Feed The World With Algae

The Harvesting Breakthrough That Makes It Possible

Breakthrough water cleanup technology for oil & gas, algae and other water-intensive industries

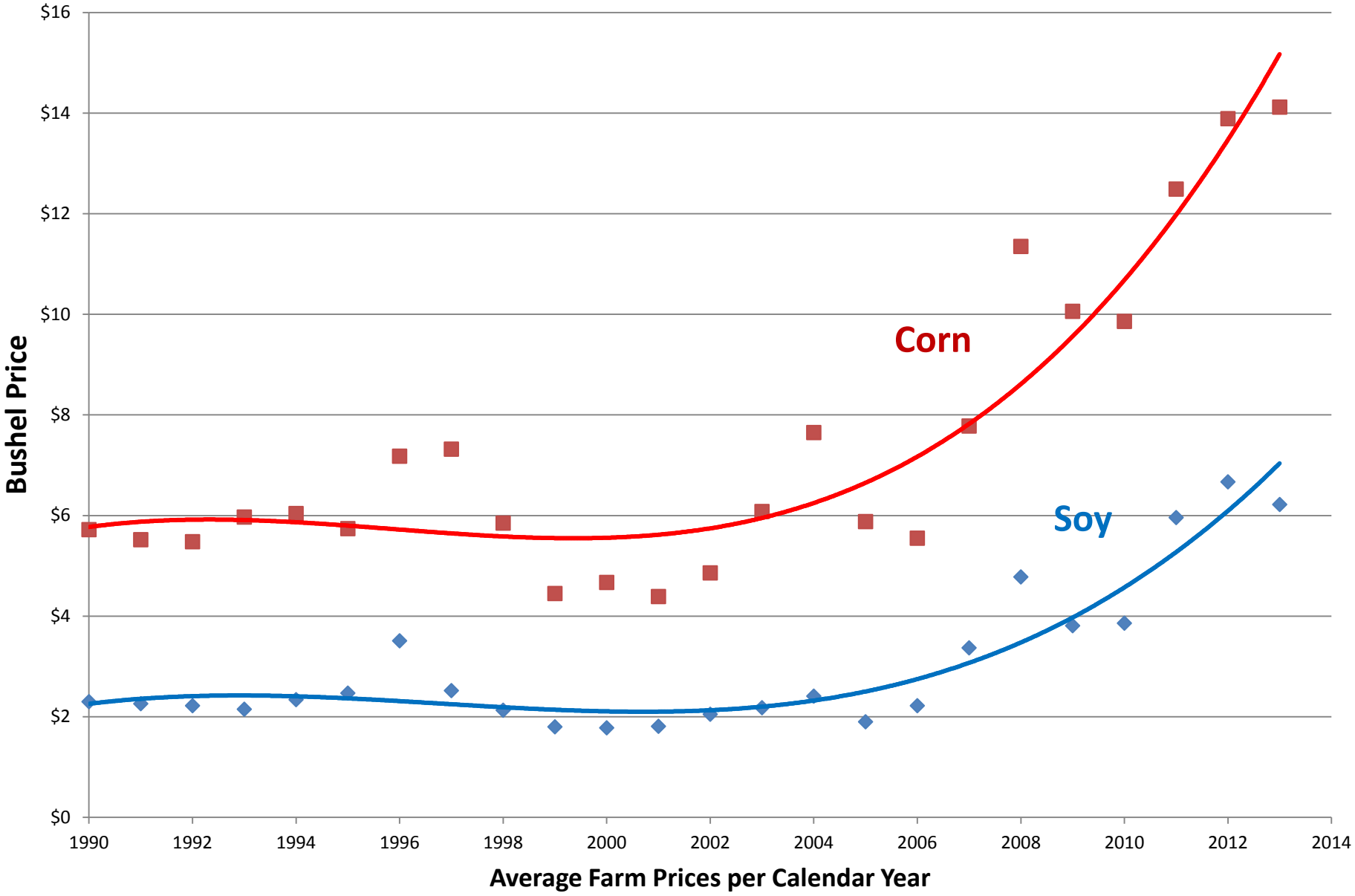
Animal Feed Shortages

- Ethanol mandate now using 40% of US corn.
- Livestock farmers face mounting losses as feed costs rise - Reuters
  - Feed accounts for 60 — 70% of the costs for animal production.
- Heat and water stress could reduce yields by 25% in the 2030 to 2049 period.

