

# The Digest's 2026 Multi-Slide Guide to Mobile Algae Cultivation Systems

No mobile deployment is evidenced; moving cannot supply the light, land, water or CO<sub>2</sub> that cultivation requires.

# Mobility looked economically attractive; the evidence base tells a narrower story

## The proposed value

- Mobile algae systems were proposed for distributed CO<sub>2</sub> capture, feedstock production and aquaculture support; these remain proposed applications, not documented deployments.
- Relocation creates value only if access to a new resource outweighs transport, setup, lost production time and renewed permitting.
- A movable module must still earn its return from product value per acre after land, water, CO<sub>2</sub> and harvesting costs.

## The observed record

- The research Library found no operating mobile algae installation, vendor deliverable, capital cost or measured productivity. This Library-wide absence does not establish that none exists elsewhere.
- At demonstrated fuel productivity of 1,500–2,500 gal/acre/year, 1 million gal/year requires roughly 400–670 acres; an 8 × 48 ft module occupies about 0.009 acre.
- The closest long-running US specialty example, Cyanotech, is fixed and site-advantaged. Its September 2025 filing reports \$649,000 cash and going-concern uncertainty.

## The supported conclusion

- Mobility supplies no additional sunlight, illuminated area, water or CO<sub>2</sub> access: the inputs governing cultivation remain tied to the site.
- The road-limited footprint and relocation downtime add constraints rather than relieve the acreage requirement; no positive mobile operating loop has been demonstrated.
- Cyanotech's financial distress may reflect market or balance-sheet factors, not cultivation physics. It offers no evidence for mobile cultivation economics.

## Takeaway

**Do not underwrite mobile algae cultivation on the current record. Reconsider only after a real deployment reports full-season output, relocation economics and a workable permit pathway; assess fixed specialty cultivation on margin and balance-sheet strength.**

# A decade of mobile algae promises



## Three proposed uses, no verified deployment

- Industrial CO<sub>2</sub>: movable cultivation was proposed beside emission sources so algae could consume supplied carbon dioxide; the Library does not substantiate the concept's CO<sub>2</sub>-capture framing.
- Feedstock production: relocatable units promised biomass near changing demand, but moving a unit does not bring the illuminated area needed to grow it.
- Aquaculture support: on-site cultivation was proposed near fish farms; specific aquaculture-feed applications are not supported by the Library.
- These were proposed applications, not documented operating cases. The research found no operating mobile algae installation, vendor deliverable, capital cost or measured productivity.

The appeal of mobility was proximity to dispersed users and resources. None of the proposed applications establishes that relocating cultivation improves output or economics; the deployment record needed to test that premise is absent from the Library.

# The deployment record is empty



## What the Library could verify

- No operating mobile algae cultivation installation was located in the Library-wide research.
- No vendor deliverable, capital cost figure, or measured productivity result was found for a mobile algae system.
- The closest bioeconomy analogue—transportable fast pyrolysis—appears only as a design study, not an operating deployment.
- This is a negative finding within the Library, not proof that no mobile algae system exists anywhere. Claims about deployed applications remain unsupported.

The available evidence does not establish a deployment record for mobile algae cultivation. Without an operating installation or measured results, claims about its deployed applications cannot be substantiated.

