OriginOil™

Algae Harvesting, Dewatering and Extraction

World biofuels MARKETS
15-17 March 2010
RAI Congress Centre, Amsterdam

A BREAKTHROUGH TECHNOLOGY TO TRANSFORM ALGAE INTO OIL

Safe Harbor Statement

Matters discussed in this presentation contain forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. When used in this press release, the words "anticipate," "believe," "estimate," "may," "intend," "expect" and similar expressions identify such forward-looking statements. Actual results, performance or achievements could differ materially from those contemplated, expressed or implied by the forward-looking statements contained herein, and while expected, there is no guarantee that we will attain the aforementioned anticipated developmental milestones. These forward-looking statements are based largely on the expectations of the Company and are subject to a number of risks and uncertainties. These include, but are not limited to, risks and uncertainties associated with: the impact of economic, competitive and other factors affecting the Company and its operations, markets, product, and distributor performance, the impact on the national and local economies resulting from terrorist actions, and U.S. actions subsequently; and other factors detailed in reports filed by the Company.

Recovering Oil: A Twofold Challenge

- Algae Grow Suspended in Large Amounts of Water
  - Cells have similar specific gravity to water
  - Algae in suspension neither sink nor float
  - Wet biomass retains interstitial water, which acts as a lubricant
  - Harvesting oil requires solids separation
  - Dewatering is energy and capital intensive
- Cell Walls are Difficult to “Crack”
  - Algae have a tough exterior to protect internal lipids
  - Cell wall has a high elasticity modulus
  - Cell rupture through mechanical friction and steam explosion requires dry biomass
  - Mechanical extraction is energy and capital intensive
  - Chemical extraction requires caustic solvents

Conventional Approach

- Current State of the Art is a 3-Stage Process:

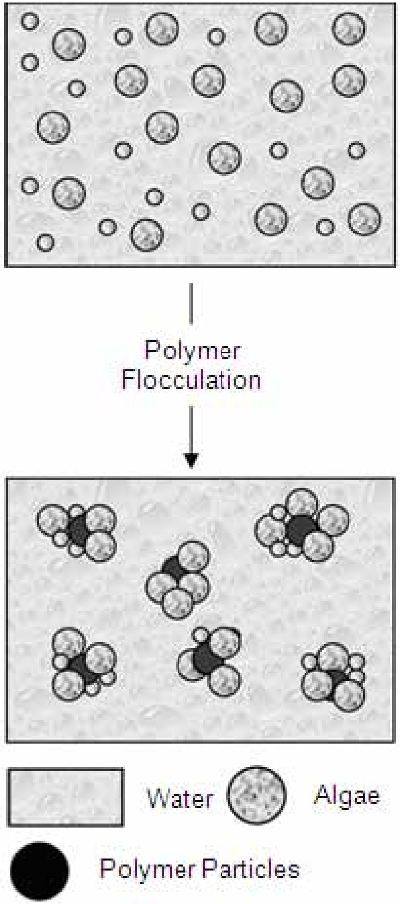
Solids Separation → **Dewatering** → **Extraction**

Solids Separation	Dewatering	Extraction
Options Include:	**Options Include:**	**Options Include**
Polymer Flocculation	Steam Drying	Expellers/Presses
Decanters/Centrifuges	Fluid Bed	Solvent Extraction
Hydrocyclones	Microwave	Supercritical CO_2

Conventional Systems Feature a Combination of Technologies

Solids Separation: Polymer Flocculation

- Solute particles form biomass aggregate called “floc”
- Two main types of flocculants
  - Inorganic Flocculants
  - Organic Polymer/Polyelectrolyte Flocculants
- Microalgae can form stable suspensions
- Advantages:
  - Capable of treating large quantities of culture
  - Applicable to wide range of algae strains
  - Less energy intensive than mechanical separation
- Limitations:
  - Flocculants can be expensive and caustic
  - Flocculation alone is not sufficient
  - Typically combined with other processes



Solids Separation: Decanters/Centrifuges

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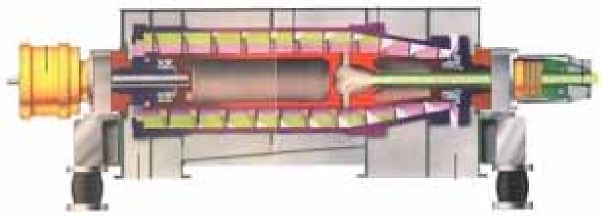
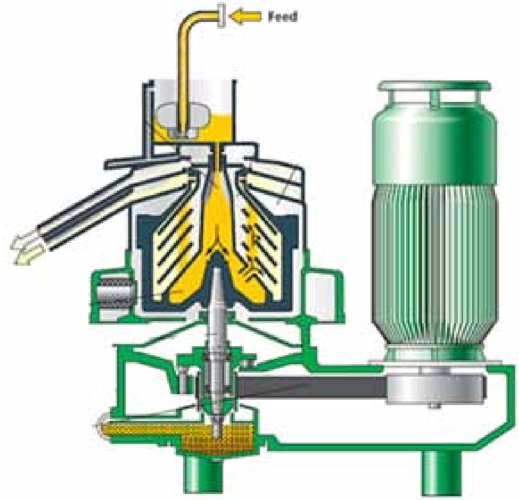
- Mechanical approach to solids separation
  - Decanters are typically used in the ethanol industry
  - Centrifuges are widely used in the algae industry
- Operates using the sedimentation principle
- Requires specific gravity differential
- Advantages
  - Seen as the most efficient recovery technique
  - Capable of processing large algae cultures
  - Appropriate for cultures that are more liquid and less solid
- Limitations
  - Capital and energy intensive
  - Requires additional drying for mechanical and chemical extraction