Feed Vs. Food

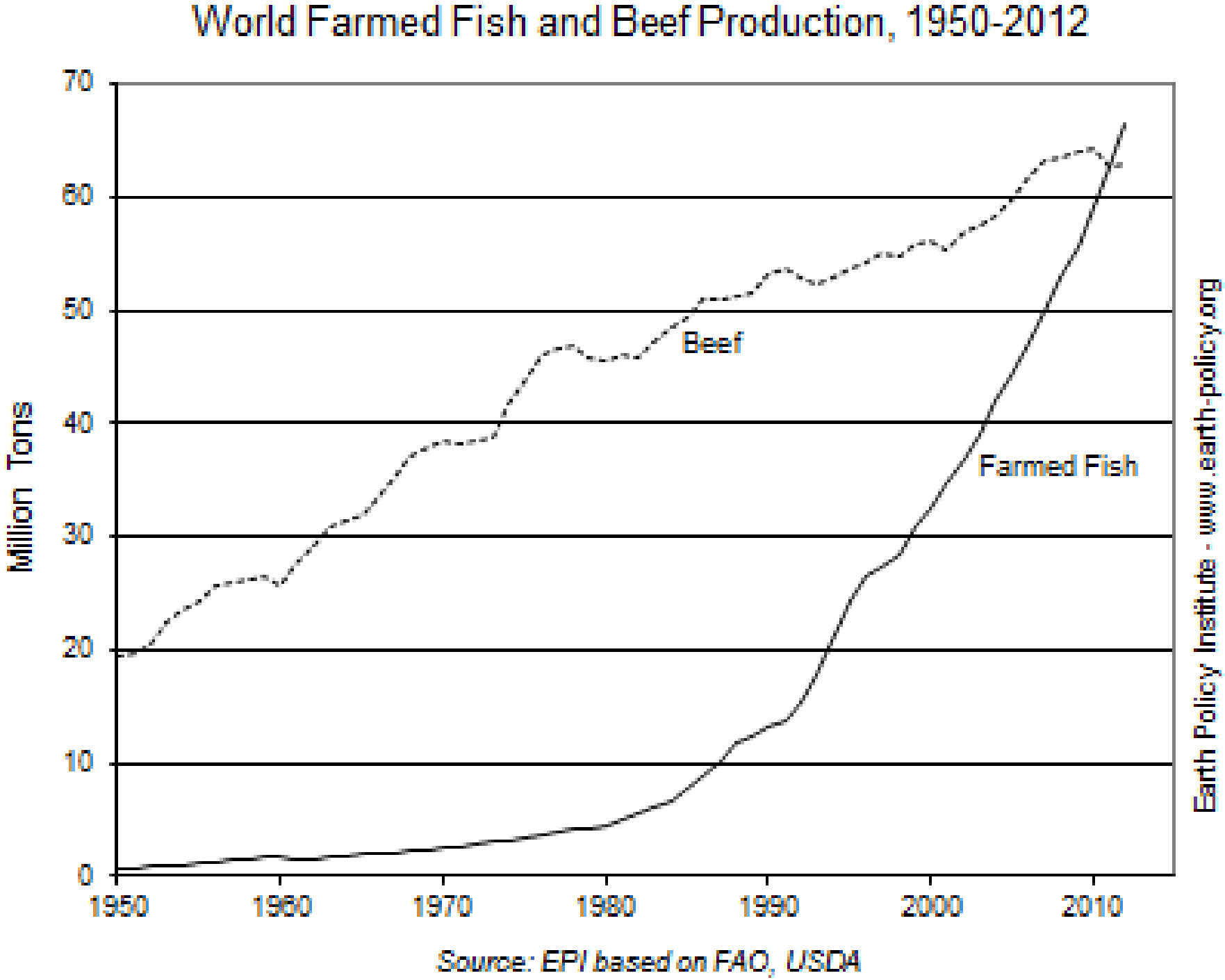
- Corn and soybean prices up over 300% in seven years.
- US Beef Prices up 8% Year on Year.
- Droughts currently depressing farming in:
  - US, China, Mongolia, and Africa.
  - Further droughts expected.