# The moving-factory test: mobility must earn its keep

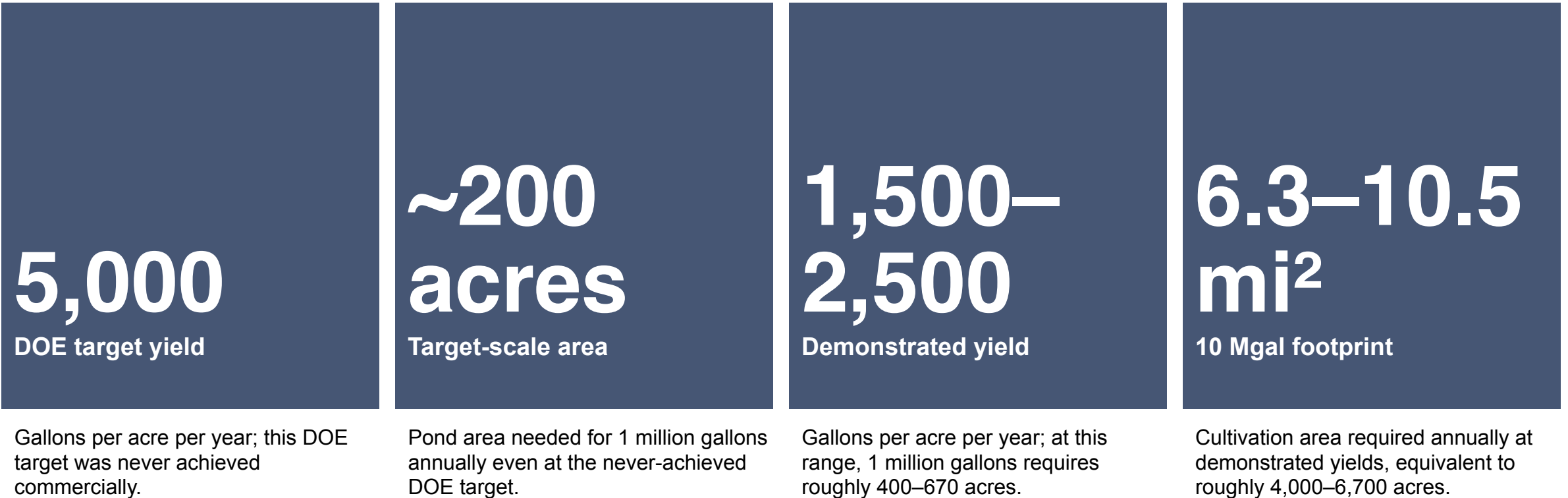


## The tests a mobile unit must pass

- Measure full-season areal productivity, not peak output, and calculate product value per acre after land, water, CO<sub>2</sub> and harvesting costs.
- Price the entire relocation cycle: shutdown, transport, setup, lost production and any new permits. Report its duration and the unit's utilization across repeated moves.
- Identify a seasonal, immovable resource valuable enough to justify relocation. Show that access to it increases net returns compared with staying at the best fixed site.
- Demonstrate a permitting pathway that travels with the unit rather than restarting at each site; account for road-legal dimensions and any oversize-load delays.
- Document an actual move and subsequent production. A unit that does not move in its first year is effectively a fixed plant that paid for wheels.

Mobility is an economic capability, not a feature of the equipment. No mobile algae deployment in the Library supplies the operating data needed to show that relocation creates net value.