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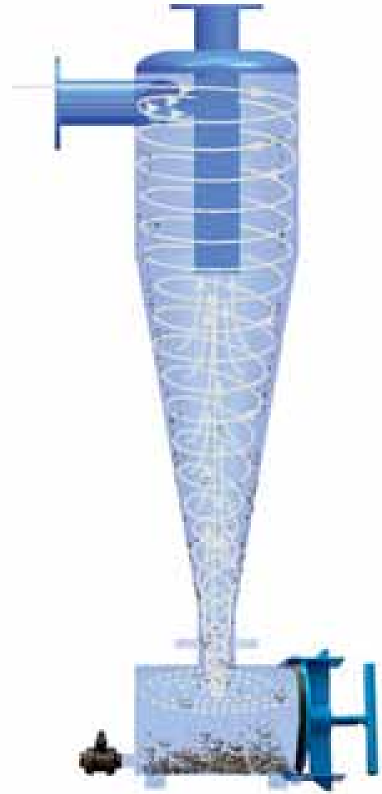
Solids Separation: Hydrocyclones

- Uses gravity to separate solids from liquids
- Requires specific gravity differential
- Hydrocyclone dimensions must be precision engineered
- Advantages
  - Low capital costs
- Limitations
  - Only appropriate for select algae strains (e.g. Coelastrum)
  - Efficiency is highly dependent on solids concentration
  - Process is energy intensive
  - Requires additional drying for mechanical and chemical extraction
  - Reliability is questionable



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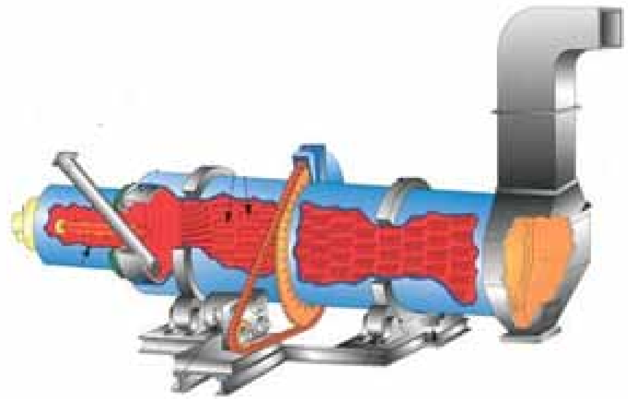
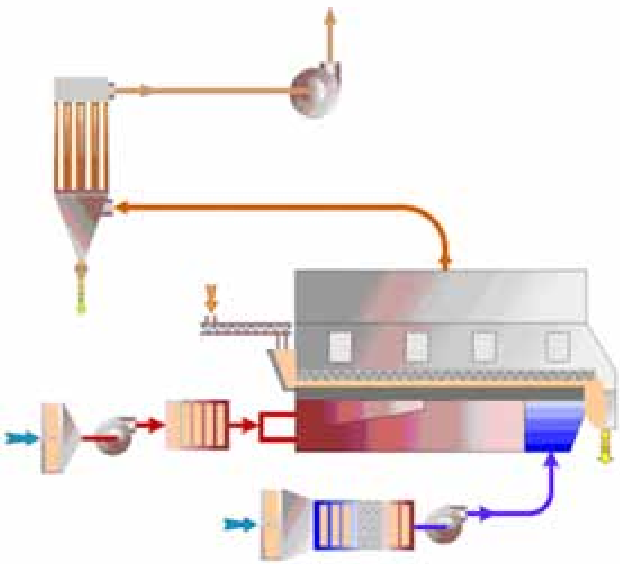
Dewatering: Indirect/Direct Heat

- Heat is used to evaporate water
- Indirect heating uses rotating disks to accelerate heat exchange
- Direct heat uses open flame to create steam
- Advantages
  - Very effective as reducing moisture content
  - Appropriate for applications with significant “waste heat”
- Limitations
  - Capital and energy intensive
  - Direct heat has combustion risks
  - Regular maintenance required



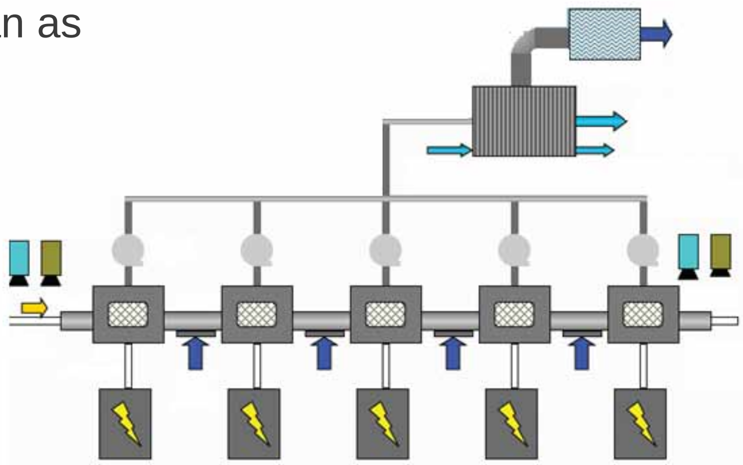
Dewatering: Fluid Bed

- Designed to dry biomass as it floats on a cushion of air
- Uses rotating screen that allows air to percolate through wet biomass
- Advantages
  - Effective at reducing moisture content of biomass
  - Does not require steam or heat
  - Relatively low maintenance costs
- Limitations
  - Typically used when moisture content is relatively low
  - Capital and energy intensive



Dewatering: Microwave

- Process uses volumetric heating to achieve even distribution
- Energy is delivered electromagnetically, rather than as heat
- Advantages
  - Drying time can be reduced significantly
  - Reduced risk of combustion
  - Lower energy cost compared to steam drying
  - Low maintenance costs
- Limitations
  - Potential of uneven drying
  - Capital and energy intensive



