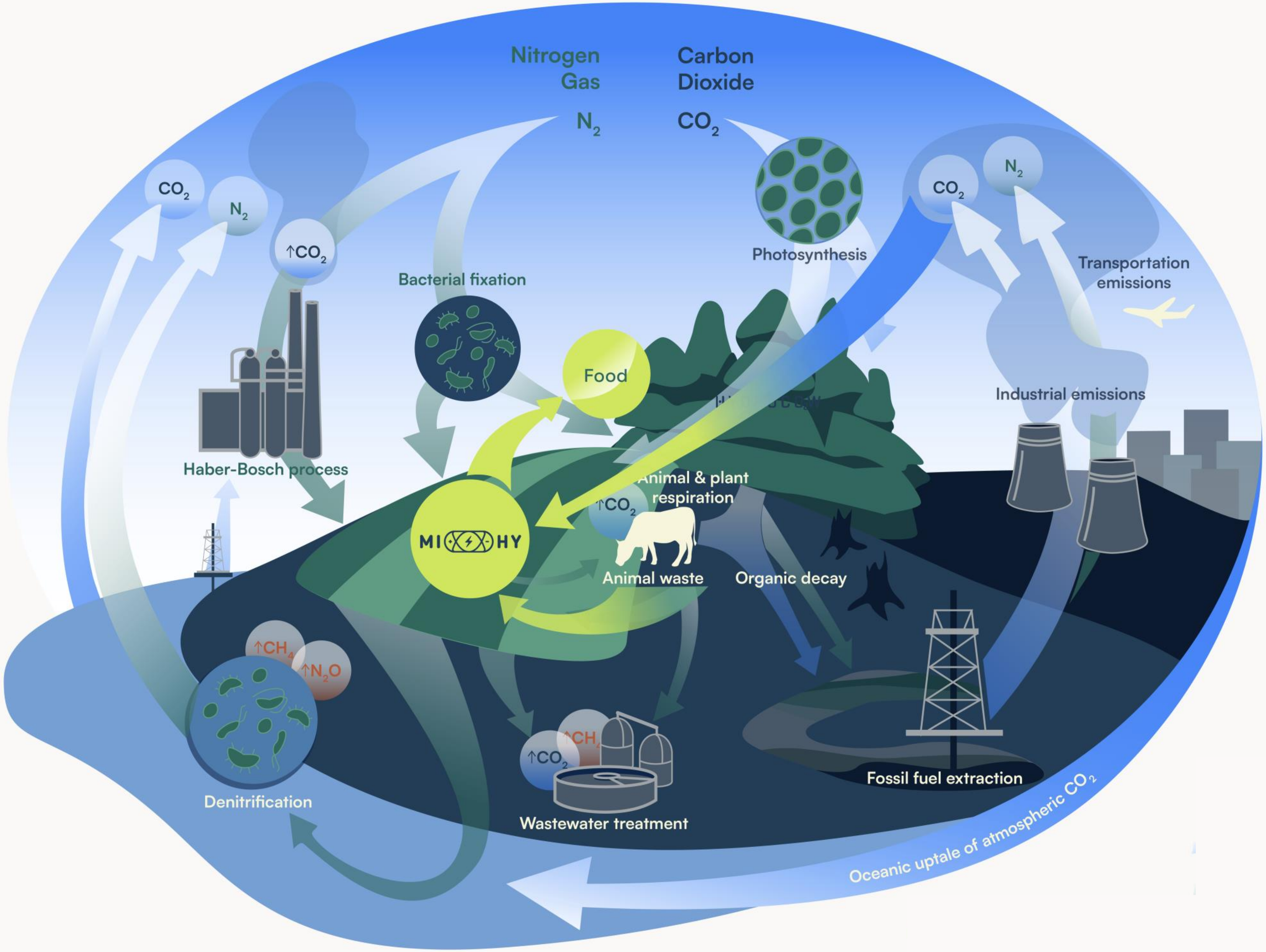

Nitrogen Gas
N_2
Carbon Dioxide
CO_2
CO_2
N_2
$\uparrow CO_2$
Bacterial fixation
Photosynthesis
CO_2
N_2
Transportation emissions
Food
Industrial emissions
Haber-Bosch process
Animal & plant respiration
$\uparrow CO_2$
MI HY
Animal waste
Organic decay
$\uparrow CH_4$
$\uparrow N_2O$
$\uparrow CH_4$
$\uparrow CO_2$
Fossil fuel extraction
Denitrification
Wastewater treatment
Oceanic uptale of atmospheric CO_2

The Consortium Story

"Finding partners started with shared passion, not CVs."

