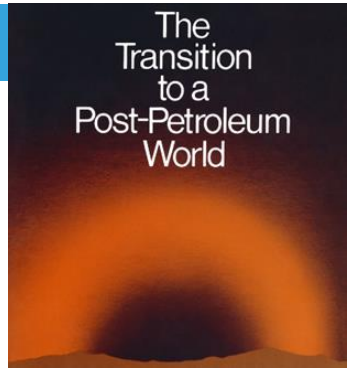
HIGHLIGHTS OF MICRO-ALGAE VALUE CHAIN DEVELOPMENT IN NW-EUROPE – IDEA PROJECT

Farmers' microalgae webinar – September 17th, 2020

Leen Bastiaens – VITO - Renewable compounds – Belgium

SUSTAINABLE RESOURCES

Petroleum based economy → **Sustainable/renewable feedstock**



Why needed?

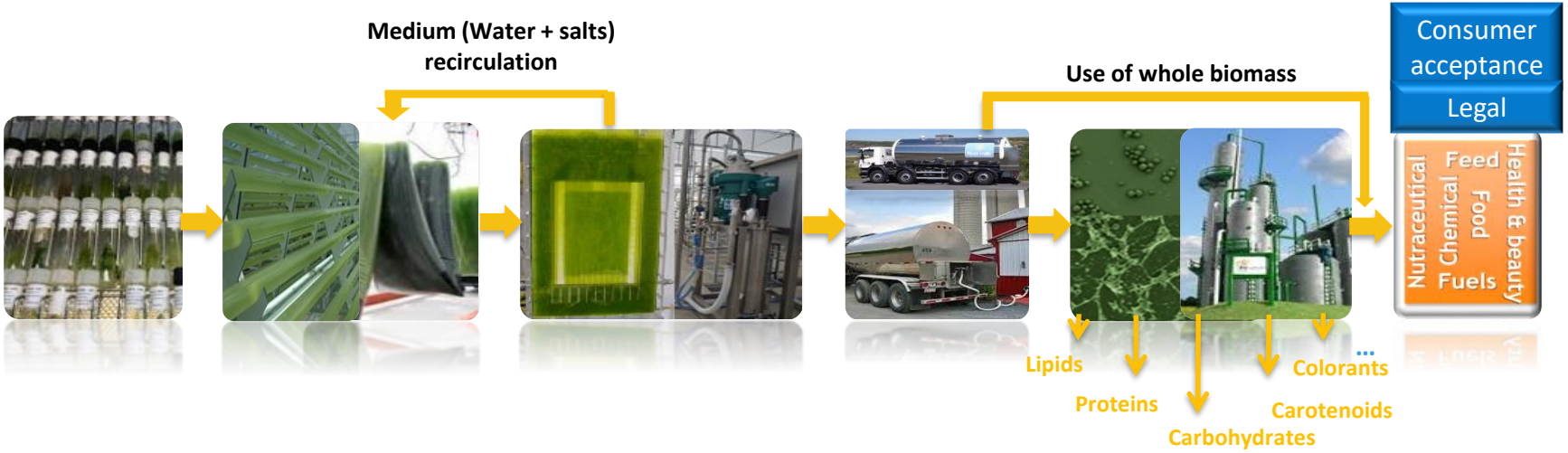
- Post-petroleum world
- Growing population → food!
- Reduce pressure on environment

Options?

- Non-petroleum based products
- Re-use of side-streams → circular economy
- Potentially biobased: insects, algae, …
- …

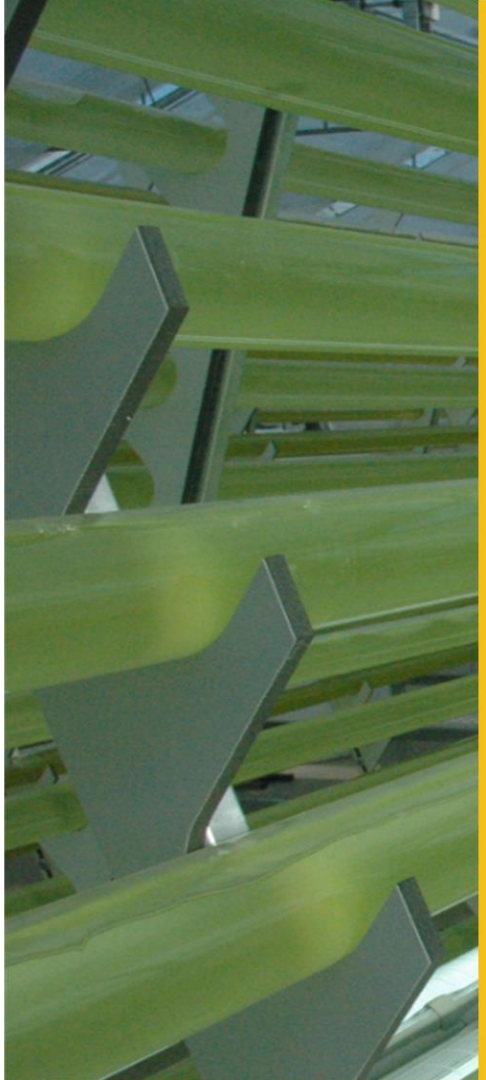
Algae have potential as feedstock for higher valuables (feed, food, cosmetics, …)