Feed Prices Take Off



World population 9B by 2050

- Quality of life rapidly improving in developing countries.
  - China, India, SE Asia, Africa
- Demand for animal products rising fast.
- Depletion of wild fisheries driving a boom in fish and shrimp farming.
- Fish farming surpassed beef production in 2010 and rising 10 times faster.


World Farmed Fish and Beef Production, 1950-2012
70
60
50
40
30
20
10
0
Million Tons
1950
1960
1970
1980
1990
2000
2010
Beef
Farmed Fish
Earth Policy Institute - www.earth-policy.org
Source: EPI based on FAO, USDA

The Feed Shortage

HOW ALGAE CAN HELP

The Promise of Algae

- Algae is...
  - ✓More nutritious than grain.
  - ✓Blends up to 60% in animal feed*
  - ✓Omega3 source for healthy fats.
- Compared to land crops, algae uses...
  - ✓3% of the land.
  - ✓2% of the water.

And... algae as feed doesn't compete with food for humans!

* Source: Texas A&M

Algae Is More Nutritious

- Algae is a higher quality feed than soybean; and it is *not* normally GMO.

Soy vs. Algae	Soy	Algae*
Protein	44%	55%
Lipids	2%	18%
Carbohydrates	39%	15%
Ash	15%	12%

* Chlorella Vulgaris

Algae can solve the world's feed problem!

But…

- Algae lives in a lot of water – up to 1000:1
- Harvesting this low density algae is cost-prohibitive.

Therefore…

The algae industry must grow dense algae — which is not sustainable.

Why Unsustainable?

- If autotrophic (Grown by Light)
  - Shadowing rapidly slows growth.
  - Predators erode nutritional value.
  - Bacterial invasions lead to crashes.
- If heterotrophic (Grown in the Dark)
  - Relies on sugars, a human food commodity.*
  - High cost and energy consumption.
  - This is not the breakthrough we're looking for!

* Sugar waste (bagasse) is geo-specific and limited.