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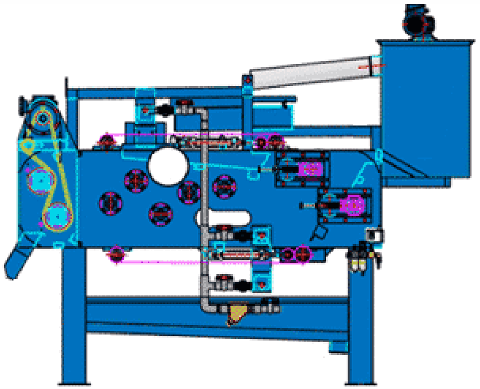
Extraction: Expellers/Presses

- Uses mechanical force to rupture algae cells
- Widely used in oil extraction from various feedstock
- Design must be tailored to algae strain
- Advantages
  - No chemical input required
  - Appropriate for high oil content algae
  - Capable of extracting up to 80% oil
- Limitations
  - Residual biomass remains with pressed oil
  - Typically requires additional solvent extraction
  - Capital and energy intensive
  - High maintenance costs



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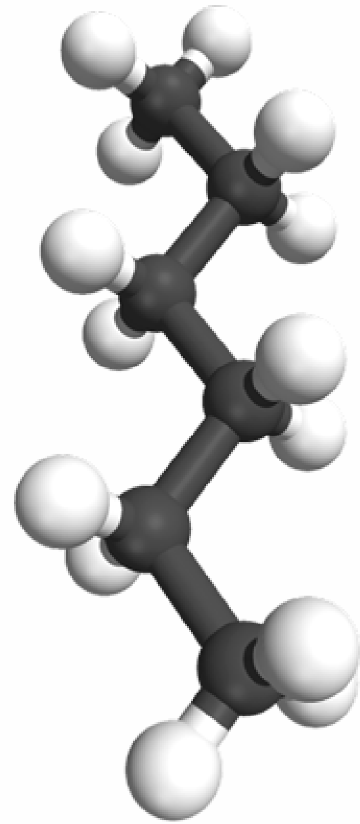
Extraction: Solvents

- Chemicals including benzene, ether and hexane are used to degrade cell walls
- Oil dissolves into solvent and is recovered through distillation
- Can be used in conjunction with mechanical extraction
- Advantages
  - Relatively inexpensive
  - Effective at releasing up to 95% oil
- Limitations
  - Requires the use of caustic chemicals
  - Hexane requires two year permitting process (U.S.)



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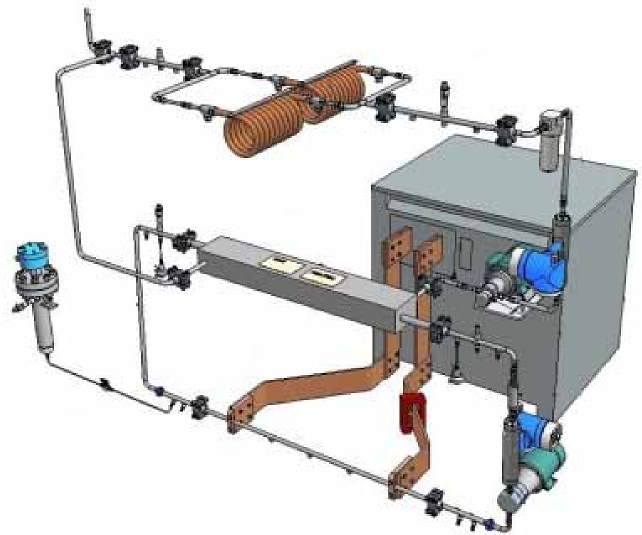
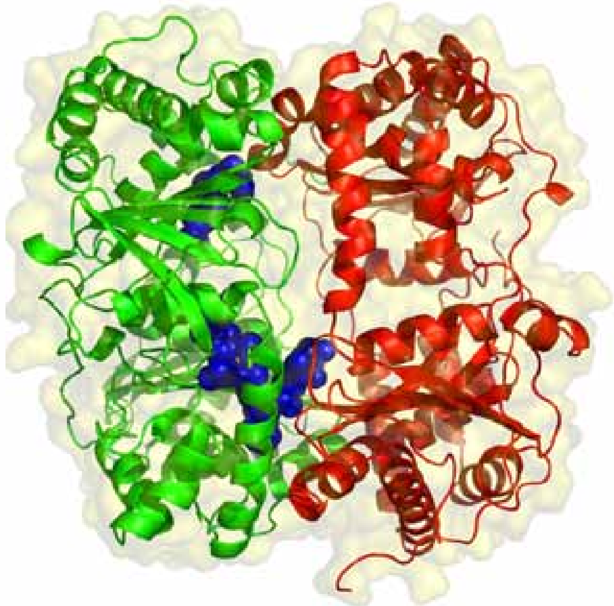
Extraction: Supercritical CO_2

- Process uses liquid CO_2 at high temperature and high pressure to extract algae oil
- CO_2 penetrates algae cells and causes them to rupture
- Widely used in various industries, including coffee
- Advantages
  - Low environmental impact
  - High quality oil and biomass product
- Limitations
  - Works best when algae cells are partially ruptured
  - Process is highly tuned and sensitive
  - High pressure systems involve risk
  - Capital and energy intensive



Other Approaches: Enzyme Extraction

- Uses enzymes to degrade cell walls
- Water acts as the solvent material
- Process makes fractionation of oil much easier
- Advantages
  - Does not require dry cake for oil extraction
  - Low environmental impact
  - No caustic chemicals
- Limitations
  - Costs are much higher than hexane extraction