ALGAE VALUE CHAIN



Selection algal strains | **Algae growth** | **Preconcentration & Harvest** | **Preservation & logistics** | **Biorefinery (crude extracts + purification)** | **Formulation & applications**

Core VITO (incl. water recycling)



Implementation & Development of Economic Viable Algae-based value chains In NWE

IDEA CONSORTIUM

8+2 partners

Downstream market
Small → Larger amounts

Sector in development

Supply of sufficient stable quality algae biomass/ fraction

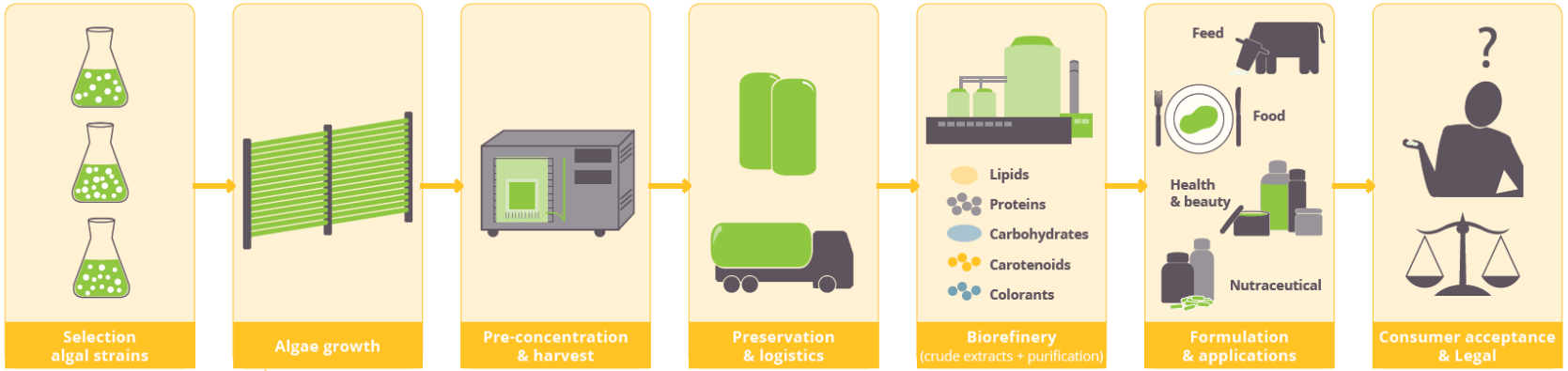
IDEA

Implementation and development of economic viable algae-based value chains

Scaling & sustainability

Competing price

Algae farms | Processing industry | Formulating industry



Economic viability

Specs higher valuables?

Increased year round production | Economically viable harvesting | Processing into marketable compounds | New sustainable products

Main objective

IDEA = Implementation & Development of Economic viable Algae-based value chains in NWE

Sub-objectives
1. Year-round algae production in NWE in a economic & sustainable way
2. Processing of algae biomass into marketable compounds
3. Concept of an algae value chain implementation plan
4. Long-term impact

IDEA CONSORTIUM

Title: Implementation & Development of Economic viable Algae-based value chains in NWEurope (IDEA)