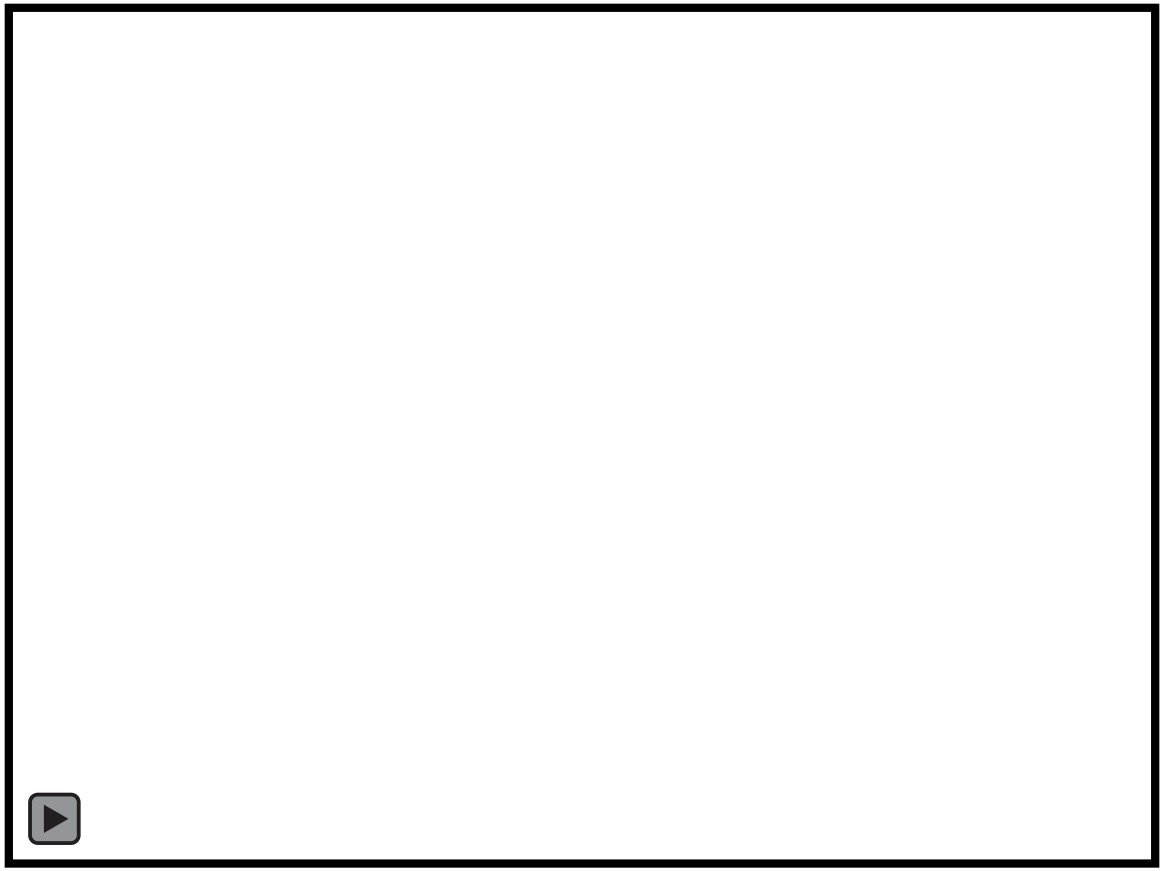
OriginOil Harvesting

- Enables commercial algae harvesting:
  - ✓Enables *daily harvest* of low density Algae*.
  - ✓Continuously delivers whole, live algae concentrate.
  - ✓Bacteria free, extends shelf life from hours to days or even weeks.
  - ✓Low energy cost: ~US$50 per ton of algae concentrate (at $0.10/KwH).

Continuous algae growing is now viable in open ponds and PBRs!

* 0.3 to 1 g/L

Video: EWS Algae Harvester



Press the symbol to Play. Right click for Full Screen.
If no response, click here to Play.

OriginOil Harvesting Benefits

- 100% CHEMICAL-FREE.
- Continuous recycling of sanitized water keeps predator and bacteria levels low.
- Low-density: shadowing isn't an issue.
- Daily turnover: crash risk greatly reduced.
- Clean concentrate, easy to dry or mix.
- Stable and predictable production costs.

OriginOil Harvesting

End Product:

An intact, clean, nutrient-rich algae concentrate with extended shelf life, ready for blending.