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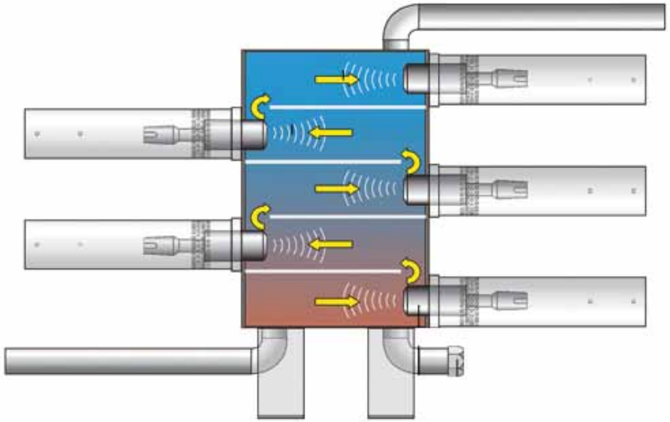
Other Approaches: Ultrasonication

- Uses ultrasonic waves to create cavitation bubbles in a solvent material
- Bubbles collapse, resulting in shock waves that beak down cell walls
- Can be used in conjunction with enzymatic extraction
- Advantages
  - Does not require dry cake for oil extraction
  - Low environmental impact
  - No caustic chemicals
- Limitations
  - Energy intensive
  - Technology unproven at industrial scale



The OriginOil Difference

Conventional Approach

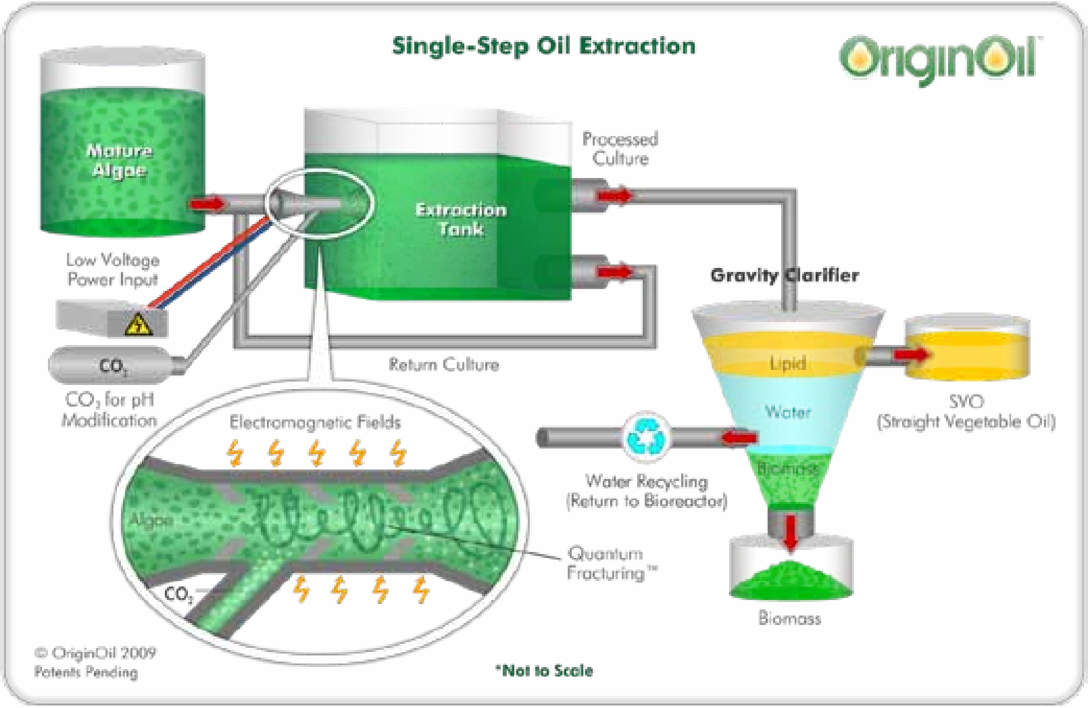
Solids Separation → Dewatering → Extraction

OriginOil Approach

Extraction → Solids Separation → Dewatering

Radical Shift vs. Incremental Gains

OriginOil Single-Step Extraction™



- In one step, Quantum Fracturing™ combines with electromagnetism and pH modification to break down cell walls.
- Algae oil rises to the top for skimming and refining, while the remaining biomass settles to the bottom for further processing as fuel and other valuable products.

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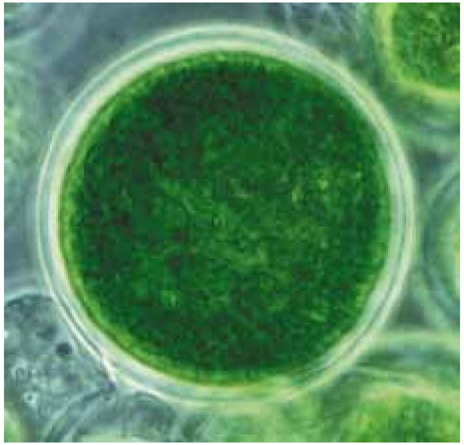
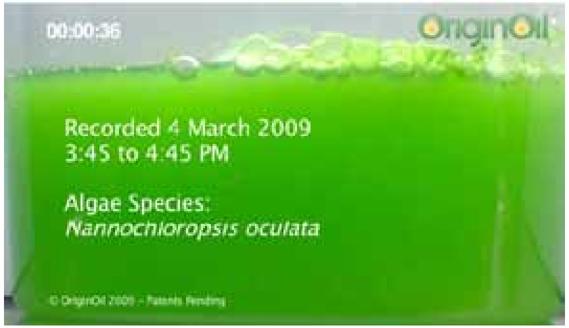
Single-Step Extraction Process Details