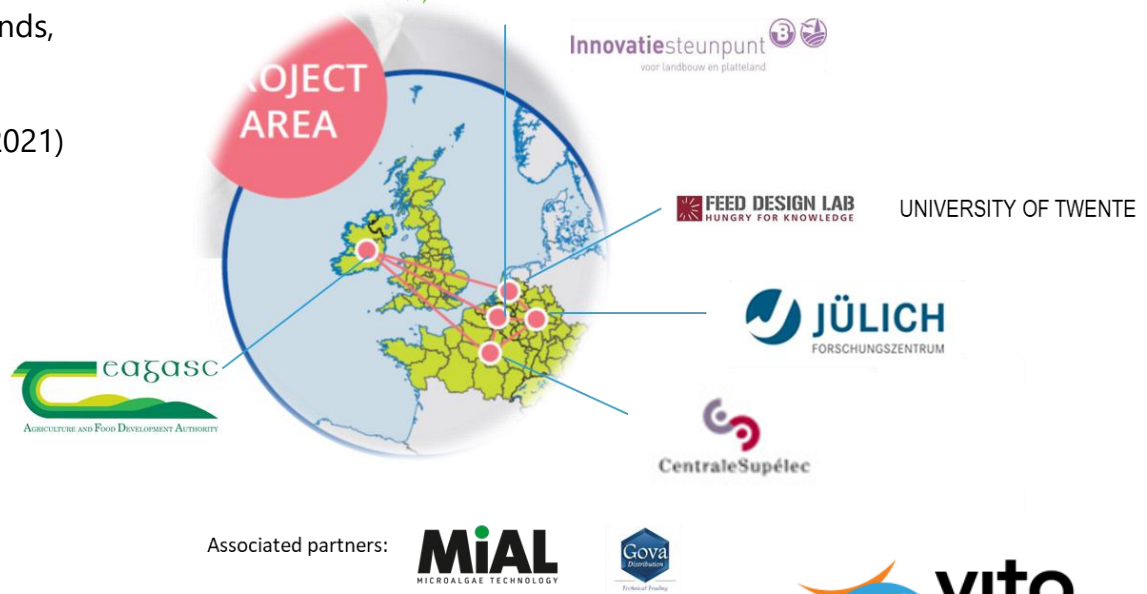
Consortium: 8 Full partners & 2 associated partners: Belgium, Germany, France, The Netherlands, Ireland

Duration: 9/2017 – 12/2020 (extended till 10/2021)

Project budget:
Total budget: 4.931.632 euro
Co-funding ERDF: 2.958.979 euro

Lead Partner: VITO

Website: www.nweurope.eu/idea



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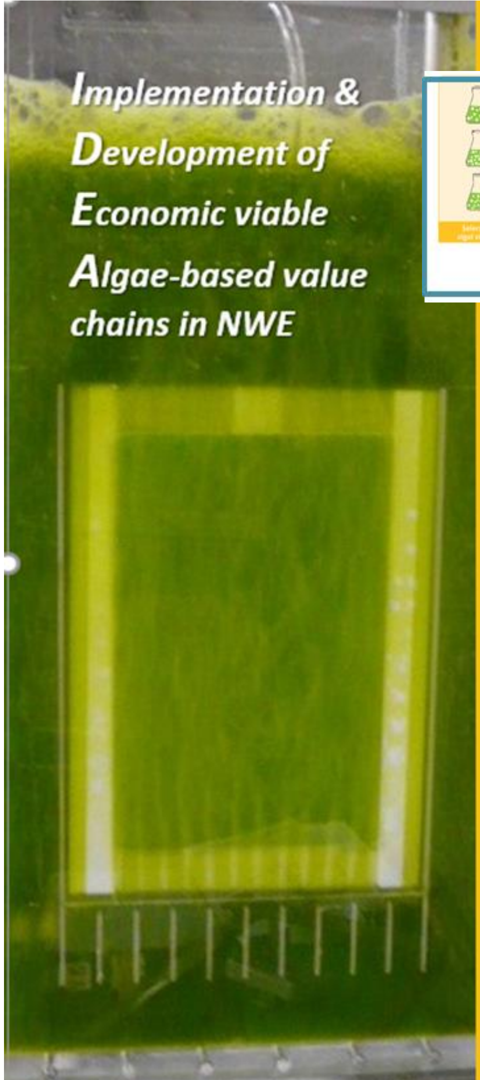