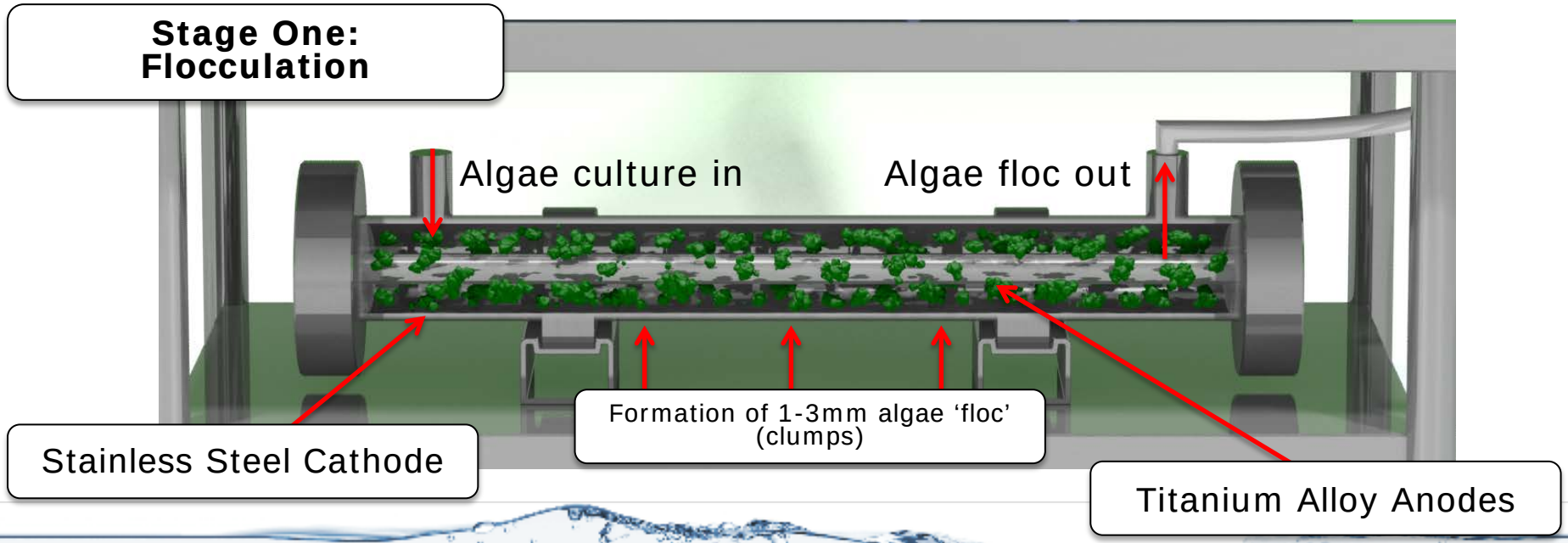
OriginOil-Harvested Paste

OriginOil's Breakthrough Harvesting Process

ELECTRO WATER SEPARATION (EWS)