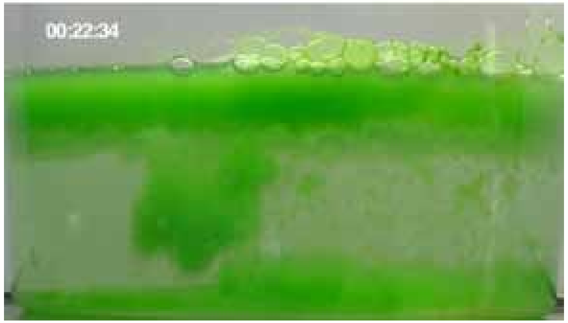
- CO_2 Injection
  - Lowers pH to optimize electromagnetic delivery
  - Chemically assists in cell degradation
- Quantum Fracturing
  - Creates fluid fracturing effect
  - Mechanically distresses algae cells
- Electromagnetic Field
  - Highly tuned EMP ruptures algae cells
  - Causes cells to release internal lipids
- Additional Key Process Innovations
  - Subject to imminent patent filings

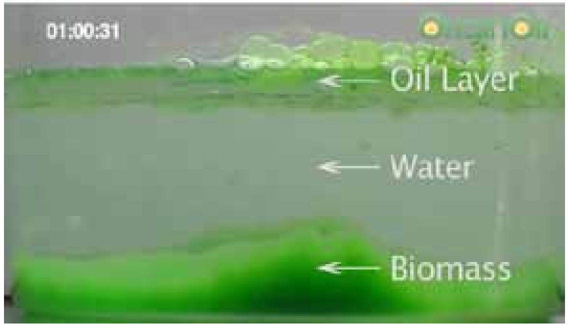


Gravity Settling

- Single Step Extraction separates oil from biomass
- Processed culture is transferred to a gravity clarifier
  - Oil rises to the top
  - Biomass sinks to the bottom
- Oil is skimmed for downstream polishing
- Biomass is drained for further drying (if necessary)
- Water is recycled to the bioreactor or pond







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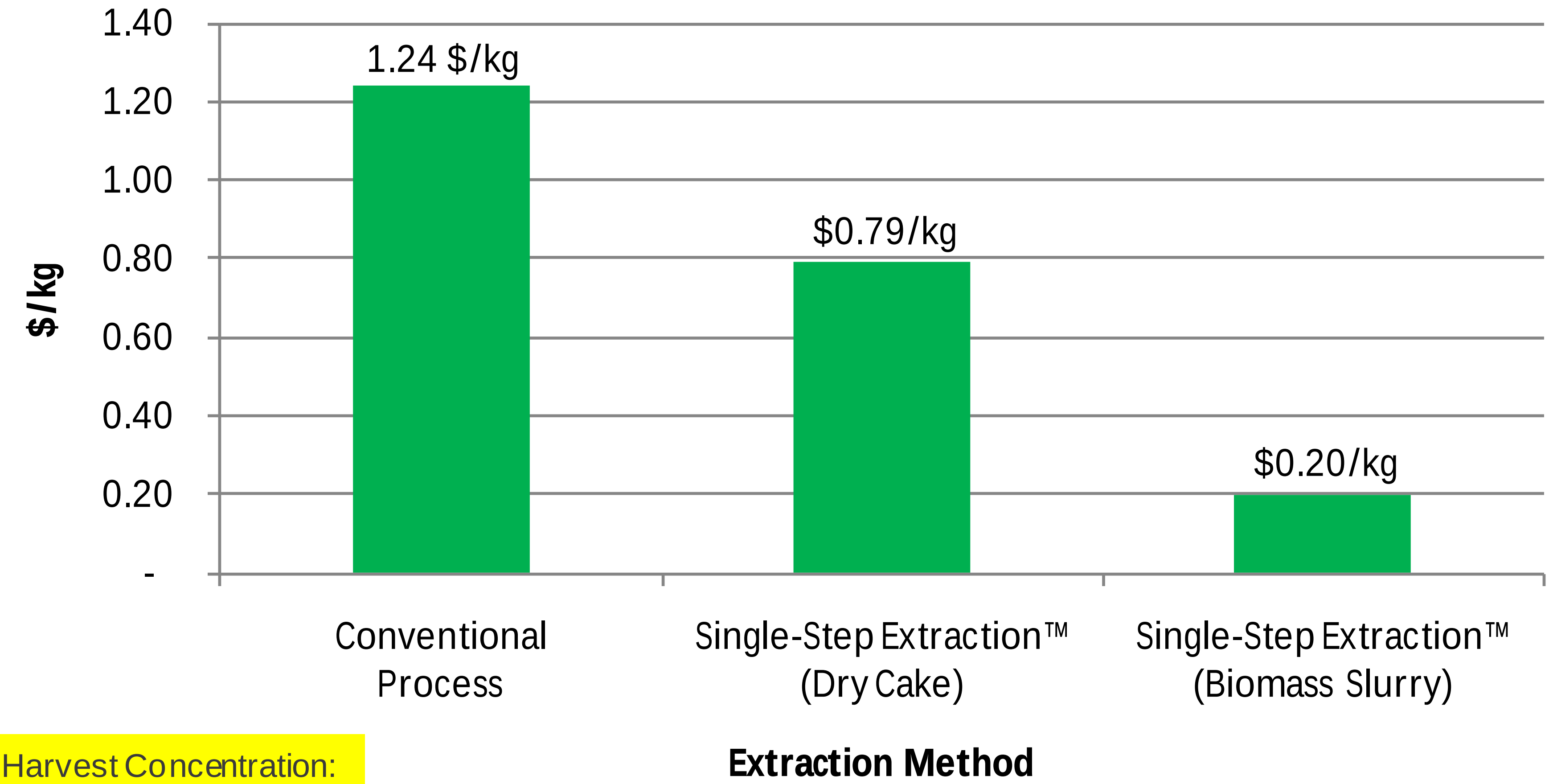
Single Step Extraction Benefits

- No initial dewatering required
- Significant energy savings
- No caustic chemicals
- Tunable to a wide range of feedstock
- Small footprint
- Easy installation
- Applicable to all growth platforms
- Fast throughput – highly scalable
- Greatly-reduced Capital Expenditure

