

Seaweed-based products *for decarbonization*

A synthesis of where seaweed can deliver durable mitigation — and the key actions needed to get there.

PRESENTER

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VENUE

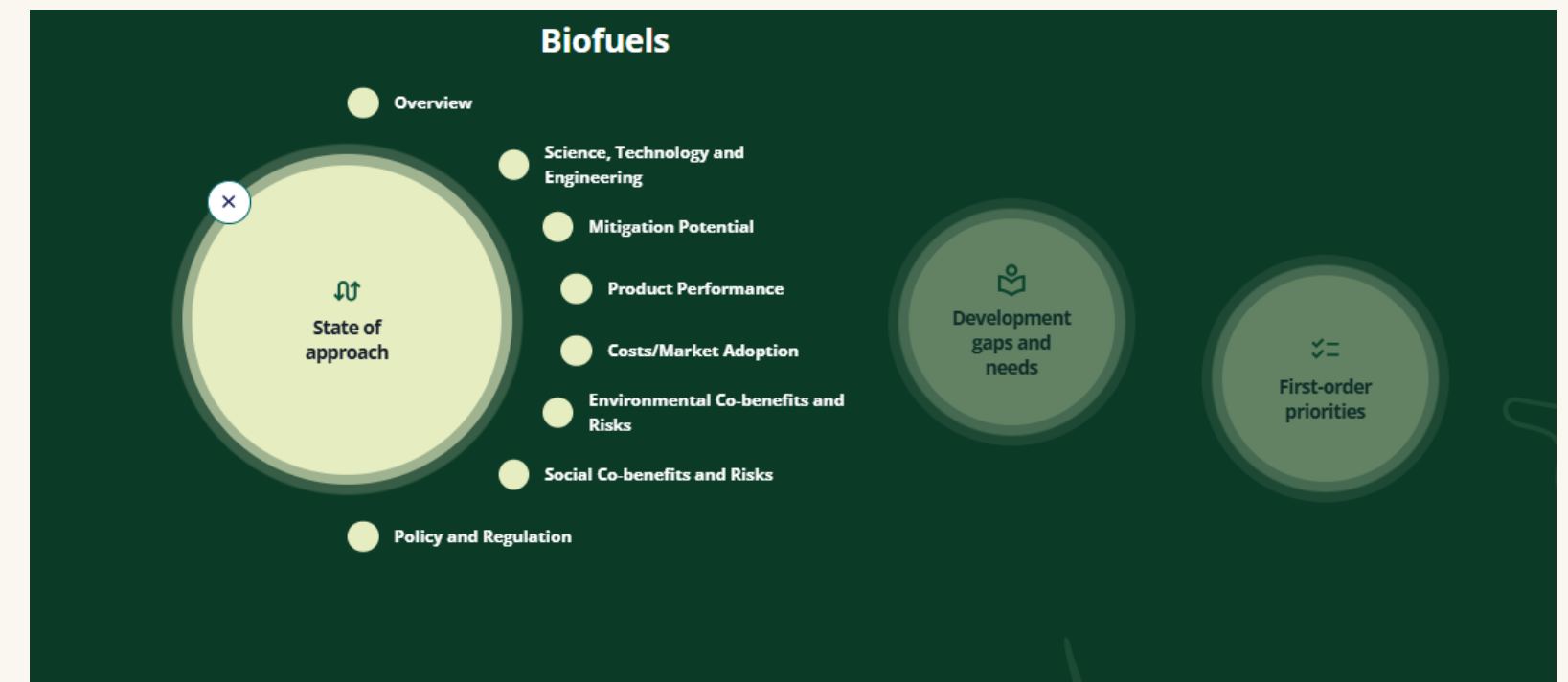
Seagriculture EU 2026

ROADMAP LAUNCHED

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A living, expert-reviewed synthesis of the seaweed decarbonization landscape.

- A digital resource — designed to help stakeholders identify where seaweed-based products can deliver meaningful decarbonization, and what they can do to scale them responsibly.
- Synthesizes current readiness, development gaps and needs and first order priorities for each product pathway.
- Updates as advances occur in science, technology, markets, and policy.