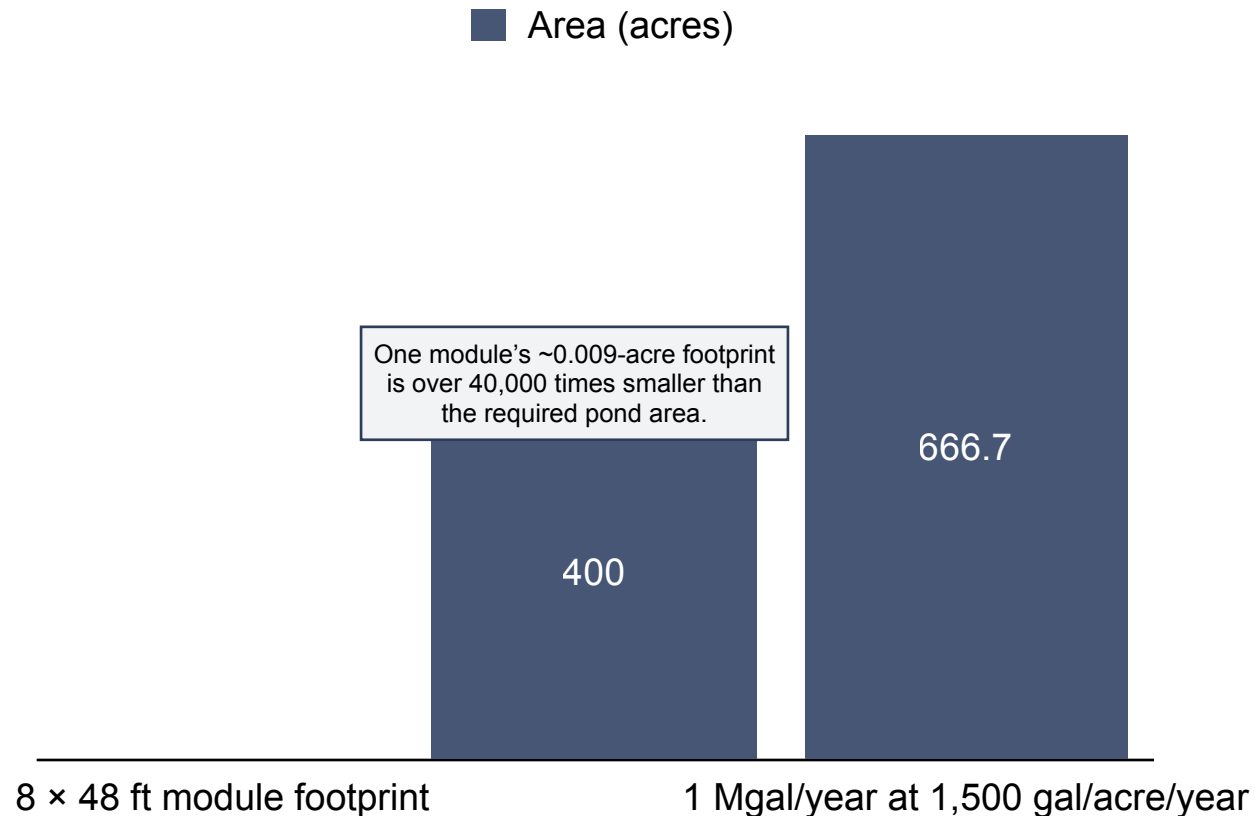
## A process measured in acres



Illuminated area is the binding scale variable: demonstrated yields require 400–670 acres for just 1 million gallons annually. Mobility cannot supply that land; these fuel-denominated figures do not imply specialty products need the same acreage.

# What fits on a road versus what the process requires

Cultivation area for 1 Mgal/year versus one road-legal module (acres, logarithmic scale)



## The footprint mismatch

- An 8 × 48 ft transportable module occupies ~384 sq ft, or ~0.009 acre of horizontal footprint.
- At demonstrated 1,500–2,500 gal/acre/year, 1 Mgal/year requires ~400–670 acres of cultivation.
- Matching that area would take roughly 45,000–76,000 module footprints; this derived comparison ignores vertical photobioreactor stacking.
- Loads near 14–16 ft wide and 14–15 ft tall approach superload permitting, potentially adding days to a month per move.
- A module produces nothing during relocation; transport expands neither its illuminated footprint nor the land available at its destination.

## The footprint mismatch

A standard 8 × 48 ft module occupies about 0.009 acre, while producing 1 million gallons annually at demonstrated areal productivity requires roughly 400–670 acres. Moving the module cannot bridge that area gap, and larger loads bring additional permitting and downtime.

# What stays behind when the unit moves

## 1. Insolation

- Sunlight intensity and daylight hours depend on latitude, weather and season—not equipment mobility.
- Moving to a sunnier site may change exposure, but transport and setup stop production during the move.
- A trailer cannot create additional sunlight at either location.

## 3. Water access

- Cultivation requires a suitable freshwater or seawater supply at each operating site.
- Intake, replenishment and spent-water handling remain site-specific requirements after relocation.
- Cyanotech's fixed location benefits from seawater access; moving a unit does not move that resource.

## 2. Illuminated area

- Biomass output depends on the cultivation area receiving usable light.
- At demonstrated fuel productivity, 1 million gallons per year requires roughly 400–670 acres of cultivation.
- An 8 × 48 ft module occupies about 0.009 acre; that footprint comparison excludes vertical stacking.