Energy Cost of Oil Extraction



Harvest Concentration:
1 gram/L dry weight

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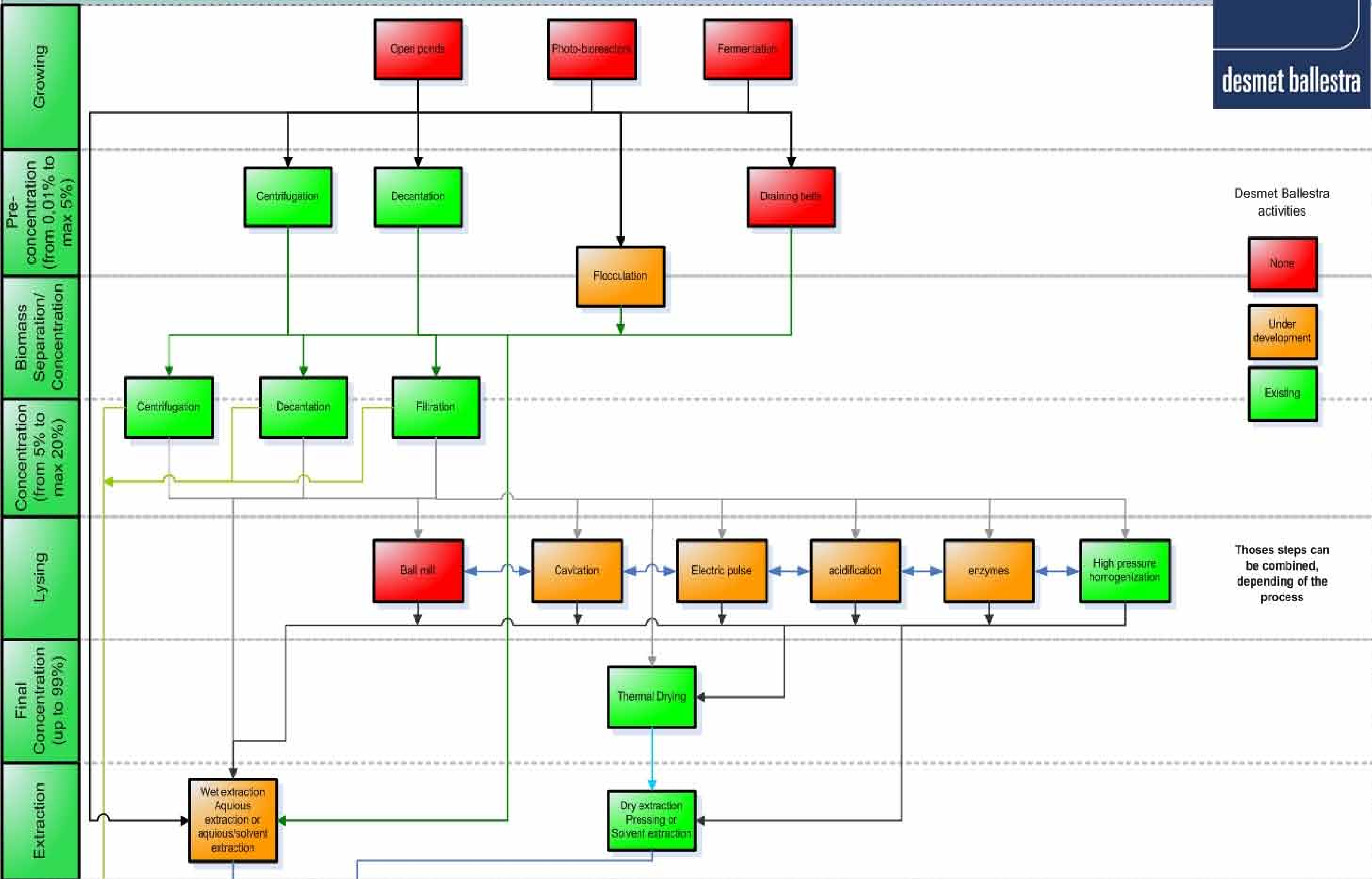
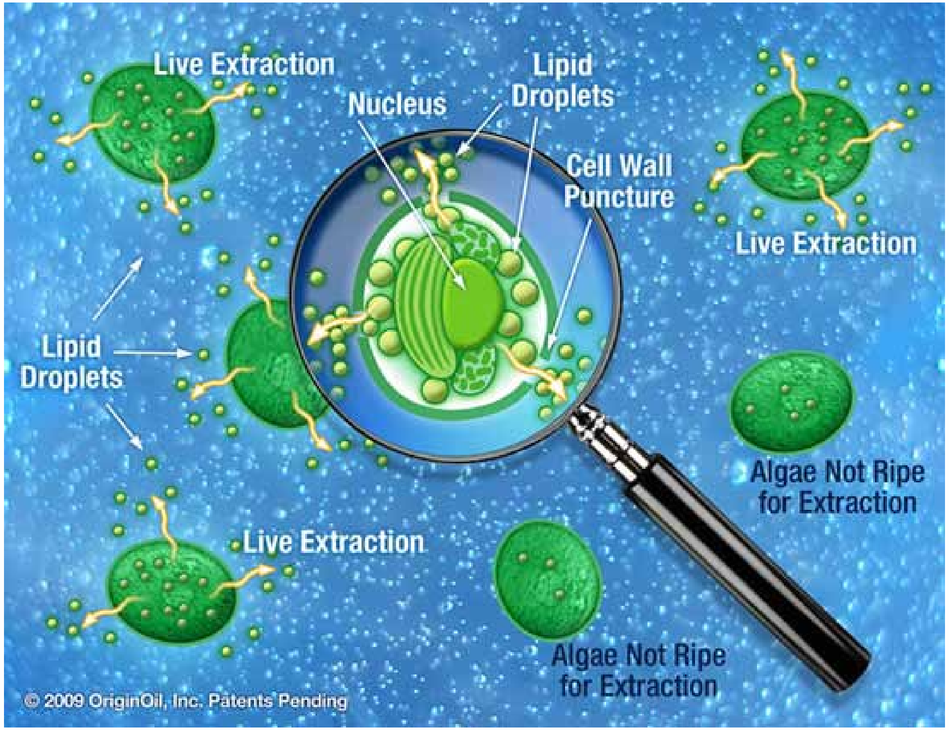
Algae processing