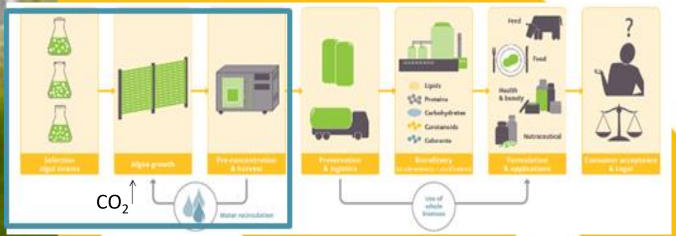

Interreg North-West Europe IDEA

European Regional Development Fund

1. Year-round algae production in NWEurope

A1-Algae adapted NWE climate

A2-Year-round production of algae biomass in NWE at pilot scale

A3-increasing the sustainability of algae growth & harvesting

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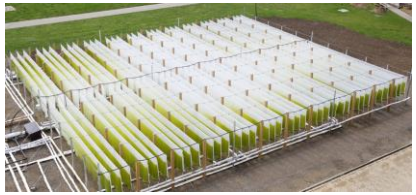
YEAR-ROUND CULTIVATION

ALGAE CULTIVATION INFRASTRUCTURE WITHIN IDEA

Germany



Greenwalls V-bags

3000 - 18000 L

Belgium - Sunbuilt

2*300 L – 2*1500 L

Tubular photobioreactors

Harvest & storage infrastructure

ALGAE SPECIES FOR YEAR ROUND PRODUCTION

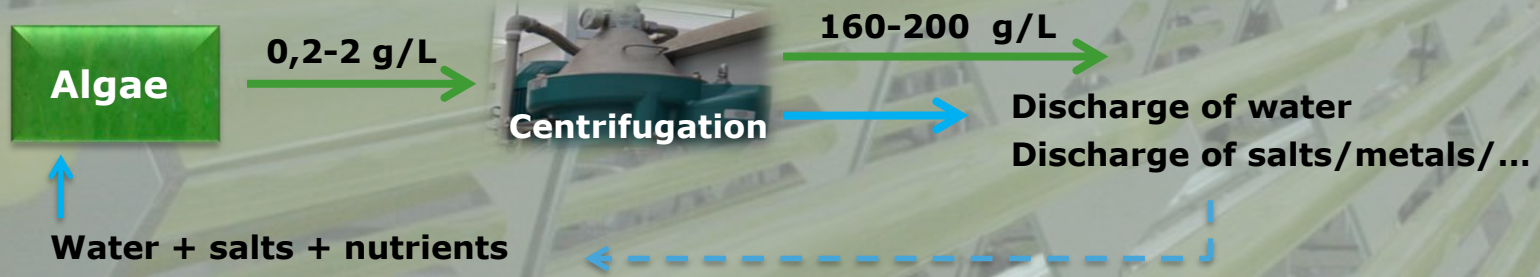
	FZJ-pilot (D)	TM/VITO-pilot (B)
		
Complemented with 'winter' strains	Mixed culture (*Chlorella Scenedesmus, Synechocistus*) – changing composition in function of the season	Alternation of algae set *Nannochloropsis* (spring/summer/autumn) *Porphyridium* (autumn/spring) *Chloromonas* (winter)

Algae in photobioreactors:

- >99,5 % water
- 0,05-0,2% DW algae

Harvesting = dewatering

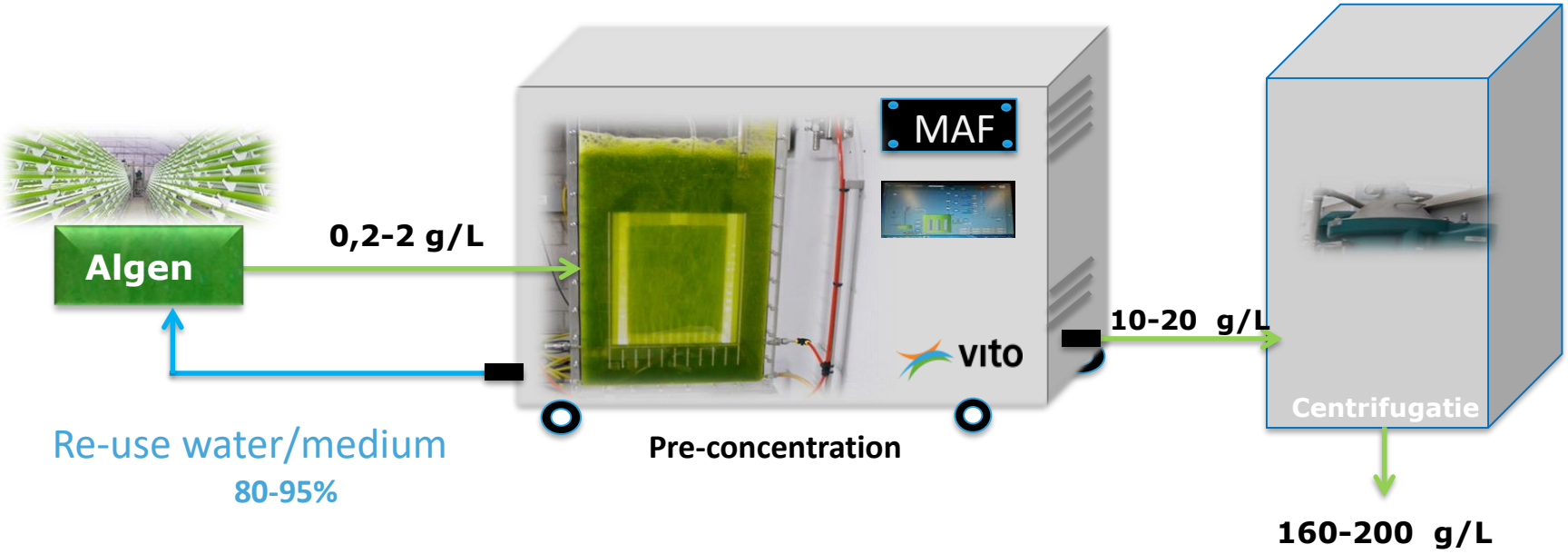
High water demand → recycling



INCREASING SUSTAINABILITY

INTEGRATED ALGAE HARVEST & MEDIUM RECYCLING TECHNOLOGY

MAF-technology = (mobiele) Membraan Algen Filtratie unit



MAF = Computer controlled submerged membrane based technology for integrated pre-harvesting of micro-algae and medium (water + salt) re-use = Device + software

MAF-TECHNOLOGY

MAF = Membrane algae filtration

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- water re-use: > 90 %
- Salt re-use: 90 %
- Algae densities reached: 10-20-30 g OM/L → > 60 g OM/L
- Continuous harvesting approach possible
- Turbidostat
- No negative impact of recycling on algae growth observed

CO_2 capture from air

UNIVERSITY OF TWENTE

Demonstration of MAF together with 'CO_2 capture from air system' → being planned.

Use within IDEA
- Screening performance with different algae species
- Continuous harvesting
- Upscaling

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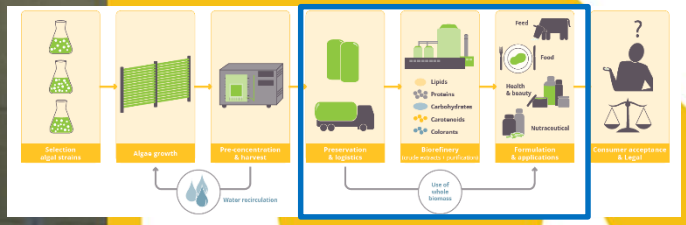
Implementation & Development of Economic viable Algae-based value chains in NWE



Interreg North-West Europe IDEA

2. From algae biomass to marketable products

A1 Preservation of algae biomass after harvest

A2 Fractionation via biorefinery

A3 Application tests & product formulation

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WET PRESERVATION OF ALGAE BIOMASS

Bridging gap between algae biomass production and its use in marketable compounds

Wet preservation:

- ‘ at algae farm’
- In storage vessels → till collection (like in milk sector)
- Impact: T, algae density, …
- Conclusion lab tests→ 8°C, up to a week
- Pilot tests ongoing

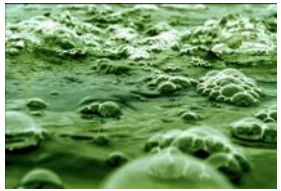
Algae species:

Nannochloropsis, Porphyridium, Chlorella

Storage vessels - cooled

BIOREFINERY OF ALGAE BIOMASS – SOME EXAMPLES

Nannochloropsis



Cascading biorefinery

- Lipid extract
- Defatted biomass

Lab to pilot

Porphyridium

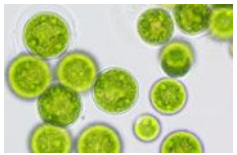
Cascading biorefinery

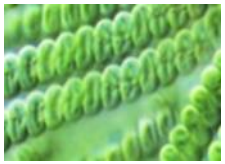
- EPS recovery
- Phycoerythrine
- Sugar enriched fraction
- Protein enriched fraction
- Oil extracts
- Defatted biomass