Tip: *"Consortium building and maintenance is 40% of the effort—start early!"*

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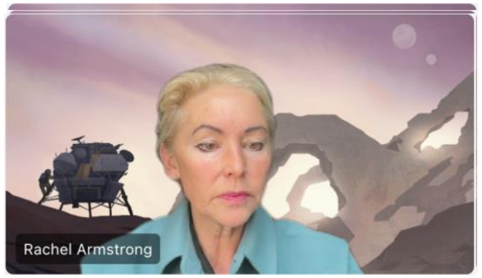
Microbial Hydroponics Consortium (PIs)

MI HY

KU LEUVEN



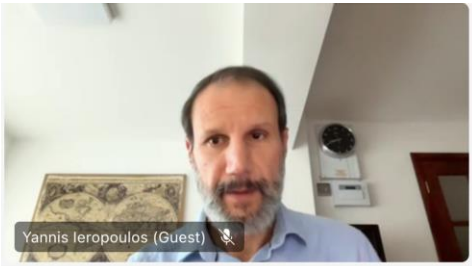
Sony CSL

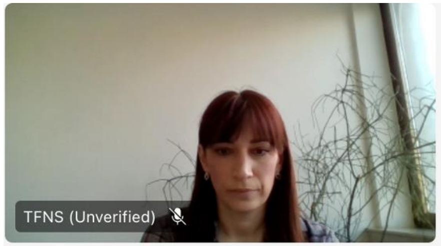
UWE Bristol | University of the West of England

Biofaction

CIB CSIC
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

University of Southampton





TEHNOLOŠKI FAKULTET NOVI SAD

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The Consortium Story

"What if wastewater could replace fertilizers in hydroponics?"

Approach: Bioelectrically and biochemically mediated biofilm-plant interactions in hydroponic system.

