A Failed Cleantech (ad)Venture:

A look back from an insider’s perspective

ABO Summit
2015
Washington, DC

Prepared by:
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Cleantech, Sustainability, Energy LLC
Disclosure

- I am owed fees and expenses by the company, which are likely never to be recovered
- I respect and am on friendly terms with the company’s former management team.
- This presentation is a personal reflection on, and an assessment of, my experience.
“A person who has not made peace with his losses is likely to accept risks that would be otherwise unacceptable to him”
Failure is popular!
Analysis

• Strategy
• Structure
• Technology

Biases
2007: Personal Context

• Background
  – CU, EPA, PB

• Two great options

• Decision drivers
  – Leadership/Influence/Vision
  – Exposure
  – Core Business Interest
  – Base/Upside
  – Relevance solving big problems
My intro to algae
(environmental nuisance to sustainability panacea)
Welcome Aboard!
Michael Gilbert Named Vice President, Strategy and Business Development for Global Green Solutions Inc.

San Diego, Ca. - February 26, 2007 -- Michael Gilbert has been named vice president, strategy and business development, for Global Green Solutions Inc., an ecotechnology company. Gilbert will be primarily responsible for the business development and marketing of Vertigro, Global Green Solutions algae-to-biofuel technology. Gilbert's previous positions included business strategy consultant for Cleantech Industry, manager for futures strategy with Pitney Bowes Inc., and international environmental technical assistance project manager for the U.S. Environmental Protection Agency. He is a graduate of Cornell University and a licensed professional engineer (PE) and certified energy manager (CEM).

"The overwhelming worldwide interest in Vertigro demanded that we expand our senior management team to maintain responsiveness to customers and investors," said Doug Frater, president and CEO of Global Green Solutions. "Michael's extensive experience in environmental and energy businesses will be a significant asset as we position Vertigro to become the leading biofuel feedstock technology."

The Vertigro technology mass produces algae and extracts the vegetable oil, which becomes feedstock for a cost effective, non-polluting biofuel. Vertigro bioreactors are extremely environmentally-friendly and utilize minimal water and no agricultural land. Production estimates are 100,000 gallons of oil per acre per year, or 4,000 barrels, with an approximate cost of $25 USD per barrel. The algae-derived fuel will be an energy efficient replacement for fossil fuels and can be used in any diesel powered vehicle or machinery.

Feb 26, 2007
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The Vertigro technology mass produces algae and extracts the vegetable oil, which becomes feedstock for a cost effective, non-polluting biofuel. Vertigro bioreactors are extremely environmentally-friendly and utilize minimal water and no agricultural land. Production estimates are 180,000 gallons of oil per acre per year, or 4,000 barrels, with an approximate cost of $25 USD per barrel. The algae-derived fuel will be an energy efficient replacement for fossil fuels and can be used in any diesel powered vehicle or machinery.

Global Green Solutions Inc

- Market Cap 2007: approx $50MM
- Market Cap 2009: Approx $5MM
- Market Cap 2011: $0.00

Gilbert joins company
## Global Green Solutions Inc

### Global Greensteam

- **Biomass Consumer**
  - *(produce steam)*
  - Sell steam

### Vertigro Algae Technologies

- **Biomass Producer**
  - *(produce algae biomass)*
  - **Accelerated Evolution**
  - **Vertical PBR**
  - **Sell biofuel feedstock production systems**
Structure

- GGRN (OTC:BB)
  El Paso/Bakersfield
  100%

- Sweetwater Capital (Vancouver)
  IR Fees to Sweetwater
  50%
  50%

- Valcent (TSX)
  El Paso, TX
  100%

- Greensteam

- Vertigro

- Verti-crop

License Fee/gal (GK, TB)
BOD (MDs)
Technology

• Vertical PBR
• Accelerated Evolution
LEDER TV SETS CAN BEGIN APPLYING FOR $40 GOVT COUPONS FOR
Major USG Algae Initiatives

A Look Back at the U.S. Department of Energy’s Aquatic Species Program: Biodiesel from Algae

Close-Out Report

July 1998

National Algal Biofuels Technology Roadmap

MAY 2010
Algae is a Solar Conversion and Storage Device

Approx 1000 MT biomass/acre/year or 120,000 gallons oil/acre/year @100% conversion efficiency
Interest explodes in 2007

Solix to develop algae biofuel plant with So. Utah
Reuters - Nov 11 2008

ExxonMobil invests in algae biofuel project
Calgary Herald - Jul 14 2009

A collection of algae biofuel firms in Southern California
Los Angeles Times - Sep 17 2009

OriginOil’s Algae Oil Extraction Process Reaches Highest Industry Efficiency Standards
Reuters - Oct 26 2009

Cavitation Technologies, Inc. Is Unveiling Renewable Fuel Technology for Algae Oil
CNNMoney.com - Jan 12 2010

BioCentric Energy Plans Travels to Evaluate High Yielding and Cost-Effective Algae Oil Extraction Options
CNNMoney.com - Mar 24 2010

More news results »
Myth vs Reality

Wide range of projections…

What is the ultimate upper limit?