## 4. CO<sub>2</sub> proximity

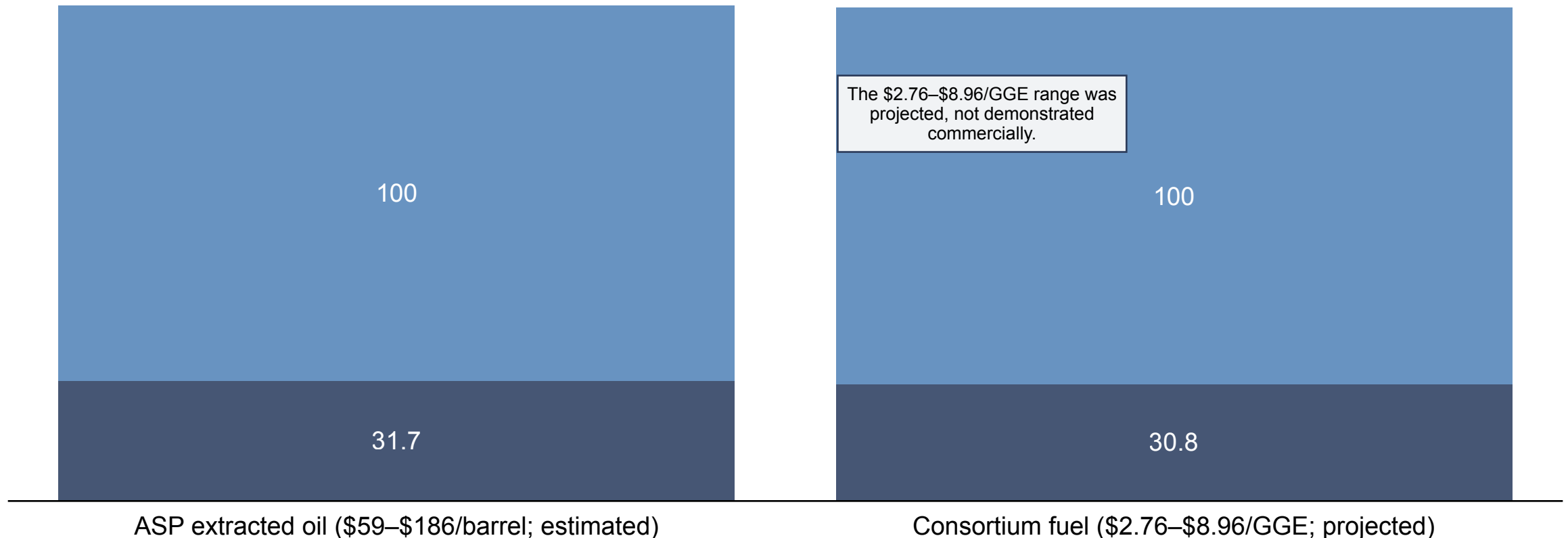
- Carbon supply depends on a usable source and delivery infrastructure at the operating site.
- Relocation cannot carry an industrial CO<sub>2</sub> source or guarantee equivalent access at the next stop.
- Any claimed CO<sub>2</sub> co-location benefit requires evidence for each proposed site; mobile capture is not established here.

**A trailer can move cultivation equipment, but not the light, acreage, water or CO<sub>2</sub> supply that determine its output. Relocation adds downtime and setup without relieving these site-bound constraints.**

# The commodity cost record never closed the gap

Historical extraction costs and later modeled fuel costs do not establish a commercially demonstrated commodity pathway. DOE no longer publishes algae-specific cost or productivity targets, but that change is not evidence of program cancellation or proof that algal fuel is inherently uneconomic.

■ Lower endpoint (% of own upper endpoint) ■ Upper endpoint (% of own upper endpoint)



# Cyanotech: the best-sited specialty producer, and it is fixed

Cyanotech pairs strong sunlight and seawater access with a high-value algae product, yet its September 2025 filing raised going-concern doubts. Its fixed-site experience offers no evidence that mobility improves cultivation economics.



## Cyanotech overview

- Long-running, publicly reporting US open-pond algae producer.
- Cultivation is fixed at a site with strong sunlight and seawater access.
- Sells high-value astaxanthin rather than commodity algal fuel.
- Its cultivation model does not use relocatable production units.

## Financial pressure despite site advantages

- Revenue was 32.7% below its FY2022 peak, challenging the assumption that a specialty product and favorable site ensure resilience.
- Its September 30, 2025 Form 10-Q reported \$649,000 in cash and explicitly raised going-concern concerns.
- Financial distress cannot be assigned solely to cultivation: nutraceutical demand, pricing and balance-sheet pressures may contribute.