Process:

Identified gaps (microbiologists, MFC experts, hydroponic engineers).

Leveraged EIC networks, portfolio partners, and personal outreach.

Aligned on a ***shared narrative*** (e.g., "closing the nitrogen loop").

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Innovation Core

Mi-Hy’s vision: **Biofilm-mediated symbiosis** bridging microbes, plants, and technology.

Novelty: Engineered microbial communities mimic soil rhizosphere in hydroponics.

Key Outputs:

- **Replaces synthetic fertilizers** with wastewater-derived nutrients.
- Plant biomass + **biosynthesized molecules** (e.g., butanediol).

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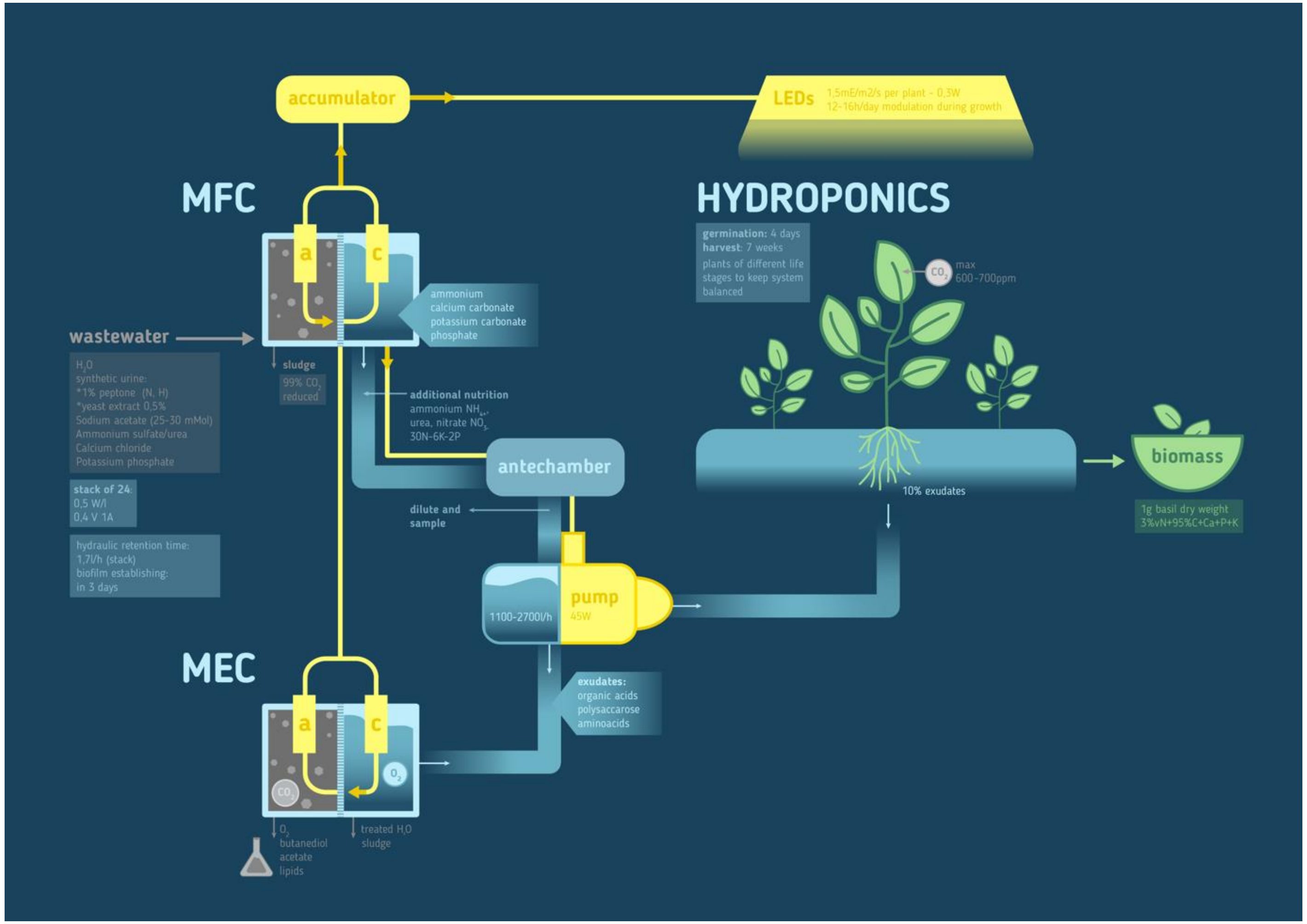
Mi-Hy set-up