What we mean by “mitigation potential.”

i **Assessment of deployment at scale**

We score the abatement available in a 2050 scenario where the product is deployed at scale.

ii **LCA-grounded where evidence exists.**

Drawn from cradle-to-grave studies in the published literature; flagged where only lab models or partial LCAs are available.

iii **Assumptions made explicit.**

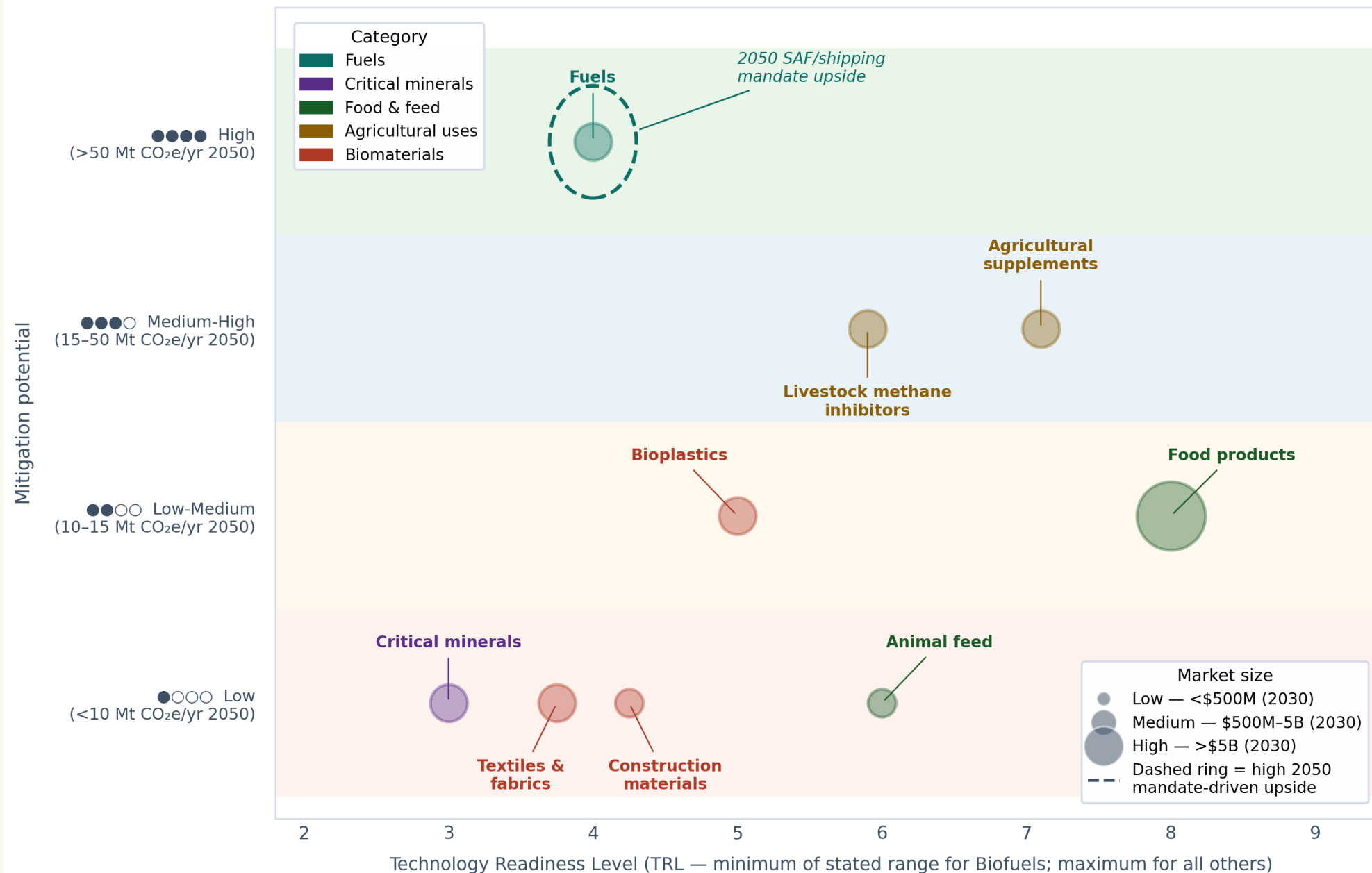
LCAs make assumptions of current and projected conditions; unknowns; assumptions are laid out