## Implication for deployment choice

- Evaluate fixed specialty cultivation on realized product margins, cash runway and financing needs alongside measured pond productivity.
- Treat strong insolation and seawater access as site-specific advantages that a mobile unit would leave behind when relocating.
- Do not cite Cyanotech as proof of mobile viability: it is a fixed producer, and the evidence contains no operating mobile analogue.

# Alternative explanations for Cyanotech's distress

Cyanotech's distress is real, but its cause is not established by the cited financial indicators. Its case supports cautious underwriting of fixed specialty cultivation—not a claim that cultivation physics failed or that mobility would improve results.

## Market and financing pressures

- Cyanotech sells specialty astaxanthin, not commodity fuel; demand and pricing in nutraceutical markets can affect revenue independently of pond productivity.
- Revenue fell 32.7% from its FY2022 peak, but that figure alone cannot separate weaker sales from changes in cultivation yield.
- Its 30 September 2025 10-Q reported \$649,000 in cash and explicit going-concern language, pointing to material financing and liquidity risk.
- The available figures do not establish whether cultivation performance, product margins, debt obligations or market conditions drove the decline.

## Fixed-site strengths remain distinct

- Cyanotech's open ponds benefit from a fixed location with strong insolation and access to seawater; those resources cannot travel with a cultivation unit.
- Going-concern language shows that favorable geography does not guarantee a resilient specialty-algae business model.
- Cyanotech is not a mobile operator, so its financial difficulties provide no measured evidence of mobile cultivation performance.
- Assess fixed producers using full-season output, product margin and balance-sheet resilience; do not infer a technology failure from financial distress alone.

# The route that escaped the area constraint: gas fermentation

Solar Foods' announced scale-up points toward a large fixed indoor plant, not distributed mobile production. Gas fermentation is a comparison, not proof that algae can achieve the same economics.

## Centralization replaces illuminated acreage

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- Solar Foods operates a 160-tonne-per-year facility and plans a single 12,800-tonne-per-year plant—an 80-fold increase in stated annual capacity, rather than replication of small sites.
- Reported investment divided by annual nameplate capacity falls from roughly €262 to €10.5 per kg (derived). Project assumptions differ; treat the figures as directional, not a like-for-like realized-cost comparison.
- Gas fermentation uses enclosed production rather than sunlight-driven cultivation, avoiding algae's dependence on illuminated horizontal acreage. The proposed expansion concentrates capacity at one site instead of making production mobile.
- This is not evidence about algae productivity or mobile algae economics. It illustrates a competing architecture: escaping an area constraint can favor indoor scale and centralization, not relocation.



# When mobility could matter



## Conditions for a viable relocation

- A seasonal resource must be valuable, immovable and unavailable year-round at one site; moving must improve access enough to offset the costs of relocation.
- A permitting pathway must remain valid across destinations rather than restarting approvals at every site. The Library establishes no such pathway for mobile algae cultivation.
- Relocation benefits must exceed transport, setup, idle time and re-permitting costs while preserving productive utilization. No operating mobile algae deployment supplies measurements for this test.
- The Library documents no bioeconomy example combining a seasonal, immovable resource with transferable permission. Brevel, Algenuity, Phycoil, aquaculture-feed and ornamental-market claims are not substantiated here.
- Contamination rates and specific EPA discharge, USDA aquaculture and FDA novel-food approval pathways are also unsupported; none can be assumed to make relocation feasible.

Mobility is a conditional economic option, not an advantage by itself. Without a documented seasonal resource, portable authorization and a relocation benefit greater than its costs, there is no evidenced case for moving algae cultivation.

# What a credible mobile proposal must show

No operating mobile algae deployment or measured relocation economics appears in the Library. A proposal becomes credible only when full-season output, the complete cost of moving, and a portable site-access pathway demonstrate more value than fixed cultivation.