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505U
VISCOMETER
BOILER
STIRRER

Target Applications and Scale

Domestic: Home hydroponics kits (reduce fertilizer use).

Urban: Green walls/farms (wastewater → food).

Industrial: Large-scale hydroponics (e.g., Almeria's greenhouses).

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Domestic

Urban

Industrial

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Mi-Hy HopOn (TFNS – Novi Sad)

SO1: Biofertilizing Products (BFP)

Microbial plant biostimulants (MPB) via submerged cultivation (TRL 3-4).

Microbial-organic fertilizer blends (MOFer) via aerobic solid-state cultivation.

Use **FPR-compliant strains** (e.g., *Azotobacter*, *Rhizobium*) with screening for **antimicrobial resistance (AMR)** and plant-growth-promoting (PGP) traits.

SO2: Green Building Materials (GBMs)

Ceramic blends from sludge + industrial waste (fly ash, red mud).

Microbially induced calcite precipitation (MICP) biobricks (*Bacillus*-based).

Align with **EU Green Deal** and **New European Bauhaus** (low-embodied-energy materials).

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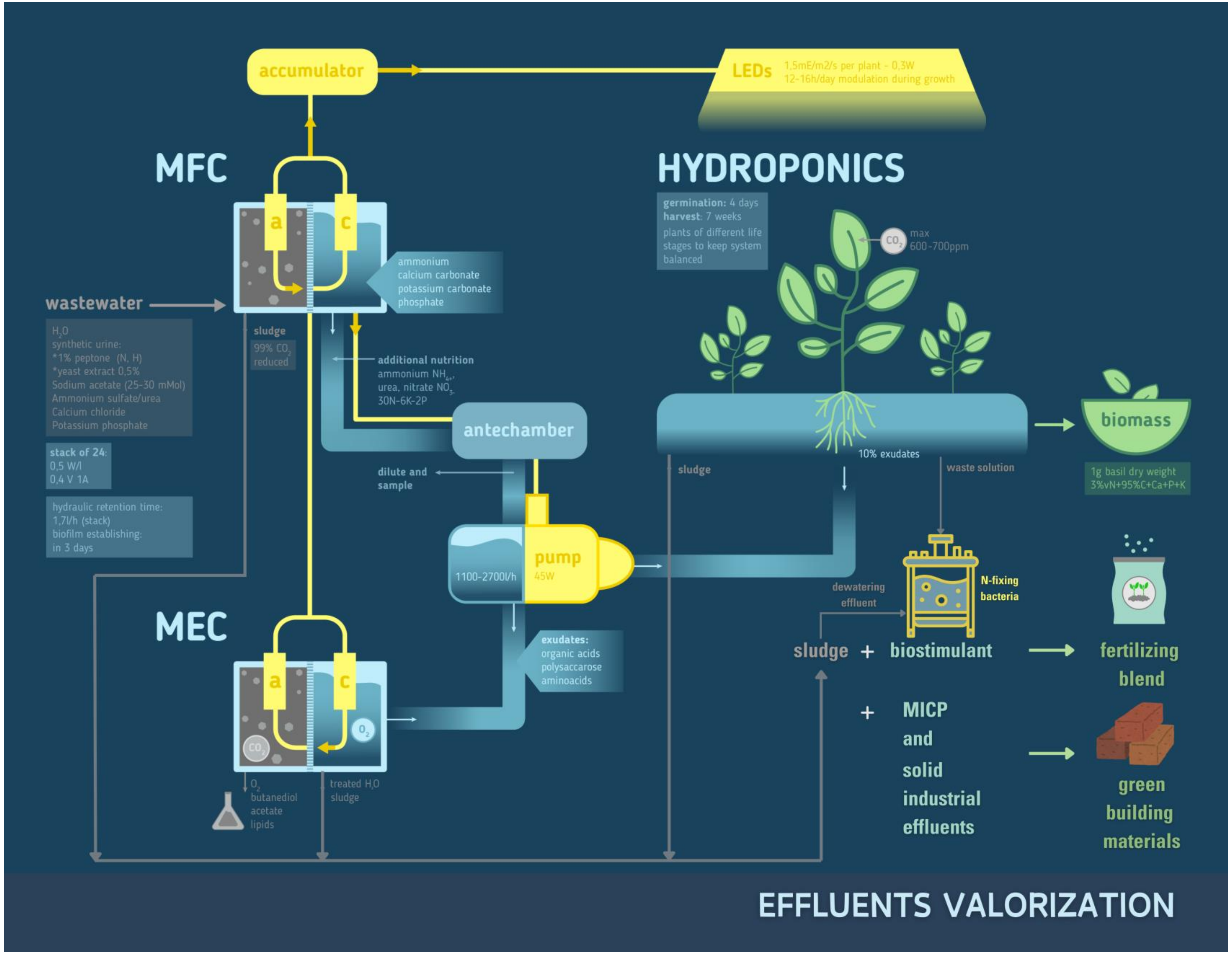

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Proposal Writing Tips

Clarity: "If a reviewer can’t grasp it in 5 minutes, refine it."

Perfection: "Typos = lost trust. Hire an editor."

Reviewer’s Shoes: "Use their terminology (e.g., ‘TRL’, ‘key exploitable results’)."

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Portfolio Synergy

Complementarity with other projects (CONFETI, ECOMO, etc.) to generate a Carbon/Nitrogen ‘trading’ economy of technologies with multiple sites of action within the C/N cycles

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Common Pitfalls

Overpromising (balance ambition with plausibility).

Ignoring EIC's **impact criteria** (link to EU Green Deal).

Weak consortium (e.g., no SME or cross-disciplinary partners).