RATING SCALE

●●●●	High	>50 Mt CO ₂ e/yr 2050
●●●○	Medium-High	15–50 Mt CO ₂ e/yr 2050
●●○○	Low-Medium	10–15 Mt CO ₂ e/yr 2050
●○○○	Low	<10 Mt CO ₂ e/yr or no data

Figure 1 — TRL vs 2050 Mitigation Potential, with 2030 Market Size: Product Stream Positioning

Each bubble represents a product stream positioned by its current Technology Readiness Level (x-axis) and 2050 mitigation potential ceiling (y-axis). Y-axis: ●●●● High = >50 Mt CO₂e/yr 2050 · ●●●○ Medium-High = 15–50 Mt CO₂e/yr · ●●○○ Low-Medium = 10–15 Mt CO₂e/yr · ●○○○ Low = <10 Mt CO₂e/yr 2050. Bubble size = 2030 seaweed-specific market size. Dashed ring = significant 2050 upside from SAF/shipping mandates (ReFuelEU, IMO). Ratings from roadmap LCA sections and published scenario analyses.



Construction materials downgraded to Low: no commercial concrete filler market exists and no cradle-to-grave LCA published. Agricultural supplements upgraded to Medium-High (2050 Scenario B: 5–17 Mt CO₂e/yr; Li et al., 2022; TNC/Bain, 2023). Biofuels upgraded to High: ~70 Mt CO₂e/yr under IMTA conditions (Czyrnek-Delètre et al., 2017). Cross-cutting streams (Biorefineries, Cultivation & Drying) carry no mitigation rating as upstream enablers.

- Biofuels can provide significant emissions reductions at scale but are at low TRL
- Agricultural uses can provide meaningful emissions in the short to medium term but have regulatory barriers.
- Other uses may have lower emissions reduction impact but can play a role in regenerating ecosystems and increasing the salience of seaweed products if developed responsibly.

2050 upside (SAF / IMO)

Bubble size $\propto$ 2030 market

The same four bottlenecks show up across nearly every product pathway.

01 · SCIENCE & ENGINEERING

Strain, Processing, Yield.

- Strains and species are not tailored to specific products
- Conversion yields remain too low for commercial viability
- Offshore cultivation is unproven at scale and potentially nutrient-limited

02 · REGULATORY

Approvals are slow and fragmented.

- Farm permitting is slow, fragmented, and inconsistent across jurisdictions
- Product approval pathways lack regulatory clarity — e.g. livestock methane inhibitors as feed additives

03 · EMISSIONS AND ENVIRONMENTAL IMPACT

Lack of end-to-end LCAs

- End-to-end LCAs are absent for most scaled-up processes
- Lack of standardized parameters in LCA from real-world settings
- Key processes carry high emissions that remain unaddressed (e.g. drying)

04 · MARKETS AND SUPPLY CHAINS

Markets are under- developed

- Seaweed products cannot yet compete on cost with conventional alternatives
- Weak demand signals for low-carbon products
- Processing and distribution infrastructure for low-carbon seaweed products is nascent

We're scoping work around key challenges that would accelerate progress in multiple workstreams

A

LCA development

Develop life cycle inventory datasets tailored to seaweed systems; Develop frameworks for claim credibility (substitution effects, system boundaries etc.)

B

Emission hotspots

Drying dominates lifecycle emissions across nearly every stream. Funding development of high-throughput low-energy dewatering and drying approaches for when wet processing is not possible

C

Addressing cultivation challenges

Supporting the early development of technologies that can drop cultivation costs

D

Demand Pull Mechanisms

Develop analysis on pull mechanisms such as advance market commitments and prizes to stimulate innovation



THANK YOU

Feedback is appreciated!

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