Desmet Ballestra Algae diagram (by VVN)



Live Extraction™



- Continuous ‘milking’ process works by stimulating the algae cells electrically.
- Algae oil is extracted continuously, algae remains alive.
- Combines with daily harvest for improved productivity, refreshed cell cultures.
- Does not use expensive consumables, not limited to one strain.
- Now being scaled up to OriginOil’s intermediate 200-gallon tank size.

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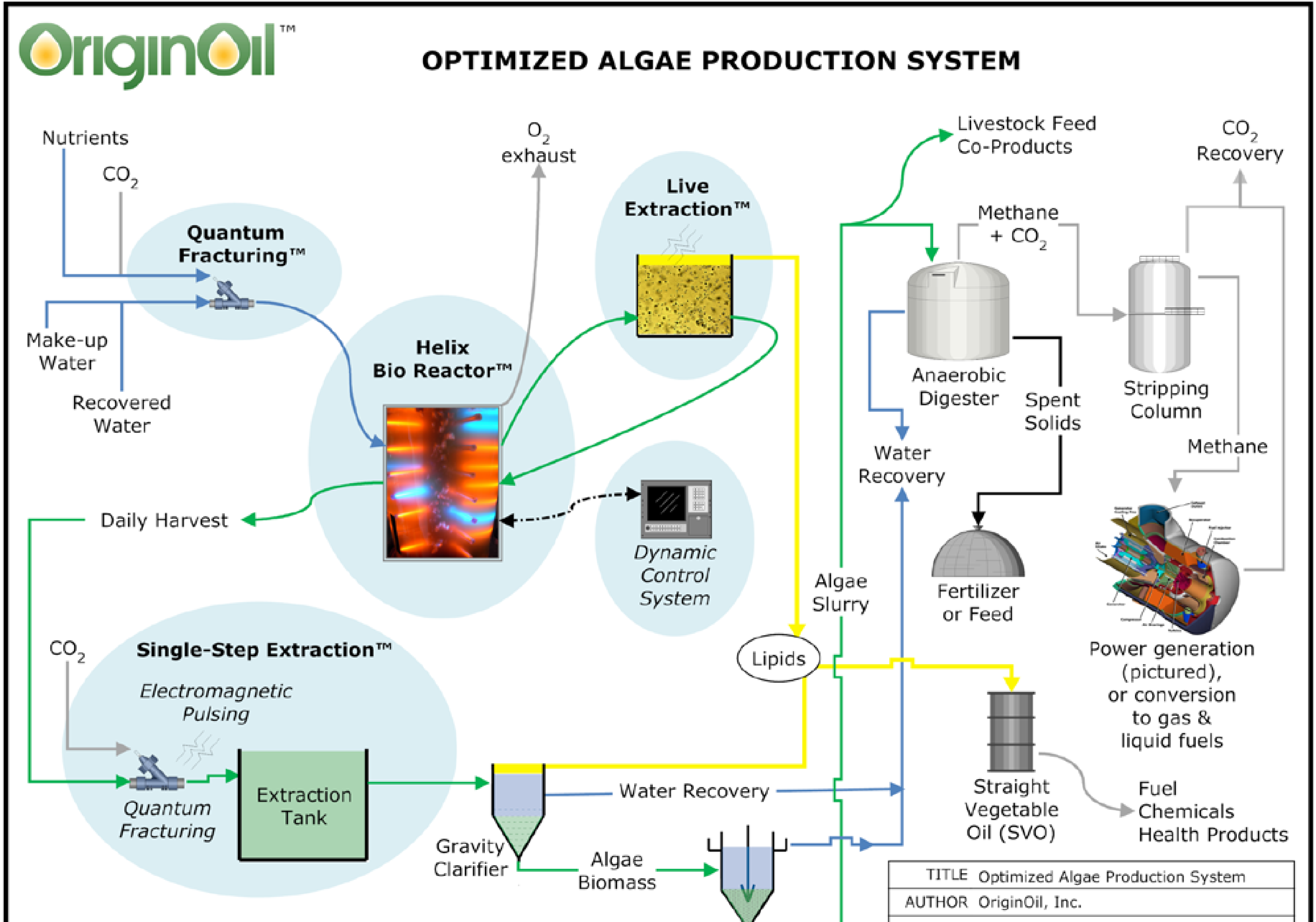