Algae Oil Projections

(1) Schenk, 2008
(2) Chisti, 2007 (30% oil)
(3) NREL ASP, Sheehan et al., 1998
(4) Schenk, 2008
(5) Chisti, 2007 (70% oil)
(6) Report on CNN, Apr 4, 2008
Industry credibility ???

Algae Oil Projections


Ultimate theoretical maximum @ 30% oil: 22,000 gal·acre⁻¹·yr⁻¹

Practical Range @ 30% oil: 2,900 – 3,900 gal·acre⁻¹·yr⁻¹

Al Darzins
National Renewable Energy Laboratory
Innovation for Our Energy Future
A call from a friend

Mick....
Do an energy balance
Check the yield claims
Top Algae Companies 2007

1. Greenfuel
2. Solazyme
3. Blue Marble Energy
4. Inventure Chemical
5. Solena
6. Live Fuels
7. Solix Biofuels
8. Aurora Biofuels
9. Aquaflow
10. PetroSun
11. Bionavitas
12. Mighty Algae Biofuels
13. Bodega Algae
14. Sembiotic
15. Cellena
16. Global Green Solutions
Trouble.....
2008: Warning Signs

- Unanswered questions
  - No validated productivity data
  - No validated constituent data
  - Capex
  - Opex

- Missed milestones

- Lack of JV focus on algae technology

- Lack of BOD focus / resources

- Check the numbers….
  - 100,000 gals/acre/yr implies Photosynthetic efficiency approx 85%
### Selected Algae Production Companies

#### Business Model and Technology Comparison

<table>
<thead>
<tr>
<th>Location</th>
<th>Aurora Biofuels</th>
<th>Origin Oil</th>
<th>Sapphire Energy</th>
<th>Petro Algae</th>
<th>Greenfuel Technologies</th>
<th>LiveFuels</th>
<th>Solix</th>
<th>Bio-King/Alga Link</th>
<th>Solazyme</th>
<th>PetroSun</th>
<th>Aquaflo Bionomic</th>
<th>Vertigro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allameda, CA, USA</td>
<td>San Diego, CA, USA</td>
<td>Melbourne FL, USA</td>
<td>Cambridge, MA, USA</td>
<td>Menlo Park, CA, USA</td>
<td>Ft. Collins, CO, USA</td>
<td>Netherlands</td>
<td>San Francisco, CA, USA</td>
<td>AZ, USA</td>
<td>New Zealand USA</td>
<td>El Paso, TX, USA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emissions Focus</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Power/Cement Plants</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Sewage</td>
<td></td>
</tr>
<tr>
<td>Growing System</td>
<td>Open</td>
<td>Closed</td>
<td>?</td>
<td>Closed</td>
<td>Closed/Vertical</td>
<td>Open/Horizontal</td>
<td>Closed</td>
<td>Open/ Closed</td>
<td>Closed</td>
<td>Open</td>
<td>Open/Horizontal</td>
<td>Closed</td>
</tr>
<tr>
<td>Genetically Modified</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Driver</td>
<td>Algae Biofuels</td>
<td>Algae Biofuels, nutrient transfer</td>
<td>Bio-Gasoline, Bio Crude</td>
<td>Algae Biofuels</td>
<td>Emissions</td>
<td>Algae Biofuels</td>
<td>Algae Biofuels</td>
<td>Biodiesel Equip/Algae Biomass</td>
<td>Sugar/cellulose to ethanol</td>
<td>Oil/Gas WW treatment</td>
<td>Algae Growth</td>
<td></td>
</tr>
<tr>
<td>Commercial Algae</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Pilot contracts signed</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Pilot</td>
<td>Pilot</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Funding</td>
<td>VC: Gabriel, Noventi, Oak Park</td>
<td>Public: OOIL</td>
<td>VC: ARCH, Venrock, Welcome Trust</td>
<td>XL Tech (Public: AIM)</td>
<td>VC: Access, Draper-Jurvetson, Polaris</td>
<td>Loose collaborati on of researcher s</td>
<td>CO State Univ VC fund</td>
<td>Private Equity, solicitation s,</td>
<td>Chevron Tech Ventures, NIST Grant, Blue Crest Cap,</td>
<td>Petro Sun organic investment s from core oil business</td>
<td>Private Equity Solicitation Purepower Asia (VC)</td>
<td>Public: GGRN</td>
</tr>
</tbody>
</table>
### Selected Algae Production Companies