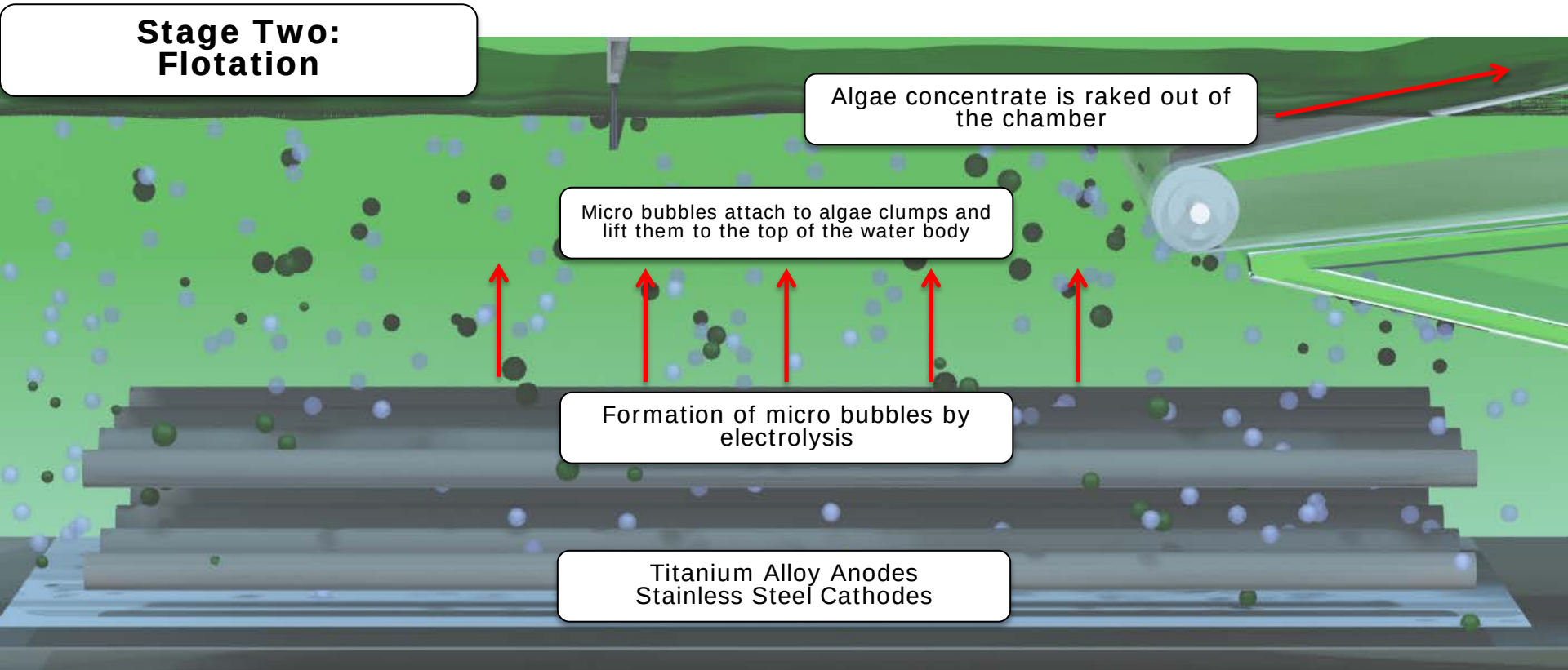
How It Works: Stage One

Single-Step Extraction (SSE) reactor tubes neutralize algae cells' electrical charge so they clump together (flocculate) with minimal damage to algae cell walls.



How It Works: Stage Two

Electrically-generated clouds of micro-bubbles force algae ‘floc’ to the surface, to be continuously raked off as intact, bacteria-free concentrate with extended shelf life.