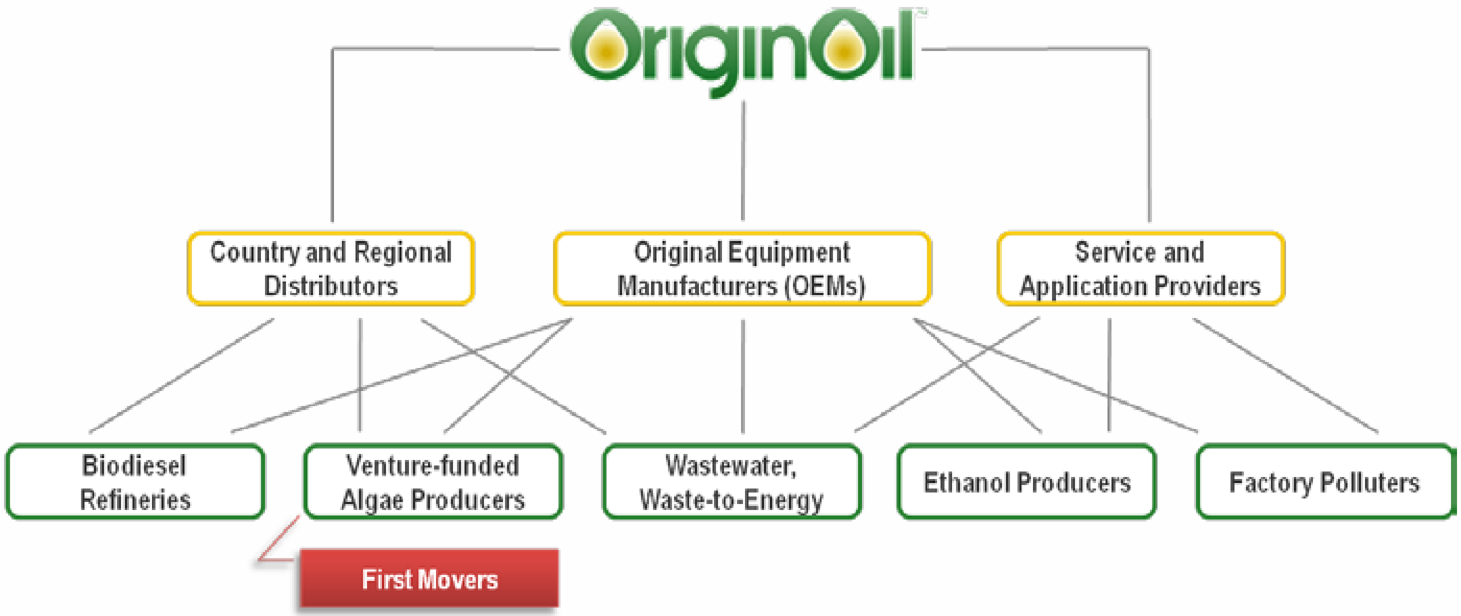
OriginOil™
OPTIMIZED ALGAE PRODUCTION SYSTEM
Nutrients
CO2
Make-up Water
Recovered Water
Quantum Fracturing™
O2 exhaust
Helix Bio Reactor™
Live Extraction™
Dynamic Control System
Daily Harvest
Livestock Feed Co-Products
Methane + CO2
CO2 Recovery
Anaerobic Digester
Stripping Column
Spent Solids
Water Recovery
Methane
Fertilizer or Feed
Algae Slurry
Power generation (pictured), or conversion to gas & liquid fuels
Lipids
CO2
Single-Step Extraction™
Electromagnetic Pulsing
Quantum Fracturing
Extraction Tank
Gravity Clarifier
Water Recovery
Algae Biomass
Straight Vegetable Oil (SVO)
Fuel Chemicals Health Products
TITLE Optimized Algae Production System
AUTHOR OriginOil, Inc.

Next Steps

- Single-Step Extraction:
  - 28 January 2010, launched pilot scale lab system (3-5gpm)
  - By mid-2010, will launch mobile algae extraction system (ALGAEMAX) – on-site demos to interested algae companies.
  - Pursuing commercial pilot projects in 2H2010.
  - Ongoing discussions with OEMs.
- Live Extraction:
  - Displayed bench scale system at 28 January event.
  - Currently scaling up to 200-gallon tank system.
  - Testing productivity singly and in tandem with daily harvest and Single-Step Extraction.

Path to an Algae Market

- Development of an integrated network of global partners, including:
  - Original Equipment Manufacturers (OEMs)
  - Country and Regional Partners
  - Device and Component Manufacturers
  - Service and Maintenance Providers
  - Customized Application Developers



A BREAKTHROUGH TECHNOLOGY TO TRANSFORM ALGAE INTO OIL

THANK YOU!

QUESTIONS?

COMMENTS?

partners@originoil.com

(SEE FOLLOWING SLIDES
FOR PROCESS COMPARISON DETAILS)

Conventional Energy Requirements

Harvest Concentration:
1 gram/L dry weight

Centrifuge for 1 MGD sludge processing	1,059	kWh
Centrifuge for processing 10,000,000 L (2.64 MG)	2,798	kWh
Sludge solid content	27	%
Sludge moisture content	73	%
Total biomass in 10,000,000 L	**10,000**	kg
Total moisture (water) content	27,037	kg
Energy requirement for water evaporation	16,770	kWh
Total energy requirement for dewatering	19,568	kWh
Cost for dewatering 10,000,000 L of algae culture	1,370	$
Energy cost for oil extraction	1,113	$
Total energy cost of crude oil	2,483	$
Energy cost per kg of crude oil	1.24	$/kg

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OriginOil Energy Requirements (Sludge)

Harvest Concentration:
1 gram/L dry weight

Case A - biomass product is bio-digestible sludge

Extraction energy for 10,000,000 L	5,625		kWh
Post-extraction dewatering of 10,000,000 L	179		kWh
Unit power cost		0.07	$/kWh
Cost for processing 10,000,000 L	**406**		**$**
Total oil content (assuming 20% yield)	2,000		kg
Energy cost per kg of crude oil		0.20	$/kg
16.4	**percent of conventional process energy cost**		

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Single-Step Extraction™ (Cake)

Harvest Concentration:
1 gram/L dry weight

Case B - biomass product is dry (10%)

Extraction energy for 10,000,000 L	5,625		kWh
Post-extraction dewatering of 10,000,000 L		179	kWh
Energy requirement for water evaporation	16,770		kWh
Unit power cost		0.07	$/kWh
Cost for processing 10,000,000 L	**1,580**		**$**
Total oil content (assuming 20% yield)	2,000		kg
Energy cost per kg of crude oil		0.79	$/kg
63.6	**percent of conventional process energy cost**		