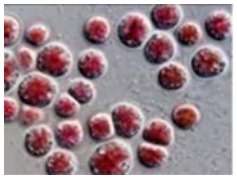
Lab to pilot

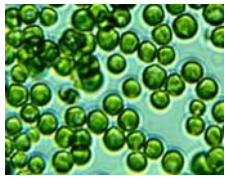
ALGAE BIOMASS PROCESSING – ENVISIONED APPLICATION DOMAINS

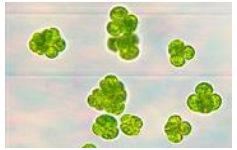
Microalgae

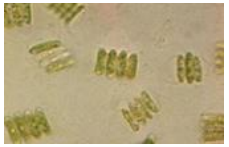

Nannochloropsis


Spirulina


Porphyridium


Chlorella


Chloromonas


Scenedesmus

Short value chain

Disruption

Long value chain

Fractionation & Purification

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cagasc

Applications

Feed

Food

Cosmetics

...

FEED DESIGN LAB HUNGRY FOR KNOWLEDGE

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MiAL MICROALGAE TECHNOLOGY

Gova Distribution Technical Trading

Open call

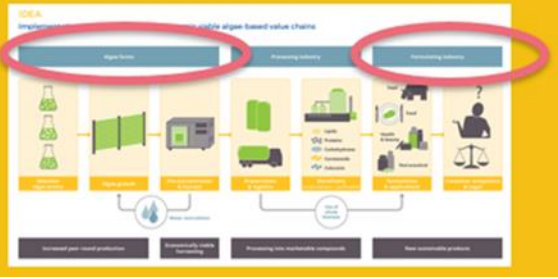
Implementation &
Development of
Economic viable
Algae-based value
chains in NWE

3. Algae value chain implementation plan

A1 Assessment of logistic and techno-economic aspects

A2 Platform for linking demand and offer of algae (fractions)

A3 Roadmap towards implementation algae value chain



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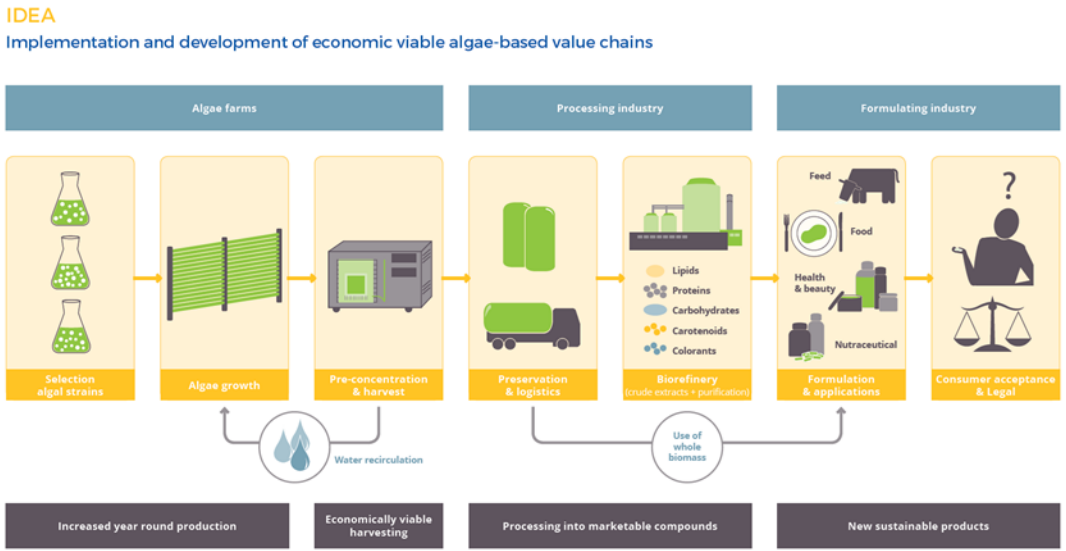
To enable algae value chains, clear applications are required!!

TAKEHOME MESSAGES

- IDEA considers & links different aspects of the algae values chain → interdisciplinary
- To establish algae value chains:
  - Clear marketable products are required
  - Collaborations will be necessary
  - High value compounds are to be targeted → Flagship markets aquaculture, cosmetics, pet food, …



THANK YOU !

- **IDEA consortium:**

- **Interreg NWE**

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