|                | Prove cultivation economics                                                                                                                                                                                                                                                                                                                                                                                                       | Prove relocation economics                                                                                                                                                                                                                                                                                                                                                                        | Prove the reason to move                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Key Activities | <ul style="list-style-type: none"> <li>• Measure actual output over complete seasons in gal/acre/yr or an equivalent area-normalized unit; report downtime and variability, not just peak yields.</li> <li>• Calculate product revenue per acre against land, water, CO<sub>2</sub> supply and harvesting costs.</li> <li>• State the illuminated area available after accounting for the road-legal module footprint.</li> </ul> | <ul style="list-style-type: none"> <li>• Price transport, disassembly, setup, commissioning and any production lost during each move.</li> <li>• Measure utilization across the entire operating-and-relocation cycle rather than only while the unit is cultivating.</li> <li>• Show that incremental value at the next site exceeds relocation expense and lost contribution margin.</li> </ul> | <ul style="list-style-type: none"> <li>• Identify a seasonal, immovable resource whose value cannot be captured as effectively by a fixed installation.</li> <li>• Document whether cultivation, water-use and discharge permissions transfer with the unit or restart at every site.</li> <li>• Demonstrate repeatable access to sunlight, land, water and CO<sub>2</sub> at each destination; none travels with the module.</li> </ul> |
| Deliverables   | <ul style="list-style-type: none"> <li>• Full-season areal productivity dataset</li> <li>• Product value and net margin per acre</li> </ul>                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Itemized move budget and schedule</li> <li>• Cycle-wide utilization and output record</li> </ul>                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• Named seasonal resource and site agreements</li> <li>• Documented permitting pathway</li> </ul>                                                                                                                                                                                                                                                                                                 |

# Where algae cultivation belongs today

Fixed, site-advantaged specialty cultivation is the only observed architecture, not proof that every fixed producer is financially sound. Investment decisions should rest on demonstrated full-season output, product margins and balance-sheet strength; mobility has no evidenced advantage.

## The evidenced production envelope

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- Fixed, site-scale ponds at an exceptional sunlight-and-seawater location are the observed model; no operating mobile algae cultivation deployment was found in the Library.
- High-value specialty products, such as astaxanthin, offer a different revenue proposition from commodity fuel, whose commercial cost and productivity projections remain undemonstrated.
- Insolation, illuminated area and full-season areal productivity determine output. Relocating equipment does not increase sunlight or supply cultivation acreage.
- Site-specific water and potential CO<sub>2</sub> access remain tied to geography; moving a unit forfeits rather than transports those advantages.

## What determines investment quality

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- Underwrite specialty producers on realized product margin per acre after land, water, carbon supply and harvesting costs—not on a claimed ability to relocate.
- Test balance-sheet resilience alongside cultivation output: fixed producer Cyanotech reported \$649,000 cash and going-concern language in its September 2025 10-Q.
- External conditions include site quality and specialty-product demand; DOE no longer publishes separate algae cost, productivity, land or water targets.
- Management controls product selection, site choice, operating costs and capital structure. Those decisions can improve returns without changing the acreage constraint.

# Executive takeaway: hold, do not fund mobile algae cultivation

The Library found no operating mobile algae installation or measured mobile output. At demonstrated fuel productivity, 1 million gallons a year requires roughly 400–670 acres; moving a road-limited module does not supply that area.

## Decision on mobility

- Do not fund mobile algae cultivation on current evidence. Hold the guide rather than present an unverified deployment envelope as established practice.
- Require measured full-season areal productivity and product value per acre after land, water, CO<sub>2</sub> and harvesting costs—not peak output alone.
- Demand relocation cost, cycle time and utilization across moves; transport, setup and downtime must be outweighed by a quantified benefit.
- Require a named seasonal, immovable resource and a permitting pathway that travels with the unit. Neither is demonstrated in the Library.

## Underwrite what exists

- Evaluate fixed, site-advantaged specialty cultivation on product margin, water and CO<sub>2</sub> access, and balance-sheet resilience—not on hypothetical mobility.
- Cyanotech is fixed and sells specialty astaxanthin, yet its September 2025 filing includes going-concern language; its distress does not establish a failure of cultivation physics.
- Treat the absence of mobile installations as a Library-wide negative finding, not proof that none exist anywhere.
- Revisit funding only after an operating mobile deployment discloses full-season output and documented relocation economics.

**Evidence favors no mobile deployment today; fixed site-scale specialty cultivation is the only observed form, and even that requires careful financial underwriting. Mobility becomes investable only when measured output and relocation economics demonstrate a benefit that exceeds the costs of moving.**