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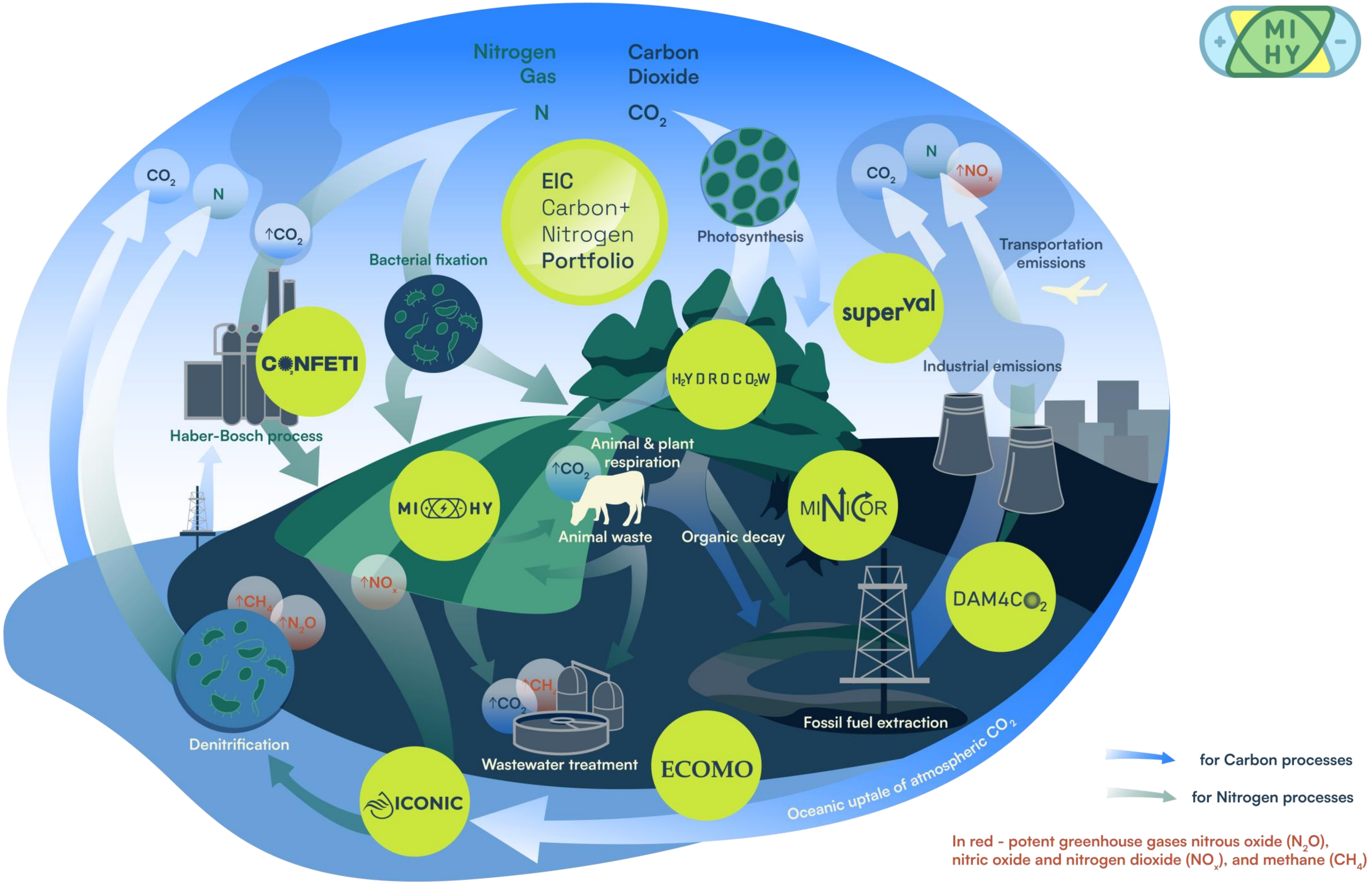

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Pathfinder Challenges Portfolio of Projects: Carbon Dioxide and Nitrogen management and valorisation
Mi-Hy **Microbial Hydroponics: Circular Sustainable Electrobiosynthesis**
HYDROCOW **Hydrogen oxidizing bacteria engineered to valorize CO2 for whey protein production**
CONFETI **Green valorization of CO2 and Nitrogen compounds for making fertilizers**
ICONIC **Integrated COnversion of NItrate and Carbonate streams**
ECOMO **Electrobiocatalytic cascade for bulk reduction of CO2 to CO coupled to fermentative production of high value diamine monomers**
SUPERVAL **SUstainable Photo-ElectRochemical VALorization of flue gases**
DAM4CO2 **Double-Active Membranes for a sustainable CO2 cycle**
MINICOR **MILD Combustion with Nitrogen and Carbon Dioxide Reforming**

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Portfolio Collaboration

Shared activities: Standardization, roadmaps, joint dissemination.

Example: Mi-Hy’s biofilm data could inform ECOMO’s diamine production.

"Portfolio synergy amplifies impact beyond individual projects."

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Market Insights

"Let the story evolve with stakeholder feedback."