**Recent Announced Deals (7/2008)**

<table>
<thead>
<tr>
<th>Aurora Biofuels</th>
<th>Sapphire Energy</th>
<th>Greenfuel Technologies</th>
<th>HR BioPetroleum</th>
<th>Bio-King/Alga Link</th>
<th>Solazyme</th>
<th>Algenol</th>
<th>Seambiotic</th>
<th>Vertigo</th>
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<tbody>
<tr>
<td><strong>Selected Recent Deal Announcements</strong></td>
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<tr>
<td>June 10, 2008 -- Aurora Biofuels, Inc., a leader in open-pond algae aquaculture technology, announced today it has completed a second round of funding, raising $20 million. The round was led by existing investor Oak Investment Partners. Previous Series A investors Gabriel Venture Partners and Noventi also participated in the round.</td>
<td>May 29, 2008 Sapphire has raised over $50 million from three investors, including Arch Venture Partners, whose Kristina Burow helped co-found the company.</td>
<td>May, 2008: GreenFuel Technologies closed a Series B round $13.9 million</td>
<td>June 12, 2007: Shell to grow algae for biofuel. The oil giant is teaming with Hawai’i’s HR BioPetroleum to construct a pilot facility to grow the next-generation feedstock</td>
<td>June 5, 2008 Dutch companies AlgaeLink N.V. and KLM Royal Dutch Airlines will cooperate on a pilot project to develop an alternative aviation fuel from algae.</td>
<td>January 23, 2008 - News Brief - The startup signed a biodiesel feedstock development and testing agreement with Chevron Technology Ventures.</td>
<td>June 11, 2008 Algenol formally introduced itself and an $850 million project with Sonora Fields S.A.P.I. de C.V., a wholly owned subsidiary of Mexican-owned BioFields.</td>
<td>June 18, 2008 Seattle, Wash.-based Inventure Chemical announced today that it entered into a joint venture agreement with Tel Aviv, Israel’s Seambiotic to build a pilot algae biofuel plant.</td>
<td>July 25, 2007 -- Vertigo and SGCEnergia, the biofuels division of the SGC Group of Portugal, have agreed to form a joint venture company to produce Vertigo algae biodiesel feedstock</td>
</tr>
</tbody>
</table>
2008: Market Feedback

- Unsuccessful road show/investor mtgs
- NYC Investor feedback: (PE, VC, Debt, Buy Side Analysts)
  - Poor capital structure
  - Tech risk
  - JV issues
  - Vancouver/RTO
- Deteriorating capital markets
- Gov’t pipeline not primed
- Cash constrained/missed payroll
- Alternate funding strategies exhausted
2008/9: A bad time to find money…

Modest Decline after a Strong 1Q11

Global Cleantech VC Investment

- $1.83 billion of venture capital investment across 161 deals
- Top deals: Fisker, Suniva, Bridgelux, Enerkem, KiOR.

Source: Cleantech Group
“Let me tell you something, my friend. Hope is a dangerous thing. Hope can drive a man insane.”

The Shawshank Redemption, 1994
2009: Running out of options

VAT Discussion Document 07/14/09

- Observations
  - We are out of money
  - We have no verifiable technical achievements
  - We have damaged credibility

- Achievements
  - High end lab facility
  - Permitted test facility
  - Supporting infrastructure
  - Industry/tech learnings (Craig, Doug, Mick, Andy?)
  - Bioreactor design
  - IP on Vertigo
  - Restructuring of VAT

- Current Status and perceived value
  - High end lab facility
    - Some gaps in equipment
    - Major gaps in staffing
    - Envisied by qualified researchers
  - Permitted test facility
    - Still in working condition
    - Perceived value as test/prototype facility
  - Supporting infrastructure
    - Value to support items above
  - Bioreactor design
    - Little external perceived value – nobody would put money into it
    - Little internal perceived value – current analysis indicates that Vertigo is not economically viable
  - IP on Vertigo
    - Ditto for Bioreactor design
  - Restructuring of VAT
    - Could improve ability to achieve milestones
    - Could improve credibility
    - Need to add expertise & credibility to BOD

- Gaps
  - Money to staff, operate facility, conduct research plan
  - Staff to operate facility, conduct research
  - Clear operating and management structure (actualized)

- Value Hypothesis: VAT's only value is located in the El Paso facility, lab itself, and our industry knowledge.

Question: Even if we find the partner, given that we only have the lab & EP facility as input, is there enough upside to make the effort worthwhile?
  - Depends upon finding a partner and structuring an agreement
Analysis

• Strategy:
  – Fuel
  – Fuel
  – Fuel

• Technology:
  – Accelerated Evolution
  – Vertical PBR
Analysis

• Strategy:
  – Pharma
  – Feed
  – Fuel

• Technology:
  – Accelerated Evolution
  – Vertical PBR
Achilles Heal
*(structure, transparency, process)*

- **Greensteam**
- **Vertigro**
- **Verti-crop**

- **License Fee/gal (GK, TB)**
- **IR Fees to Sweetwater**
- **Valcent (TSX)**
  - El Paso, TX

- **GGRN (OTC:BB)**
  - El Paso/Bakersfield

- **Sweetwater Capital (Vancouver)**

- **100%**
  - GGRN
  - Greensteam
  - Vertigro

- **50%**
  - GGRN
  - Verti-crop

- **50%**
  - GGRN

- **Valcent (TSX)**
  - El Paso, TX

- **BOD**
“The confidence individuals have in their beliefs depends mostly on the story they can tell about what they see, even if they see very little”
A word of caution about falling in love ...

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