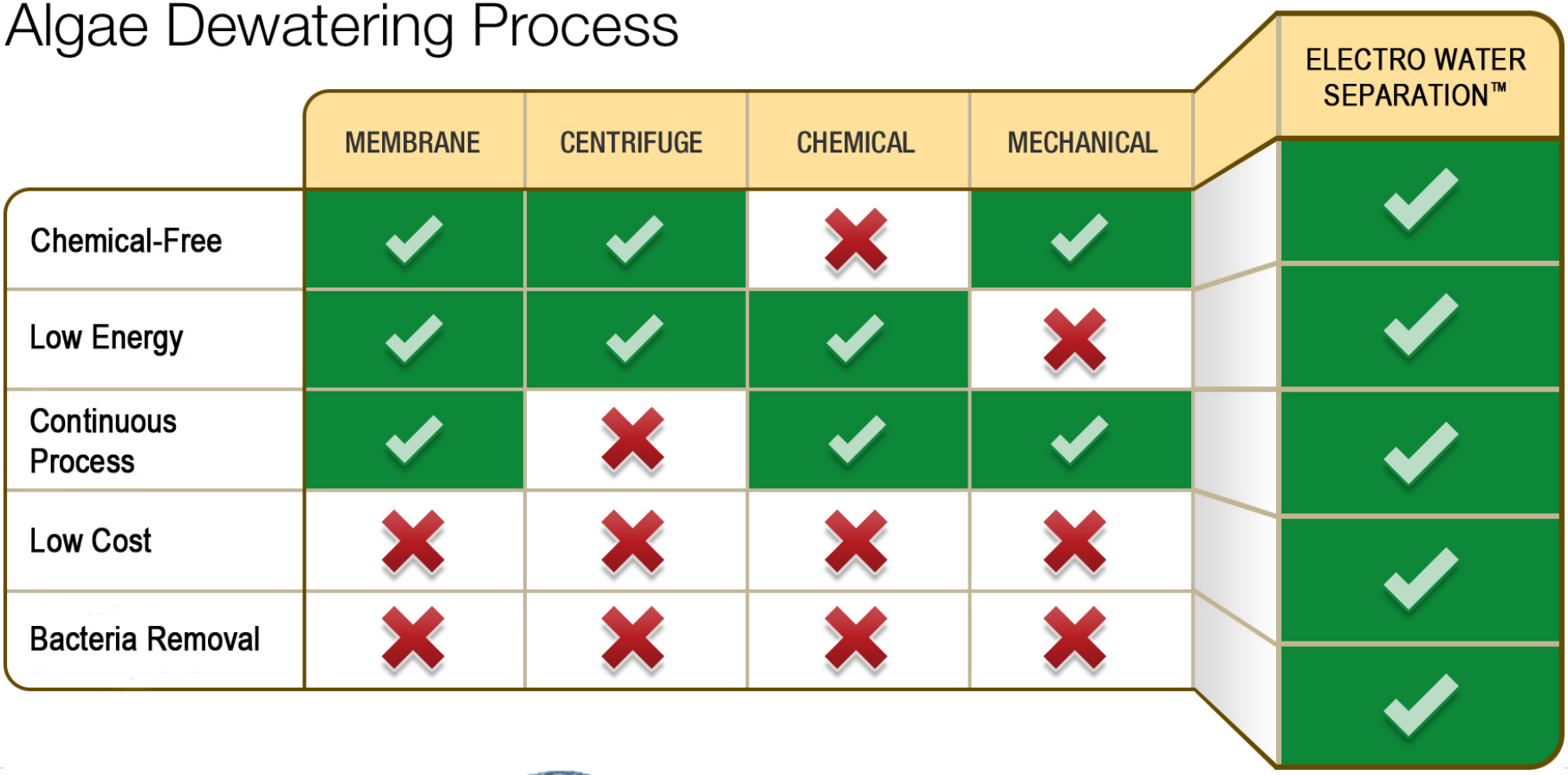
The EWS Algae Harvester

- Skid-mounted or trailered for rapid deployment.
  - ✓Drying and pelletizing attachment available.
- Models are rated in Liters/minute.

EWS Algae Model 120 shown

EWS Algae Is Superior

Algae Dewatering Process



RESEARCH AND SHOWCASE SITES

Algae Feed Research Site

- Catalina Sea Ranch: First US deepwater shellfish program.
- OriginOil will:
  - Provide EWS Algae Model 12 to:
    - ✓Treat incoming seawater
    - ✓Harvest algae to feed shellfish nursery
  - Get access to nursery for field research.

Global mussel production: ~2 million metric tons
Over $1 billion annually

Showcase Sites

- National Algae Association: made OriginOil's algae harvester part of its permanent algae demonstration site in Houston, Texas.
- Ennesys: French joint venture focused on algae production to meet European Union's energy and waste regulations for buildings.
- Aqua Farming Tech: OriginOil technology in use to sanitize 120 acres of ponds and produce algae for fish feed.

Commercial Strategy

1. Work with end-users to prove scale
2. Work with institutions to develop new applications
3. License non-exclusive OEMs worldwide to integrate our technology into offerings…
   - ✓Feed suppliers
   - ✓Equipment vendors
   - ✓Integrated algae producers
   - ✓What's *your* business model? Talk to us!

Powered by OriginOil®

OriginOil's Algae Team

- Research: Nicholas Eckelberry
- Engineering: Lee Portillo
- Product Management: Dave Anderson
- Commercialization: Jean-Louis Kindler
- Sales Support: Devin Angus

MORE INFO AT ORIGINOIL.COM/ABOUT-US

For More Information

- Call:

  US: (877) 939-6645 Ext. 5

  Int'l: +001-323-939-6645 Ext. 5

- Email: sales@originoil.com
- Meet us at shows:

  European Algae Biomass 2014 — Seville, Spain

  Algae Biomass Summit 2014 — San Diego, CA