Milan Triennale installation

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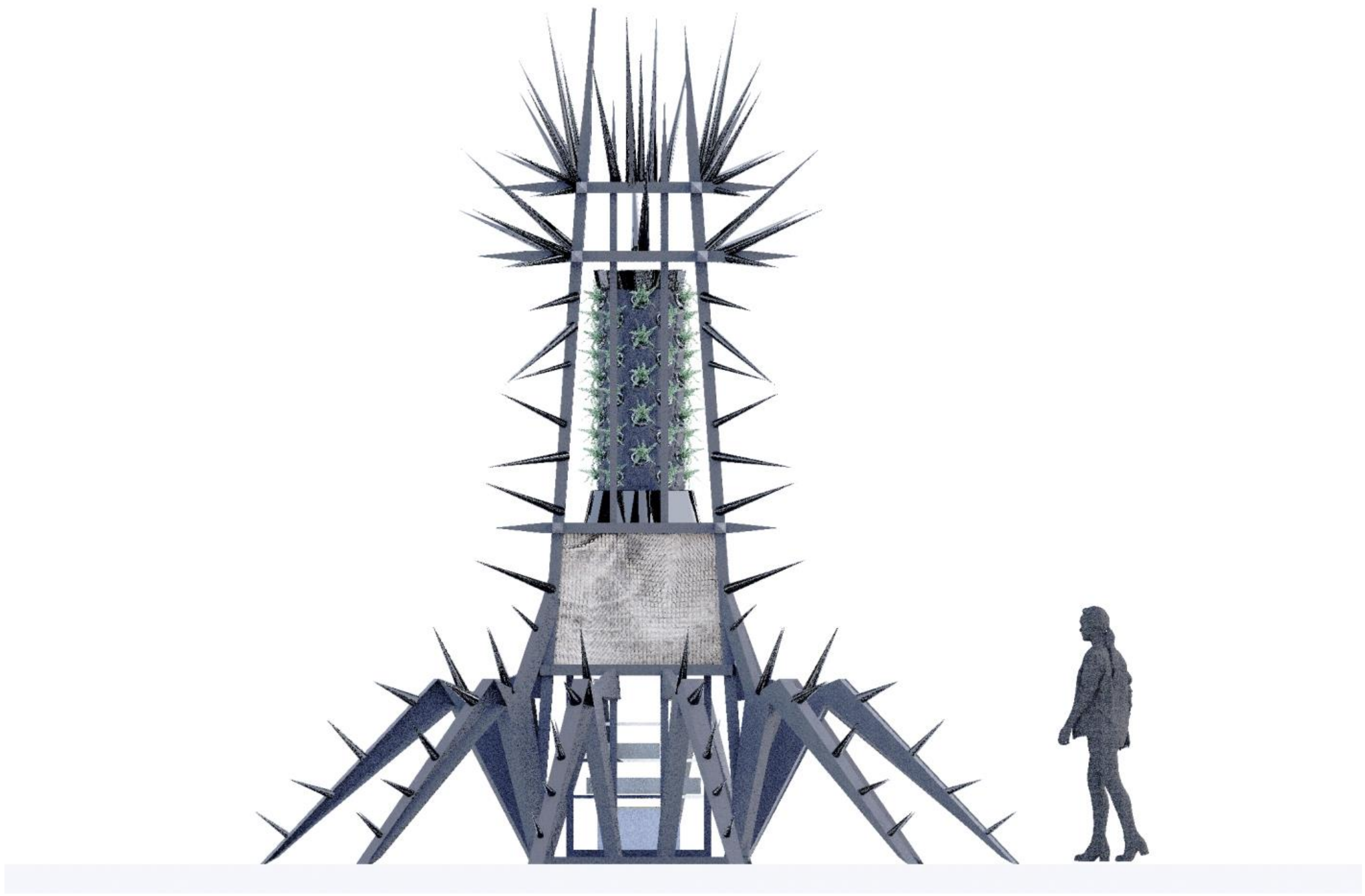
Spika: Mi-Hy @ Milan Triennale



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ACORN Booster Grant

Advancing Circular Economy with Bio-Based Solutions for CO2 & Nitrogen Management & Valorisation (ACORN)

Develop **business models** for commercial/industrial adoption of **bio-based products** in the **Carbon & Nitrogen Portfolio (CDNMVP)**, aligned with circular economy principles.

Key Challenges:

- Competing with **Haber-Bosch** (USD 205B industry) requires **distributed, sustainable alternatives**combining tech innovation, policy, and consumer behavior changes.

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Timeline and Next Steps

Now: Consortium agreements, pre-proposal feedback.

2025: Full proposal submission (aim for draft 2 weeks early).

2026: Kick-off (if successful).

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Key Advice

Story First: Frame your project as a *journey* with a clear "why."

Consortium Chemistry: Prioritize partners who share your vision, not just skills.

Portfolio Thinking: Explicitly state how you’ll collaborate with other projects.

Embrace Risk: Pathfinder rewards bold ideas—but show mitigation plans.

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Thank you

"Your tactics can make a difference, but your strategy—your commitment to a way of being and a story to be told and a promise to be made—can change everything."

— **Seth Godin, This Is Marketing: You Can't Be Seen Until You Learn to See**

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